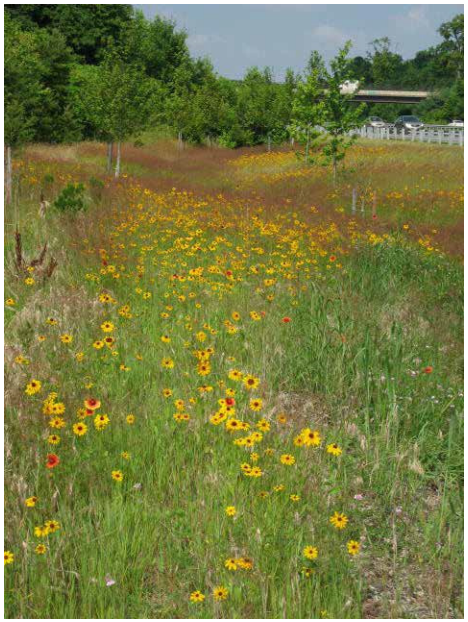
State Highway Administration

Impervious Restoration and Coordinated Total Maximum Daily Load Implementation Plan

October 8, 2016







Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*

SHA State Highway Administration
Maryland Department of Transportation

Pete K. Rahn, *Secretary*
Gregory C. Johnson, P.E., *Administrator*

October 7, 2016

Mr. Raymond Bahr
Sediment, Stormwater, and Dam Safety Program
Water Management Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 440
Baltimore, Maryland 21230

Dear Mr. Bahr,

The State Highway Administration (SHA) is pleased to submit this Impervious Restoration and Coordinated TMDL Plan addressing conditions under the SHA National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit (11-DP-3313 MD 0068276) which took effect on October 9, 2015. The plan covers the permit requirements of treating or offsetting 20 percent of currently untreated baseline impervious surfaces, Chesapeake Bay restoration efforts and working toward meeting stormwater wasteload allocations for local watersheds through implementation of a Coordinated TMDL Implementation Plan. This submission includes one hard copy of the plan.

If you have any questions or need additional information regarding this delivery, please contact Ms. Karen Coffman at 410-545-8407 (or via email at kcoffman@sha.state.md.us) or me at 410-545-8640 (or via email at sram@sha.state.md.us).

Sincerely,

Sonal Ram

Sonal Ram, Director
Office of Environmental Design

Enclosure: Impervious Restoration and Coordinated TMDL Plan

Cc: Mr. Robert Shreeve, Office of Environmental Design, SHA
Ms. Karen Coffman, Office of Environmental Design, SHA
Mr. Brian Cooper, Sediment, Stormwater, and Dam Safety Program, MDE

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ABBREVIATIONS

AA	Anne Arundel (County)
AA-DPW	Anne Arundel County, Department of Public Works
AAH	Adopt-A-Highway
AASHTO	American Association of State Highway and Transportation Officials
ac	Acre
AFB	Air Force Base
Alt	Alternative
AMT	Automated Modeling Tool
AMT, Inc.	A. Morton Thomas and Associates, Inc.
ATV	All-terrain vehicle
BA	Baltimore (County)
BARC	Beltsville Agriculture Research Center
Bay	Chesapeake Bay
BBO	Beaverdam Run, Baisman Run, and Oregon Branch Subwatersheds of the Loch Raven Reservoir Watershed
BC-DEPRM	Baltimore County, Department of Environmental Protection and Resource Management
BC-DEPS	Baltimore County, Department of Environmental Protection and Sustainability
BIBI	Benthic Index of Biotic Integrity
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BSID	Biological Stressor Identification
BST	Bacterial Source Tracking
CAFO	Concentrated Animal Feeding Operation
CBP	Chesapeake Bay Program
CBWM	Chesapeake Bay Watershed Model
CC	Charles (County)
CC-BRM	Carroll County, Bureau of Resource Management
CC-DPGM	Charles County, Department of Planning & Growth
CCMS	Customer Care Management System
CFR	Code of Federal Regulations
CIP	Capital Improvement Project
CL	Carroll (County)
CRP	Community Reforestation Program
CSN	Chesapeake Stormwater Network
CSO	Combined Sewer Overflow
CTP	Consolidated Transportation Program
CWA	Clean Water Act
CWAPTW	Clean Water Action Plan Technical Workgroup
CWP	Center for Watershed Protection
DC	District of Columbia
DO	Dissolved Oxygen
DEL	Delivered Loads
DMCF	Dredged Material Containment Facilities
DNR	Maryland Department of Natural Resources
DRMO	Defense Reutilization and Marketing Office
ECD	Environmental Compliance Division (SHA)
E. coli	*Escherichia coli*
ED	Extended Detention
EMC	Event Mean Concentration
EMS	Environmental Management System
EOS	Edge of Stream

EPA	United States Environmental Protection Agency
EPD	Environmental Programs Division
ESC	Erosion and Sediment Control
ESD	Environmental Site Design
FC	Fecal Coliform
FC-DPW	Frederick County, Division of Public Works
FEMA	Federal Emergency Management Administration
FIB	Fecal Indicator Bacteria
FIBI	Fish Index of Biotic Integrity
FMD	Facility Maintenance Division (SHA)
FR	Frederick (County)
FY	Fiscal Year
GIS	Geographic Information System
HA	Harford (County)
HC-DPW	Harford County, Department of Public Works
HO	Howard (County)
HUC	Hydrologic Unit Code
HWG	Horsley Witten Group, Inc.
ICPRB	Interstate Commission on the Potomac River Basin
IDDE	Illicit Discharge Detection and Elimination
ISWBMPDB	International Stormwater BMP Database
LA	Load Allocations
lbs	Pounds (weight)
LF	Linear Feet
LN	Lower North
LNB	Lower North Branch
LRE	Loch Raven East subwatershed
LJF	Lower Jones Falls (Watershed)
LU	Land Use
MAA	Maryland Aviation Administration
MAST	Maryland Assessment Scenario Tool
MC-DEP	Montgomery County, Department of Environmental Protection
MD	Maryland
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDOT	Maryland Department of Transportation
MDP	Maryland Department of Planning
MEP	Maximum Extent Practicable
MEPA	Maryland Environmental Policy Act
MGF	Middle Gwynns Falls (Watershed)
MO	Montgomery (County)
MOS	Margin of Safety
MPR	Maximum Practicable Reduction
MS4	Municipal Separate Storm Sewer System
NBOD	Nitrogenous Biochemical Oxygen Demand
NEPA	National Environmental Policy Act
NFHL	National Flood Hazard Layer
NJF	Northeastern Jones Falls (Watershed)
NPDES	National Pollutant Discharge Elimination System
NSQD	National Stormwater Quality Database
OCRI	Office of Customer Relations and Information (SHA)
OED	Office of Environmental Design
OOM	Office of Maintenance (SHA)
OP	Orthophosphate
OPPE	Office of Preliminary Planning and Engineering

PACD	Pennsylvania Association of Conservation Districts
PB	Parsons Brinckerhoff
PCB	Polychlorinated Biphenyl
PERC	Perchloroethylene
PG	Prince George's (County)
PGC-DoE	Prince George's County, Department of the Environment
RBP	Rapid Bioassessment Protocol
RGP	Regional General Permit
ROW	Rights-Of-Way
Reqd	Required
RR	Runoff Reduction
RSPSC	Regenerative Step Pool System Conveyance
SAH	Sponsor-A-Highway
SB	Spring Branch subwatershed
SCA	Stream Corridor Assessment
SFEI	San Francisco Estuary Institute
SGW	Submerged Gravel Wetlands
SHA	State Highway Administration
SPR	State Planning and Research
SSO	Sanitary Sewer Overflow
ST	Stormwater Treatment
SW	Stormwater
SWAP	Small Watershed Action Plan
SWM	Stormwater Management
SWS	Subwatershed
SW-WLA	Stormwater Wasteload Allocation
TBD	To Be Determined
TBR	Tidal Back River (Watershed)
TBS	To Be Specified
TCWG	Toxic Contaminants Work Group
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
tPCB	Total Polychlorinated Biphenyl
TSS	Total Suspended Solids
TWGCB	Toxics Work Group Chesapeake Bay Partnership
UBR	Upper Back River (Watershed)
UGF	Upper Gwynns Falls (Watershed)
UJF	Upper Jones Falls (Watershed)
US	United States
USACE	United States Army Corps of Engineers
USDA-NRCS	United States Department of Agriculture, Natural Resources Conservation Service
USGS	United States Geological Survey
USWG	Urban Stormwater Work Group
WA	Washington (County)
WC-DPW	Washington County, Division of Public Works
WCSCD	Washington County Soil Conservation District
WIP	Watershed Implementation Plan
WLA	Wasteload Allocation
WPD	Water Programs Division
WQLS	Water Quality Limited Segment
WQSs	Water Quality Standards
WQv	Water Quality Volume
WQGIT	Water Quality Goal Implementation Team

WRAS	Watershed Restoration Action Strategy
WTM	Watershed Treatment Model
WTWG	Watershed Technical Work Group
WWTP	Waste Water Treatment Plant
yr	Year
12-SW	Maryland General Permit for Discharges from Stormwater Associated with Industrial Activities

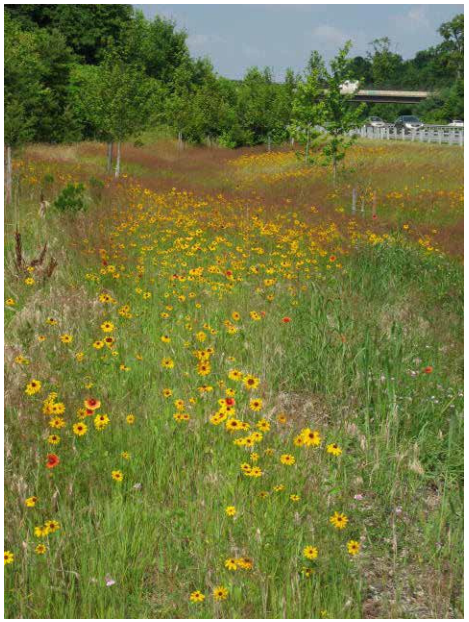
State Highway Administration
Maryland Department of Transportation

Part I

Program Introduction







I. PROGRAM INTRODUCTION

A. PURPOSE

The State Highway Administration (SHA) is required to reduce water pollution to the maximum extent practicable (MEP) as a condition of the agency's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit 11-DP-3313 (hereinafter referred to as the "MS4 Permit") issued on October 9, 2015. The Maryland Department of the Environment (MDE) issues permits to contributors, such as SHA, under the NPDES program. Urban stormwater runoff is regulated under the MS4 Permit. MS4 permit holders are required to manage their stormwater runoff to prohibit pollution from discharging into water bodies and to attain the targeted wasteload allocations (WLAs) for pollutants.

This Impervious Restoration and Coordinated Total Maximum Daily Load (TMDL) Implementation Plan (Plan) is a required document under SHA's MS4 Permit to establish SHA's protocol for ensuring that wasteloads are reduced and are not exceeding thresholds that would cause excessive pollution in local waterways or the Chesapeake Bay. SHA's approach is unique in each county and watershed. This Plan is divided into four parts:

- **Part I, Program Introduction** provides an overview and introduction to SHA's MS4 Permit, TMDLs, and best management practices (BMPs) used for compliance;
- **Part II, Impervious Restoration and Chesapeake Bay TMDL Compliance** details the strategy, assessment, costs, and schedule for impervious surface treatment in each of the MS4 counties and restoration efforts for Chesapeake Bay TMDL compliance;
- **Part III, Coordinated TMDL Implementation Plan** describes coordination with county MS4 jurisdictions concerning watershed assessments and the development of a coordinated TMDL implementation plan; and
- **Part IV, SHA Watershed TMDL Implementation Plans** detail the strategy, assessment, costs, and schedule for pollution reduction strategies in each of the locally designated TMDL watersheds.

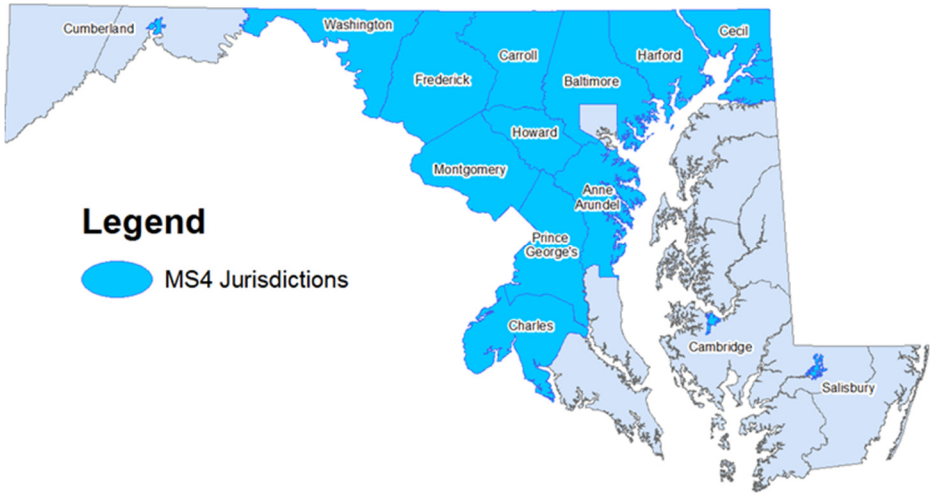


Figure 1-1: MS4 Permit Coverage Area

B. SCOPE

MDE issued MS4 Permits to cover stormwater discharges from the storm drain systems owned or operated by SHA in the NPDES Phase I and II jurisdictions of Anne Arundel, Baltimore, Carroll, Charles, Cecil, Frederick, Harford, Howard, Montgomery, Prince George's, and Washington counties and the cities of Cumberland, Salisbury, and Cambridge. See **Figure 1-1** for a map of the Phase I and II jurisdictions of Maryland where SHA owns and maintains right-of-way (ROW). It is important to note that while Baltimore City is also an MS4 jurisdiction within the State of Maryland. However, SHA does not own

any ROW or stormwater management (SWM) facilities within the city limits and therefore is not part of SHA's MS4 permit coverage area.

SHA also owns and maintains several industrial facilities, such as maintenance shops, that are regulated by the State's General Permit for Discharges from Stormwater Associated with Industrial Activities (12-SW). The 12-SW states that impervious restoration requirements for industrial properties shall be included in the jurisdictional MS4 Permit. Therefore, SHA is including maintenance shops within MS4 areas as a part of the MS4 impervious restoration and TMDL implementation strategy. Restoration projects that are located within SHA industrial properties within MS4 jurisdictional areas are included as a part of this Plan. All other 12-SW requirements remain separate from the MS4 Permit requirements.

C. BACKGROUND

C.1. Surface Water Quality Standards

The Clean Water Act (CWA) requires that Maryland manage a water quality program that establishes Water Quality Standards (WQSs) for Maryland waters, monitors the conditions of the waters, and lists water bodies that do not meet WQSs with technology-based controls alone. Results can be found in MDE's biennial *Integrated Report of Surface Water Quality* (MDE, 2015a). This includes water quality assessments and lists of impaired watersheds, which is formally known as the 303(d) List. Furthermore, the State is required to set priority rankings for the water bodies listed and establish TMDLs that meet WQSs for each listed water body.

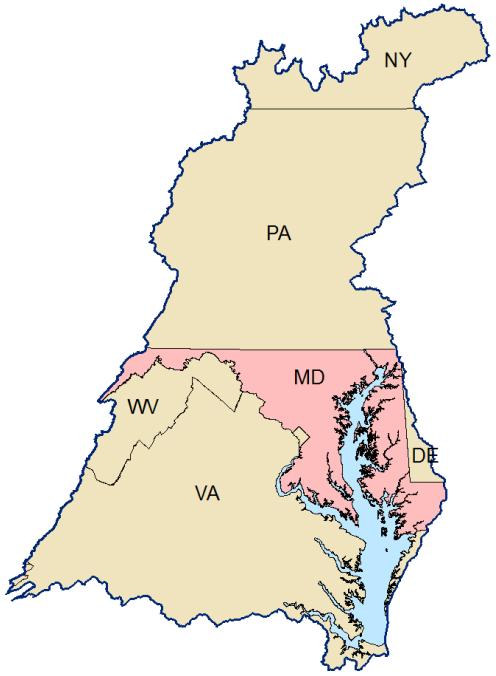


Figure 1-2: Chesapeake Bay Watershed

TMDLs are a tool for implementing State WQSs, and they are based on the relationship between pollution sources and in-stream water quality conditions. The TMDLs are established for the maximum amount of an impairing substance or stressor that a water body can assimilate and still meet WQSs. The TMDL allocates that load among several pollution contributors. Contributors can include point sources, such as sewage treatment plants or regulated municipal storm sewers; and non-point sources, such as runoff from agricultural land. The United States Environmental Protection Agency (EPA) approves TMDLs.

C.2. Chesapeake Bay TMDL Requirements

The Chesapeake Bay (Bay) is a national treasure constituting the largest estuary in the United States and one of the largest and most biologically productive estuaries in the world. Pollution from surface stormwater runoff and other sources that discharge to the Bay have become a serious threat to the ecologic health of the Bay, and prevents the attainment of existing State WQSs for dissolved oxygen (DO), water clarity, and chlorophyll. The pollutants that are largely responsible for impairing the Bay are sediment and the nutrients nitrogen and phosphorus, although other pollutants also present a risk in more specific areas.

In 2009, President Obama issued Executive Order 13508 directing the Federal Government to lead the restoration efforts of the Chesapeake Bay, which has a 64,000 square mile watershed (See **Figure 1-2**) that includes the jurisdictions of Maryland, Virginia, Pennsylvania, Delaware, West Virginia, New York, and the District of Columbia (DC). In 2010, the EPA developed a nutrient and sediment pollution TMDL for the Bay in coordination with these jurisdictions. As a partner with the other Bay watershed jurisdictions and EPA, Maryland played a key role in the development of the Bay TMDL.

EPA has instituted accountability measures to ensure clean-up commitments are met by each State, including short and long-term benchmarks, a tracking and accountability system for activities, and federal contingency actions that can be employed if necessary to promote progress. The TMDL is designed to ensure that all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025, with at least 60 percent of the actions completed by 2017.

The TMDL addresses impairments for tidal segments of the Bay and identifies necessary pollution reductions for nitrogen, phosphorus, and sediment. These allocations are split between several pollutant sources (also referred to as sectors) including agriculture, urban stormwater, septic, wastewater, and others.

The Bay watershed jurisdictions developed Watershed Implementation Plans (WIPs) in two phases detailing how maximum loads for each pollutant will be met. Maryland's Phase I and Phase II WIPs were developed by MDE, and the initial SHA implementation plan is included in Appendix E of WIP I. The EPA-approved WIPs are available on MDE's website.

SHA is included within the urban stormwater sector, and Bay requirements for this sector are tied to impervious restoration. The MS4 permits include impervious restoration requirements that are discussed below in **Section D**, **MS4 Permit Requirements** and in **Part II.A Urbanization and Impervious Surface Restoration** of this Plan.

C.3. SHA Local TMDL Requirements

TMDLs are issued for local tidal and non-tidal waterways throughout Maryland. These TMDLs are also based on State WQSs, issued by MDE, and approved by EPA. TMDLs are enforced through NPDES permits, including MS4 permits. Because SHA is an MS4 permittee, SHA is required to address local WLAs where SHA is a designated contributor. **Figure 1-3** and **Table 1-1** on the following pages show the current local watershed TMDLs where SHA has an individual wasteload reduction allocation or an aggregated wasteload reduction target. The Bush River watershed representing a local TMDL with SHA responsibility is not shown in Figure 1-3 at this time due to incomplete data from MDE's TMDL Data Center. The TMDL pollutants that SHA is required to address within designated watersheds include bacteria, PCBs, phosphorus, sediment, and trash. The SHA plan to meet local TMDLs is provided in **Part III, Coordinated TMDL Implementation Plan** and **Part IV, SHA Watershed TMDL Implementation Plans**.

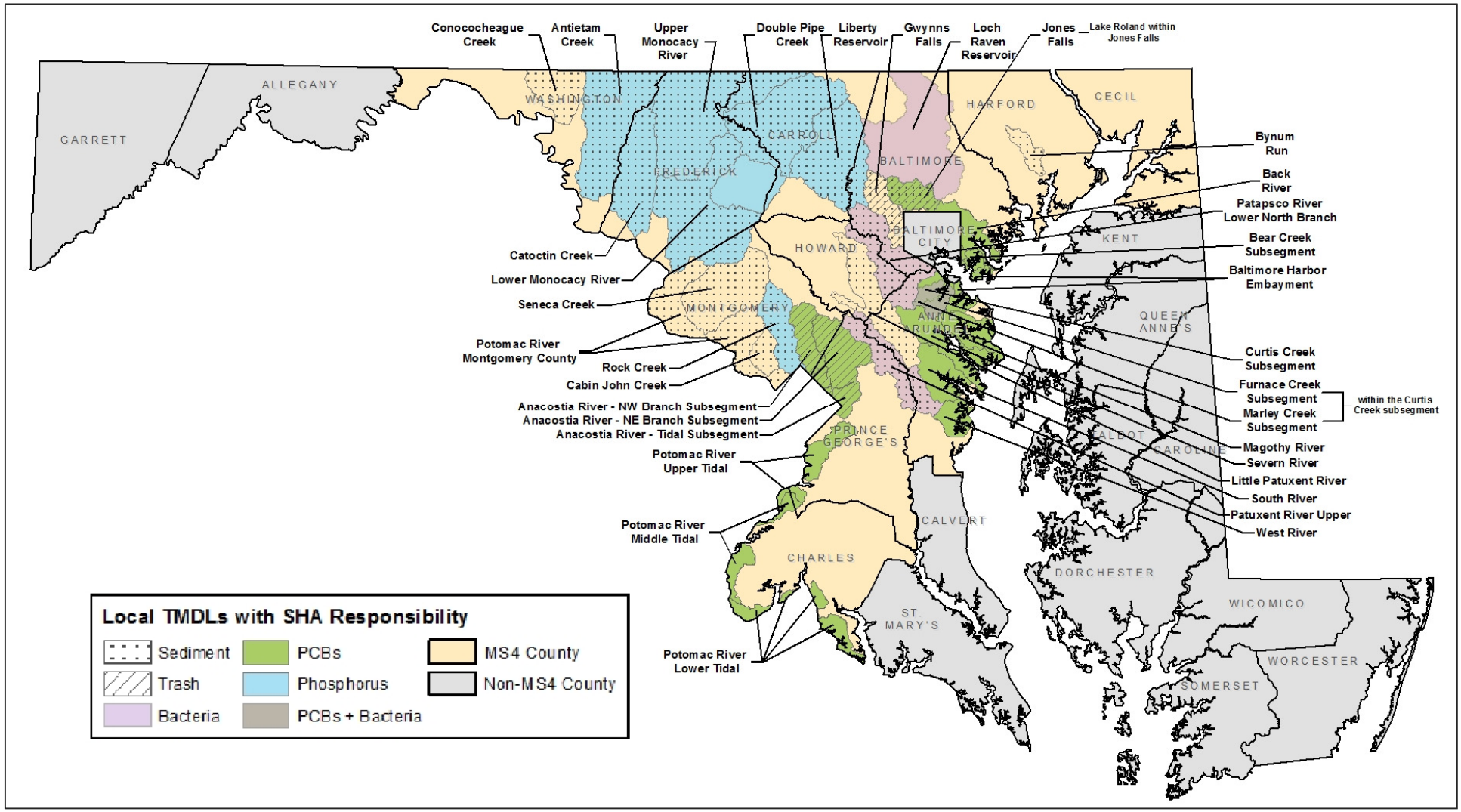


Figure 1-3: Local TMDL Watersheds with SHA Wasteload Reduction Requirement

Table 1-1: Local 8 Digit TMDL Watersheds with SHA Responsibility						
Watershed Name	MD Basin Code/ Assessment Unit ID	Pollutant				
		Bacteria	PCBs	Phosphorus	Sediment	Trash
Anacostia River	02140205		✓			✓
Antietem Creek	02140502			✓	✓	
Back River	MD-BACOH		✓			
Baltimore Harbor	02130903					
• **Baltimore Harbor**	02130903 - EMBAYMENT		✓			
• **Bear Creek Subwatershed**	02130903 MD-PATMH-BEAR-CREEK		✓			
• **Curtis Creek/Bay Subwatershed**	02130903 MD-PATMH-CURTIS_BAY_CREEK		✓			
• **Furnace Creek Subwatershed**	02130903 MD-PATMH-FURNACE_CREEK	✓				
• **Marley Creek Subwatershed**	02130903 MD-PATMH-MARLEY_CREEK	✓				
Bush River Oligohaline	MD-BSHOH-02130701		✓			
Bynum Run	02130704				✓	
Cabin John Creek	02140207				✓	
Catoctin Creek	02140305			✓	✓	
Conococheague Creek	02140504				✓	
Double Pipe Creek	02140304			✓	✓	
Gwynns Falls	02130905				✓	✓

Table 1-1: Local 8 Digit TMDL Watersheds with SHA Responsibility						
Watershed Name	**MD Basin Code/ Assessment Unit ID**	**Pollutant**				
		Bacteria	**PCBs**	**Phosphorus**	**Sediment**	**Trash**
Jones Falls	02130904				✓	✓
• **Lake Roland Subwatershed**	MD-02130904-Lake_Roland		✓			
Liberty Reservoir	02130907			✓	✓	
Little Patuxent River	02131105				✓	
Loch Raven Reservoir	02130805	✓				
Lower Monocacy River	02140302			✓	✓	
Magothy River	MD-MAGMH-02131001		✓			
Patapsco River LN Branch	02130906	✓			✓	
Patuxent River Upper	02131104	✓			✓	
Potomac River MO County	02140202				✓	
Potomac River Lower Tidal	02140101		✓			
Potomac River Middle Tidal	02140102		✓			
Potomac River Upper Tidal	02140201		✓			
Rock Creek	02140206			✓	✓	
Seneca Creek	02140208				✓	
Severn River Mesohaline	MD-SEVMH-02131002		✓			
South River Mesohaline	MD-SOUMH-02131003		✓			

Table 1-1: Local 8 Digit TMDL Watersheds with SHA Responsibility						
Watershed Name	**MD Basin Code/ Assessment Unit ID**	**Pollutant**				
		Bacteria	**PCBs**	**Phosphorus**	**Sediment**	**Trash**
Upper Monocacy River	02140303			✓	✓	
West and Rhode Rivers Mesohaline	MD-WST-RHDMH-02131004		✓			
Note: See Tables 3-2, and 3-3 for details on SHA WLAs, reduction requirements and implementation plan modeling results.						

D. SHA MS4 PERMIT REQUIREMENTS

Requirements in the SHA MS4 Permit that pertain to this impervious restoration and coordinated TMDL implementation plan are listed below and taken from Part III.E of the Permit:

Restoration Plans and Total Maximum Daily Loads (Permit Part III.E)

In compliance with §402(p)(3)(B)(iii) of the CWA, MS4 Permits must require stormwater controls to reduce the discharge of pollutants to the MEP. By regulation at 40 CFR §122.44, BMPs and programs implemented pursuant to this permit must be consistent with applicable WLAs developed under EPA approved TMDLs. In pursuit of these goals, SHA shall coordinate watershed assessments with surrounding jurisdictions and annually report on restoration plans, opportunities for public participation, and TMDL compliance status to MDE. As required below, watershed assessments and restoration plans shall include a thorough discussion of water quality analysis findings based on coordination with surrounding jurisdictions, TMDL documents and other resources when available, identification of water quality improvement opportunities, and a schedule for BMP and programmatic implementation to meet stormwater WLAs included in EPA approved TMDLs. SHA shall address both specific WLAs and target loads when SHA is part of larger aggregate loads. A list of EPA approved TMDLs for SHA in the permit area is included in Attachment B of the permit.

Watershed Assessments (Permit Part III.E.1)

SHA shall coordinate watershed assessments with surrounding jurisdictions, which shall include, but not be limited to the evaluation of available State and county watershed assessments, SHA data, visual watershed inspections targeting SHA ROW and facilities, and approved stormwater WLAs to:

- *Determine current water quality conditions;*
- *Include the results of visual inspections targeting SHA ROW and facilities conducted in areas identified as priority for restoration;*
- *Identify and rank water quality problems for restoration associated with SHA ROW and facilities;*
- *Achieve water quality goals by identifying all structural and nonstructural water quality improvement projects to be*

implemented using the watershed assessments established; and

- *Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater WLAs.*

Restoration Plans (Permit Part III.E.2.a)

Within one year of permit issuance, SHA shall submit an impervious surface area assessment consistent with the methods described in the MDE document "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, August 2014 or subsequent versions). Upon approval by MDE, this impervious surface area assessment shall serve as the baseline for the restoration efforts required in this permit.

By the end of this permit term, SHA shall commence and complete the implementation of restoration efforts for twenty percent of SHA's impervious surface area consistent with the methodology described in the MDE document cited in PART IV.E.2.a. that has not already been restored to the MEP. Equivalent acres restored of impervious surfaces, through new retrofits or the retrofit of pre-2002 structural BMPs, shall be based upon the treatment of the WQv [Water Quality Volume] *criteria and associated list of practices defined in the 2000 Maryland Stormwater Design Manual. For alternate BMPs, the basis for calculation of equivalent impervious acres restored is based upon the pollutant loads from forested cover.*

Coordinated TMDL Implementation Plan (Permit Part III.E.2.b)

Within one year of permit issuance, a coordinated TMDL implementation plan shall be submitted to MDE for approval that addresses all EPA approved stormwater WLAs (prior to the effective date of the permit) and requirements of Part VI.A., Chesapeake Bay Restoration by 2025 for SHA's storm sewer system. Both specific WLAs and aggregate WLAs which SHA is a part of shall be addressed in the TMDL implementation plans. Any subsequent stormwater WLAs for SHA's storm sewer system shall be addressed by the coordinated TMDL implementation plan within one year of EPA approval. Upon approval by MDE, this implementation plan will be enforceable under this permit. As part of the coordinated TMDL implementation plan, SHA shall:

- *Include a final date for meeting applicable WLAs and a detailed schedule for implementing all structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;*

- *Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;*

- *Evaluate and track the execution of the coordinated implementation plan through monitoring or modeling to document the progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and*

- *Develop an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, program enhancements, new and additional programs, and alternative BMPs where the EPA-approved*

TMDL stormwater WLAs are not being met according to the benchmarks and deadlines established as part of SHA's watershed assessments.

Public Participation (Permit Part III.E.3)

SHA shall provide opportunity to the public regarding the development of its coordinated TMDL implementation plan by allowing for public participation, soliciting input, and incorporating any relevant ideas and program improvements that can aid in achieving TMDLs and water quality standards according to the actions below. SHA shall provide:

- *Notice in a regional newspaper and on SHA's website outlining how the public may obtain information on the development of the coordinated TMDL implementation plan and opportunities for comment;*
- *Procedures for providing copies of the coordinated TMDL implementation plan to interested parties upon request;*
- *A minimum 30-day comment period before finalizing the coordinated TMDL implementation plan; and*
- *A summary in each annual report of how SHA addressed or will address any material comment received from the public.*

In response to this public participation requirement, SHA posted a draft of the Plan on its website on August 1, 2016. The 30-day public comment period ended on August 31. A summary of comments received will be included in the SHA MS4 annual report submitted to MDE. The annual report will also be posted on SHA's MS4 Permit webpage accessed from the link below:

http://www.roads.maryland.gov/Index.aspx?pageid=336

E. PROJECT IMPLEMENTATION METHODOLOGIES

E.1 Regulatory Guidance and Permitting

Compliance efforts for impervious restoration, the Bay TMDL and local TMDLs are included in this Plan. Because of these multiple areas of compliance (MS4 and separate TMDLs), accounting for progress can be complicated. The MS4 impervious restoration and Chesapeake Bay TMDL compliance can be handled with the same set of practices that reduce nitrogen, phosphorus, and sediment for local TMDLs. Other local TMDLs require reductions of trash, Polychlorinated Biphenyls (PCBs), and bacteria, and these pollutants call for different strategies. Guidance for preparing implementation plans has been developed by MDE and the Chesapeake Bay Program (CBP) listed below.

MDE TMDL Data Center Guidance

The following guidance is available on the MDE TMDL Data Center website:

- Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, MDE, August 2014;
- General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan, MDE, October 2014;
- Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Daily Loads, MDE, May 2014;
- MDE Recommendations for Addressing the PCB SW-WLA, MDE, July 2013;
- Trash Monitoring Guidance, MDE, July 2014;

- Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Nutrient and Sediment Total Maximum Daily Loads, MDE, November 2014;
- Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Trash/Debris Total Maximum Daily Loads, MDE, May 2014.

Chesapeake Bay Program (CBP) Guidance

The following guidance is approved by the CBP and is available on the Chesapeake Stormwater Network (CSN) website:

- Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects, CBP Urban Stormwater Work Group (USWG), Watershed Technical Work Group (WTWG) and Water Quality Goal Implementation Team (WQGIT), September 2104;
- U-4 Urban Stream Restoration: Good Recipes for the Bay Pollution Diet, CBP, June 2015;
- Guidance for Verifying Stream Restoration Projects, CBP, January 2014;
- Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards, CBP USWG, WTWG, WQGIT, January 2015;
- Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects, CBP USWG, WTWG, WQGIT, January 2015;
- U-2 Stormwater Practices for New and Redevelopment Projects: Good Recipes for the Bay Pollution Diet, CBP, June 2015;
- U-1 Urban Stormwater Retrofits: Good Recipes for the Bay Pollution Diet, CBP, June 2015;
- Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices, CBP, May 2016;
- Potential Benefits of Nutrient and Sediment Practices to Reduce Toxic Contaminants in the Chesapeake Bay Watershed, Part 1: Removal of Urban Toxic Contaminants, CBP Toxic Contaminants Work Group (TCW), December 2015.

Permits for Construction Projects

Permits for construction projects are obtained following standard practices to comply with all State and Federal laws. General permits are pursued when possible. Permits include:

- National Environmental Policy Act (NEPA)/Maryland Environmental Policy Act (MEPA) clearances that also include Section 106 cultural resources;
- Maryland SWM and Erosion and Sediment Control Approvals
- Maryland Reforestation Law, Roadside Tree Law and Forest Conservation Act;
- Maryland Aviation Administration (MAA) for projects within airport clear zones;
- Critical Areas Commission;
- Maryland Dam Safety for thermal impacts related to construction in Use III waters and certain stormwater embankments;
- Maryland and Federal Wetland and Waterways for impacts to US waters and wetlands;
- US Army Corps of Engineers (USACE) Chesapeake Bay Total Maximum Daily Load Regional General Permit (Bay TMDL RGP); USACE, July 2015;
- Others as needed.

E.2. Urban Sector Focus

MDE has specified that at least half of the 20 percent impervious restoration should be within the urban sector. At least 10 percent of the impervious restoration must be provided by practices that treat SHA impervious surface runoff directly or are placed within urban land areas if outside SHA ROW.

The Bay TMDL considers Phase I and II MS4 jurisdiction areas the 'urban sector'. An area is considered a Phase I or II MS4 jurisdiction based upon population. Medium sized MS4 jurisdictions are located in an incorporated place or county with a population between 100,000 and 249,999. Large MS4 jurisdictions are located in an incorporated place or county with a population of 250,000 or greater. See **Figure 1-1** for MS4 jurisdictions in Maryland. These counties and cities also hold their own MS4 Permits.

In the Maryland WIP I, the urban sector is required to meet MS4 impervious treatment as the method to address Bay restoration. For purposes of complying with the MS4 Permit, MDE considers all lands within SHA ROW as urban. Under this definition, SHA roads that traverse agricultural, forested, or rural areas are considered urban areas.

SHA plans to provide impervious restoration to at least 10 percent of the untreated impervious area within SHA ROW or urban land use areas as defined by the 2010 Maryland Department of Planning (MDP) land use classifications (MDP, 2010). These classifications include:

11 Low-density residential
12 Medium-density residential
13 High-density residential
14 Commercial
15 Industrial
16 Institutional
17 Extractive
18 Open urban land
191 Large lot subdivision (agriculture)
192 Large lot subdivision (forest)
80 Transportation

E.3. Watershed Focus

For impervious restoration efforts within each county, SHA is prioritizing impaired watersheds that have EPA approved TMDLs with SHA WLAs. Impervious restoration efforts that target local TMDLs count towards the 20 percent MS4 impervious restoration requirement, Bay TMDL, and local WLAs. Because restoration practices in these watersheds count towards compliance with the statewide requirements, increased efficiency in utilizing funding and staffing as well as meeting timeframes for compliance can be achieved by targeting these local TMDLs for impervious restoration efforts.

The anti-degradation policy defined in the CWA and Maryland law requires that high quality waters be maintained in good condition. Maryland has Tier II waters (high quality) but not Tier III (waters of national significance). SHA identifies high quality waters when performing site searches and, if opportunities exist, targets these areas with restoration practices.

Input from counties is also sought regularly and in instances when a local jurisdiction requests SHA to have a stronger focus on certain watersheds, SHA works with the jurisdiction to develop agreements under which the implementation of appropriate practices can be undertaken as a partnership. In most instances, these would be watersheds with an EPA-approved TMDL in place, but they could also be watersheds of other local significance.

E.4 Coordination with Other MS4 Jurisdictions

SHA has established an outreach program tasked with coordinating pollution reduction strategies with each of the MS4 jurisdictions and

counties. The purpose is to establish a cooperative relationship and identify partnering opportunities. This coordination is important to ensure that local officials are informed and have the opportunity to provide input on SHA's planned activities. These meetings result in more efficient efforts to address TMDL load reductions in targeted areas and establish relationships to coordinate other MS4 program initiatives.

As discussed above, Memoranda of Understandings or Agreements are being actively sought with other MS4 jurisdictions, government agencies and private organizations with the intent to share resources in restoring local and regional waters.

E.5. Redevelopment Credit

As SHA modifies or expands the existing roadway network to improve safety and mobility, SWM practices are implemented or upgraded to treat runoff from existing, untreated roadway segments and to meet current SWM standards. Per MDE (2014a), "Any project that meets or exceeds the regulatory requirements for redevelopment may be used to claim credit toward impervious acre treatment requirements and pollutant load reductions." This redevelopment credit is computed based on the method agreed upon between MDE and SHA on March 15, 2016 and includes both reconstructed impervious area credit and impervious area removal credit. As the majority of all SHA projects are classified as redevelopment, meaning 40% or more of the site area is impervious, and typically these projects include reconstruction of existing untreated impervious area within the limit of disturbance, SHA can receive credit for pollution reduction with the implementation of these reconstruction projects. For further discussion of redevelopment credit, see **Part II.B.2 Baseline Runoff Treatment Assessment**.

E.6. Existing Grass Channel Inventory

Many of SHA's roadways drain to open channel grass swales that convey flows from the roadway to stormdrains or waterways. See **Figure 1-4** for an example. MDE recognizes that these channels provide water pollution treatment and allow for "open section roads with swales that meet the grass swale criteria in the Manual [MDE, 2009a]" to be considered as providing acceptable water quality treatment (MDE, 2014a, p. 9, Table 1). A full inventory and analysis of existing grass swales along SHA ROW and within the MS4 jurisdictions has been completed. This analysis has been used to calculate actual levels of treatment currently being provided for both pollutant reductions and treated impervious acreages. These existing swales have been documented as spatial features within the SHA NPDES database and the computed treatment added to the impervious baseline calculations. For further discussion of how this analysis affects the SHA baseline impervious calculation and to find the MDE approved *SHA Existing Water Quality Grass Swale Identification Protocol*, refer to **Part II.B.2., Baseline Runoff Treatment Assessment**.



Figure 1-4: Existing Grass Channel along Median of I-70 in Baltimore County

E.7.Nutrient Credit Trading Program

The Maryland Department of Agriculture (MDA) and MDE are partnering to establish a nutrient credit trading and offset program. Although the program is currently under development, principles and draft guidance are available. Under this approach, sectors are given the flexibility to meet their load limits by purchasing credits or offsets generated from load reductions elsewhere. MS4s would be allowed to purchase credits at market rate and enter into cross-sector trading agreements to meet up to half of their impervious surface area treatment required under the MS4 Permit conditions. Cross-sector trading will include point source and non-point sources. For example, transactions can occur between two point sources such as Waste Water Treatment Plants (WWTP) and regulated MS4 jurisdictions, or between a point source and non-point source such as regulated MS4 jurisdictions and agricultural operations.

Trading is proposed to be permitted within three geographic regions called Maryland Trading Regions (see **Figure 1-5**):

- Potomac River Basin;
- Patuxent River Basin; and
- A combination of the remaining Susquehanna River Basin, Eastern Shore, and Western Shore.

The unit of trade is a mass unit in time termed a pollution reduction credit. For example, in the case of sediment, the unit of trade is tons per year and in the case of nitrogen and phosphorus, the unit of trade is pounds per year.

Once the trading program and guidance are finalized, SHA intends to utilize this program as another practice to meet restoration requirements. For example, in areas where opportunities to implement traditional nutrient and sediment reduction strategies are limited, SHA anticipates the ability to utilize credit trading.

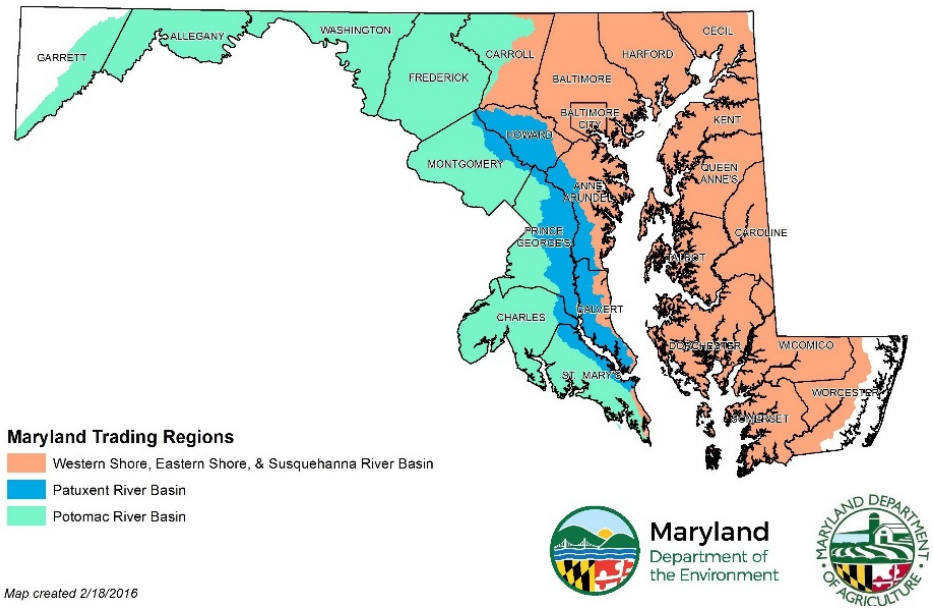


Figure 1-5: Proposed Maryland Trading Regions
(MDE, 2016)

E.8. Research

By employing improvements to practices, SHA can ensure the most effective use of ROW, funding and other resources. Some current practices under study include outfall stabilization crediting for nutrient removal; methods to measure pollutant removal from inlet cleaning and street sweeping; determining effectiveness of stormwater control practices in removing bacteria and toxic contaminants such as PCBs; and development of an outfall inspection protocol for PCBs, bacteria and other health related impairing pollutants.

E.9. Program Funding

SHA utilizes capital funds for planning, engineering, construction, inspections, establishment, remediation and research activities associated with impervious treatment and TMDL implementation. Operations and maintenance funds are used to maintain structural stormwater controls and conduct certain activities such as street sweeping and inlet cleaning. Projected expenditures for impervious restoration are discussed in **Part II, Impervious Restoration Plan and Chesapeake Bay TMDL Compliance** and expenditures for local TMDL implementation are discussed in **Parts III, Coordinated TMDL Implementation Plan** and **Part IV, SHA Watershed TMDL Implementation Plans**.

F. RESTORATION PRACTICE DESCRIPTIONS

This section describes the practices used to meet impervious restoration goals and TMDL pollutant reductions. **Part II** and **Part III** detail how these practices are or will be combined in implementing restoration and TMDL reduction strategies. Current restoration practices are taken from MDE (2014a) and the CBP technical workgroup protocols. As new practices are developed, SHA will consider potential to implement them. Some practices under consideration by SHA that are either currently under development or recently approved by these programs include:

- Floating Treatment Wetlands;
- Urban Filter Strips;
- Disconnecting Impervious Areas;
- Urban Tree Canopy;
- Urban Nutrient Management;
- Enhanced Erosion and Sediment Control;
- Shoreline Management;
- Illicit Discharge Detection; and
- Urban Tree Planting/Forest (revision to current BMP).

For the most efficient treatment or offset of stormwater pollution, combinations of currently approved measures are being implemented. SHA's ROW has been reviewed using geographic information system (GIS) analysis and a myriad of base data to determine the best combination of treatment strategies along any given roadway corridor with the goal of maximizing the use of ROW. Additionally, SHA is partnering with local jurisdictions, other organizations and agencies, and private citizens to implement projects outside of SHA ROW.

F.1. Design, Inspection & Maintenance Standards

A variety of restoration practices are being employed. Some practices produce reductions through an annually conducted activity such as street sweeping, inlet cleaning or educational outreach. Others, such as structural stormwater controls and tree planting, are permanent, built practices and are designed and constructed to certain standards. SHA adheres to the following standards for constructed practices:

- MDE 2000 Maryland Stormwater Design Manual;
- MDE 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control;
- Specifications for Performing Landscaping Activities for the Maryland Aviation Administration;
- AASHTO Roadside Design Guide;
- SHA Book of Standards for Highway & Incidental Structures;
- SHA Standard Specifications for Construction Materials;
- SHA Highway Drainage Manual;

- SHA Stormwater Management Site Development Criteria Manual; and
- SHA Landscape Design Guide.

Built restoration practices are required to be inspected every three years and necessary maintenance or remediation efforts undertaken in order to ensure optimal pollutant removal and to continue to receive credit against the 20% impervious restoration and pollutant load reductions. SHA has developed inspection and maintenance manuals for structural stormwater controls and tree sites. A geodatabase is used to track inspection timeframes, maintenance or remediation requirements and completion dates. Also, the Bay Program requires that pollutant removal credits be renewed for certain practices and these inspections will serve as confirmation of practice functionality.

F.2. Alternative Practices

MDE recognizes that not all of this restoration can be accomplished by building new or upgrading existing structural stormwater controls and allows for construction of alternative practices that are effective at offsetting the pollutant loads generated by impervious surfaces without treating stormwater runoff directly. These alternative practices are assigned impervious treatment equivalencies that calibrate the effectiveness of these practices against equivalent reductions in loading rates from urban land use. MDE (2014a, p. 19, Table 7) has provided a list of acceptable alternative practices. Accordingly, the alternative practices currently used by SHA include tree planting, stream restoration, catch basin cleaning, street sweeping, outfall stabilization, and impervious area removal. Other types of alternative practices may be employed in the future.

F.3. Categories of Practices

Restoration practices can also be organized into four categories: structural stormwater controls, land use changes, environmental restoration, and source controls. These categories are helpful in understanding the mechanisms for pollutant removal. Each category is defined below and detailed descriptions of practices and how they are being used by SHA are included in **Sections F.4** to **F.7**.

Structural Stormwater Controls

Structural stormwater controls are engineered practices that receive stormwater runoff from developed areas and, using a variety of mechanisms, reduce pollutants and slow runoff velocities to minimize impacts when discharged to local waterways. They are engineered to optimize pollutant removal and are designed and built under standards contained in the 2000 Maryland Stormwater Design Manual (MDE, 2009a).

Land Use Changes

Land use change practices reduce pollutants by replacing land cover that generates high levels of pollutants with one that generates lower levels. This will provide an overall decrease in pollutants without capturing and treating stormwater runoff directly. Examples of land use changes are planting trees or removing impervious pavement.

Environmental Restoration

Environmental restoration aims to counteract the effects of urbanization on natural stream channels. Urbanization with increased impervious surfaces, reduced tree canopy and straightened, steepened and less permeable runoff conveyances changes the characteristics of storm runoff by increasing volumes and duration of flows. In other words, there is much more water flowing for longer periods of time often with higher velocities and power. Waterway

systems conveying these flows can be impacted by one or more of the following problems: flooding, increased erosion of banks, deeper channel bottoms, changes in channel configuration and location, loss of aquatic habitat and species, and loss of wetlands as floodplains become dryer. Activities that restore natural channels establish equilibrium between the flowing water, structure and configuration of channels, species and habitat. Environmental restoration practices include stream restoration, wetland restoration, and outfall stabilization.

Source Controls

Source controls remove pollutants before they reach waterways and include methods to reduce the generation of pollutants such as recycling/reuse efforts or educational campaigns. They also include physically capturing and removing pollutants for disposal elsewhere, typically in landfills. Catch basin cleaning and street sweeping are examples.

F.4. Structural Stormwater Controls

Grass Swales

Grass swales are grass-lined channels that convey stormwater draining from roadways towards discharge points or outfalls. They are designed to certain cross-sectional geometries, longitudinal, and side slopes in order to control the rate and depth at which stormwater flows through the swale. Pollutant reductions are achieved through vegetative filtering, sedimentation and biological uptake. Swales can attenuate larger flows by slowing and infiltrating runoff during conveyance. They are typically located within roadway median areas or along roadsides. See **Figure 1-6** for an example of a grass swale.



Figure 1-6: Grass Swale Example along MD 220 in Washington County

Bioswales

Bioswales are structural swales designed with a multi-tier filtration system consisting of filter media, transition, and drainage layers working in combination to remove pollutants. Bioswales use an engineered soil filter media that is very porous and consists of sand, soil and organic matter such as mulch or compost. Stormwater flows onto the surface of the facility and as it seeps through the media, it is filtered. Plants within the facility also provide treatment through biological processes in the root systems and uptake of water and nutrients. The process removes sediment, as well as nitrogen and phosphorus. Bioswales can also attenuate flows by storing and infiltrating stormwater runoff to the ground below. They are viable in all soil types (based on United States Geological Survey [USGS] Hydrologic Soil classifications); however underdrain systems are required in soils with low infiltration rates (typically hydraulic soil groups C & D). They can be used in areas with lower infiltration rates if an underdrain is also used. See **Figure 1-7** for an example bio-swale under construction.



Figure 1-7: Bio-Swale during construction along MD 214 in Prince George's County

Wet Swales

Wet swales are structural swales that can be used in poorly drained soil types and are ideal for treating highway runoff in low-lying, flat terrain with high groundwater. Wet swales often intercept shallow groundwater to maintain a wetland plant community. Check dams are placed within the swale to help promote saturated soil or shallow standing water conditions and to temporarily store runoff before returning the treated stormwater to the conveyance system. The saturated soil and wetland vegetation provide an ideal environment for gravitational settling, biological uptake, and microbial activity.

Submerged Gravel Wetlands

Submerged gravel wetlands (SGW) are "flow through" filters that use wetland plants, a soil layer, and a gravel chamber to provide water quality treatment. Stormwater runoff draining to an SGW is treated primarily through filtration, but also sedimentation, physical and chemical sorption, microbially mediated transformation, uptake, and attenuation. Stormwater flows to the pretreatment forebay, where sedimentation occurs first; the pretreated runoff is then stored on the surface of the wetland. Filtration, sorption, and transformation occur as the stormwater travels through the wetland vegetation, soil layer, and/or gravel chimneys and passes through the gravel substrate that hosts a microbe-rich environment, removing nitrogen and phosphorus. While some uptake occurs in the wetland vegetation, most of the treatment is within the gravel substrate. To sustain the microbes and the wetland plants, the gravel substrate and soil layers must remain wet between storm events. For this reason, SGWs are used typically in poorly draining soils (typically hydraulic soil groups C & D) and/or areas of high ground water. The outlet invert is located four inches below the soil surface to maintain a subsurface permanent pool. Although hydraulic control is just below the wetland surface, the system is configured so that flow exiting the SGW must first traverse the underground gravel substrate. See **Figure 1-8** for an example of a submerged gravel wetland.



Figure 1-8: Submerged Gravel Wetland in Silver Spring, Montgomery County, MD

Surface Sand Filters

Surface sand filters are practices that capture and temporarily store runoff and pass it through a filter bed of sand media as noted in the Chapter 3/Section F-1 of the MDE Design Manual (MDE, 2009a). Filtered stormwater is either returned to the conveyance system or partially infiltrated into the soil. Surface sand filter facilities are versatile and may be adapted for use almost anywhere. Facilities located in poorly draining soils use underdrain systems to outfall the treated runoff to the conveyance system. See **Figure 1-9** for an example of a surface sand filter.



Figure 1-9: Surface Sand Filter along MD 355 in Montgomery County

Bioretention and Micro-Bioretention Facilities

Bioretention systems use very porous media consisting of sand, soil and organic matter such as mulch or compost for filtering stormwater runoff. Stormwater flows onto the surface of the facility and as it seeps through the media, it is filtered. Plants within the facility also provide treatment through biological processes in the root systems and uptake of water and nutrients.

Filtered stormwater is either returned to the conveyance system or partially infiltrated into the soil. Facilities may use underdrains to discharge the treated runoff to storm drain systems, though underdrains are not necessary in well-drained soils.

Bioretention facilities are versatile and may be adapted for use anywhere there is landscaping, although maintenance considerations prohibit their use in certain contexts. The specific facility type, bioretention or micro-bioretention, is determined based on the size of the area draining to the facility. Micro-bioretention facilities are typically limited to a half acre drainage area, and are typically used in smaller landscaped areas. If properly maintained, micro-bioretention facilities can provide additional water quality treatment while adding aesthetic value to the site. Bioretention systems have proven effective at removing many pollutants from stormwater and increasing infiltration to the ground below. See **Figure 1-10** for an example of a bioretention facility.



Figure 1-10: Bioretention Facility at MD 139 in Baltimore County

Rain Gardens

Rain gardens are shallow, planted depressional areas designed to infiltrate stormwater into the soil. This is an effective method to remove pollutants and recharge groundwater supplies. Soil requirements are an important factor when planning to implement this strategy. Soils must have high infiltration capabilities, low groundwater tables, and be located within a relatively flat area. Also, they must not be located within areas of karst topography, which are areas geologically characterized by soluble bedrock, such as limestone. Water infiltrating into the ground in these areas can dissolve bedrock and increase the potential of causing sink holes.

Infiltration Trenches

Infiltration trenches are relatively deep linear trenches designed to capture and infiltrate a certain amount of runoff volume based on the size of the area draining to them. They are limited by certain infiltration capabilities of the underlying soils and restrictions in karst topography. These trenches are sized to hold the runoff while allowing infiltration into the native soils over a prescribed period of time. They are filled with stone and the sides are lined with geotextile to prevent soils along the sides of the trenches from migrating to the bottom and clogging them with fine sediments that will prevent water from infiltrating. SHA uses this practice when space is limited and the right soils are underlying the area. See **Figure 1-11** for an example of an infiltration trench.



Figure 1-11: Infiltration Trench along US 113 in Worcester County

Wet Ponds and Wetlands

Using permanent pools of water to reduce pollutants in stormwater runoff has been a long standing treatment method in Maryland. Recent SWM practices that encourage infiltration to native soils and emulate natural flow patterns prior to urban development have been determined to be more effective at removing pollutants. For this reason, SHA uses wet pond and surface wetland facilities when necessary due to site constraints such as high ground water and/or large drainage areas.

Stormwater wet ponds and surface wetlands are facilities that have a permanent pool or shallow wetland with deep water zones. These facilities provide water quality treatment through biological uptake from algae growing within the permanent pool/wetland areas. Wetland plants provide additional nutrient uptake, and physical and chemical treatment processes allow filtering and absorption of nutrients. Surface pond/wetlands practices are best suited for areas of high ground water and/or poorly draining soils; however, they can be used if larger drainage areas exist and impermeable liners are placed beneath the facility to ensure the permanent ponding necessary to achieve the pollutant removal is provided. See **Figure 1-12** for an example wet pond.



Figure 1-12: Wet Pond along US 113 in Worcester County

F.5. Land Use Changes

Impervious Area Removal

Impervious surfaces increase runoff because they prevent rainwater from penetrating the ground. As a result, runoff can increase water volumes in nearby streams and cause flooding and erosion. Pollutants that are deposited on impervious surfaces from vehicles or atmospheric deposition, such as gasoline, nitrogen and oil, can wash into streams. Impervious surfaces often increase the temperature of runoff which can raise stream water temperatures. These factors all lead to poor stream health. Replacing impervious surfaces such as abandoned roadways and concrete lined ditches with permeable surfaces allows rainfall to infiltrate into the ground which reduces runoff and pollution entering adjacent waterways.

Impervious area removal is the replacement of impervious surfaces, such as asphalt and concrete, with pervious surfaces, such as grass or trees. Grass surfaces provide increased runoff infiltration and pollutant removal, but trees provide better infiltration and pollutant removal. SHA will choose either grass or trees to replace impervious areas depending upon the site context, roadside safety and sight distance requirement for motorists. See **Figure 1-13** for an example of impervious area removal.



Figure 1-13: Before and After image of a Concrete Ditch Removal along I-70 in Washington County

Tree Planting

Tree plantings are an economical strategy that converts grass or meadow areas to forested land. Tree sites do not usually capture stormwater runoff directly, but provide higher absorption rates of nutrients and sediment for rainwater falling on the site directly. Trees produce less runoff than impervious surfaces and grass areas and can absorb up to 100 gallons of water from the soil per day. By capturing rainfall in the canopy and bark; trees encourage rainwater to evaporate back into the air. Leaves also release moisture in a process call transpiration. Trees also absorb many pollutants through their root systems. In addition, their roots and leaf litter improve soil conditions for infiltration and can transform pollutants into less harmful substances. The roots also bind soils, preventing erosion. See **Figures 1-14** and **1-15** below for photos of recent SHA tree planting sites.



Figure 1-14: SHA Tree Planting Site at Perring Parkway and I-695 in Baltimore County



Figure 1-15: SHA Tree Planting Site along US 15 in Frederick County

F.6. Environmental Restoration

Stream Restoration

Stream restoration reestablishes the structure, function, and self-sustaining behavior of the stream system prior to disturbance. The restoration design focuses on the physical and biological components of the stream system and its watershed. Restoration includes a broad range of measures such as removing watershed disturbances that are causing stream instability; installing structures and planting vegetation to stabilize stream banks and provide habitat; and reconstructing the curves, bends and depth of channels within the stream. See **Figure 1-16** for an example of stream restoration.



Figure 1-16: SHA Stream Restoration Project at MD 139 Before, During, and After Construction

Regenerative Step Pool System Conveyance

Regenerative Step Pool System Conveyances (RSPSCs) are a series of stepped pools and aquatic beds, riffle weirs with an underlying filtration system to treat stormwater runoff. The shallow aquatic beds receive and filter the stormwater runoff and the riffle weirs convey the overflow to the next aquatic bed. This practice is well suited for sites where topography is characterized by steeper slopes, where soils can infiltrate and outfalls may be confined in a steep valley. RSPSCs incorporate native materials including vegetation, cobbles, boulders and woodchips and sand in the underlying filtration system. See **Figure 1-17** for an example of a RSPSC.



Figure 1-17: Regenerative Step Pool System Conveyance in Anne Arundel County

Outfall Stabilization

Outfall stabilization repairs channels when significant erosion occurs due to increase and change in the characteristics of stormwater discharge to ditches, adjacent lands or stream channels. Different methods are used to stabilize outfalls including the use of natural materials and structures, rock riprap, vegetation and matting, or stepped grade changes. The stabilization is designed to control flows for existing storm drains based on the magnitude and frequency of a flow event. See **Figure 1-18** for an example of outfall stabilization.



Figure 1-18: I-97 Outfall Before and After Stabilization in Anne Arundel County

F.7. Source Controls

Street Sweeping

Sweeping roadways is not only an important means to keep them clear of trash and debris, but it also results in a reduction of pollutants associated with roadway debris. This material is collected for disposal into approved landfills resulting in pollutants removed prior to entering waterways. Different types of sweeping equipment exist with different levels of effectiveness at removing debris. SHA currently uses mechanical street sweepers which are considered by the CBP expert panel on street sweeping and inlet cleaning to be not as effective as regenerative-air or vacuum assisted sweepers. This material, such as dirt, sand, and trash, collects along curbs and gutters; bridge parapets; and inlets and outlet pipes. Sweeping prevents buildup along sections of roadway and allows for the free flow of water from the highway to enter into the highway drainage system. SHA typically sweeps roadways approximately twice per month during spring, summer, and fall months from April through November. See **Figure 1-19** for an example of street sweeping.



Figure 1-19 – Typical SHA Mechanical Street Sweeper

Inlet Cleaning

Inlets are compartments in the storm drain that allow stormwater to run off but capture sediment and debris preventing them from entering the waterways. These catch basins must be cleaned periodically. Sediment and trash make up the majority of the material that is removed. SHA operates vacuum trucks in central Maryland, spanning most MS4 Counties. Catch basin cleaning is routinely performed in Anne Arundel, Baltimore, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Prince George's and St. Mary's counties. This practice ensures safer roadways through maintaining proper drainage and improves water quality in Maryland streams by removing captured sediment and trash before they enter adjacent waterways. See **Figure 1-20** for an example of inlet cleaning.



Figure 1-20 – Inlet Catch Basin Cleaning Before and After

Structural Stormwater Controls

Structural stormwater controls capture trash and regular maintenance provides removal and disposal.

Litter Education and Outreach Program

SHA's Office of Customer Relations and Information (OCRI) engages in public outreach efforts to discourage littering. Because most littering along roadways originates from motorists, this effort mainly uses radio messaging. Roadway signs are also used at spots that have been identified as frequent dumping areas, rest areas, and other locations as needed. SHA will evaluate the effectiveness of these current programs and identify areas for improvement which may include:

- Public Service Announcements;
- Social Media using SHA's Twitter, Facebook, YouTube, and Instagram accounts;
- Maryland Roads website information;
- Recorded messages played during "on hold' times and for all 511 calls;
- Press releases; and
- Annual SHA customer level of service surveys.

SHA is working to improve these current efforts by initiating a research study to determine target audiences, baseline levels of awareness of the negative impacts of littering, costs associated with littering, motivations for littering, and motivations to stop littering. Based on the results of this research, SHA will develop messages and tactics for each segment of the target audience develop methods to measure the success of the campaign.

The EPA guideline *Getting in Step* (EPA, 2010a) has helped to determine appropriate new efforts that may be implemented. Some additional activities may include:

- Updated SHA webpage for anti-littering message;
- Public outreach efforts such as storm drain stenciling, presentations to community and school groups, activity books stressing the Chesapeake Bay and local waterways, and event booths at pertinent events;

- Partnering with counties and watershed groups;
- Messaging including:
  - Radio;
  - Interpretive signage at SHA rest stops;
  - Social media feeds;
  - Bumper stickers;
  - Press releases and articles; and
- Other activities as determined to augment littering awareness.
-

Recycling and Reuse Program

Reducing trash through recycling and reuse is a practice that can prevent littering and reduce waste. In support of the SHA Business Plan, the Environmental Compliance and Stewardship Key Performance Area launched the SHA Recycles Campaign on April 22, 2008 to raise awareness and encourage change in consumer culture throughout the organization. The goal of this campaign is to reduce waste and litter by making conservation a priority, reusing what was previously discarded, and recycling as much as possible.

The SHA Recycles Campaign is working to build a consortium of stakeholders across the entire SHA organization towards this collective goal. The campaign encourages all employees to give feedback on what can be done to save energy and fuel, reduce or eliminate waste, improve current recycling efforts, or change business practices to conserve resources. It provides education and outreach through displays and presentations at SHA events such as the Annual Earth Day Celebration, and office-wide training and recognition days.

A statewide Recycling Task Force has also been formed at SHA to examine key issues in recycling and identify ways to improve the SHA Statewide Recycling Program.

Litter Collection and Disposal

Litter is trash that is disposed of improperly. For SHA, a large quantity of litter is deposited along roadways. Collecting and removing litter to landfills is a practice necessary to keep Maryland's roadsides attractive, but is also a practice for meeting trash reduction requirements in TMDLs. SHA conducts the following programs for litter collection and disposal:

- Maintenance Crew Clean-ups – SHA's maintenance crews are responsible to perform a number of routine activities including litter clean-up (as well as mowing, plowing, and other activities to ensure safety and environmental stewardship) along the ROW. Litter clean-ups are performed regularly before mowing and supplemental clean-ups occur as needed or upon public request when possible.

- Contracted Crew Clean-ups – In addition to maintenance crew clean-ups, SHA's Office of Maintenance (OOM) also issues trash removal contracts for supplemental clean-ups along the ROW. Contractors include private companies and inmate cleaning crews. Contracts are awarded for designated roadway segments and contractors are required to pick up on a regular schedule.

- Adopt-A-Highway – SHA's Adopt-A-Highway Program utilizes volunteer groups that pick up litter along one to three mile stretches of non-interstate roadways. The groups are encouraged to perform this community service a minimum of four times per year for a two-year period.

- Sponsor-A-Highway – The Sponsor-A-Highway Program allows corporate sponsors to fund contracted clean-ups for one-mile sections of Maryland roadways. The sponsor has an agreement with a maintenance provider to remove litter from the sponsored highway segment. Segments are typically interstate roadways.

Illicit Discharge Detection and Elimination

SHA also has an Environmental Compliance Division (ECD) that manages SHA's Illicit Discharge Detection and Elimination (IDDE) program. Illicit discharges are defined as a storm drain that has measurable flow during dry weather containing pollutants or pathogens, and they have potential to contain harmful bacteria or other pollutants. SHA's IDDE program conducts regular inspections and testing for any suspected illicit discharge. Sampling does not directly test for bacteria and PCBs, but the testing does detect indicators of sewage, including phenol and detergents. If an illicit discharge is confirmed, the ECD works with local jurisdictions to disconnect the discharge from SHA's drainage system.

Geese/Waterfowl Prevention at Ponds

Waterfowl have been known to establish colonies at pond sites, particularly in large stormwater ponds with a permanent pool adjacent to grassy areas, or areas with attractive waterfowl habitat. As these colonies increase in size, overcrowding can result. In general, an overcrowded bird population in a pond creates high nutrient and bacteria loads from fecal material. Waterfowl are also known to carry pathogens that can be dangerous to humans. These pathogens include *Escherichia coli* (*E. coli)*, *Salmonella*, *Protozoan Cryptosporidium*, *Streptococcus*, and *Staphylococcus*. Two birds per acre of pond is a manageable number that will not result in significant property damage or water quality impairments (Clemson Cooperative Extension, 2015). Once the number of waterfowl exceed this ratio, control measures may be considered.

Generally, SHA ponds are not attractive to waterfowl because 'shore areas' are not maintained in a lawn condition. SHA inspects SWM control structures on a 3-year cycle and evidence of waterfowl infestation is taken into consideration. If a colony is identified, measures are undertaken to eradicate the colony in cooperation with the Maryland Department of Natural Resources (DNR).

Cattle Fencing and Pasture Stream Buffers

Cows and other pasture animals with open access to streams contribute to poor water quality, stream bank degradation, and erosion. As the animals walk through the water, they pollute the stream with manure, urine, and pathogens such as bacteria. Cattle can also consume and trample the vegetation on stream banks as they enter and exit the channel. The decrease in stream bank vegetation and associated root systems leads to an increased amount of sediment, pesticides, nutrients, and phosphorus entering into the water (Pennsylvania Association of Conservation Districts [PACD], 2009).

Installing fences or vegetative buffers limits the animal's access to stream banks and establishes a protective riparian buffer along the stream. The fencing helps to protect banks, allowing a natural riparian buffer to thrive. When there is space, additional vegetation can be planted to help establish a healthy riparian buffer. A riparian buffer is a vegetated area running parallel to a stream that helps limit runoff and protects the stream from farm animals. The riparian buffer traps sediment, pesticides, and nutrients before they enter the water while also helping to maintain a stable streambank. See **Figure 1-21** for examples of streams with and without cattle fencing.



Figure 1-21: Example of Stream Edge Treatments with and without Cattle Fencing

SHA does not own farmland or pasture land; however, SHA may use these strategies on stream restoration projects in rural areas if there is potential for the presence of cattle or horses. Farmers who implement cattle fencing and create riparian buffers on their property must do so on their own accord. Once implemented, farmers may utilize nutrient credit trading as discussed above in **Section E.7**.

Pet Waste Disposal Stations

A component of bacteria pollution can be attributed to pet waste. Dog feces have been found to contain *E. coli*, Giardia, *Salmonella*, and other microscopic pathogens (Vaughn, 2012). Dog feces are also very rich in nutrients. Some pet owners may not pick up after their pets. When the waste is left on a lawn or impervious surface, it washes into storm drains and nearby streams. Domestic pet waste accounts for 24% of the bacteria that pollute Maryland's urban and suburban waterways (Lazarick, 2013).

SHA has pet waste stations at highway rest areas and is collaborating with local jurisdictions to identify additional opportunities to install them in other locations. See **Figure 1-22** for an example of a pet waste disposal station.



Figure 1-22: Pet Waste Disposal Station at the I-70 Eastbound Rest Area and Welcome Center

Targeted Drainage System and Waterway Clean-ups

Trash, litter, dumping and other forms of debris are collected and removed from stream valleys and riparian areas. Participants can be composed of state worker, volunteers or contracted crew.

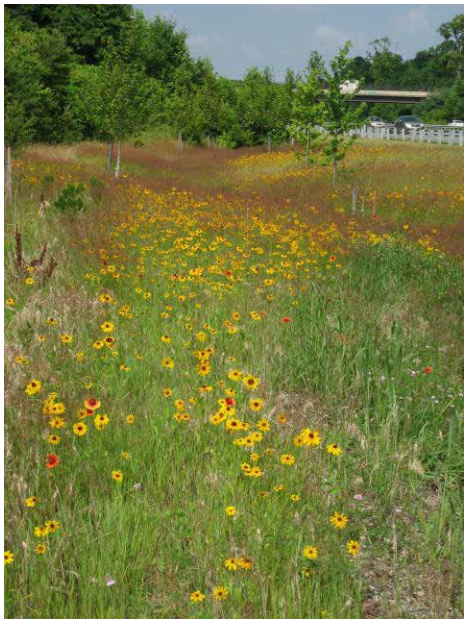
SHA
State Highway Administration
Maryland Department of Transportation

Part II

Impervious Restoration Plan & Chesapeake Bay TMDL Compliance







II. IMPERVIOUS RESTORATION PLAN AND CHESAPEAKE BAY TMDL COMPLIANCE

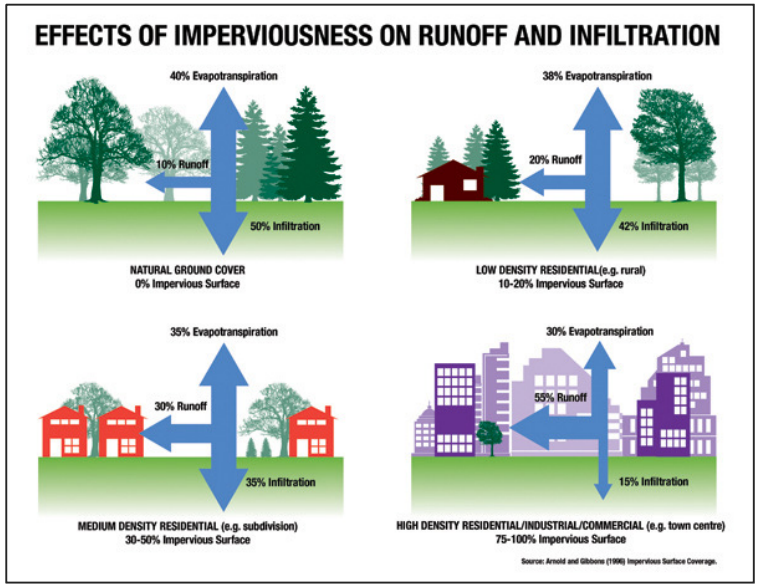


Figure 2-1: Effects of Imperviousness on Runoff and Infiltration
(Source: EPA, 2016)

A. URBANIZATION AND IMPERVIOUS SURFACE RESTORATION

Urbanization increases paved surfaces and decreases areas where rainfall can seep into the ground. This results in increased volumes and frequency of stormwater runoff because more water flows from impervious surfaces that had previously infiltrated into the ground (see **Figure 2-1**). Along with this runoff come pollutants including trash, organic debris and sediments that are picked up along the way. Often, urban runoff flows directly to waterways without being detained and treated to minimize pollutant discharges or to allow infiltration. By requiring MS4 jurisdictions to treat a portion of their existing impervious surfaces, EPA and MDE are seeking to offset increases in runoff and pollutant loading from past development. This will improve conditions in the waterways where these areas drain.


Park and Rides


Urban Interstates


Rural Interstates


Collector Roads


Rest Areas


Maintenance Shops/Offices

Figure 2-2: SHA Typical Impervious Surfaces

SHA owns and manages impervious surfaces in the form of interstate highways, arterial and collector roads, park and rides, rest areas, maintenance shops, material storage facilities, and offices. Examples of SHA impervious surfaces are shown in **Figure 2-2**.

SHA MS4 Permit Requirements

This part of the plan details SHA compliance for impervious restoration. Wording detailing this requirement taken from **Part III.E.2.a** of the SHA MS4 permit is copied below. Full wording from the permit for **Part III.E. Restoration Plans and TMDLs**, is included in **Part I, Program Introduction**.

Restoration Plans (Permit Part III.E.2.a)

Within one year of permit issuance, SHA shall submit an impervious surface area assessment consistent with the methods described in the MDE document "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, August 2014 or subsequent versions). Upon approval by MDE, this impervious surface area assessment shall serve as the baseline for the restoration efforts required in this permit.

By the end of this permit term, SHA shall commence and complete the implementation of restoration efforts for twenty percent of SHA's impervious surface area consistent with the methodology described in the MDE document cited in PART III.E.2.a. that has not already been restored to the MEP. Equivalent acres restored of impervious surfaces, through new retrofits or the retrofit of pre-2002 structural BMPs, shall be based upon the treatment of the WQv criteria and associated list of practices defined in the 2000 Maryland Stormwater Design Manual. For alternate BMPs, the basis for calculation of equivalent impervious acres restored is based upon the pollutant loads from forested cover.

By complying with the 20 percent impervious restoration requirement, SHA will also be accomplishing its part in restoring the Chesapeake Bay (Bay). The Bay TMDL was issued in December 2010 and Maryland issued its WIP I that same month (see **Part I, Program Introduction** for additional discussion). Wording from the SHA MS4 permit relating the 20 percent restoration requirement to Chesapeake Bay restoration is copied below.

Chesapeake Bay Restoration by 2025 (Permit Part VI.A)

A Chesapeake Bay TMDL has been developed by the EPA for the six Bay States (Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia) and the District of Columbia. The TMDL describes the level of effort that will be necessary for meeting water quality criteria and restoring the Chesapeake Bay. This permit is requiring compliance with the Chesapeake Bay TMDL through the use of a strategy that calls for the restoration of twenty percent of previously developed impervious land with little or no controls within this five year permit term as described in Maryland's Watershed Implementation Plan. The TMDL is an aggregate of nonpoint sources or the load allocations (LA), and point sources or WLAs, and a margin of safety. The State is required to issue NPDES permits to point source discharges that are consistent with the assumptions of any applicable TMDL, including those approved subsequent to permit issuance.

Urban stormwater is defined in the CWA as a point source discharge and will subsequently be a part of Maryland's Chesapeake Bay WLA. The NPDES stormwater permits can play a significant role in regulating pollutants from Maryland's urban sector and in the development of Chesapeake Bay

Watershed Implementation Plans. Therefore, Maryland's NPDES stormwater permits issued to SHA and other municipalities will require coordination with MDE's Watershed Implementation Plan and be used as the regulatory backbone for controlling urban pollutants toward meeting the Chesapeake Bay TMDL by 2025.

B. IMPERVIOUS AREA ASSESSMENT

An inventory of impervious surfaces (in acres) currently owned by SHA within the MS4 areas and an assessment to quantify those impervious surfaces that receive runoff treatment was performed. This inventory and assessment was used to compute the untreated acreage baseline and 20 percent treatment requirement. MDE and SHA agreed on the date of October 21, 2010 to define baseline treatment requirements. In other words, impervious surfaces, stormwater control structures and alternative restoration practices built prior to this date are used in this baseline inventory and assessment for calculating the amount of impervious surfaces that SHA is responsible for treating. The baseline development process and data are being compiled into a separate protocol and will be included in SHA's 2016 annual report. The results are:

- SHA owns 26,301 acres of impervious surfaces within the MS4 areas.
- Treated impervious surfaces total 2,705 acres.
- Untreated impervious surfaces total 23,596 acres (26,301 minus 2,705). This is the untreated surface baseline.
- 4,719 acres of impervious surfaces (23,596 multiplied by 0.2) must be treated or offset within the five year permit term by October 9, 2020. This is the baseline treatment requirement.

B.1. Impervious Surface Inventory

An inventory of SHA-owned impervious surfaces was conducted by producing a planning-level ROW GIS layer demarcating SHA-owned property and an impervious surface layer. The ROW layer was produced by extracting data from the MDP Property View GIS product and refining it with property boundary data from other sources such as recorded plats and ROW GIS data from other agencies. The ROW layer was then edited to contain only those surfaces within the MS4 areas.

The impervious surface layer was produced using high-resolution aerial imagery consistent with the baseline date of October 21, 2010. The layer was generated using the Feature Analyst toolset within GIS, along with desktop review and calibration, to produce polygons from the aerial imagery. This layer was then intersected with the ROW layer to create a GIS layer representing SHA's impervious surfaces within MS4 areas.

B.2.Baseline Runoff Treatment Assessment

Baseline runoff treatment is provided by restoration facilities built as a condition to the last MS4 permit (October 2005 to October 2010) and structural stormwater controls built under stormwater regulations for roadway development. To be consistent with the impervious inventory, only facilities built prior to October 21, 2010 were used.

A database of existing SHA-owned stormwater control structures, conveyances and drainage areas was developed by SHA under the previous MS4 permit database development, tracking and reporting requirement. There are 2,081 stormwater control structures that were constructed prior to the baseline date and used in this assessment. Runoff treatment for impervious surfaces located within the SHA ROW that is treated by stormwater control structures which are owned and operated by SHA are included. Also, restoration projects built under

the previous permit term including stream stabilization, stormwater control structure retrofits and outfall stabilization are included. There are 159 restoration BMPs including structural stormwater controls, tree planting, outfall stabilization and stream restoration in the baseline treatment assessment.

MDE requires all practices be inspected every three years and maintained as appropriate to ensure they function as designed. Before being included in the SHA baseline assessment of facilities providing runoff treatment, data associated with these practices were evaluated to ensure they meet requirements for inspection, maintenance and functionality. SHA has a maintenance program focused on performing major maintenance within three years after a failed inspection. SHA does not include practices that have required major maintenance for longer than three years unless the facility is included in a retrofit design and construction project that is programmed for completion within the permit term. SHA also does not include facilities that were not inspected within the three-year timeframe.

MDE also requires documentation including plans, design specifications and complete maintenance records in order to claim baseline or restoration credit. For baseline facilities, SHA has evaluated its records for existing stormwater control structures to determine if adequate documentation exists to demonstrate water quality treatment levels provided. In cases where records were not located, an analysis was performed using field surveys and accepted engineering computational standards to determine water quality treatment levels used in the baseline assessment. Documentation was produced to accompany these analyses and support runoff treatment assigned to these facilities. All documentation supporting treatment assessment are filed and associated with database records.

MDE allows removing impervious surfaces from the treatment requirement for areas that are considered to be “disconnected” from storm drain systems because they drain to open areas or channels. One method to employ this concept is the use of open section roads with swales that meet the grass swale criteria provided by MDE (2009a) (MDE, 2014a). An open section road is one where stormwater is not conveyed by closed storm drain systems but instead drains to open channels. SHA developed the *Existing Water Quality Grass Swale Identification Protocol* to document criteria used to evaluate existing open channels or ditches that meet these criteria. This protocol was initially approved by MDE on April 16, 2013 and was recently revised and approved by MDE on May 18, 2016. It is available on the SHA website.

An extensive inventory was undertaken within the MS4 areas along SHA ROW and open section roadways to identify, document, field verify and place open channels that qualify for this treatment credit into the SHA database. These open channels are considered to be structural stormwater controls and will be inspected according to the three-year requirement for other practices.

Lastly, MDE allows SHA to claim redevelopment credit and pavement removal associated with new roadway development against SHA’s baseline assessment and restoration treatment requirement (discussed in the following **Section C**). Redevelopment is a requirement of past and present stormwater regulations that currently requires 50 percent of existing impervious surfaces within a site development area to be included in the water quality volume calculations used in sizing the stormwater control structure. This existing impervious area that received runoff treatment for new roadway projects and impervious surfaces removed are subtracted from the baseline treatment requirement.

Figure 2-3 illustrates a GIS analysis of SHA roadways and stormwater control structures to determine impervious runoff treatment. The blue lines designate drainage areas associated with stormwater control structures. The yellow areas are SHA impervious surfaces draining to control structures and considered treated. The red areas are SHA impervious surfaces that are not draining to control structures or qualifying open channels and are considered untreated. The green areas are impervious surfaces outside of SHA ROW and not owned by SHA. Although these off-site areas fall within the drainage areas of

SHA structural stormwater controls, it was the practice in the past for SHA to treat only water quality volumes associated with SHA roadways and allow the volumes associated with these offsite areas to bypass the water quality treatment components of structural stormwater controls. Therefore, for the baseline development, these off-site areas are not included as SHA runoff treatment provided.



Figure 2-3: GIS Analysis of Impervious Accounting Categories

C. IMPERVIOUS TREATMENT

SHA determined 4,719 acres of existing impervious surfaces must be retrofitted for runoff treatment or offset by alternative practices. This is the 20 percent restoration requirement that must be met by October 9, 2020.

C.1. MEP Treatment Standard

In compliance with the CWA, the MS4 permit requires the use of structural stormwater controls or alternate practices to reduce the discharge of pollutants from SHA storm sewer systems to the MEP. The MEP standard for impervious restoration projects is treatment of the WQv. The WQv is defined as the storage needed to capture and treat runoff from 90% of the average annual rainfall and is equal to 1 inch in the Eastern Rainfall Zone (east of Frederick County) and 0.9 inch in the Western Rainfall Zone (west of and including Frederick County) in Maryland (MDE, 2009a).

MDE recognizes that not all of this restoration can be accomplished through the use to structural stormwater controls. Therefore, MDE has developed a list of alternative practices that are acceptable to offset the impacts of impervious surfaces in the areas they are constructed. These alternative practices are assigned impervious treatment equivalencies that can be used to determine the amount of impervious surfaces that are considered treated by these practices (see Table 7 in *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated*, MDE, 2014a).

Also, MDE allows for pro-rating of the treatment credit for practices that cannot meet the WQv. This means that if a facility treats less than the WQv, the credit will be reduced and if the facility treats more, the credit will be increased. For MDE-provided rates for reduction and increase, see MDE (2014a), *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Section III - BMP Implementation and Restoration Credits*.

C.2. Restoration Treatment Strategy

SHA developed a restoration implementation plan to meet the 4,719 acre treatment requirement. SHA began developing restoration projects in 2011 to comply with the Bay TMDL and Maryland WIP I,

which were issued in December 2010. MDE has allowed SHA to claim credit for restoration practices constructed between October 2010 and September 2015, prior to the current MS4 permit issue date of October 2015, against the 20 percent treatment requirement in the current permit.

SHA plans to meet the 20 percent treatment requirement through a combination of built practices, maintenance activities, redevelopment credit and credit trading (future practice) which are included in **Tables 2-2a-g** located at the end of this part starting on page 2-11. Each entry includes location information and estimated impervious runoff treatment acreages. **Figure 2-5** illustrates the mix of practices proposed and the amount of impervious restoration to be accomplished by each practice type. This is a draft plan and is contingent upon availability of sites for built projects. In instances where specific sites have not yet been identified for later years, the percentages of treatment to be provided by specific practices each year were estimated. Descriptions of the built and annual activity practices are included in **Part I.F. Restoration Practices**.

Figure 2-4 illustrates the current SHA impervious restoration plan by State fiscal year (FY). The State FY is from July 1 to June 30. For each FY over the permit duration, a certain number of practices will be built including tree planting, pavement removal, new stormwater control structures, retrofit stormwater control structures, stream restoration and outfall stabilization. Although it appears from the graph that restoration efforts will continue beyond the 2020 deadline into FY 2021, the deadline of October 9, 2020 is actually in the first quarter of FY 2021. The total built projects shown increases each year as more are constructed until a sufficient number are in place to meet the target acreages. Built practices, once in place, provide a defined amount of pollutant reduction and impervious restoration acreages each year. They must be inspected and maintained in order to ensure the original pollutant removal functions continue.

Figure 2-4 also illustrates maintenance activities such as inlet cleaning and street sweeping, which will be increased during the permit term to meet its ultimate impervious credit acreage goal as shown in **Table 2-2a**. Redevelopment is another practice shown that is currently estimated as SHA is developing the baseline redevelopment numbers now. Moving forward, redevelopment credit will be assessed for restoration credit as new roadway projects are built.

Progress Reporting and Adaptive Management

Annual reports will be submitted to MDE that will document progress in meeting proposed benchmarks. Each report will include a database and written description of compliance measures. If benchmarks are not being met, both the Bay TMDL and the MDE MS4 permit allow for adjustments in the plan to accommodate shortages. MDE (2014a) explains this adaptive management concept as follows:

> *With respect to permit compliance, MS4 jurisdictions are required to continuously re-evaluate, fine tune and adjust restoration efforts when established benchmarks cannot be met. Remaining on schedule to accomplish all permit conditions while continuously looking for opportunities to improve these efforts becomes a delicate balance. MS4 jurisdictions should carefully identify any delays in implementation schedules and provide a remedial action plan for current and future projects in order to facilitate restoration and improve program implementation. MDE will consider the level of restoration achieved and compare to implementation schedules and required benchmarks to determine compliance with permit requirements.* (p. 25)

SHA foresees adjustments in this plan being necessary and will provide an updated plan in each MS4 annual report that will identify new practices to be implemented while meeting the established overall 2020 restoration goal of 4,719 acres. Some of the means to fill gaps in implementation may include increased maintenance activities such as inlet cleaning and street sweeping; nutrient credit trading with associated impervious restoration equivalencies; partnerships with other agencies and organizations to implement practices off-site; or

revisions to practice protocols by the Bay Program or MDE that increase reductions allowed (see guidance listed in **Part I.E.1. Regulatory Guidance & Permitting**), research and implementation of new technologies or crediting methods.

Urban BMP Placement

As stated in **Part I.E.2. Urban Sector Focus,** a focus on urban areas is required with a minimum of half of the 20 percent restoration requirement (2,360 acres) accomplished with practices on SHA ROW or placing practices within urban land uses if placed off-site. The current strategy as illustrated in **Figure 2-5**, addresses this requirement with 96 percent (4,530 acres of impervious restoration) being urban focused and 4 percent (189 acres) implemented in non-urban areas such as rural, park, agricultural or conservation areas.

SHA has prepared a best management practice (BMP) placement protocol to outline this approach to locating BMPs for impervious treatment credit. Baseline practices do not have to comply with these criteria.

Per MDE (2014a), three categories of practices can be implemented to treat impervious surfaces. These include certain environmental site design (ESD) structural stormwater controls (MDE, 2009a, Chapter 5), non-ESD structural stormwater controls (MDE, 2009a, Chapter 3), and alternative practices (MDE, 2014a). For MDE's list of qualifying practices, see MDE (2014a), Table 5, and Table 7.

C.3. Restoration Treatment Assessment

Quantifying restoration treatment is similar to the baseline treatment assessment. SHA is maximizing the treatment that can be provided by each practice built. This is particularly true for structural stormwater controls that treat stormwater runoff directly. Some impervious surfaces that are not owned by SHA, but drain to and are treated by a SHA restoration practice. These areas are used to offset the SHA restoration requirement at a 1:1 ratio, unless an agreement is in place with the surrounding jurisdiction to split credit. Refering back to the example shown in **Figure 2-3**, the green areas would not be included in treatment accounting for the baseline assessment, but may be counted towards SHA restoration if the stormwater control structure was designed to include these areas at the MEP treatment rate (or prorated if the MEP is not met or exceeded).

SHA developed a website with an interactive map that the public can use to follow implementation progress and to explore projects in their area and throughout the eleven MS4 counties. The SHA Bay Restoration Viewer can be found at the link:

www.roads.maryland.gov/index.aspx?PageId=714

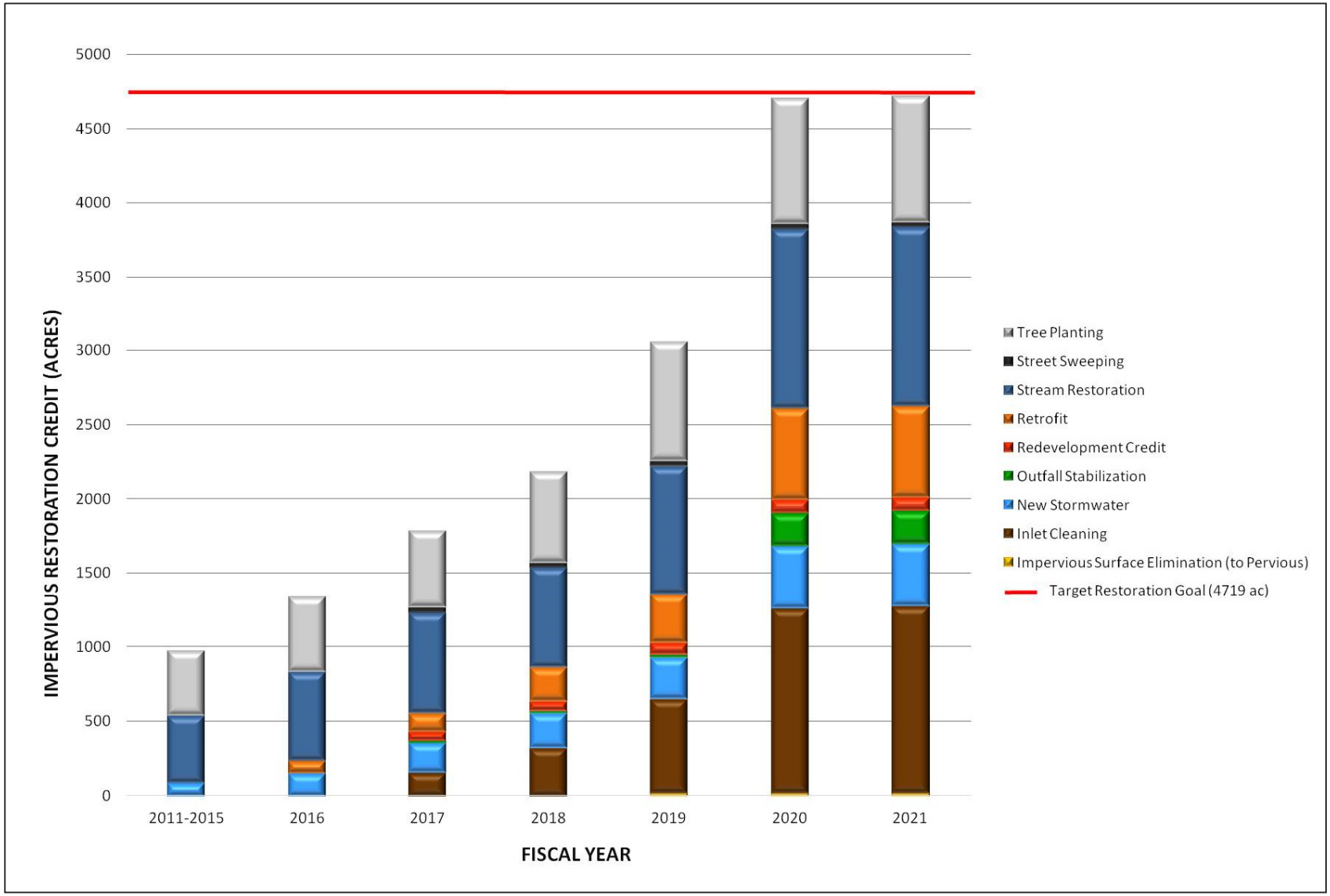


Figure 2-4: Restoration Plan by Fiscal Year with Practice Menu

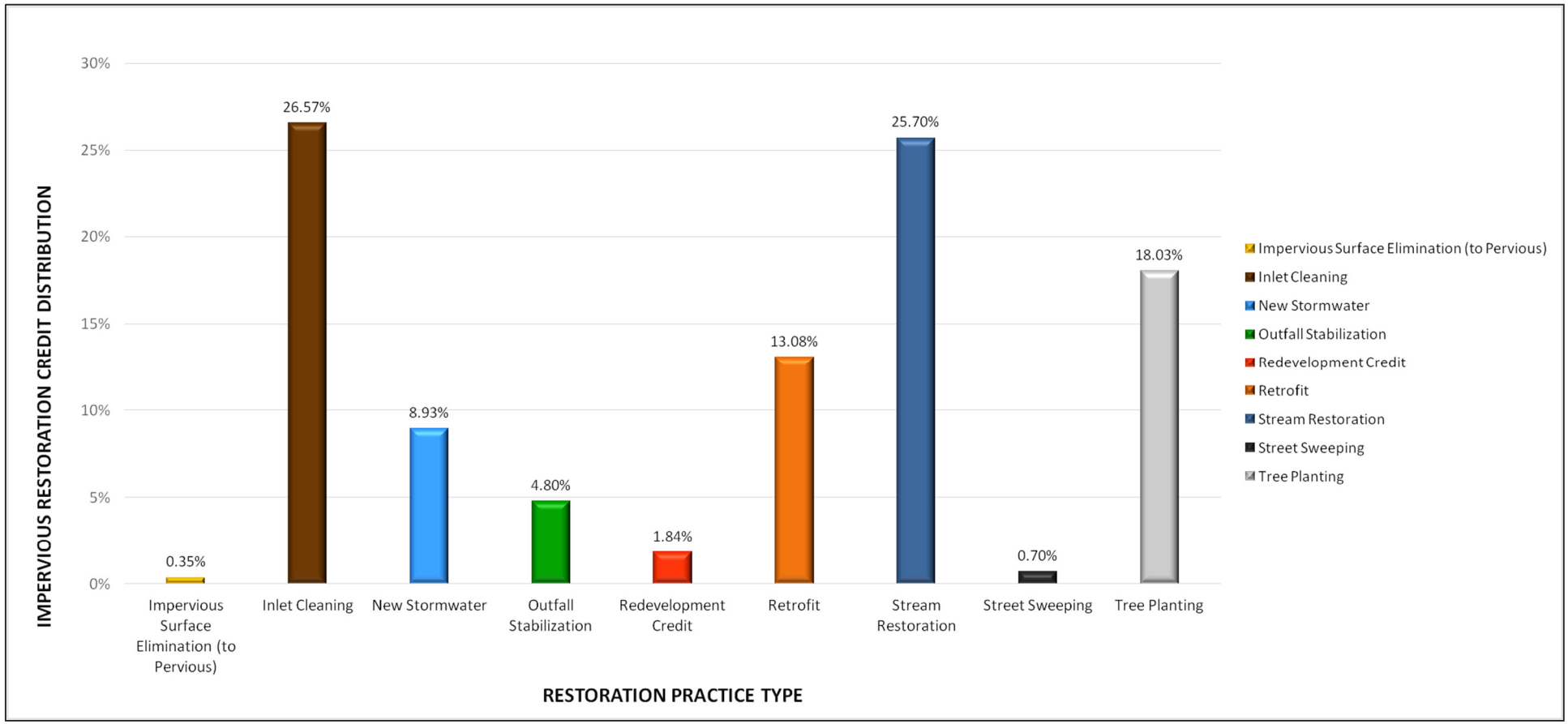


Figure 2-5 – Percent of Restoration Treatment Accomplished by Practice Type

D. SCHEDULE AND FUNDING

In order to meet the 20 percent impervious restoration requirement by October 9, 2020, a specific number of acres have been planned for treatment each year. **Table 2-1** shows the cumulative percentages of impervious treatment with projected funding for each fiscal year. The impervious treatment acres by fiscal year were determined based on the 20 percent restoration goal for 2020 and based on completed projects and preliminary planning efforts that assessed the feasibility of implementing various restoration strategies, along with the associated project design and construction schedules. Projected funding was determined based on the estimated costs to implement each strategy specific project over the permit term.

These funding projections are consistent with the Maryland Department of Transportation (MDOT) Consolidated Transportation Program (CTP) for FY 2016 to FY 2021, which is Maryland's six-year capital budget for transportation projects. In addition, the projected funding also accounts for operational activities. As SHA carries out this program, and it is anticipated that additional efficiencies will be realized in project implementation schedules and costs. FY funding projections will be adjusted, as necessary.

Table 2-1: Percentage of Impervious Treatment by Fiscal Year & Funding Allocations 2011-2021

Year (Fiscal)	Cumulative Percentage of Impervious Treatment Acres	Projected Funding Expenditures by Fiscal Year (Millions)
2011-15	4%	$96*
2016	6%	$53*
2017	8%	$82
2018	9%	$137
2019	13%	$115
2020	19%	$114
2021	20%	$114

** Funding Projections for FY 2011 – 2015 and FY 2016 are based on actual expenditures.*

E. COMPREHENSIVE LIST OF RESTORATION PRACTICES

Tables 2-2a through **2-2g** below provide a comprehensive list of annual operations practices and completed, programmed and planned built impervious restoration practices broken down by year. This list is based on preliminary baseline impervious estimates. Projects and information listed are subject to change and may be modified due to unforeseen circumstances. Revised lists will be provided annually in the MS4 annual reports.

Table 2-2a: Annual Operations Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
TBD	Inlet Cleaning	Area-wide	Area-wide	-	-	1254.00
TBD	Street Sweeping	Area-wide	Area-wide	-	-	33.00
					BMP Acreage Total	***1,287.00***

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15RST160827	Bio-Swale	Anacostia River	02140205	1351407.50	465774.38	0.71
SHA15RST160830	Other filtering	Anacostia River	02140205	1350635.97	471414.65	0.73
SHA15RST160831	Other filtering	Anacostia River	02140205	1350393.04	471576.67	0.63
SHA12ALN150011UR	Stream Restoration	Anacostia River	02140205	1301934.45	522509.00	60.11
SHA13ALN150001UR	Stream Restoration	Anacostia River	02140205	1318992.20	523679.42	20.26
SHA13ALN150005UR	Stream Restoration	Anacostia River	02140205	1316576.33	525649.66	5.46
SHA13ALN150007UR	Stream Restoration	Anacostia River	02140205	1317227.15	521754.47	27.89
SHA15ALN150002UR	Stream Restoration	Anacostia River	02140205	1314568.18	520991.45	7.12
SHA15ALN150006UR	Stream Restoration	Anacostia River	02140205	1314484.95	519141.73	20.14

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15ALN160001UR	Stream Restoration	Anacostia River	02140205	1331333.63	488003.24	64.50
SHA15ALN160006UR	Stream Restoration	Anacostia River	02140205	1339961.33	496289.99	12.09
SHA11APY160026UT	Tree Planting	Anacostia River	02140205	1352061.19	467688.94	0.49
SHA11APY160027UT	Tree Planting	Anacostia River	02140205	1352141.80	467418.88	0.68
SHA11APY160028UT	Tree Planting	Anacostia River	02140205	1351455.52	468071.17	0.41
SHA11APY160029UT	Tree Planting	Anacostia River	02140205	1351690.17	467482.25	0.33
SHA11APY160030UT	Tree Planting	Anacostia River	02140205	1352075.65	466380.48	0.01
SHA11APY160031UT	Tree Planting	Anacostia River	02140205	1352596.87	466642.38	0.83
SHA11APY160035UT	Tree Planting	Anacostia River	02140205	1352692.09	466700.81	0.02
SHA11APY160036UT	Tree Planting	Anacostia River	02140205	1352206.69	466394.37	0.29
SHA11APY160038UT	Tree Planting	Anacostia River	02140205	1352000.63	465975.88	0.34
SHA11APY160039UT	Tree Planting	Anacostia River	02140205	1352290.23	466025.48	0.33
SHA11APY160040UT	Tree Planting	Anacostia River	02140205	1352122.73	465896.17	0.30
SHA11APY160041UT	Tree Planting	Anacostia River	02140205	1352841.96	466064.61	0.82
SHA11APY160042UT	Tree Planting	Anacostia River	02140205	1352678.26	466347.94	0.40
SHA11APY160044UT	Tree Planting	Anacostia River	02140205	1353211.28	466060.52	0.58
SHA11APY160046UT	Tree Planting	Anacostia River	02140205	1353390.69	466206.86	0.16
SHA11APY160047UT	Tree Planting	Anacostia River	02140205	1353034.15	466596.61	0.02
SHA11APY160048UT	Tree Planting	Anacostia River	02140205	1353454.88	465968.37	0.11
SHA11APY160050UT	Tree Planting	Anacostia River	02140205	1352342.82	465492.74	0.50
SHA11APY160051UT	Tree Planting	Anacostia River	02140205	1352530.70	465609.45	0.09
SHA11APY160052UT	Tree Planting	Anacostia River	02140205	1352624.04	465228.68	0.43
SHA11APY160054UT	Tree Planting	Anacostia River	02140205	1352757.80	465033.64	0.03
SHA11APY160055UT	Tree Planting	Anacostia River	02140205	1352245.90	465318.31	0.03
SHA11APY160057UT	Tree Planting	Anacostia River	02140205	1352812.46	464484.61	0.88

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA11APY160058UT	Tree Planting	Anacostia River	02140205	1353067.60	465262.81	0.75
SHA11APY160062UT	Tree Planting	Anacostia River	02140205	1353029.12	465501.68	0.25
SHA11APY160066UT	Tree Planting	Anacostia River	02140205	1352959.16	465646.41	0.40
SHA11APY160070UT	Tree Planting	Anacostia River	02140205	1353298.37	464685.52	1.10
SHA11APY160073UT	Tree Planting	Anacostia River	02140205	1351734.36	465450.41	0.32
SHA11APY160075UT	Tree Planting	Anacostia River	02140205	1351939.56	465558.21	0.09
SHA11APY160076UT	Tree Planting	Anacostia River	02140205	1351250.14	465739.18	0.15
SHA11APY160080UT	Tree Planting	Anacostia River	02140205	1351883.65	466056.02	0.14
SHA12APY150003UT	Tree Planting	Anacostia River	02140205	1314488.31	501046.15	0.27
SHA12APY150004UT	Tree Planting	Anacostia River	02140205	1332389.18	525914.43	0.14
SHA13APY150031UT	Tree Planting	Anacostia River	02140205	1308005.37	491609.49	0.21
SHA13APY150032UT	Tree Planting	Anacostia River	02140205	1307813.51	491135.91	0.14
SHA13APY150033UT	Tree Planting	Anacostia River	02140205	1307349.92	491249.56	0.07
SHA13APY150034UT	Tree Planting	Anacostia River	02140205	1307474.08	491606.14	0.18
SHA13APY150035UT	Tree Planting	Anacostia River	02140205	1310770.67	490992.78	0.09
SHA13APY150036UT	Tree Planting	Anacostia River	02140205	1310487.31	491465.89	0.13
SHA13APY160102UT	Tree Planting	Anacostia River	02140205	1354524.14	456314.66	0.09
SHA15APY160237UT	Tree Planting	Anacostia River	02140205	1333406.54	504299.74	0.06
SHA15APY160240UT	Tree Planting	Anacostia River	02140205	1333231.02	506671.31	0.22
SHA15APY160241UT	Tree Planting	Anacostia River	02140205	1337796.26	509916.92	0.22
SHA15APY160242UT	Tree Planting	Anacostia River	02140205	1337515.33	509504.18	0.02
SHA14RST210208	Bio-Swale	Antietam Creek	02140502	1104369.94	723750.35	0.04
SHA14RST210209	Bio-Swale	Antietam Creek	02140502	1104220.60	723833.27	0.30
SHA13APY210013UT	Tree Planting	Antietam Creek	02140502	1120152.83	705259.65	0.65
SHA13APY210014UT	Tree Planting	Antietam Creek	02140502	1120408.82	704610.64	0.79

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY210015UT	Tree Planting	Antietam Creek	02140502	1140984.11	684443.07	0.52
SHA13APY210047UT	Tree Planting	Antietam Creek	02140502	1107164.41	706575.28	0.80
SHA13APY210048UT	Tree Planting	Antietam Creek	02140502	1107151.94	707459.48	0.91
SHA13APY210052UT	Tree Planting	Antietam Creek	02140502	1106616.81	706574.73	0.56
SHA13APY210429UT	Tree Planting	Antietam Creek	02140502	1120601.94	705206.92	0.29
SHA15APY210132UT	Tree Planting	Antietam Creek	02140502	1133525.41	691613.66	0.05
SHA15APY210133UT	Tree Planting	Antietam Creek	02140502	1130380.19	694054.42	0.37
SHA15APY210134UT	Tree Planting	Antietam Creek	02140502	1132358.29	692501.98	0.11
SHA15APY210160UT	Tree Planting	Antietam Creek	02140502	1139428.88	687005.86	0.07
SHA15APY210165UT	Tree Planting	Antietam Creek	02140502	1131751.81	692962.96	0.14
SHA15APY210166UT	Tree Planting	Antietam Creek	02140502	1129934.36	694629.57	0.09
SHA15APY210179UT	Tree Planting	Antietam Creek	02140502	1140341.44	685079.99	0.37
SHA15APY210180UT	Tree Planting	Antietam Creek	02140502	1139101.25	687111.63	0.16
SHA15APY210181UT	Tree Planting	Antietam Creek	02140502	1135284.92	690385.58	0.16
SHA15APY210182UT	Tree Planting	Antietam Creek	02140502	1128055.28	696281.29	0.15
SHA15APY210183UT	Tree Planting	Antietam Creek	02140502	1127036.98	697176.29	0.03
SHA15APY210184UT	Tree Planting	Antietam Creek	02140502	1125387.72	698623.13	0.12
SHA15APY210185UT	Tree Planting	Antietam Creek	02140502	1124882.92	699067.62	0.11
SHA15APY210186UT	Tree Planting	Antietam Creek	02140502	1124421.27	699473.96	0.08
SHA15APY210198UT	Tree Planting	Antietam Creek	02140502	1139267.80	687148.71	0.02
SHA15APY210200UT	Tree Planting	Antietam Creek	02140502	1132098.70	692678.97	0.23
SHA15APY210207UT	Tree Planting	Antietam Creek	02140502	1127681.36	702730.63	0.13
SHA15APY210322UT	Tree Planting	Antietam Creek	02140502	1132042.94	699774.17	0.02
SHA15APY210427UT	Tree Planting	Antietam Creek	02140502	1132094.99	699853.38	0.02
SHA12RST120311	Bio-Swale	Atkisson Reservoir	02130703	1502376.61	665487.15	0.28

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA12RST120312	Bio-Swale	Atkisson Reservoir	02130703	1502271.51	665734.93	0.15
SHA12RST120313	Bio-Swale	Atkisson Reservoir	02130703	1502070.85	666145.22	0.37
SHA12RST120314	Bio-Swale	Atkisson Reservoir	02130703	1501662.19	666988.51	0.24
SHA12RST120315	Bio-Swale	Atkisson Reservoir	02130703	1500831.05	668543.22	0.47
SHA12RST120317	Bio-Swale	Atkisson Reservoir	02130703	1500628.11	668852.22	0.28
SHA12RST120318	Bio-Swale	Atkisson Reservoir	02130703	1499725.25	669892.21	0.11
SHA12RST120321	Bio-Swale	Atkisson Reservoir	02130703	1498022.85	672843.42	0.29
SHA12RST120323	Bio-Swale	Atkisson Reservoir	02130703	1493501.31	678717.20	0.14
SHA12RST120324	Bio-Swale	Atkisson Reservoir	02130703	1491955.09	680092.26	0.21
SHA12RST120328	Bio-Swale	Atkisson Reservoir	02130703	1497203.17	675653.58	0.41
SHA13RST120341	Bio-Swale	Atkisson Reservoir	02130703	1498279.45	671823.76	0.85
SHA13RST120343	Bio-Swale	Atkisson Reservoir	02130703	1497857.42	673508.61	0.23
SHA13RST120345	Bio-Swale	Atkisson Reservoir	02130703	1496434.64	676471.63	0.73
SHA13RST120347	Bio-Swale	Atkisson Reservoir	02130703	1495875.08	676867.14	0.62
SHA13RST120349	Bio-Swale	Atkisson Reservoir	02130703	1492766.64	679362.50	0.35
SHA12RST120319	Micro-Bioretention	Atkisson Reservoir	02130703	1499156.95	670517.08	0.15
SHA12RST120320	Micro-Bioretention	Atkisson Reservoir	02130703	1499091.68	670589.61	0.94
SHA15ALN120001UR	Stream Restoration	Atkisson Reservoir	02130703	1498492.68	671619.73	21.00
SHA13APY120004UT	Tree Planting	Atkisson Reservoir	02130703	1489570.20	676160.32	0.34
SHA13APY120005UT	Tree Planting	Atkisson Reservoir	02130703	1490437.63	682264.78	0.40
SHA13APY120015UT	Tree Planting	Atkisson Reservoir	02130703	1490195.97	682807.29	0.39
SHA15APY120048UT	Tree Planting	Atkisson Reservoir	02130703	1477769.21	675145.34	0.13
SHA15APY120049UT	Tree Planting	Atkisson Reservoir	02130703	1480743.59	670767.10	0.25
SHA15APY120060UT	Tree Planting	Atkisson Reservoir	02130703	1460006.70	684545.19	0.48
SHA15APY120063UT	Tree Planting	Atkisson Reservoir	02130703	1488797.63	691580.73	0.06

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY120080UT	Tree Planting	Atkisson Reservoir	02130703	1477386.82	675308.51	0.39
SHA15APY120089UT	Tree Planting	Atkisson Reservoir	02130703	1489143.02	690950.11	0.04
SHA15APY120124UT	Tree Planting	Atkisson Reservoir	02130703	1498698.47	671219.80	0.11
SHA15APY120131UT	Tree Planting	Atkisson Reservoir	02130703	1488926.55	691357.13	0.05
SHA15APY120132UT	Tree Planting	Atkisson Reservoir	02130703	1472040.14	677979.89	0.12
SHA15APY120143UT	Tree Planting	Atkisson Reservoir	02130703	1471565.21	678216.40	0.12
SHA15APY120150UT	Tree Planting	Atkisson Reservoir	02130703	1457191.17	686954.66	0.05
SHA15APY120151UT	Tree Planting	Atkisson Reservoir	02130703	1459494.80	684984.19	0.13
SHA15APY120155UT	Tree Planting	Atkisson Reservoir	02130703	1453805.21	690718.24	0.13
SHA15APY120244UT	Tree Planting	Atkisson Reservoir	02130703	1499000.72	670838.59	0.15
SHA15APY070006UT	Tree Planting	Back Creek	02130604	1646149.21	678224.48	0.11
SHA15APY070007UT	Tree Planting	Back Creek	02130604	1645948.10	678261.61	0.17
SHA13APY030074UT	Tree Planting	Back River	02130901	1457628.91	602891.93	0.24
SHA13APY030075UT	Tree Planting	Back River	02130901	1452598.80	593477.62	0.30
SHA13APY030076UT	Tree Planting	Back River	02130901	1452968.09	593189.54	0.12
SHA13APY030077UT	Tree Planting	Back River	02130901	1453194.21	591601.21	0.15
SHA13APY030078UT	Tree Planting	Back River	02130901	1453131.45	591305.95	0.27
SHA13APY030079UT	Tree Planting	Back River	02130901	1454757.63	590267.30	0.28
SHA13APY030080UT	Tree Planting	Back River	02130901	1454810.83	590582.59	0.18
SHA13APY030081UT	Tree Planting	Back River	02130901	1455610.41	590027.32	0.80
SHA13APY030082UT	Tree Planting	Back River	02130901	1456972.23	589030.59	0.16
SHA13APY030084UT	Tree Planting	Back River	02130901	1461351.07	587583.47	0.22
SHA13APY030086UT	Tree Planting	Back River	02130901	1461871.51	586785.33	0.63
SHA13APY030088UT	Tree Planting	Back River	02130901	1464713.54	582732.88	0.11
SHA13APY030089UT	Tree Planting	Back River	02130901	1464701.47	583453.75	0.22

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY030090UT	Tree Planting	Back River	02130901	1466020.36	579013.55	0.11
SHA13APY030091UT	Tree Planting	Back River	02130901	1465637.31	578779.47	0.17
SHA13APY030092UT	Tree Planting	Back River	02130901	1466713.53	575886.19	0.27
SHA13APY030096UT	Tree Planting	Back River	02130901	1439600.40	630364.70	0.72
SHA13APY030098UT	Tree Planting	Back River	02130901	1439394.12	630642.89	0.42
SHA13APY030102UT	Tree Planting	Back River	02130901	1440456.81	630149.33	0.11
SHA13APY030103UT	Tree Planting	Back River	02130901	1440198.06	630401.47	0.24
SHA13APY030111UT	Tree Planting	Back River	02130901	1465548.57	602235.51	0.11
SHA13APY030112UT	Tree Planting	Back River	02130901	1465864.82	602344.28	0.14
SHA13APY030113UT	Tree Planting	Back River	02130901	1465809.04	601608.54	0.73
SHA13APY030114UT	Tree Planting	Back River	02130901	1452855.40	594583.82	0.30
SHA13APY030115UT	Tree Planting	Back River	02130901	1448436.59	592814.51	0.36
SHA13APY030116UT	Tree Planting	Back River	02130901	1449475.31	592798.14	0.26
SHA13APY030117UT	Tree Planting	Back River	02130901	1448959.12	592642.10	0.19
SHA13APY030118UT	Tree Planting	Back River	02130901	1448997.94	593028.67	0.31
SHA13APY030119UT	Tree Planting	Back River	02130901	1457183.43	606797.96	0.11
SHA13APY030120UT	Tree Planting	Back River	02130901	1456990.24	607519.61	0.16
SHA13APY030121UT	Tree Planting	Back River	02130901	1457215.22	607340.08	0.31
SHA13APY030125UT	Tree Planting	Back River	02130901	1461820.18	587235.68	0.12
SHA13APY030126UT	Tree Planting	Back River	02130901	1461214.03	587286.59	0.29
SHA13APY030128UT	Tree Planting	Back River	02130901	1474764.03	586174.13	0.83
SHA13APY030136UT	Tree Planting	Back River	02130901	1461684.09	586849.16	0.23
SHA13APY030137UT	Tree Planting	Back River	02130901	1461227.35	587355.56	0.06
SHA13APY030138UT	Tree Planting	Back River	02130901	1464619.62	583526.50	0.01
SHA15APY030147UT	Tree Planting	Back River	02130901	1453622.43	591496.70	0.22

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY030161UT	Tree Planting	Back River	02130901	1466152.86	578255.28	0.08
SHA15APY030162UT	Tree Planting	Back River	02130901	1465044.41	582711.07	1.12
SHA15APY030166UT	Tree Planting	Back River	02130901	1458144.44	606071.28	0.22
SHA15APY030167UT	Tree Planting	Back River	02130901	1463947.77	603483.10	0.17
SHA15APY030174UT	Tree Planting	Back River	02130901	1452493.91	617234.54	0.67
SHA15APY030179UT	Tree Planting	Back River	02130901	1452503.73	593503.27	0.24
SHA15APY030180UT	Tree Planting	Back River	02130901	1466619.21	600375.55	0.09
SHA15APY030181UT	Tree Planting	Back River	02130901	1466286.66	601142.73	0.12
SHA15APY030183UT	Tree Planting	Back River	02130901	1466359.98	601560.86	0.24
SHA15APY030186UT	Tree Planting	Back River	02130901	1466244.78	574372.59	0.82
SHA15APY030193UT	Tree Planting	Back River	02130901	1455652.58	609198.47	0.08
SHA15APY030196UT	Tree Planting	Back River	02130901	1449357.19	620682.41	0.78
SHA15APY030202UT	Tree Planting	Back River	02130901	1464555.53	583623.77	0.03
SHA15APY030213UT	Tree Planting	Back River	02130901	1452599.74	593859.59	0.15
SHA15APY030215UT	Tree Planting	Back River	02130901	1466481.50	600714.70	0.19
SHA15APY030217UT	Tree Planting	Back River	02130901	1466918.72	600266.97	0.14
SHA15APY030218UT	Tree Planting	Back River	02130901	1457873.89	606447.13	0.07
SHA15APY030222UT	Tree Planting	Back River	02130901	1464555.42	583701.67	0.05
SHA15APY030224UT	Tree Planting	Back River	02130901	1455725.71	609047.21	0.08
SHA15APY030226UT	Tree Planting	Back River	02130901	1463119.05	610805.60	0.06
SHA15APY030237UT	Tree Planting	Back River	02130901	1457922.37	589022.16	0.13
SHA15APY030240UT	Tree Planting	Back River	02130901	1456803.75	607288.21	0.10
SHA15APY030246UT	Tree Planting	Back River	02130901	1456145.26	608731.99	0.69
SHA12APY020026UT	Tree Planting	Baltimore Harbor	02130903	1414073.09	560508.99	0.21
SHA12APY020027UT	Tree Planting	Baltimore Harbor	02130903	1416479.51	559141.25	0.25

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA12APY020031UT	Tree Planting	Baltimore Harbor	02130903	1414819.95	548502.18	0.20
SHA12APY020032UT	Tree Planting	Baltimore Harbor	02130903	1412892.87	539411.06	0.06
SHA12APY020033UT	Tree Planting	Baltimore Harbor	02130903	1412892.18	539107.64	0.06
SHA12APY020034UT	Tree Planting	Baltimore Harbor	02130903	1412745.77	538097.93	0.94
SHA12APY020036UT	Tree Planting	Baltimore Harbor	02130903	1425259.14	559338.16	0.46
SHA12APY020037UT	Tree Planting	Baltimore Harbor	02130903	1424728.08	543776.64	0.71
SHA12APY020038UT	Tree Planting	Baltimore Harbor	02130903	1428988.45	535027.01	0.10
SHA12APY020039UT	Tree Planting	Baltimore Harbor	02130903	1425999.10	534883.09	0.30
SHA13APY020049UT	Tree Planting	Baltimore Harbor	02130903	1402585.94	540581.70	0.19
SHA13APY020050UT	Tree Planting	Baltimore Harbor	02130903	1412512.19	542357.03	0.72
SHA13APY020051UT	Tree Planting	Baltimore Harbor	02130903	1412517.48	541771.95	1.68
SHA13APY020052UT	Tree Planting	Baltimore Harbor	02130903	1413154.92	541661.42	0.65
SHA13APY020053UT	Tree Planting	Baltimore Harbor	02130903	1413289.47	540913.19	1.03
SHA13APY020054UT	Tree Planting	Baltimore Harbor	02130903	1413192.67	540500.48	0.74
SHA13APY020057UT	Tree Planting	Baltimore Harbor	02130903	1414041.14	547442.75	0.59
SHA13APY020058UT	Tree Planting	Baltimore Harbor	02130903	1415702.56	550692.61	0.08
SHA13APY020059UT	Tree Planting	Baltimore Harbor	02130903	1415504.09	550400.47	0.32
SHA13APY020060UT	Tree Planting	Baltimore Harbor	02130903	1407286.18	541636.60	0.39
SHA13APY020061UT	Tree Planting	Baltimore Harbor	02130903	1407739.82	541927.35	3.01
SHA13APY030083UT	Tree Planting	Baltimore Harbor	02130903	1461558.06	586668.11	0.11
SHA13APY030087UT	Tree Planting	Baltimore Harbor	02130903	1463652.13	584694.14	0.11
SHA15APY020417UT	Tree Planting	Baltimore Harbor	02130903	1429327.48	534651.05	0.16
SHA15APY030220UT	Tree Planting	Baltimore Harbor	02130903	1461139.05	586968.08	0.12
SHA12APY070001UT	Tree Planting	Big Elk Creek	02130606	1638458.05	748375.32	0.94
SHA12APY070002UT	Tree Planting	Big Elk Creek	02130606	1635514.30	745256.89	1.32

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY030158UT	Tree Planting	Bird River	02130803	1474334.16	619452.14	0.09
SHA15APY030164UT	Tree Planting	Bird River	02130803	1454997.80	624888.45	0.31
SHA15APY030176UT	Tree Planting	Bird River	02130803	1448378.18	625044.69	0.31
SHA15APY030187UT	Tree Planting	Bird River	02130803	1472948.15	621919.42	0.10
SHA15APY030190UT	Tree Planting	Bird River	02130803	1463071.03	624348.18	0.03
SHA15APY030200UT	Tree Planting	Bird River	02130803	1474734.80	618935.84	0.31
SHA15APY030204UT	Tree Planting	Bird River	02130803	1462751.74	624374.83	0.04
SHA15APY030212UT	Tree Planting	Bird River	02130803	1449896.59	624838.90	0.32
SHA14APY020414UT	Tree Planting	Bodkin Creek	02130902	1451420.59	529462.88	0.38
SHA14APY020419UT	Tree Planting	Bodkin Creek	02130902	1451596.19	529249.73	0.03
SHA14APY120023UT	Tree Planting	Broad Creek	02120205	1509934.36	736519.68	0.12
SHA14APY120024UT	Tree Planting	Broad Creek	02120205	1508305.21	737956.11	0.40
SHA14APY120025UT	Tree Planting	Broad Creek	02120205	1507899.78	738209.45	0.11
SHA14APY120026UT	Tree Planting	Broad Creek	02120205	1495795.18	748796.05	0.16
SHA14APY120037UT	Tree Planting	Broad Creek	02120205	1503638.29	739989.74	0.10
SHA14APY120040UT	Tree Planting	Broad Creek	02120205	1498331.34	742938.63	0.05
SHA14APY120050UT	Tree Planting	Broad Creek	02120205	1497121.17	748775.19	0.03
SHA14APY120070UT	Tree Planting	Broad Creek	02120205	1507296.18	738491.35	0.03
SHA14APY120071UT	Tree Planting	Broad Creek	02120205	1505694.95	739173.86	0.10
SHA14APY120072UT	Tree Planting	Broad Creek	02120205	1505652.78	739136.00	0.22
SHA14APY120074UT	Tree Planting	Broad Creek	02120205	1488840.43	739118.13	0.59
SHA14APY120075UT	Tree Planting	Broad Creek	02120205	1495877.79	746146.00	0.12
SHA14APY120076UT	Tree Planting	Broad Creek	02120205	1510563.41	736132.45	0.05
SHA14APY120084UT	Tree Planting	Broad Creek	02120205	1484811.21	734077.40	0.07
SHA14APY120086UT	Tree Planting	Broad Creek	02120205	1503616.45	740069.79	0.03

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA14APY120091UT	Tree Planting	Broad Creek	02120205	1496834.23	747662.71	0.03
SHA14APY120093UT	Tree Planting	Broad Creek	02120205	1497016.82	748315.90	0.01
SHA14APY120094UT	Tree Planting	Broad Creek	02120205	1488194.86	736375.06	0.31
SHA14APY120102UT	Tree Planting	Broad Creek	02120205	1509657.17	736685.98	0.02
SHA14APY120103UT	Tree Planting	Broad Creek	02120205	1505088.08	739363.91	0.06
SHA14APY120104UT	Tree Planting	Broad Creek	02120205	1501044.11	741361.86	0.09
SHA14APY120105UT	Tree Planting	Broad Creek	02120205	1490038.53	741275.96	0.36
SHA14APY120107UT	Tree Planting	Broad Creek	02120205	1484480.20	733924.14	0.25
SHA14APY120109UT	Tree Planting	Broad Creek	02120205	1495362.16	745621.08	0.18
SHA14APY120118UT	Tree Planting	Broad Creek	02120205	1507268.95	738447.42	0.07
SHA14APY120121UT	Tree Planting	Broad Creek	02120205	1486600.84	734519.33	1.61
SHA14APY120126UT	Tree Planting	Broad Creek	02120205	1504854.03	739486.99	0.05
SHA14APY120157UT	Tree Planting	Broad Creek	02120205	1495573.49	748642.61	0.22
SHA14APY120158UT	Tree Planting	Broad Creek	02120205	1495315.52	748630.37	0.46
SHA14APY120238UT	Tree Planting	Broad Creek	02120205	1487925.49	735451.20	0.61
SHA14APY120243UT	Tree Planting	Broad Creek	02120205	1489781.45	741229.96	0.05
SHA15APY120036UT	Tree Planting	Bush River	02130701	1528001.39	658675.28	0.12
SHA15APY120055UT	Tree Planting	Bush River	02130701	1526373.69	660131.26	0.89
SHA15APY120079UT	Tree Planting	Bush River	02130701	1526167.52	662873.35	0.10
SHA15APY120125UT	Tree Planting	Bush River	02130701	1522978.63	664224.59	0.08
SHA15APY120240UT	Tree Planting	Bush River	02130701	1525985.69	662636.47	0.17
SHA15APY120241UT	Tree Planting	Bush River	02130701	1525651.11	662201.37	0.53
SHA15APY120242UT	Tree Planting	Bush River	02130701	1525040.28	661916.83	0.04
SHA13APY120006UT	Tree Planting	Bynum Run	02130704	1490643.90	687365.42	0.41
SHA13APY120007UT	Tree Planting	Bynum Run	02130704	1490816.40	687997.22	0.26

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY120008UT	Tree Planting	Bynum Run	02130704	1490918.08	688304.21	0.18
SHA13APY120009UT	Tree Planting	Bynum Run	02130704	1491151.45	688593.95	0.52
SHA13APY120010UT	Tree Planting	Bynum Run	02130704	1491307.73	689025.17	1.28
SHA13APY120011UT	Tree Planting	Bynum Run	02130704	1490835.08	688818.01	0.29
SHA15APY120019UT	Tree Planting	Bynum Run	02130704	1488290.94	692453.92	0.09
SHA15APY120033UT	Tree Planting	Bynum Run	02130704	1491521.85	688697.84	0.24
SHA15APY120034UT	Tree Planting	Bynum Run	02130704	1494135.63	692014.57	1.32
SHA15APY120039UT	Tree Planting	Bynum Run	02130704	1495498.87	693595.13	0.63
SHA15APY120051UT	Tree Planting	Bynum Run	02130704	1495794.24	694345.10	0.20
SHA15APY120064UT	Tree Planting	Bynum Run	02130704	1488473.04	692141.85	0.05
SHA15APY120090UT	Tree Planting	Bynum Run	02130704	1497812.60	696181.64	0.15
SHA15APY120098UT	Tree Planting	Bynum Run	02130704	1487910.41	692960.72	0.18
SHA15APY120115UT	Tree Planting	Bynum Run	02130704	1495301.20	693231.55	0.46
SHA15APY120123UT	Tree Planting	Bynum Run	02130704	1493333.78	694030.34	0.21
SHA15APY120160UT	Tree Planting	Bynum Run	02130704	1487379.13	693555.09	0.16
SHA11APY150042UT	Tree Planting	Cabin John Creek	02140207	1279339.67	504922.27	0.01
SHA11APY150163UT	Tree Planting	Cabin John Creek	02140207	1279067.27	504584.49	0.11
SHA11APY150164UT	Tree Planting	Cabin John Creek	02140207	1279475.82	504668.49	0.11
SHA11APY150166UT	Tree Planting	Cabin John Creek	02140207	1278858.86	505316.28	0.08
SHA11APY150167UT	Tree Planting	Cabin John Creek	02140207	1278961.58	505134.96	0.04
SHA11APY100099UT	Tree Planting	Catoctin Creek	02140305	1169505.74	651984.53	0.08
SHA11APY100101UT	Tree Planting	Catoctin Creek	02140305	1168349.27	652883.15	0.13
SHA14APY100118UT	Tree Planting	Catoctin Creek	02140305	1167919.06	655530.58	0.23
SHA14APY100119UT	Tree Planting	Catoctin Creek	02140305	1157919.84	644787.44	0.21
SHA14APY100120UT	Tree Planting	Catoctin Creek	02140305	1157086.24	644166.66	0.19

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA14APY100121UT	Tree Planting	Catoctin Creek	02140305	1145840.64	635692.70	0.14
SHA14APY100423UT	Tree Planting	Catoctin Creek	02140305	1168086.11	655209.43	0.15
SHA14APY100424UT	Tree Planting	Catoctin Creek	02140305	1158187.73	645235.99	0.62
SHA15APY100135UT	Tree Planting	Catoctin Creek	02140305	1156195.64	616196.40	0.26
SHA15APY100136UT	Tree Planting	Catoctin Creek	02140305	1161084.22	616643.31	0.31
SHA15APY100140UT	Tree Planting	Catoctin Creek	02140305	1164888.96	660266.32	0.03
SHA15APY100144UT	Tree Planting	Catoctin Creek	02140305	1154858.25	664082.42	0.22
SHA15APY100145UT	Tree Planting	Catoctin Creek	02140305	1149897.42	668870.11	0.33
SHA15APY100147UT	Tree Planting	Catoctin Creek	02140305	1159176.02	616705.93	0.51
SHA15APY100148UT	Tree Planting	Catoctin Creek	02140305	1163363.89	617783.32	0.33
SHA15APY100152UT	Tree Planting	Catoctin Creek	02140305	1164640.61	660726.45	0.08
SHA15APY100155UT	Tree Planting	Catoctin Creek	02140305	1162065.32	616862.74	0.11
SHA15APY100164UT	Tree Planting	Catoctin Creek	02140305	1164972.33	656483.98	1.40
SHA15APY100165UT	Tree Planting	Catoctin Creek	02140305	1149437.35	668950.97	0.15
SHA15APY100178UT	Tree Planting	Catoctin Creek	02140305	1147460.79	615909.49	0.05
SHA15APY100179UT	Tree Planting	Catoctin Creek	02140305	1142710.12	615419.00	0.08
SHA15APY100180UT	Tree Planting	Catoctin Creek	02140305	1153628.89	615971.48	0.20
SHA15APY100194UT	Tree Planting	Catoctin Creek	02140305	1161795.23	616788.20	0.08
SHA15APY100202UT	Tree Planting	Catoctin Creek	02140305	1163356.30	657594.29	0.52
SHA15APY100213UT	Tree Planting	Catoctin Creek	02140305	1161741.33	617039.45	0.24
SHA15APY100224UT	Tree Planting	Catoctin Creek	02140305	1162055.75	617140.37	0.06
SHA15APY100234UT	Tree Planting	Catoctin Creek	02140305	1164442.06	617853.47	0.42
SHA15APY100434UT	Tree Planting	Catoctin Creek	02140305	1148259.76	615571.83	0.06
SHA15APY100435UT	Tree Planting	Catoctin Creek	02140305	1164455.73	660754.12	0.48
SHA15APY100437UT	Tree Planting	Catoctin Creek	02140305	1165324.90	655804.10	0.42

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY100438UT	Tree Planting	Catoctin Creek	02140305	1165851.93	655318.74	0.11
SHA15APY100439UT	Tree Planting	Catoctin Creek	02140305	1164287.44	656753.71	0.53
SHA14RST210199	Bio-Swale	Conococheague Creek	02140504	1100536.87	724394.35	0.29
SHA14RST210201	Bio-Swale	Conococheague Creek	02140504	1099538.18	724403.26	0.43
SHA14RST210202	Bio-Swale	Conococheague Creek	02140504	1099370.34	724396.24	0.19
SHA14RST210203	Bio-Swale	Conococheague Creek	02140504	1098562.08	724400.22	0.69
SHA14RST210204	Bio-Swale	Conococheague Creek	02140504	1099055.21	724417.05	0.17
SHA14RST210205	Bio-Swale	Conococheague Creek	02140504	1099019.33	724373.66	0.09
SHA14RST210216	Bio-Swale	Conococheague Creek	02140504	1103284.27	724310.12	0.28
SHA13APY210006UT	Tree Planting	Conococheague Creek	02140504	1072509.60	723658.47	1.04
SHA13APY210007UT	Tree Planting	Conococheague Creek	02140504	1074084.26	723195.89	0.55
SHA13APY210008UT	Tree Planting	Conococheague Creek	02140504	1076886.54	721768.06	0.49
SHA13APY210009UT	Tree Planting	Conococheague Creek	02140504	1090882.04	710895.17	0.58
SHA13APY210010UT	Tree Planting	Conococheague Creek	02140504	1091413.00	711161.86	0.70
SHA13APY210011UT	Tree Planting	Conococheague Creek	02140504	1091695.87	711421.33	0.35
SHA13APY210016UT	Tree Planting	Conococheague Creek	02140504	1066291.58	724040.98	1.30
SHA13APY210017UT	Tree Planting	Conococheague Creek	02140504	1068711.04	723767.43	0.84
SHA13APY210019UT	Tree Planting	Conococheague Creek	02140504	1064093.97	724014.56	0.18
SHA13APY210043UT	Tree Planting	Conococheague Creek	02140504	1101668.22	724620.22	0.56
SHA13APY210044UT	Tree Planting	Conococheague Creek	02140504	1103932.88	741712.89	0.37
SHA13APY210045UT	Tree Planting	Conococheague Creek	02140504	1104211.98	741218.01	1.15
SHA13APY210046UT	Tree Planting	Conococheague Creek	02140504	1104570.74	741452.21	0.45
SHA13APY210051UT	Tree Planting	Conococheague Creek	02140504	1102214.45	724547.94	0.19
SHA13APY210053UT	Tree Planting	Conococheague Creek	02140504	1087345.70	725787.57	0.63
SHA13APY210110UT	Tree Planting	Conococheague Creek	02140504	1063971.73	723990.32	0.09

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY210113UT	Tree Planting	Conococheague Creek	02140504	1094937.81	707479.90	0.37
SHA15APY210215UT	Tree Planting	Conococheague Creek	02140504	1095074.91	707230.63	0.69
SHA13APY120012UT	Tree Planting	Conowingo Dam	02120204	1537326.38	723257.59	0.23
SHA13ALN120002UR	Stream Restoration	Deer Creek	02120202	1446856.99	726476.19	11.60
SHA12APY030052UT	Tree Planting	Deer Creek	02120202	1409381.70	747721.02	0.43
SHA12APY030070UT	Tree Planting	Deer Creek	02120202	1411585.40	744495.85	0.49
SHA12APY030072UT	Tree Planting	Deer Creek	02120202	1410132.97	747803.45	0.19
SHA12APY120189UT	Tree Planting	Deer Creek	02120202	1517710.12	713190.20	2.81
SHA12APY120190UT	Tree Planting	Deer Creek	02120202	1516818.98	713696.61	4.94
SHA14APY120020UT	Tree Planting	Deer Creek	02120202	1535949.90	696567.77	0.54
SHA15APY030141UT	Tree Planting	Deer Creek	02120202	1412550.27	743570.70	1.02
SHA15APY030211UT	Tree Planting	Deer Creek	02120202	1410837.00	745808.99	0.02
SHA15APY030243UT	Tree Planting	Deer Creek	02120202	1409613.12	747772.10	0.08
SHA15APY030317UT	Tree Planting	Deer Creek	02120202	1410958.15	745567.74	0.19
SHA15APY120116UT	Tree Planting	Deer Creek	02120202	1498736.28	696961.68	0.63
SHA13APY060002UT	Tree Planting	Double Pipe Creek	02140304	1308122.59	694886.22	0.30
SHA13APY060003UT	Tree Planting	Double Pipe Creek	02140304	1303126.02	689293.82	0.23
SHA13APY060004UT	Tree Planting	Double Pipe Creek	02140304	1300840.47	688426.20	0.28
SHA13APY060005UT	Tree Planting	Double Pipe Creek	02140304	1285460.90	684002.07	0.22
SHA13APY060006UT	Tree Planting	Double Pipe Creek	02140304	1299048.09	703987.47	0.69
SHA13APY060007UT	Tree Planting	Double Pipe Creek	02140304	1296471.54	705577.44	0.80
SHA13APY060012UT	Tree Planting	Double Pipe Creek	02140304	1309853.57	698690.08	0.34
SHA13APY060013UT	Tree Planting	Double Pipe Creek	02140304	1309206.75	696189.24	0.17
SHA13APY060265UT	Tree Planting	Double Pipe Creek	02140304	1308493.22	695230.87	0.05
SHA13APY060266UT	Tree Planting	Double Pipe Creek	02140304	1306827.72	692969.45	0.14

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY060267UT	Tree Planting	Double Pipe Creek	02140304	1307700.12	694345.76	0.18
SHA13APY060268UT	Tree Planting	Double Pipe Creek	02140304	1307288.09	693649.58	0.14
SHA13APY060269UT	Tree Planting	Double Pipe Creek	02140304	1301748.38	688753.70	0.01
SHA13APY060270UT	Tree Planting	Double Pipe Creek	02140304	1299448.26	687435.74	0.09
SHA13APY060271UT	Tree Planting	Double Pipe Creek	02140304	1300285.66	688106.02	0.11
SHA13APY060272UT	Tree Planting	Double Pipe Creek	02140304	1299778.90	687722.43	0.08
SHA14APY060019UT	Tree Planting	Double Pipe Creek	02140304	1265638.37	693231.46	0.19
SHA14APY060020UT	Tree Planting	Double Pipe Creek	02140304	1276465.32	688476.39	0.43
SHA14APY060021UT	Tree Planting	Double Pipe Creek	02140304	1289081.45	684643.98	0.25
SHA14APY060022UT	Tree Planting	Double Pipe Creek	02140304	1293808.56	685322.46	0.73
SHA14APY060026UT	Tree Planting	Double Pipe Creek	02140304	1304418.98	690253.75	0.86
SHA14APY060027UT	Tree Planting	Double Pipe Creek	02140304	1306095.99	692076.39	0.45
SHA14APY060028UT	Tree Planting	Double Pipe Creek	02140304	1308682.09	695445.56	0.06
SHA14APY060038UT	Tree Planting	Double Pipe Creek	02140304	1290388.55	655446.27	0.27
SHA14APY060049UT	Tree Planting	Double Pipe Creek	02140304	1282106.55	715141.95	0.14
SHA14APY060273UT	Tree Planting	Double Pipe Creek	02140304	1305485.53	691444.67	0.39
SHA15APY060050UT	Tree Planting	Double Pipe Creek	02140304	1264650.12	693924.96	0.08
SHA15APY060051UT	Tree Planting	Double Pipe Creek	02140304	1265982.56	693176.79	0.18
SHA15APY060052UT	Tree Planting	Double Pipe Creek	02140304	1265750.75	693377.12	0.05
SHA15APY060053UT	Tree Planting	Double Pipe Creek	02140304	1267809.27	693124.20	0.82
SHA15APY060055UT	Tree Planting	Double Pipe Creek	02140304	1269719.68	692105.77	0.31
SHA15APY060073UT	Tree Planting	Double Pipe Creek	02140304	1287811.56	684369.33	0.54
SHA15APY060075UT	Tree Planting	Double Pipe Creek	02140304	1265149.11	693520.20	0.05
SHA15APY060077UT	Tree Planting	Double Pipe Creek	02140304	1266594.04	693318.08	0.11
SHA15APY060091UT	Tree Planting	Double Pipe Creek	02140304	1289553.89	684833.17	0.30

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY060092UT	Tree Planting	Double Pipe Creek	02140304	1285329.38	684008.75	0.08
SHA13RST070081	Bioretention	Furnace Bay	02130609	1585505.86	698599.62	0.55
SHA13RST070088	Bioretention	Furnace Bay	02130609	1591643.02	700416.58	0.67
SHA13RST070073	Bio-Swale	Furnace Bay	02130609	1581682.43	697593.18	0.53
SHA13RST070074	Bio-Swale	Furnace Bay	02130609	1582259.29	697744.61	0.46
SHA13RST070075	Bio-Swale	Furnace Bay	02130609	1582840.27	697890.42	0.64
SHA13RST070076	Bio-Swale	Furnace Bay	02130609	1583412.82	698048.16	0.56
SHA13RST070077	Bio-Swale	Furnace Bay	02130609	1584798.54	698411.17	1.15
SHA13RST070082	Bio-Swale	Furnace Bay	02130609	1586032.87	698739.02	0.82
SHA13RST070083	Bio-Swale	Furnace Bay	02130609	1587029.82	699002.22	0.37
SHA13RST070084	Bio-Swale	Furnace Bay	02130609	1587645.10	699168.23	0.74
SHA13RST070085	Bio-Swale	Furnace Bay	02130609	1589116.93	699557.42	0.92
SHA13RST070086	Bio-Swale	Furnace Bay	02130609	1590795.71	700053.92	0.69
SHA13RST070087	Bio-Swale	Furnace Bay	02130609	1591241.96	700235.96	0.27
SHA12APY030002UT	Tree Planting	Gunpowder River	02130801	1493177.29	617527.67	7.64
SHA13APY120003UT	Tree Planting	Gunpowder River	02130801	1507331.04	639625.43	0.07
SHA12APY030037UT	Tree Planting	Gwynns Falls	02130905	1382911.44	622499.44	0.20
SHA12APY030050UT	Tree Planting	Gwynns Falls	02130905	1379843.60	626869.94	2.95
SHA12APY030051UT	Tree Planting	Gwynns Falls	02130905	1380948.20	625708.52	1.29
SHA12APY030105UT	Tree Planting	Gwynns Falls	02130905	1384022.61	622383.23	0.38
SHA12APY030122UT	Tree Planting	Gwynns Falls	02130905	1387161.10	625552.59	0.28
SHA12APY030123UT	Tree Planting	Gwynns Falls	02130905	1387334.27	625355.74	0.28
SHA13APY030036UT	Tree Planting	Gwynns Falls	02130905	1364286.78	643730.81	0.24
SHA13APY030038UT	Tree Planting	Gwynns Falls	02130905	1382763.26	622893.45	0.33
SHA13APY030039UT	Tree Planting	Gwynns Falls	02130905	1382548.12	623509.66	1.41

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY030040UT	Tree Planting	Gwynns Falls	02130905	1379942.07	627413.40	0.59
SHA13APY030041UT	Tree Planting	Gwynns Falls	02130905	1377848.81	632976.56	0.26
SHA13APY030042UT	Tree Planting	Gwynns Falls	02130905	1374112.34	634596.81	0.30
SHA13APY030043UT	Tree Planting	Gwynns Falls	02130905	1373333.72	634905.71	0.13
SHA13APY030044UT	Tree Planting	Gwynns Falls	02130905	1371878.01	635692.93	0.50
SHA13APY030045UT	Tree Planting	Gwynns Falls	02130905	1370796.42	636421.96	0.18
SHA13APY030046UT	Tree Planting	Gwynns Falls	02130905	1362911.37	645868.21	0.19
SHA13APY030047UT	Tree Planting	Gwynns Falls	02130905	1362709.03	646094.39	0.09
SHA13APY030048UT	Tree Planting	Gwynns Falls	02130905	1360689.98	649166.45	0.27
SHA13APY030049UT	Tree Planting	Gwynns Falls	02130905	1371247.73	635138.80	0.64
SHA13APY030101UT	Tree Planting	Gwynns Falls	02130905	1384705.93	600013.96	0.25
SHA13APY030104UT	Tree Planting	Gwynns Falls	02130905	1384228.36	599366.12	0.41
SHA13APY030131UT	Tree Planting	Gwynns Falls	02130905	1384174.52	597592.82	1.55
SHA15APY030143UT	Tree Planting	Gwynns Falls	02130905	1372460.78	635941.35	0.70
SHA15APY030146UT	Tree Planting	Gwynns Falls	02130905	1370638.83	635408.94	0.18
SHA15APY030148UT	Tree Planting	Gwynns Falls	02130905	1369610.36	633240.85	0.23
SHA15APY030149UT	Tree Planting	Gwynns Falls	02130905	1383714.50	597472.94	0.08
SHA15APY030156UT	Tree Planting	Gwynns Falls	02130905	1381243.04	625266.58	0.11
SHA15APY030169UT	Tree Planting	Gwynns Falls	02130905	1382284.04	597378.67	0.14
SHA15APY030170UT	Tree Planting	Gwynns Falls	02130905	1380912.34	626380.35	0.50
SHA15APY030173UT	Tree Planting	Gwynns Falls	02130905	1378882.49	631283.42	0.09
SHA15APY030175UT	Tree Planting	Gwynns Falls	02130905	1381800.33	624006.27	0.02
SHA15APY030194UT	Tree Planting	Gwynns Falls	02130905	1384354.59	597766.16	0.26
SHA15APY030201UT	Tree Planting	Gwynns Falls	02130905	1379450.22	628308.94	0.13
SHA15APY030203UT	Tree Planting	Gwynns Falls	02130905	1369882.12	636897.95	0.09

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY030210UT	Tree Planting	Gwynns Falls	02130905	1379166.37	628366.94	0.15
SHA15APY030221UT	Tree Planting	Gwynns Falls	02130905	1379999.68	627450.88	0.31
SHA15APY030230UT	Tree Planting	Gwynns Falls	02130905	1362486.94	646628.28	0.78
SHA15APY030236UT	Tree Planting	Gwynns Falls	02130905	1385053.54	597375.67	0.06
SHA15APY030239UT	Tree Planting	Gwynns Falls	02130905	1385570.62	597344.22	0.59
SHA15APY030245UT	Tree Planting	Gwynns Falls	02130905	1381980.09	624625.24	0.12
SHA15APY030247UT	Tree Planting	Gwynns Falls	02130905	1380295.75	627108.12	0.31
SHA15APY030248UT	Tree Planting	Gwynns Falls	02130905	1374033.83	634899.64	0.20
SHA15APY030314UT	Tree Planting	Gwynns Falls	02130905	1385118.33	597975.00	0.13
SHA15APY030315UT	Tree Planting	Gwynns Falls	02130905	1385265.15	597662.14	0.67
SHA15APY030318UT	Tree Planting	Gwynns Falls	02130905	1378968.77	631022.82	0.14
SHA15APY030319UT	Tree Planting	Gwynns Falls	02130905	1379039.77	630769.44	0.03
SHA15APY030320UT	Tree Planting	Gwynns Falls	02130905	1381769.43	624219.96	0.16
SHA15APY030321UT	Tree Planting	Gwynns Falls	02130905	1372460.61	636316.48	0.08
SHA12APY030003UT	Tree Planting	Jones Falls	02130904	1407771.07	636532.76	0.22
SHA12APY030004UT	Tree Planting	Jones Falls	02130904	1407075.62	636451.23	0.01
SHA12APY030005UT	Tree Planting	Jones Falls	02130904	1406772.53	636888.01	0.08
SHA12APY030006UT	Tree Planting	Jones Falls	02130904	1406836.51	636377.15	0.31
SHA12APY030007UT	Tree Planting	Jones Falls	02130904	1407503.52	634585.38	0.74
SHA12APY030008UT	Tree Planting	Jones Falls	02130904	1407707.87	635185.25	0.55
SHA12APY030009UT	Tree Planting	Jones Falls	02130904	1407878.61	635296.45	0.03
SHA12APY030010UT	Tree Planting	Jones Falls	02130904	1408132.35	634394.62	0.07
SHA12APY030012UT	Tree Planting	Jones Falls	02130904	1407700.95	633455.23	0.21
SHA12APY030013UT	Tree Planting	Jones Falls	02130904	1407270.96	631607.30	0.50
SHA12APY030014UT	Tree Planting	Jones Falls	02130904	1407640.60	631563.44	0.15

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA12APY030015UT	Tree Planting	Jones Falls	02130904	1407108.26	631201.08	0.12
SHA12APY030016UT	Tree Planting	Jones Falls	02130904	1407264.45	627141.72	0.22
SHA12APY030017UT	Tree Planting	Jones Falls	02130904	1407509.06	626403.36	0.07
SHA12APY030018UT	Tree Planting	Jones Falls	02130904	1408099.47	624373.54	0.24
SHA12APY030019UT	Tree Planting	Jones Falls	02130904	1408257.61	623943.75	0.20
SHA12APY030020UT	Tree Planting	Jones Falls	02130904	1410226.44	622327.44	0.22
SHA12APY030056UT	Tree Planting	Jones Falls	02130904	1415474.85	645427.75	0.11
SHA12APY030099UT	Tree Planting	Jones Falls	02130904	1415304.64	638180.76	0.45
SHA12APY030106UT	Tree Planting	Jones Falls	02130904	1414503.67	638930.77	0.38
SHA12APY030107UT	Tree Planting	Jones Falls	02130904	1399793.01	629937.54	0.14
SHA12APY030381UT	Tree Planting	Jones Falls	02130904	1407929.56	634852.75	0.23
SHA13APY030035UT	Tree Planting	Jones Falls	02130904	1417102.52	637401.46	0.05
SHA13APY030100UT	Tree Planting	Jones Falls	02130904	1413560.40	638671.58	0.64
SHA13APY030382UT	Tree Planting	Jones Falls	02130904	1416860.49	636905.62	0.08
SHA15APY030157UT	Tree Planting	Jones Falls	02130904	1407488.38	634610.33	0.34
SHA15APY030177UT	Tree Planting	Jones Falls	02130904	1406266.91	634161.31	0.06
SHA15APY030178UT	Tree Planting	Jones Falls	02130904	1404489.46	633360.85	0.54
SHA15APY030199UT	Tree Planting	Jones Falls	02130904	1393906.85	628298.24	0.13
SHA15APY030229UT	Tree Planting	Jones Falls	02130904	1394000.31	628464.66	0.15
SHA15APY030252UT	Tree Planting	Jones Falls	02130904	1390816.27	628012.66	0.06
SHA12APY060001UI	Impervious Surface Elimination (to Pervious)	Liberty Reservoir	02130907	1337206.16	659925.07	0.12
SHA15APY030277UT	Tree Planting	Liberty Reservoir	02130907	1358223.99	657324.72	0.15
SHA12APY210001UT	Tree Planting	Little Conococheague	02140505	1044026.31	739608.82	1.62
SHA12APY210411UT	Tree Planting	Little Conococheague	02140505	1045260.24	739742.41	0.58
SHA13APY210018UT	Tree Planting	Little Conococheague	02140505	1063047.06	724036.45	0.43

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY210020UT	Tree Planting	Little Conococheague	02140505	1054405.60	724680.78	0.88
SHA13APY210021UT	Tree Planting	Little Conococheague	02140505	1062391.50	724084.84	0.44
SHA13APY210022UT	Tree Planting	Little Conococheague	02140505	1052796.97	723693.70	0.27
SHA13APY210025UT	Tree Planting	Little Conococheague	02140505	1052006.52	723813.46	1.78
SHA13APY210049UT	Tree Planting	Little Conococheague	02140505	1057511.84	724301.54	0.93
SHA13APY210112UT	Tree Planting	Little Conococheague	02140505	1049386.12	722843.92	0.07
SHA15APY070013UT	Tree Planting	Little Elk Creek	02130605	1634640.75	727993.36	0.43
SHA15APY070014UT	Tree Planting	Little Elk Creek	02130605	1634794.05	727288.83	0.23
SHA15APY070017UT	Tree Planting	Little Elk Creek	02130605	1626486.41	743236.13	0.04
SHA15APY070019UT	Tree Planting	Little Elk Creek	02130605	1634989.79	726929.55	0.12
SHA15APY070031UT	Tree Planting	Little Elk Creek	02130605	1636001.99	725455.96	0.05
SHA15APY070045UT	Tree Planting	Little Elk Creek	02130605	1621901.57	741429.27	0.34
SHA15APY070049UT	Tree Planting	Little Elk Creek	02130605	1635214.24	726643.91	0.22
SHA15APY070050UT	Tree Planting	Little Elk Creek	02130605	1636164.27	724979.33	0.13
SHA15APY070051UT	Tree Planting	Little Elk Creek	02130605	1636549.67	710679.22	0.13
SHA15APY070053UT	Tree Planting	Little Elk Creek	02130605	1634590.72	728649.32	0.06
SHA11APY120192UT	Tree Planting	Little Gunpowder Falls	02130804	1491059.15	636864.44	1.10
SHA11APY120193UT	Tree Planting	Little Gunpowder Falls	02130804	1491093.65	636473.82	0.56
SHA13APY120014UT	Tree Planting	Little Gunpowder Falls	02130804	1481637.40	668001.92	0.25
SHA15APY120041UT	Tree Planting	Little Gunpowder Falls	02130804	1470473.86	678739.87	0.15
SHA15APY120047UT	Tree Planting	Little Gunpowder Falls	02130804	1476810.60	675652.46	0.17
SHA15APY120058UT	Tree Planting	Little Gunpowder Falls	02130804	1469037.07	679527.80	0.31
SHA15APY120073UT	Tree Planting	Little Gunpowder Falls	02130804	1473085.02	677477.29	0.57
SHA15APY120092UT	Tree Planting	Little Gunpowder Falls	02130804	1469826.22	679098.11	0.22
SHA15APY120096UT	Tree Planting	Little Gunpowder Falls	02130804	1458410.01	685938.33	0.15

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY120128UT	Tree Planting	Little Gunpowder Falls	02130804	1458952.69	685472.50	0.02
SHA15APY120129UT	Tree Planting	Little Gunpowder Falls	02130804	1470115.49	678954.77	0.02
SHA15APY120135UT	Tree Planting	Little Gunpowder Falls	02130804	1463243.82	682814.07	0.09
SHA15APY120136UT	Tree Planting	Little Gunpowder Falls	02130804	1461137.34	683838.35	0.31
SHA15APY120137UT	Tree Planting	Little Gunpowder Falls	02130804	1466884.66	680756.88	0.05
SHA15APY120138UT	Tree Planting	Little Gunpowder Falls	02130804	1467947.54	680159.68	0.05
SHA15APY120239UT	Tree Planting	Little Gunpowder Falls	02130804	1469430.04	679305.14	0.03
SHA12RST130533	Bio-Swale	Little Patuxent River	02131105	1345933.32	589747.30	0.54
SHA12RST130536	Bio-Swale	Little Patuxent River	02131105	1347398.57	588812.45	0.37
SHA13RST130520	Bio-Swale	Little Patuxent River	02131105	1337694.83	595387.16	0.27
SHA13RST130521	Bio-Swale	Little Patuxent River	02131105	1338359.95	594794.79	0.42
SHA13RST130522	Bio-Swale	Little Patuxent River	02131105	1339273.01	593986.16	0.73
SHA13RST130524	Bio-Swale	Little Patuxent River	02131105	1340679.88	592936.85	0.48
SHA13RST130525	Bio-Swale	Little Patuxent River	02131105	1341143.35	592657.97	0.41
SHA13RST130526	Bio-Swale	Little Patuxent River	02131105	1341850.72	592227.52	0.35
SHA13RST130527	Bio-Swale	Little Patuxent River	02131105	1342405.47	591891.33	0.51
SHA13RST130528	Bio-Swale	Little Patuxent River	02131105	1343023.06	591514.63	0.54
SHA13RST130529	Bio-Swale	Little Patuxent River	02131105	1343215.82	591399.68	0.45
SHA13RST130530	Bio-Swale	Little Patuxent River	02131105	1345255.29	590173.09	0.42
SHA13RST130534	Bio-Swale	Little Patuxent River	02131105	1346897.27	589154.67	0.94
SHA13RST130539	Bio-Swale	Little Patuxent River	02131105	1340511.57	593045.12	0.42
SHA15RST021449	Bio-Swale	Little Patuxent River	02131105	1397152.19	484147.70	1.00
SHA15RST021450	Bio-Swale	Little Patuxent River	02131105	1397285.41	484794.66	0.37
SHA15RST021451	Bio-Swale	Little Patuxent River	02131105	1397362.06	485178.52	0.23
SHA15RST130544	Bio-Swale	Little Patuxent River	02131105	1359485.56	544810.13	0.31

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15RST130546	Bio-Swale	Little Patuxent River	02131105	1362676.87	539429.52	0.49
SHA15RST130549	Bio-Swale	Little Patuxent River	02131105	1364223.71	537209.08	0.95
SHA15RST130551	Bio-Swale	Little Patuxent River	02131105	1364899.58	536671.23	0.38
SHA15RST130552	Bio-Swale	Little Patuxent River	02131105	1367619.88	534617.46	0.20
SHA15RST130568	Bio-Swale	Little Patuxent River	02131105	1355275.72	548315.94	0.12
SHA15RST130569	Bio-Swale	Little Patuxent River	02131105	1355416.62	548449.12	0.37
SHA15RST130570	Bio-Swale	Little Patuxent River	02131105	1357538.11	546839.34	0.30
SHA15RST130571	Bio-Swale	Little Patuxent River	02131105	1355416.62	548449.12	0.39
SHA15RST130572	Bio-Swale	Little Patuxent River	02131105	1353636.62	549070.28	0.44
SHA15RST130573	Bio-Swale	Little Patuxent River	02131105	1354038.46	548876.19	0.20
SHA15RST130574	Bio-Swale	Little Patuxent River	02131105	1354334.68	548742.53	0.20
SHA15RST130575	Bio-Swale	Little Patuxent River	02131105	1354788.31	548536.87	0.20
SHA15RST130576	Bio-Swale	Little Patuxent River	02131105	1353742.58	549214.79	0.36
SHA15RST130577	Bio-Swale	Little Patuxent River	02131105	1352791.07	549651.66	0.31
SHA13RST130532	Micro-Bioretention	Little Patuxent River	02131105	1345711.80	589881.24	0.46
SHA12ALN130002UR	Stream Restoration	Little Patuxent River	02131105	1373209.42	539038.06	19.73
SHA12ALN130004UR	Stream Restoration	Little Patuxent River	02131105	1365244.13	571640.31	10.44
SHA15ALN130001UR	Stream Restoration	Little Patuxent River	02131105	1354631.24	581541.76	45.00
SHA11APY130011UT	Tree Planting	Little Patuxent River	02131105	1351515.73	550115.79	1.66
SHA11APY130012UT	Tree Planting	Little Patuxent River	02131105	1354022.50	548424.49	0.11
SHA11APY130017UT	Tree Planting	Little Patuxent River	02131105	1343014.55	597000.63	0.14
SHA11APY130019UT	Tree Planting	Little Patuxent River	02131105	1362439.59	577061.48	1.69
SHA11APY130020UT	Tree Planting	Little Patuxent River	02131105	1365151.86	570751.60	0.43
SHA11APY130024UT	Tree Planting	Little Patuxent River	02131105	1364544.19	573107.68	0.32
SHA11APY130025UT	Tree Planting	Little Patuxent River	02131105	1341228.50	539134.59	0.64

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA11APY130029UT	Tree Planting	Little Patuxent River	02131105	1342308.41	538172.84	0.12
SHA11APY130030UT	Tree Planting	Little Patuxent River	02131105	1343770.92	538418.84	0.03
SHA11APY130031UT	Tree Planting	Little Patuxent River	02131105	1344035.47	538362.82	0.02
SHA11APY130032UT	Tree Planting	Little Patuxent River	02131105	1344717.82	537996.32	0.05
SHA11APY130033UT	Tree Planting	Little Patuxent River	02131105	1344817.70	538101.19	0.06
SHA11APY130034UT	Tree Planting	Little Patuxent River	02131105	1345460.12	537678.87	0.09
SHA11APY130035UT	Tree Planting	Little Patuxent River	02131105	1346559.31	537122.67	0.15
SHA11APY130036UT	Tree Planting	Little Patuxent River	02131105	1347915.78	536413.72	0.09
SHA11APY130038UT	Tree Planting	Little Patuxent River	02131105	1364344.40	575127.98	0.25
SHA11APY130039UT	Tree Planting	Little Patuxent River	02131105	1354039.91	548973.24	1.98
SHA11APY130040UT	Tree Planting	Little Patuxent River	02131105	1340985.54	538725.67	1.16
SHA11APY130126UT	Tree Planting	Little Patuxent River	02131105	1340772.84	538551.82	0.05
SHA11APY130200UT	Tree Planting	Little Patuxent River	02131105	1344069.27	543054.47	0.44
SHA11APY130202UT	Tree Planting	Little Patuxent River	02131105	1355233.61	548430.86	2.00
SHA11APY130205UT	Tree Planting	Little Patuxent River	02131105	1352516.62	549662.74	1.54
SHA11APY130207UT	Tree Planting	Little Patuxent River	02131105	1364920.91	572001.85	0.28
SHA11APY130214UT	Tree Planting	Little Patuxent River	02131105	1364557.08	573386.61	0.21
SHA12APY130002UT	Tree Planting	Little Patuxent River	02131105	1343569.47	543312.92	0.11
SHA12APY130004UT	Tree Planting	Little Patuxent River	02131105	1347683.40	551012.61	0.21
SHA12APY130005UT	Tree Planting	Little Patuxent River	02131105	1351756.12	558300.91	0.23
SHA12APY130008UT	Tree Planting	Little Patuxent River	02131105	1362794.92	577518.81	0.72
SHA12APY130009UT	Tree Planting	Little Patuxent River	02131105	1363140.76	576922.21	0.40
SHA12APY130010UT	Tree Planting	Little Patuxent River	02131105	1362360.17	577588.24	0.75
SHA12APY130125UT	Tree Planting	Little Patuxent River	02131105	1347562.77	550790.87	0.08
SHA12APY130215UT	Tree Planting	Little Patuxent River	02131105	1343408.37	542917.17	0.00

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA12APY130216UT	Tree Planting	Little Patuxent River	02131105	1343485.31	543004.26	0.01
SHA13APY130068UT	Tree Planting	Little Patuxent River	02131105	1365258.77	555678.64	0.25
SHA13APY130069UT	Tree Planting	Little Patuxent River	02131105	1365378.45	555341.76	0.59
SHA13APY130070UT	Tree Planting	Little Patuxent River	02131105	1365854.20	555023.24	0.14
SHA13APY130077UT	Tree Planting	Little Patuxent River	02131105	1366018.46	536340.40	0.71
SHA13APY130078UT	Tree Planting	Little Patuxent River	02131105	1365144.06	536032.87	0.79
SHA13APY130079UT	Tree Planting	Little Patuxent River	02131105	1365655.39	535662.39	0.61
SHA13APY130081UT	Tree Planting	Little Patuxent River	02131105	1357994.03	572832.87	0.49
SHA13APY130082UT	Tree Planting	Little Patuxent River	02131105	1356483.77	568419.86	0.05
SHA13APY130083UT	Tree Planting	Little Patuxent River	02131105	1356610.45	568745.86	0.15
SHA13APY130084UT	Tree Planting	Little Patuxent River	02131105	1356461.76	568076.43	0.08
SHA13APY130085UT	Tree Planting	Little Patuxent River	02131105	1349779.71	555036.18	0.07
SHA13APY130088UT	Tree Planting	Little Patuxent River	02131105	1348272.21	552223.10	0.07
SHA13APY130089UT	Tree Planting	Little Patuxent River	02131105	1348087.24	551226.72	0.24
SHA13APY130090UT	Tree Planting	Little Patuxent River	02131105	1336770.69	596491.28	0.24
SHA13APY130091UT	Tree Planting	Little Patuxent River	02131105	1336224.60	596627.44	0.34
SHA13APY130095UT	Tree Planting	Little Patuxent River	02131105	1348253.30	536247.79	0.06
SHA13APY130096UT	Tree Planting	Little Patuxent River	02131105	1345708.18	537722.38	0.20
SHA13APY130097UT	Tree Planting	Little Patuxent River	02131105	1343117.37	538304.47	0.06
SHA13APY130098UT	Tree Planting	Little Patuxent River	02131105	1343552.15	538280.83	0.05
SHA13APY130099UT	Tree Planting	Little Patuxent River	02131105	1343789.62	538225.91	0.01
SHA14APY130135UT	Tree Planting	Little Patuxent River	02131105	1364928.70	536327.04	0.43
SHA14APY130137UT	Tree Planting	Little Patuxent River	02131105	1347388.32	551564.59	0.68
SHA14APY130140UT	Tree Planting	Little Patuxent River	02131105	1356066.11	567066.90	0.30
SHA14APY130142UT	Tree Planting	Little Patuxent River	02131105	1364028.02	575301.83	0.23

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA14APY130143UT	Tree Planting	Little Patuxent River	02131105	1363921.13	575087.14	0.19
SHA14APY130144UT	Tree Planting	Little Patuxent River	02131105	1364310.73	575645.04	0.23
SHA14APY130148UT	Tree Planting	Little Patuxent River	02131105	1364815.95	573736.95	0.09
SHA14APY130150UT	Tree Planting	Little Patuxent River	02131105	1365326.96	556165.38	0.95
SHA14APY130155UT	Tree Planting	Little Patuxent River	02131105	1361910.44	541057.01	0.11
SHA14APY130156UT	Tree Planting	Little Patuxent River	02131105	1368873.47	533226.82	1.60
SHA14APY130157UT	Tree Planting	Little Patuxent River	02131105	1369147.12	533554.69	0.15
SHA14APY130158UT	Tree Planting	Little Patuxent River	02131105	1366330.77	535969.98	0.57
SHA14APY130159UT	Tree Planting	Little Patuxent River	02131105	1357379.13	547196.81	0.37
SHA14APY130164UT	Tree Planting	Little Patuxent River	02131105	1363230.29	576120.40	1.69
SHA14APY130165UT	Tree Planting	Little Patuxent River	02131105	1364054.08	576151.36	0.73
SHA14APY130166UT	Tree Planting	Little Patuxent River	02131105	1370532.16	552301.61	0.70
SHA14APY130167UT	Tree Planting	Little Patuxent River	02131105	1341758.17	538738.58	1.94
SHA14APY130168UT	Tree Planting	Little Patuxent River	02131105	1370783.47	532269.20	0.40
SHA14APY130170UT	Tree Planting	Little Patuxent River	02131105	1348784.92	553769.45	0.12
SHA14APY130171UT	Tree Planting	Little Patuxent River	02131105	1364133.42	557201.29	0.50
SHA14APY130179UT	Tree Planting	Little Patuxent River	02131105	1360767.52	543021.38	0.39
SHA14APY130180UT	Tree Planting	Little Patuxent River	02131105	1370842.25	531851.41	0.85
SHA14APY130181UT	Tree Planting	Little Patuxent River	02131105	1367692.74	534780.41	0.45
SHA14APY130189UT	Tree Planting	Little Patuxent River	02131105	1347561.29	551504.66	0.29
SHA14APY130190UT	Tree Planting	Little Patuxent River	02131105	1347560.32	551689.87	0.25
SHA14APY130191UT	Tree Planting	Little Patuxent River	02131105	1364106.10	557830.58	0.15
SHA14APY130219UT	Tree Planting	Little Patuxent River	02131105	1365160.94	535759.84	0.09
SHA13APY210030UT	Tree Planting	Little Tonoloway Creek	02140509	978823.74	745019.85	0.54
SHA13APY210032UT	Tree Planting	Little Tonoloway Creek	02140509	978353.52	747032.93	0.70

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY210033UT	Tree Planting	Little Tonoloway Creek	02140509	977343.26	747663.24	0.73
SHA13APY210034UT	Tree Planting	Little Tonoloway Creek	02140509	979015.13	745822.10	0.37
SHA13APY210035UT	Tree Planting	Little Tonoloway Creek	02140509	978877.40	745543.61	0.33
SHA13APY210036UT	Tree Planting	Little Tonoloway Creek	02140509	978138.84	748539.34	0.85
SHA13APY210037UT	Tree Planting	Little Tonoloway Creek	02140509	977759.70	748016.10	0.48
SHA13APY210038UT	Tree Planting	Little Tonoloway Creek	02140509	952177.36	748190.91	0.91
SHA13APY210039UT	Tree Planting	Little Tonoloway Creek	02140509	961255.58	742141.56	0.27
SHA13APY210040UT	Tree Planting	Little Tonoloway Creek	02140509	961696.52	742116.85	0.25
SHA13APY210041UT	Tree Planting	Little Tonoloway Creek	02140509	966262.36	747703.80	0.25
SHA13APY210042UT	Tree Planting	Little Tonoloway Creek	02140509	966684.76	747751.22	0.12
SHA13RST030570	Bio-Swale	Loch Raven Reservoir	02130805	1413320.53	739954.12	0.12
SHA13RST030571	Bio-Swale	Loch Raven Reservoir	02130805	1413156.72	739336.72	0.23
SHA13RST030572	Bio-Swale	Loch Raven Reservoir	02130805	1412562.54	737140.97	0.25
SHA13RST030573	Bio-Swale	Loch Raven Reservoir	02130805	1412454.70	736705.59	0.07
SHA13RST030574	Bio-Swale	Loch Raven Reservoir	02130805	1412419.92	736552.19	0.39
SHA13RST030575	Bio-Swale	Loch Raven Reservoir	02130805	1412282.22	735556.97	1.04
SHA13RST030576	Bio-Swale	Loch Raven Reservoir	02130805	1412344.63	734022.19	0.23
SHA13RST030577	Bio-Swale	Loch Raven Reservoir	02130805	1412394.37	733262.69	0.77
SHA13RST030578	Bio-Swale	Loch Raven Reservoir	02130805	1412392.93	732267.44	1.08
SHA13RST030580	Bio-Swale	Loch Raven Reservoir	02130805	1411816.14	729999.99	0.16
SHA13RST030581	Bio-Swale	Loch Raven Reservoir	02130805	1411505.04	729047.72	0.20
SHA13RST030582	Bio-Swale	Loch Raven Reservoir	02130805	1411182.01	728052.18	0.19
SHA13RST030583	Bio-Swale	Loch Raven Reservoir	02130805	1410826.25	726956.62	0.22
SHA13RST030584	Bio-Swale	Loch Raven Reservoir	02130805	1410585.32	726215.33	0.21
SHA13RST030585	Bio-Swale	Loch Raven Reservoir	02130805	1410311.41	725567.14	1.24

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13RST030587	Bio-Swale	Loch Raven Reservoir	02130805	1412115.28	730895.41	0.70
SHA14RST030567	Bio-Swale	Loch Raven Reservoir	02130805	1413043.62	742148.82	0.97
SHA14RST030568	Bio-Swale	Loch Raven Reservoir	02130805	1413413.70	740855.27	1.30
SHA14RST030569	Bio-Swale	Loch Raven Reservoir	02130805	1413351.34	740068.30	0.25
SHA11APY030130UT	Tree Planting	Loch Raven Reservoir	02130805	1409275.84	658549.89	0.21
SHA12APY030053UT	Tree Planting	Loch Raven Reservoir	02130805	1411815.49	742449.77	0.35
SHA12APY030055UT	Tree Planting	Loch Raven Reservoir	02130805	1406460.82	665436.86	0.22
SHA12APY030059UT	Tree Planting	Loch Raven Reservoir	02130805	1406103.72	685711.86	0.55
SHA12APY030060UT	Tree Planting	Loch Raven Reservoir	02130805	1408471.96	705797.61	0.24
SHA12APY030061UT	Tree Planting	Loch Raven Reservoir	02130805	1407257.31	709819.99	0.12
SHA12APY030062UT	Tree Planting	Loch Raven Reservoir	02130805	1405554.97	714138.10	0.62
SHA12APY030063UT	Tree Planting	Loch Raven Reservoir	02130805	1407808.22	723464.93	0.17
SHA12APY030065UT	Tree Planting	Loch Raven Reservoir	02130805	1411079.99	727364.07	0.13
SHA12APY030066UT	Tree Planting	Loch Raven Reservoir	02130805	1411997.47	730192.92	0.47
SHA12APY030067UT	Tree Planting	Loch Raven Reservoir	02130805	1412206.50	730817.96	0.10
SHA12APY030068UT	Tree Planting	Loch Raven Reservoir	02130805	1412482.14	731855.16	0.10
SHA12APY030069UT	Tree Planting	Loch Raven Reservoir	02130805	1412207.83	734283.31	0.32
SHA12APY030071UT	Tree Planting	Loch Raven Reservoir	02130805	1412533.31	742288.28	0.93
SHA12APY030073UT	Tree Planting	Loch Raven Reservoir	02130805	1408024.75	677708.83	0.31
SHA12APY030127UT	Tree Planting	Loch Raven Reservoir	02130805	1411703.94	651517.24	0.15
SHA12APY030129UT	Tree Planting	Loch Raven Reservoir	02130805	1409320.15	658328.33	0.10
SHA12APY030307UT	Tree Planting	Loch Raven Reservoir	02130805	1409240.57	658537.19	0.04
SHA12APY030309UT	Tree Planting	Loch Raven Reservoir	02130805	1408183.26	655345.66	0.34
SHA12APY030310UT	Tree Planting	Loch Raven Reservoir	02130805	1408086.04	657215.97	0.05
SHA12APY030311UT	Tree Planting	Loch Raven Reservoir	02130805	1407897.87	656759.13	0.03

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY030058UT	Tree Planting	Loch Raven Reservoir	02130805	1405965.33	666769.67	0.29
SHA13APY030097UT	Tree Planting	Loch Raven Reservoir	02130805	1425486.16	636086.25	0.28
SHA13APY030108UT	Tree Planting	Loch Raven Reservoir	02130805	1421535.64	636689.69	0.19
SHA13APY030109UT	Tree Planting	Loch Raven Reservoir	02130805	1424599.72	636431.86	0.12
SHA15APY030253UT	Tree Planting	Loch Raven Reservoir	02130805	1404517.66	701918.30	0.27
SHA15APY030254UT	Tree Planting	Loch Raven Reservoir	02130805	1405964.81	715462.82	0.23
SHA15APY030255UT	Tree Planting	Loch Raven Reservoir	02130805	1430692.32	635065.85	0.85
SHA15APY030256UT	Tree Planting	Loch Raven Reservoir	02130805	1404261.17	701486.29	0.10
SHA15APY030257UT	Tree Planting	Loch Raven Reservoir	02130805	1425691.20	636436.58	0.11
SHA15APY030258UT	Tree Planting	Loch Raven Reservoir	02130805	1406005.28	712348.77	0.19
SHA15APY030259UT	Tree Planting	Loch Raven Reservoir	02130805	1406464.37	684817.21	0.13
SHA15APY030272UT	Tree Planting	Loch Raven Reservoir	02130805	1413024.08	738378.41	0.42
SHA15APY030275UT	Tree Planting	Loch Raven Reservoir	02130805	1405319.49	714083.07	0.15
SHA15APY030282UT	Tree Planting	Loch Raven Reservoir	02130805	1394912.25	662684.25	0.09
SHA15APY030287UT	Tree Planting	Loch Raven Reservoir	02130805	1412441.75	734463.58	0.16
SHA15APY030288UT	Tree Planting	Loch Raven Reservoir	02130805	1413292.82	739361.92	0.19
SHA15APY030289UT	Tree Planting	Loch Raven Reservoir	02130805	1409867.20	725289.55	0.09
SHA12APY030001UT	Tree Planting	Lower Gunpowder Falls	02130802	1474510.95	639702.36	17.15
SHA13APY030093UT	Tree Planting	Lower Gunpowder Falls	02130802	1435233.02	631847.59	0.19
SHA13APY030110UT	Tree Planting	Lower Gunpowder Falls	02130802	1431186.38	635278.11	0.24
SHA15APY030155UT	Tree Planting	Lower Gunpowder Falls	02130802	1441213.37	632522.40	0.15
SHA15APY030205UT	Tree Planting	Lower Gunpowder Falls	02130802	1431627.70	635652.63	0.07
SHA15APY030241UT	Tree Planting	Lower Gunpowder Falls	02130802	1433851.33	632767.45	0.24
SHA15APY030249UT	Tree Planting	Lower Gunpowder Falls	02130802	1431623.19	635423.15	0.03
SHA11APY100009UT	Tree Planting	Lower Monocacy River	02140302	1190925.12	630962.66	2.22

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA11APY100010UT	Tree Planting	Lower Monocacy River	02140302	1191292.78	631513.36	1.92
SHA11APY100011UT	Tree Planting	Lower Monocacy River	02140302	1191191.05	631993.07	0.62
SHA11APY100012UT	Tree Planting	Lower Monocacy River	02140302	1191717.16	631373.90	0.23
SHA11APY100013UT	Tree Planting	Lower Monocacy River	02140302	1192294.49	631267.92	0.60
SHA11APY100017UT	Tree Planting	Lower Monocacy River	02140302	1193159.80	630197.33	2.11
SHA11APY100018UT	Tree Planting	Lower Monocacy River	02140302	1193662.74	630317.92	0.44
SHA11APY100019UT	Tree Planting	Lower Monocacy River	02140302	1193424.04	630552.22	1.16
SHA11APY100023UT	Tree Planting	Lower Monocacy River	02140302	1193026.74	630882.83	0.22
SHA11APY100024UT	Tree Planting	Lower Monocacy River	02140302	1192345.29	630636.38	0.52
SHA11APY100026UT	Tree Planting	Lower Monocacy River	02140302	1192548.16	630927.45	0.42
SHA11APY100028UT	Tree Planting	Lower Monocacy River	02140302	1192026.38	630918.57	0.12
SHA11APY100029UT	Tree Planting	Lower Monocacy River	02140302	1191905.93	631127.85	0.13
SHA11APY100032UT	Tree Planting	Lower Monocacy River	02140302	1190892.96	631305.18	0.43
SHA13APY100037UT	Tree Planting	Lower Monocacy River	02140302	1194566.37	631083.07	0.75
SHA13APY100038UT	Tree Planting	Lower Monocacy River	02140302	1204688.76	632737.12	2.17
SHA13APY100040UT	Tree Planting	Lower Monocacy River	02140302	1212760.59	633353.08	0.25
SHA13APY100042UT	Tree Planting	Lower Monocacy River	02140302	1224246.29	677781.87	0.28
SHA13APY100043UT	Tree Planting	Lower Monocacy River	02140302	1223790.65	682624.39	0.22
SHA13APY100044UT	Tree Planting	Lower Monocacy River	02140302	1198218.56	646990.67	0.17
SHA13APY100045UT	Tree Planting	Lower Monocacy River	02140302	1198701.96	647712.18	0.43
SHA13APY100046UT	Tree Planting	Lower Monocacy River	02140302	1198491.58	647184.66	0.25
SHA13APY150030UT	Tree Planting	Lower Monocacy River	02140302	1220769.29	587282.86	0.47
SHA14APY060044UT	Tree Planting	Lower Monocacy River	02140302	1280082.76	654131.77	0.17
SHA14APY100117UT	Tree Planting	Lower Monocacy River	02140302	1189177.24	637039.80	0.38
SHA14APY100122UT	Tree Planting	Lower Monocacy River	02140302	1230916.38	625508.52	0.04

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA14APY100123UT	Tree Planting	Lower Monocacy River	02140302	1234610.77	624218.92	0.42
SHA14APY100124UT	Tree Planting	Lower Monocacy River	02140302	1254221.59	620510.65	0.12
SHA14APY100125UT	Tree Planting	Lower Monocacy River	02140302	1255552.46	619754.17	0.12
SHA14APY100126UT	Tree Planting	Lower Monocacy River	02140302	1170718.46	619507.94	0.59
SHA14APY100127UT	Tree Planting	Lower Monocacy River	02140302	1172566.18	621001.17	0.28
SHA14APY100129UT	Tree Planting	Lower Monocacy River	02140302	1182975.09	626332.18	0.13
SHA14APY100130UT	Tree Planting	Lower Monocacy River	02140302	1251155.81	661337.64	0.31
SHA14APY100131UT	Tree Planting	Lower Monocacy River	02140302	1247216.63	661633.64	0.08
SHA14APY100132UT	Tree Planting	Lower Monocacy River	02140302	1224457.83	678569.69	0.76
SHA14APY100134UT	Tree Planting	Lower Monocacy River	02140302	1263999.22	616544.62	0.36
SHA14APY100247UT	Tree Planting	Lower Monocacy River	02140302	1247477.27	661556.03	0.08
SHA14APY100425UT	Tree Planting	Lower Monocacy River	02140302	1250755.72	661336.15	0.02
SHA14APY100426UT	Tree Planting	Lower Monocacy River	02140302	1224549.36	679494.75	0.14
SHA15APY060088UT	Tree Planting	Lower Monocacy River	02140302	1285984.53	653047.24	0.28
SHA15APY100137UT	Tree Planting	Lower Monocacy River	02140302	1189592.01	636877.20	0.41
SHA15APY100138UT	Tree Planting	Lower Monocacy River	02140302	1189274.41	637415.49	0.13
SHA15APY100139UT	Tree Planting	Lower Monocacy River	02140302	1198666.76	648559.57	0.27
SHA15APY100141UT	Tree Planting	Lower Monocacy River	02140302	1177594.76	637555.43	0.15
SHA15APY100142UT	Tree Planting	Lower Monocacy River	02140302	1211246.22	603848.01	0.26
SHA15APY100143UT	Tree Planting	Lower Monocacy River	02140302	1183764.20	632648.24	0.06
SHA15APY100146UT	Tree Planting	Lower Monocacy River	02140302	1180564.58	633418.76	0.49
SHA15APY100149UT	Tree Planting	Lower Monocacy River	02140302	1189422.56	636481.81	0.13
SHA15APY100150UT	Tree Planting	Lower Monocacy River	02140302	1189430.09	637674.87	0.07
SHA15APY100153UT	Tree Planting	Lower Monocacy River	02140302	1211436.04	603342.67	0.20
SHA15APY100161UT	Tree Planting	Lower Monocacy River	02140302	1209558.20	604273.58	0.22

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY100162UT	Tree Planting	Lower Monocacy River	02140302	1223981.11	627442.01	0.11
SHA15APY100163UT	Tree Planting	Lower Monocacy River	02140302	1198609.52	632260.79	0.12
SHA15APY100172UT	Tree Planting	Lower Monocacy River	02140302	1189762.11	637726.13	0.17
SHA15APY100173UT	Tree Planting	Lower Monocacy River	02140302	1194176.32	642073.83	0.39
SHA15APY100181UT	Tree Planting	Lower Monocacy River	02140302	1174570.79	621696.52	0.29
SHA15APY100182UT	Tree Planting	Lower Monocacy River	02140302	1194460.45	642305.01	0.22
SHA15APY100188UT	Tree Planting	Lower Monocacy River	02140302	1239005.18	624439.47	0.22
SHA15APY100190UT	Tree Planting	Lower Monocacy River	02140302	1201677.69	613150.73	0.27
SHA15APY100191UT	Tree Planting	Lower Monocacy River	02140302	1220950.64	628601.90	0.41
SHA15APY100197UT	Tree Planting	Lower Monocacy River	02140302	1224223.90	681277.64	0.16
SHA15APY100199UT	Tree Planting	Lower Monocacy River	02140302	1189865.03	636936.41	0.05
SHA15APY100200UT	Tree Planting	Lower Monocacy River	02140302	1227374.64	626347.94	0.32
SHA15APY100201UT	Tree Planting	Lower Monocacy River	02140302	1185333.72	632634.96	0.42
SHA15APY100221UT	Tree Planting	Lower Monocacy River	02140302	1182542.05	626331.17	0.40
SHA15APY100225UT	Tree Planting	Lower Monocacy River	02140302	1170933.89	620031.22	0.22
SHA15APY100227UT	Tree Planting	Lower Monocacy River	02140302	1181731.37	625828.27	0.36
SHA15APY100228UT	Tree Planting	Lower Monocacy River	02140302	1180914.50	625315.19	0.12
SHA15APY100232UT	Tree Planting	Lower Monocacy River	02140302	1187922.26	630961.61	0.73
SHA15APY100233UT	Tree Planting	Lower Monocacy River	02140302	1187194.56	632025.45	0.50
SHA15APY100235UT	Tree Planting	Lower Monocacy River	02140302	1187387.20	631109.05	0.61
SHA15APY100236UT	Tree Planting	Lower Monocacy River	02140302	1181174.46	625476.00	0.12
SHA15APY100243UT	Tree Planting	Lower Monocacy River	02140302	1188421.38	630406.41	1.49
SHA15APY100244UT	Tree Planting	Lower Monocacy River	02140302	1207042.29	606202.45	0.33
SHA15APY100245UT	Tree Planting	Lower Monocacy River	02140302	1208265.26	604903.73	0.21
SHA15APY100430UT	Tree Planting	Lower Monocacy River	02140302	1181516.40	633015.73	0.28

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY100431UT	Tree Planting	Lower Monocacy River	02140302	1182627.97	632805.29	0.28
SHA13RST070053	Bioretention	Lower Susquehanna River	02120201	1577774.70	696342.84	1.23
SHA13RST070046	Bio-Swale	Lower Susquehanna River	02120201	1575770.55	695189.89	0.44
SHA13RST070051	Bio-Swale	Lower Susquehanna River	02120201	1576219.22	695465.33	0.44
SHA13RST070052	Bio-Swale	Lower Susquehanna River	02120201	1576863.42	695843.10	0.45
SHA13RST070071	Bio-Swale	Lower Susquehanna River	02120201	1578498.76	696654.43	0.21
SHA13RST070072	Bio-Swale	Lower Susquehanna River	02120201	1579176.02	696901.10	1.45
SHA11APY120175UT	Tree Planting	Lower Susquehanna River	02120201	1556322.72	704619.91	1.23
SHA11APY120176UT	Tree Planting	Lower Susquehanna River	02120201	1556274.41	704366.32	1.19
SHA11APY120177UT	Tree Planting	Lower Susquehanna River	02120201	1556995.41	704586.61	1.16
SHA11APY120178UT	Tree Planting	Lower Susquehanna River	02120201	1555557.54	703416.88	1.81
SHA11APY120179UT	Tree Planting	Lower Susquehanna River	02120201	1555062.52	702822.13	3.65
SHA11APY120184UT	Tree Planting	Lower Susquehanna River	02120201	1552839.06	705144.86	2.80
SHA11APY120185UT	Tree Planting	Lower Susquehanna River	02120201	1552570.92	704745.79	2.84
SHA11APY120186UT	Tree Planting	Lower Susquehanna River	02120201	1553308.04	704791.68	1.91
SHA11APY120187UT	Tree Planting	Lower Susquehanna River	02120201	1553543.33	704399.56	5.74
SHA11APY120188UT	Tree Planting	Lower Susquehanna River	02120201	1552456.36	704329.54	2.88
SHA11APY120194UT	Tree Planting	Lower Susquehanna River	02120201	1555478.04	704447.77	2.81
SHA14APY120022UT	Tree Planting	Lower Susquehanna River	02120201	1547959.31	695626.61	0.87
SHA14APY120029UT	Tree Planting	Lower Susquehanna River	02120201	1553908.55	695745.28	0.33
SHA14APY120031UT	Tree Planting	Lower Susquehanna River	02120201	1547009.82	695219.82	0.30
SHA14APY120046UT	Tree Planting	Lower Susquehanna River	02120201	1550107.44	696199.66	0.36
SHA14APY120065UT	Tree Planting	Lower Susquehanna River	02120201	1546213.10	695194.45	0.38
SHA14APY120085UT	Tree Planting	Lower Susquehanna River	02120201	1547606.80	695376.26	0.11
SHA14APY120113UT	Tree Planting	Lower Susquehanna River	02120201	1546988.89	695361.70	0.85

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA14APY120120UT	Tree Planting	Lower Susquehanna River	02120201	1552497.84	696193.12	0.30
SHA12RST120310	Bio-Swale	Lower Winters Run	02130702	1504460.55	660868.12	0.55
SHA13RST120333	Bio-Swale	Lower Winters Run	02130702	1504558.67	660509.45	0.31
SHA13RST120335	Bio-Swale	Lower Winters Run	02130702	1503838.05	662430.67	0.30
SHA13RST120337	Bio-Swale	Lower Winters Run	02130702	1503283.33	663593.21	0.24
SHA13APY120002UT	Tree Planting	Lower Winters Run	02130702	1507317.30	640311.86	0.25
SHA13APY120017UT	Tree Planting	Lower Winters Run	02130702	1507242.18	640000.66	0.04
SHA15APY120054UT	Tree Planting	Lower Winters Run	02130702	1497904.07	645476.71	0.33
SHA15APY120077UT	Tree Planting	Lower Winters Run	02130702	1510296.05	648302.23	0.23
SHA13APY210012UT	Tree Planting	Marsh Run	02140503	1099272.78	707143.97	0.53
SHA13APY210050UT	Tree Planting	Marsh Run	02140503	1098492.68	707473.66	0.53
SHA13APY210412UT	Tree Planting	Marsh Run	02140503	1099429.67	707041.69	0.28
SHA13APY210432UT	Tree Planting	Marsh Run	02140503	1096159.95	707437.97	0.39
SHA12APY080002UT	Tree Planting	Mattawoman Creek	02140111	1267863.33	331504.16	8.85
SHA12APY080004UT	Tree Planting	Mattawoman Creek	02140111	1287933.76	328364.58	0.35
SHA12APY080064UT	Tree Planting	Mattawoman Creek	02140111	1288522.40	326247.51	0.25
SHA12APY080066UT	Tree Planting	Mattawoman Creek	02140111	1288840.62	326025.48	0.15
SHA12APY080067UT	Tree Planting	Mattawoman Creek	02140111	1288622.68	325692.35	0.05
SHA12APY080068UT	Tree Planting	Mattawoman Creek	02140111	1288638.89	324574.37	0.46
SHA12APY080069UT	Tree Planting	Mattawoman Creek	02140111	1288617.67	322507.15	0.32
SHA12APY080070UT	Tree Planting	Mattawoman Creek	02140111	1288334.81	321514.06	0.08
SHA12APY080071UT	Tree Planting	Mattawoman Creek	02140111	1288484.28	321415.49	0.02
SHA12APY080106UT	Tree Planting	Mattawoman Creek	02140111	1288687.86	323703.06	0.24
SHA15RST130555	Bio-Swale	Middle Patuxent River	02131106	1347054.07	552099.62	0.64
SHA15RST130557	Bio-Swale	Middle Patuxent River	02131106	1329568.35	560788.51	0.29

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15RST130559	Bio-Swale	Middle Patuxent River	02131106	1330196.99	560366.15	1.11
SHA15RST130561	Bio-Swale	Middle Patuxent River	02131106	1335461.85	556353.97	0.54
SHA15RST130562	Bio-Swale	Middle Patuxent River	02131106	1335811.65	556232.51	0.05
SHA15RST130563	Bio-Swale	Middle Patuxent River	02131106	1335877.09	556209.76	0.12
SHA15RST130564	Bio-Swale	Middle Patuxent River	02131106	1338419.72	555116.91	0.70
SHA15RST130566	Bio-Swale	Middle Patuxent River	02131106	1340187.71	553807.04	0.19
SHA11APY130013UT	Tree Planting	Middle Patuxent River	02131106	1342951.25	552485.47	0.27
SHA11APY130014UT	Tree Planting	Middle Patuxent River	02131106	1305578.79	605493.78	0.07
SHA11APY130015UT	Tree Planting	Middle Patuxent River	02131106	1319341.34	600649.93	0.09
SHA11APY130016UT	Tree Planting	Middle Patuxent River	02131106	1321142.04	599682.60	0.26
SHA11APY130203UT	Tree Planting	Middle Patuxent River	02131106	1343890.30	552424.91	0.10
SHA11APY130204UT	Tree Planting	Middle Patuxent River	02131106	1319905.45	600350.48	0.07
SHA11APY130217UT	Tree Planting	Middle Patuxent River	02131106	1321679.72	599404.34	0.03
SHA12APY130122UT	Tree Planting	Middle Patuxent River	02131106	1343626.68	543420.26	0.14
SHA13APY130072UT	Tree Planting	Middle Patuxent River	02131106	1315892.29	585442.25	0.49
SHA13APY130073UT	Tree Planting	Middle Patuxent River	02131106	1316143.98	585291.93	0.21
SHA13APY130086UT	Tree Planting	Middle Patuxent River	02131106	1347375.38	551069.55	0.23
SHA13APY130087UT	Tree Planting	Middle Patuxent River	02131106	1347192.12	551784.63	0.26
SHA13APY130092UT	Tree Planting	Middle Patuxent River	02131106	1325455.00	597803.62	0.79
SHA13APY130093UT	Tree Planting	Middle Patuxent River	02131106	1324887.81	598379.73	0.30
SHA13APY130208UT	Tree Planting	Middle Patuxent River	02131106	1317133.24	586969.56	0.61
SHA13APY130209UT	Tree Planting	Middle Patuxent River	02131106	1319279.02	588426.39	0.87
SHA14APY130130UT	Tree Planting	Middle Patuxent River	02131106	1342039.27	552836.11	0.17
SHA14APY130131UT	Tree Planting	Middle Patuxent River	02131106	1343398.01	543458.15	0.26
SHA14APY130132UT	Tree Planting	Middle Patuxent River	02131106	1345710.73	552528.51	0.06

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA14APY130133UT	Tree Planting	Middle Patuxent River	02131106	1341296.16	552874.68	0.31
SHA14APY130136UT	Tree Planting	Middle Patuxent River	02131106	1340687.80	553163.59	0.54
SHA14APY130138UT	Tree Planting	Middle Patuxent River	02131106	1338625.83	554689.55	0.67
SHA14APY130139UT	Tree Planting	Middle Patuxent River	02131106	1331926.28	558981.54	0.30
SHA14APY130153UT	Tree Planting	Middle Patuxent River	02131106	1329153.59	560892.24	0.31
SHA14APY130154UT	Tree Planting	Middle Patuxent River	02131106	1335890.69	556083.54	0.09
SHA14APY130160UT	Tree Planting	Middle Patuxent River	02131106	1333584.24	557439.16	0.17
SHA14APY130161UT	Tree Planting	Middle Patuxent River	02131106	1330638.47	560177.27	0.34
SHA14APY130172UT	Tree Planting	Middle Patuxent River	02131106	1347168.29	551652.36	0.43
SHA14APY130177UT	Tree Planting	Middle Patuxent River	02131106	1316513.79	585666.26	0.25
SHA14APY130178UT	Tree Planting	Middle Patuxent River	02131106	1332404.18	558214.85	0.06
SHA14APY130182UT	Tree Planting	Middle Patuxent River	02131106	1333974.35	557148.63	0.13
SHA14APY130220UT	Tree Planting	Middle Patuxent River	02131106	1341387.42	552571.52	0.08
SHA14APY130221UT	Tree Planting	Middle Patuxent River	02131106	1339616.63	554094.24	0.13
SHA14APY130222UT	Tree Planting	Middle Patuxent River	02131106	1345279.97	552553.93	0.09
SHA12APY080020UT	Tree Planting	Nanjemoy Creek	02140110	1290298.94	284541.79	1.23
SHA12APY080097UT	Tree Planting	Nanjemoy Creek	02140110	1288896.90	283270.61	1.01
SHA12APY080098UT	Tree Planting	Nanjemoy Creek	02140110	1289500.70	283340.44	0.56
SHA12APY080100UT	Tree Planting	Nanjemoy Creek	02140110	1288561.75	283662.08	0.21
SHA12APY080101UT	Tree Planting	Nanjemoy Creek	02140110	1289325.66	283778.03	0.12
SHA15APY070020UT	Tree Planting	Northeast River	02130608	1607688.67	715495.07	0.03
SHA15APY070024UT	Tree Planting	Northeast River	02130608	1607714.59	715421.05	0.04
SHA15APY070035UT	Tree Planting	Northeast River	02130608	1605621.49	731166.71	0.12
SHA15APY070037UT	Tree Planting	Northeast River	02130608	1605501.53	731398.04	0.04
SHA15APY070054UT	Tree Planting	Northeast River	02130608	1607799.48	715050.80	0.21

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY070088UT	Tree Planting	Northeast River	02130605	1624285.72	722056.77	0.31
SHA15APY070090UT	Tree Planting	Northeast River	02130608	1607422.49	719588.91	2.86
SHA15APY070008UT	Tree Planting	Octoraro Creek	02120203	1585012.20	749772.22	0.47
SHA15APY070009UT	Tree Planting	Octoraro Creek	02120203	1580893.24	747128.59	0.31
SHA15APY070010UT	Tree Planting	Octoraro Creek	02120203	1571822.00	717147.80	0.07
SHA15APY070025UT	Tree Planting	Octoraro Creek	02120203	1581599.78	747378.47	0.07
SHA15APY070027UT	Tree Planting	Octoraro Creek	02120203	1581662.75	747244.49	0.13
SHA15APY070040UT	Tree Planting	Octoraro Creek	02120203	1574495.64	745104.60	0.24
SHA15APY070041UT	Tree Planting	Octoraro Creek	02120203	1580611.72	746855.06	0.54
SHA15APY070042UT	Tree Planting	Octoraro Creek	02120203	1573141.73	733076.99	0.10
SHA15APY070044UT	Tree Planting	Octoraro Creek	02120203	1567736.98	740088.93	0.38
SHA15APY070052UT	Tree Planting	Octoraro Creek	02120203	1573055.27	731320.63	0.16
SHA15APY070057UT	Tree Planting	Octoraro Creek	02120203	1572182.82	717492.10	0.04
SHA15APY070061UT	Tree Planting	Octoraro Creek	02120203	1571310.45	716638.79	0.09
SHA15APY070071UT	Tree Planting	Octoraro Creek	02120203	1575609.00	745172.46	0.30
SHA15APY070076UT	Tree Planting	Octoraro Creek	02120203	1568139.93	740437.78	0.06
SHA15APY070078UT	Tree Planting	Octoraro Creek	02120203	1584787.63	749521.60	0.34
SHA11APY130028UT	Tree Planting	Patapsco River L N Br	02130906	1376121.33	554859.72	0.44
SHA11APY130037UT	Tree Planting	Patapsco River L N Br	02130906	1376158.90	559854.46	0.48
SHA11APY130211UT	Tree Planting	Patapsco River L N Br	02130906	1385258.29	566291.12	2.82
SHA12APY020022UT	Tree Planting	Patapsco River L N Br	02130906	1409211.18	566011.47	0.37
SHA12APY020023UT	Tree Planting	Patapsco River L N Br	02130906	1409391.61	565518.28	0.47
SHA12APY020024UT	Tree Planting	Patapsco River L N Br	02130906	1408967.44	565347.30	0.52
SHA12APY020041UT	Tree Planting	Patapsco River L N Br	02130906	1390990.82	546430.14	0.04
SHA12APY020042UT	Tree Planting	Patapsco River L N Br	02130906	1391170.59	546869.07	0.01

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY020048UT	Tree Planting	Patapsco River L N Br	02130906	1389145.33	547816.86	1.07
SHA13APY020062UT	Tree Planting	Patapsco River L N Br	02130906	1399111.44	540789.29	1.16
SHA13APY130063UT	Tree Planting	Patapsco River L N Br	02130906	1372978.97	561535.95	0.39
SHA13APY130064UT	Tree Planting	Patapsco River L N Br	02130906	1373634.04	561497.51	0.11
SHA13APY130065UT	Tree Planting	Patapsco River L N Br	02130906	1374049.16	561526.39	0.09
SHA13APY130066UT	Tree Planting	Patapsco River L N Br	02130906	1381939.41	554124.73	0.22
SHA13APY130067UT	Tree Planting	Patapsco River L N Br	02130906	1381346.92	554697.94	0.24
SHA13APY130094UT	Tree Planting	Patapsco River L N Br	02130906	1361127.84	593749.10	0.08
SHA13APY130121UT	Tree Planting	Patapsco River L N Br	02130906	1390837.95	554490.26	0.77
SHA13APY130218UT	Tree Planting	Patapsco River L N Br	02130906	1390619.21	554632.73	0.61
SHA14APY130134UT	Tree Planting	Patapsco River L N Br	02130906	1370354.46	563628.06	0.20
SHA14APY130141UT	Tree Planting	Patapsco River L N Br	02130906	1363221.64	587211.96	0.40
SHA14APY130145UT	Tree Planting	Patapsco River L N Br	02130906	1370635.42	562337.62	0.12
SHA14APY130147UT	Tree Planting	Patapsco River L N Br	02130906	1371552.50	561772.52	0.11
SHA14APY130149UT	Tree Planting	Patapsco River L N Br	02130906	1378494.83	556978.28	0.75
SHA14APY130151UT	Tree Planting	Patapsco River L N Br	02130906	1370309.09	562729.83	0.09
SHA14APY130152UT	Tree Planting	Patapsco River L N Br	02130906	1362740.04	586213.55	0.28
SHA14APY130162UT	Tree Planting	Patapsco River L N Br	02130906	1363993.86	587268.07	0.11
SHA14APY130169UT	Tree Planting	Patapsco River L N Br	02130906	1377936.16	557469.73	0.40
SHA14APY130174UT	Tree Planting	Patapsco River L N Br	02130906	1373600.73	561631.72	0.17
SHA14APY130175UT	Tree Planting	Patapsco River L N Br	02130906	1379562.51	556499.17	0.15
SHA14APY130176UT	Tree Planting	Patapsco River L N Br	02130906	1375384.03	560640.28	0.23
SHA14APY130187UT	Tree Planting	Patapsco River L N Br	02130906	1369727.16	563120.04	0.77
SHA14APY130188UT	Tree Planting	Patapsco River L N Br	02130906	1369310.50	562504.77	0.57
SHA14APY130210UT	Tree Planting	Patapsco River L N Br	02130906	1369905.59	562503.67	0.72

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY020416UT	Tree Planting	Patapsco River L N Br	02130906	1388753.58	547303.90	1.40
SHA15APY020418UT	Tree Planting	Patapsco River L N Br	02130906	1386567.60	550541.38	0.27
SHA15APY030165UT	Tree Planting	Patapsco River L N Br	02130906	1396978.25	566787.87	0.26
SHA15APY030168UT	Tree Planting	Patapsco River L N Br	02130906	1372721.62	597668.98	0.14
SHA15APY030172UT	Tree Planting	Patapsco River L N Br	02130906	1376957.28	597281.90	0.02
SHA15APY030235UT	Tree Planting	Patapsco River L N Br	02130906	1401404.81	575685.40	0.09
SHA15APY030266UT	Tree Planting	Patapsco River L N Br	02130906	1402334.05	576313.96	0.02
SHA15APY030273UT	Tree Planting	Patapsco River L N Br	02130906	1402388.10	576391.29	0.06
SHA15APY030291UT	Tree Planting	Patapsco River L N Br	02130906	1402164.86	576235.93	0.16
SHA15APY030316UT	Tree Planting	Patapsco River L N Br	02130906	1377144.41	597307.21	0.08
SHA15APY130223UT	Tree Planting	Patapsco River L N Br	02130906	1369255.85	562723.03	0.11
SHA14RST082122	Bio-Swale	Patuxent River lower	02131101	1376774.82	306683.57	0.45
SHA14RST082123	Bio-Swale	Patuxent River lower	02131101	1376779.02	306937.73	0.27
SHA14RST082124	Bio-Swale	Patuxent River lower	02131101	1376784.57	307295.66	0.17
SHA14RST082125	Bio-Swale	Patuxent River lower	02131101	1376795.09	307858.97	0.26
SHA14RST082126	Bio-Swale	Patuxent River lower	02131101	1376800.01	308213.09	0.26
SHA14RST082127	Bio-Swale	Patuxent River lower	02131101	1376805.99	308716.11	0.44
SHA14RST082128	Bio-Swale	Patuxent River lower	02131101	1376809.92	309100.91	0.75
SHA12APY080005UT	Tree Planting	Patuxent River lower	02131101	1372930.42	318885.17	0.41
SHA12APY080006UT	Tree Planting	Patuxent River lower	02131101	1375260.20	316228.12	0.32
SHA12APY080008UT	Tree Planting	Patuxent River lower	02131101	1375715.99	315623.29	0.08
SHA12APY080009UT	Tree Planting	Patuxent River lower	02131101	1375884.06	315672.25	0.27
SHA12APY160002UT	Tree Planting	Patuxent River lower	02131101	1399383.57	352777.64	1.41
SHA12APY160216UT	Tree Planting	Patuxent River lower	02131101	1400034.07	351976.48	0.73
SHA12APY160218UT	Tree Planting	Patuxent River lower	02131101	1399354.35	350288.08	1.08

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA12APY160219UT	Tree Planting	Patuxent River lower	02131101	1397997.21	351034.45	0.50
SHA13APY080012UT	Tree Planting	Patuxent River lower	02131101	1375830.25	315220.77	0.24
SHA13APY080013UT	Tree Planting	Patuxent River lower	02131101	1376209.80	315226.55	0.15
SHA13APY080014UT	Tree Planting	Patuxent River lower	02131101	1376318.12	314698.03	0.14
SHA13APY080015UT	Tree Planting	Patuxent River lower	02131101	1376081.12	315667.45	0.08
SHA13APY080016UT	Tree Planting	Patuxent River lower	02131101	1373383.20	318487.70	0.15
SHA13APY080017UT	Tree Planting	Patuxent River lower	02131101	1375547.38	316480.88	0.53
SHA13APY080018UT	Tree Planting	Patuxent River lower	02131101	1374759.60	316968.64	0.29
SHA14RST021338	Bio-Swale	Patuxent River middle	02131102	1409923.38	401099.35	0.29
SHA14RST021341	Bio-Swale	Patuxent River middle	02131102	1407482.27	408797.80	0.64
SHA14RST021343	Bio-Swale	Patuxent River middle	02131102	1407250.96	409240.15	0.42
SHA14RST021348	Bio-Swale	Patuxent River middle	02131102	1402931.88	412620.67	0.49
SHA14RST021349	Bio-Swale	Patuxent River middle	02131102	1402764.55	412735.39	0.06
SHA14RST021351	Bio-Swale	Patuxent River middle	02131102	1402660.04	412811.43	0.05
SHA14RST021354	Bio-Swale	Patuxent River middle	02131102	1402537.28	412896.32	0.31
SHA14RST021359	Bio-Swale	Patuxent River middle	02131102	1402158.97	413160.60	0.18
SHA14RST021364	Bio-Swale	Patuxent River middle	02131102	1401787.06	413430.10	0.35
SHA14RST021369	Bio-Swale	Patuxent River middle	02131102	1400222.12	414626.52	0.32
SHA14RST021370	Bio-Swale	Patuxent River middle	02131102	1398454.45	415884.33	0.34
SHA14RST021371	Bio-Swale	Patuxent River middle	02131102	1397273.64	416425.36	0.50
SHA14RST021374	Bio-Swale	Patuxent River middle	02131102	1395883.26	416777.76	0.68
SHA12APY160001UT	Tree Planting	Patuxent River middle	02131102	1395987.00	391085.70	0.49
SHA12APY160221UT	Tree Planting	Patuxent River middle	02131102	1395163.26	391184.81	0.27
SHA12APY160225UT	Tree Planting	Patuxent River middle	02131102	1394369.47	388261.32	1.00
SHA12APY160226UT	Tree Planting	Patuxent River middle	02131102	1393048.28	387009.91	2.64

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA14RST160412	Bio-Swale	Patuxent River upper	02131104	1391281.16	449045.36	0.73
SHA14RST160415	Bio-Swale	Patuxent River upper	02131104	1392049.13	448855.47	0.38
SHA14RST160416	Bio-Swale	Patuxent River upper	02131104	1393205.32	448568.91	0.63
SHA14RST160418	Bio-Swale	Patuxent River upper	02131104	1393552.52	448483.77	0.75
SHA15RST021298	Bio-Swale	Patuxent River upper	02131104	1403223.03	469711.51	0.32
SHA15RST021299	Bio-Swale	Patuxent River upper	02131104	1404699.84	469879.00	0.41
SHA11APY130026UT	Tree Planting	Patuxent River upper	02131104	1350741.82	532643.22	0.94
SHA11APY130027UT	Tree Planting	Patuxent River upper	02131104	1352164.63	531879.87	0.10
SHA14APY130146UT	Tree Planting	Patuxent River upper	02131104	1351779.05	531703.06	1.30
SHA14APY130173UT	Tree Planting	Patuxent River upper	02131104	1352331.77	531664.11	0.07
SHA13APY160095UT	Tree Planting	Piscataway Creek	02140203	1320018.04	386541.27	1.54
SHA13APY160096UT	Tree Planting	Piscataway Creek	02140203	1321186.53	388936.09	0.15
SHA12APY080021UT	Tree Planting	Port Tobacco River	02140109	1298178.82	284951.58	0.04
SHA12APY080022UT	Tree Planting	Port Tobacco River	02140109	1298421.47	283083.49	1.67
SHA12APY080024UT	Tree Planting	Port Tobacco River	02140109	1299872.18	284193.68	0.32
SHA12APY080103UT	Tree Planting	Port Tobacco River	02140109	1297319.91	283470.06	1.05
SHA12APY080104UT	Tree Planting	Port Tobacco River	02140109	1291798.72	283327.56	0.27
SHA12APY080105UT	Tree Planting	Port Tobacco River	02140109	1290177.85	283494.14	0.18
SHA14APY100128UT	Tree Planting	Potomac River FR Cnty	02140301	1132555.05	610851.44	0.07
SHA14APY100422UT	Tree Planting	Potomac River FR Cnty	02140301	1132882.35	611133.21	0.06
SHA15APY100151UT	Tree Planting	Potomac River FR Cnty	02140301	1169294.56	612592.04	0.53
SHA15APY100187UT	Tree Planting	Potomac River FR Cnty	02140301	1135514.04	613104.27	0.17
SHA15APY100189UT	Tree Planting	Potomac River FR Cnty	02140301	1166601.99	598452.17	0.33
SHA15APY100192UT	Tree Planting	Potomac River FR Cnty	02140301	1137597.91	613946.20	0.05
SHA12RST080501	Bio-Swale	Potomac River L tidal	02140101	1322594.68	255240.38	0.25

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA12RST080502	Bio-Swale	Potomac River L tidal	02140101	1322924.36	255516.39	0.28
SHA12RST080503	Bio-Swale	Potomac River L tidal	02140101	1323359.28	255958.11	0.31
SHA13RST080525	Bio-Swale	Potomac River L tidal	02140101	1321149.17	277093.44	0.43
SHA12APY080019UT	Tree Planting	Potomac River L tidal	02140101	1296476.20	280694.22	1.66
SHA12APY080072UT	Tree Planting	Potomac River L tidal	02140101	1292753.79	279722.88	2.72
SHA12APY080073UT	Tree Planting	Potomac River L tidal	02140101	1298167.04	281916.28	0.95
SHA12APY080074UT	Tree Planting	Potomac River L tidal	02140101	1291573.36	278075.03	0.81
SHA12APY080075UT	Tree Planting	Potomac River L tidal	02140101	1293622.62	278083.02	0.84
SHA12APY080076UT	Tree Planting	Potomac River L tidal	02140101	1294870.23	279332.92	1.03
SHA12APY080077UT	Tree Planting	Potomac River L tidal	02140101	1292464.11	278282.65	0.48
SHA12APY080078UT	Tree Planting	Potomac River L tidal	02140101	1299235.46	282629.40	0.64
SHA12APY080081UT	Tree Planting	Potomac River L tidal	02140101	1293551.45	279142.75	0.39
SHA12APY080082UT	Tree Planting	Potomac River L tidal	02140101	1292563.98	276937.67	0.32
SHA12APY080083UT	Tree Planting	Potomac River L tidal	02140101	1291970.20	277936.30	0.37
SHA12APY080086UT	Tree Planting	Potomac River L tidal	02140101	1292318.06	279183.75	0.24
SHA12APY080088UT	Tree Planting	Potomac River L tidal	02140101	1293532.26	279479.74	0.10
SHA12APY080089UT	Tree Planting	Potomac River L tidal	02140101	1293144.24	279794.87	0.19
SHA12APY080090UT	Tree Planting	Potomac River L tidal	02140101	1297479.30	281329.66	0.13
SHA12APY080091UT	Tree Planting	Potomac River L tidal	02140101	1291392.05	277530.75	0.04
SHA12APY080092UT	Tree Planting	Potomac River L tidal	02140101	1297106.48	280998.40	0.09
SHA12APY080001UT	Tree Planting	Potomac River M tidal	02140102	1236533.41	288607.60	1.34
SHA12APY080003UT	Tree Planting	Potomac River M tidal	02140102	1279272.17	347446.58	2.16
SHA12APY080063UT	Tree Planting	Potomac River M tidal	02140102	1278140.65	346718.85	2.71
SHA13RST150449	Other SWM	Potomac River MO Cnty	02140202	1246092.78	531181.45	0.23
SHA13RST150450	Other SWM	Potomac River MO Cnty	02140202	1247085.54	530399.12	0.22

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13RST150451	Other SWM	Potomac River MO Cnty	02140202	1248873.26	528943.45	0.29
SHA13RST150452	Other SWM	Potomac River MO Cnty	02140202	1252264.64	525116.50	0.16
SHA13RST150459	Other SWM	Potomac River MO Cnty	02140202	1245872.85	531416.73	0.40
SHA13RST150460	Other SWM	Potomac River MO Cnty	02140202	1247366.39	530244.76	0.22
SHA12APY150114UT	Tree Planting	Potomac River MO Cnty	02140202	1206967.74	515626.64	0.81
SHA12APY150115UT	Tree Planting	Potomac River MO Cnty	02140202	1206656.91	514962.50	2.15
SHA12APY150116UT	Tree Planting	Potomac River MO Cnty	02140202	1206128.24	514297.87	1.16
SHA12APY150117UT	Tree Planting	Potomac River MO Cnty	02140202	1205043.18	514879.30	0.39
SHA12APY150118UT	Tree Planting	Potomac River MO Cnty	02140202	1204042.74	513052.88	2.09
SHA12APY150119UT	Tree Planting	Potomac River MO Cnty	02140202	1201691.91	511443.60	1.28
SHA12APY150120UT	Tree Planting	Potomac River MO Cnty	02140202	1201842.20	511933.93	1.68
SHA12APY150121UT	Tree Planting	Potomac River MO Cnty	02140202	1202039.94	512850.89	2.38
SHA12APY150123UT	Tree Planting	Potomac River MO Cnty	02140202	1200636.01	513802.86	1.77
SHA12APY150124UT	Tree Planting	Potomac River MO Cnty	02140202	1201848.92	514162.79	1.35
SHA12APY150125UT	Tree Planting	Potomac River MO Cnty	02140202	1198463.02	513342.96	0.33
SHA12APY150126UT	Tree Planting	Potomac River MO Cnty	02140202	1198213.52	513168.18	0.22
SHA12APY150127UT	Tree Planting	Potomac River MO Cnty	02140202	1195787.17	513943.53	0.39
SHA12APY150128UT	Tree Planting	Potomac River MO Cnty	02140202	1195689.18	513597.32	1.12
SHA12APY150129UT	Tree Planting	Potomac River MO Cnty	02140202	1195756.77	513362.86	1.01
SHA12APY150130UT	Tree Planting	Potomac River MO Cnty	02140202	1193762.08	513413.65	0.73
SHA12APY150131UT	Tree Planting	Potomac River MO Cnty	02140202	1193555.55	513223.58	0.57
SHA12APY150132UT	Tree Planting	Potomac River MO Cnty	02140202	1202113.30	512158.33	0.37
SHA13APY160091UT	Tree Planting	Potomac River U tidal	02140201	1334702.42	420340.95	0.21
SHA13APY160092UT	Tree Planting	Potomac River U tidal	02140201	1334842.16	420240.07	0.33
SHA13APY160093UT	Tree Planting	Potomac River U tidal	02140201	1335205.61	420543.40	0.46

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY160094UT	Tree Planting	Potomac River U tidal	02140201	1335439.14	420297.18	0.37
SHA13APY160098UT	Tree Planting	Potomac River U tidal	02140201	1312942.44	412788.99	0.70
SHA13APY210023UT	Tree Planting	Potomac River WA Cnty	02140501	1048834.32	722601.22	0.54
SHA13APY210024UT	Tree Planting	Potomac River WA Cnty	02140501	1046074.24	721113.55	1.37
SHA13APY210026UT	Tree Planting	Potomac River WA Cnty	02140501	1043173.61	718906.54	0.33
SHA13APY210027UT	Tree Planting	Potomac River WA Cnty	02140501	1000540.97	737516.86	0.95
SHA13APY210028UT	Tree Planting	Potomac River WA Cnty	02140501	979574.25	745344.35	0.19
SHA13APY210029UT	Tree Planting	Potomac River WA Cnty	02140501	979230.18	745207.19	0.31
SHA13APY210031UT	Tree Planting	Potomac River WA Cnty	02140501	992670.02	739639.95	0.44
SHA13APY210109UT	Tree Planting	Potomac River WA Cnty	02140501	979407.25	745221.96	0.16
SHA13APY210426UT	Tree Planting	Potomac River WA Cnty	02140501	1042837.24	718730.52	0.28
SHA13ALN150012UR	Stream Restoration	Rock Creek	02140206	1269958.61	534818.91	48.54
SHA14ALN150008UR	Stream Restoration	Rock Creek	02140206	1285998.17	533059.76	29.07
SHA11APY150043UT	Tree Planting	Rock Creek	02140206	1279515.74	504728.50	0.30
SHA11APY150160UT	Tree Planting	Rock Creek	02140206	1279419.85	504925.30	0.07
SHA11APY150161UT	Tree Planting	Rock Creek	02140206	1279713.35	504799.96	0.16
SHA11APY150165UT	Tree Planting	Rock Creek	02140206	1279498.43	505024.65	0.30
SHA15APY150169UT	Tree Planting	Rock Creek	02140206	1290028.96	487336.74	0.53
SHA15APY150170UT	Tree Planting	Rock Creek	02140206	1290175.15	487059.01	0.12
SHA11APY130021UT	Tree Planting	Rocky Gorge Dam	02131107	1340064.78	538372.43	0.34
SHA11APY130022UT	Tree Planting	Rocky Gorge Dam	02131107	1339651.21	537736.27	0.12
SHA11APY130023UT	Tree Planting	Rocky Gorge Dam	02131107	1339177.87	538684.66	0.24
SHA11APY130041UT	Tree Planting	Rocky Gorge Dam	02131107	1341271.25	538330.78	0.08
SHA12APY150005UT	Tree Planting	Rocky Gorge Dam	02131107	1332624.28	526620.54	0.14
SHA12APY150006UT	Tree Planting	Rocky Gorge Dam	02131107	1332925.98	527720.97	0.12

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA12APY150007UT	Tree Planting	Rocky Gorge Dam	02131107	1333456.69	529961.77	0.08
SHA12APY150008UT	Tree Planting	Rocky Gorge Dam	02131107	1333219.93	530073.68	0.11
SHA12APY150009UT	Tree Planting	Rocky Gorge Dam	02131107	1333360.36	530400.83	0.31
SHA12APY150010UT	Tree Planting	Rocky Gorge Dam	02131107	1333185.34	530404.45	0.15
SHA12APY150011UT	Tree Planting	Rocky Gorge Dam	02131107	1333561.89	530333.18	0.11
SHA12APY150012UT	Tree Planting	Rocky Gorge Dam	02131107	1333842.20	530796.25	0.56
SHA12APY150013UT	Tree Planting	Rocky Gorge Dam	02131107	1334425.80	531788.03	0.33
SHA11APY130018UT	Tree Planting	S Branch Patapsco	02130908	1312796.64	602935.79	0.14
SHA13APY060008UT	Tree Planting	S Branch Patapsco	02130908	1271818.15	623851.28	0.06
SHA13APY060009UT	Tree Planting	S Branch Patapsco	02130908	1270936.79	620709.00	0.22
SHA13APY060010UT	Tree Planting	S Branch Patapsco	02130908	1268572.06	618649.89	0.12
SHA13APY060011UT	Tree Planting	S Branch Patapsco	02130908	1321924.08	618065.03	0.16
SHA14APY060023UT	Tree Planting	S Branch Patapsco	02130908	1272071.22	625082.60	1.14
SHA14APY060030UT	Tree Planting	S Branch Patapsco	02130908	1272391.31	626050.85	0.16
SHA14APY060032UT	Tree Planting	S Branch Patapsco	02130908	1270130.00	617350.41	0.21
SHA14APY060041UT	Tree Planting	S Branch Patapsco	02130908	1290965.96	650941.40	0.22
SHA14APY060042UT	Tree Planting	S Branch Patapsco	02130908	1272471.68	628786.18	0.34
SHA14APY060045UT	Tree Planting	S Branch Patapsco	02130908	1294705.50	649244.01	0.16
SHA14APY060150UT	Tree Planting	S Branch Patapsco	02130908	1272242.52	626293.30	0.46
SHA14APY060151UT	Tree Planting	S Branch Patapsco	02130908	1272283.93	627001.03	0.51
SHA15APY060062UT	Tree Planting	S Branch Patapsco	02130908	1264842.40	616196.00	0.45
SHA15APY060063UT	Tree Planting	S Branch Patapsco	02130908	1265809.01	616916.49	0.46
SHA15APY060068UT	Tree Planting	S Branch Patapsco	02130908	1269686.74	619040.26	0.14
SHA15APY060069UT	Tree Planting	S Branch Patapsco	02130908	1272379.09	628058.78	0.08
SHA15APY060070UT	Tree Planting	S Branch Patapsco	02130908	1298013.50	647707.10	0.18

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY060071UT	Tree Planting	S Branch Patapsco	02130908	1290504.04	651101.46	0.11
SHA15APY060083UT	Tree Planting	S Branch Patapsco	02130908	1270779.99	620036.78	0.13
SHA15APY060084UT	Tree Planting	S Branch Patapsco	02130908	1271629.16	623279.27	0.38
SHA15APY060086UT	Tree Planting	S Branch Patapsco	02130908	1272434.96	626717.12	0.23
SHA15APY060089UT	Tree Planting	S Branch Patapsco	02130908	1291576.80	650727.57	0.13
SHA15APY060093UT	Tree Planting	S Branch Patapsco	02130908	1321176.74	623829.13	0.12
SHA15APY060094UT	Tree Planting	S Branch Patapsco	02130908	1322230.08	622197.28	0.04
SHA13RST150444	Other open channel system	Seneca Creek	02140208	1235644.31	537066.67	0.16
SHA13RST150445	Other SWM	Seneca Creek	02140208	1236925.15	535928.37	0.14
SHA13RST150446	Other SWM	Seneca Creek	02140208	1236753.94	535984.43	0.23
SHA13RST150447	Other SWM	Seneca Creek	02140208	1243883.36	533611.40	0.20
SHA13RST150448	Other SWM	Seneca Creek	02140208	1244030.04	533471.24	0.17
SHA13RST150456	Other SWM	Seneca Creek	02140208	1239190.06	535767.94	0.21
SHA13RST150457	Other SWM	Seneca Creek	02140208	1243378.10	533955.01	0.58
SHA13ALN150017UR	Stream Restoration	Seneca Creek	02140208	1259876.93	561514.79	39.91
SHA13APY150037UT	Tree Planting	Seneca Creek	02140208	1260612.33	562095.36	0.36
SHA13APY150038UT	Tree Planting	Seneca Creek	02140208	1260942.56	562604.62	0.34
SHA13APY150039UT	Tree Planting	Seneca Creek	02140208	1261357.21	563098.03	0.13
SHA13APY150040UT	Tree Planting	Seneca Creek	02140208	1260690.60	563048.05	0.31
SHA13APY150041UT	Tree Planting	Seneca Creek	02140208	1260107.52	562280.71	0.17
SHA12APY020385UT	Tree Planting	Severn River	02131002	1425002.68	511597.89	0.63
SHA13APY020047UT	Tree Planting	Severn River	02131002	1398848.06	522266.16	0.37
SHA13APY020055UT	Tree Planting	Severn River	02131002	1418104.74	519272.22	1.77
SHA13APY020056UT	Tree Planting	Severn River	02131002	1418330.45	520708.15	0.37
SHA12APY210002UT	Tree Planting	Sideling Hill Creek	02140510	934363.15	729387.00	1.18

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15RST021282	Bio-Swale	South River	02131003	1415460.31	472560.04	0.67
SHA15RST021283	Bio-Swale	South River	02131003	1411806.10	471785.86	0.31
SHA15RST021295	Bio-Swale	South River	02131003	1413878.03	472202.53	0.33
SHA15RST021302	Bio-Swale	South River	02131003	1420974.72	476597.39	0.35
SHA14APY120021UT	Tree Planting	Swan Creek	02130706	1536685.42	696873.09	0.20
SHA14APY120099UT	Tree Planting	Swan Creek	02130706	1536420.16	696763.99	0.10
SHA15APY120057UT	Tree Planting	Swan Creek	02130706	1549497.90	674025.38	0.19
SHA12APY060002UI	Impervious Surface Elimination (to Pervious)	Upper Monocacy River	02140303	1267920.58	731364.86	0.21
SHA12APY060003UI	Impervious Surface Elimination (to Pervious)	Upper Monocacy River	02140303	1276894.66	745472.07	0.16
SHA13APY100047UT	Tree Planting	Upper Monocacy River	02140303	1192231.16	706526.78	0.20
SHA13APY100048UT	Tree Planting	Upper Monocacy River	02140303	1197131.33	717520.68	0.33
SHA13APY100049UT	Tree Planting	Upper Monocacy River	02140303	1225080.63	741282.72	0.04
SHA13APY100050UT	Tree Planting	Upper Monocacy River	02140303	1224444.65	741642.36	0.21
SHA13APY100253UT	Tree Planting	Upper Monocacy River	02140303	1196787.30	717320.00	0.11
SHA14APY060033UT	Tree Planting	Upper Monocacy River	02140303	1265884.13	728643.52	1.04
SHA14APY060034UT	Tree Planting	Upper Monocacy River	02140303	1267332.25	730544.38	0.62
SHA14APY060037UT	Tree Planting	Upper Monocacy River	02140303	1276859.11	744248.83	0.12
SHA14APY060039UT	Tree Planting	Upper Monocacy River	02140303	1271591.27	737415.89	0.30
SHA14APY060040UT	Tree Planting	Upper Monocacy River	02140303	1277398.04	746923.69	0.30
SHA14APY060141UT	Tree Planting	Upper Monocacy River	02140303	1271332.04	736946.57	0.18
SHA14APY060152UT	Tree Planting	Upper Monocacy River	02140303	1265087.86	727720.01	0.17
SHA15APY060058UT	Tree Planting	Upper Monocacy River	02140303	1268660.70	732457.78	0.15
SHA15APY060059UT	Tree Planting	Upper Monocacy River	02140303	1269137.31	733160.86	0.18
SHA15APY060060UT	Tree Planting	Upper Monocacy River	02140303	1271785.66	737822.04	0.13
SHA15APY060061UT	Tree Planting	Upper Monocacy River	02140303	1276403.80	741761.87	0.14

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY060080UT	Tree Planting	Upper Monocacy River	02140303	1268469.77	732137.31	0.15
SHA15APY060119UT	Tree Planting	Upper Monocacy River	02140303	1273544.52	739648.27	0.05
SHA15APY060120UT	Tree Planting	Upper Monocacy River	02140303	1273976.32	739920.15	0.28
SHA15APY060121UT	Tree Planting	Upper Monocacy River	02140303	1275706.19	740949.66	0.16
SHA15APY060122UT	Tree Planting	Upper Monocacy River	02140303	1269313.07	733444.30	0.07
SHA15APY060123UT	Tree Planting	Upper Monocacy River	02140303	1269931.77	734500.87	0.46
SHA15APY060125UT	Tree Planting	Upper Monocacy River	02140303	1276004.69	741223.34	0.02
SHA15APY060127UT	Tree Planting	Upper Monocacy River	02140303	1277060.62	745655.58	0.25
SHA15APY060128UT	Tree Planting	Upper Monocacy River	02140303	1272184.18	738417.31	0.19
SHA15APY060129UT	Tree Planting	Upper Monocacy River	02140303	1272860.89	739102.25	0.66
SHA15APY060130UT	Tree Planting	Upper Monocacy River	02140303	1270769.61	735960.97	0.64
SHA15APY100156UT	Tree Planting	Upper Monocacy River	02140303	1193858.52	709352.75	0.14
SHA15APY100157UT	Tree Planting	Upper Monocacy River	02140303	1218736.30	736365.85	0.22
SHA15APY100158UT	Tree Planting	Upper Monocacy River	02140303	1223707.86	740546.77	0.03
SHA15APY100166UT	Tree Planting	Upper Monocacy River	02140303	1225822.76	747235.56	0.06
SHA15APY100167UT	Tree Planting	Upper Monocacy River	02140303	1225599.05	747161.97	0.16
SHA15APY100168UT	Tree Planting	Upper Monocacy River	02140303	1224115.70	742853.06	0.12
SHA15APY100169UT	Tree Planting	Upper Monocacy River	02140303	1206729.59	726297.70	0.27
SHA15APY100170UT	Tree Planting	Upper Monocacy River	02140303	1197227.58	717344.15	0.44
SHA15APY100171UT	Tree Planting	Upper Monocacy River	02140303	1198254.73	718100.25	0.11
SHA15APY100174UT	Tree Planting	Upper Monocacy River	02140303	1198894.23	669873.12	0.34
SHA15APY100175UT	Tree Planting	Upper Monocacy River	02140303	1190859.41	688691.25	0.09
SHA15APY100176UT	Tree Planting	Upper Monocacy River	02140303	1209717.46	655620.43	0.23
SHA15APY100177UT	Tree Planting	Upper Monocacy River	02140303	1211169.86	658551.87	0.42
SHA15APY100183UT	Tree Planting	Upper Monocacy River	02140303	1200069.51	666437.98	0.13

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA15APY100184UT	Tree Planting	Upper Monocacy River	02140303	1190632.26	691491.13	0.35
SHA15APY100186UT	Tree Planting	Upper Monocacy River	02140303	1215088.22	661897.97	0.74
SHA15APY100195UT	Tree Planting	Upper Monocacy River	02140303	1194461.59	712764.75	0.09
SHA15APY100196UT	Tree Planting	Upper Monocacy River	02140303	1194205.10	709921.43	0.08
SHA15APY100203UT	Tree Planting	Upper Monocacy River	02140303	1224761.79	744655.84	0.16
SHA15APY100204UT	Tree Planting	Upper Monocacy River	02140303	1193573.38	708700.20	0.31
SHA15APY100205UT	Tree Planting	Upper Monocacy River	02140303	1224003.91	741339.07	0.05
SHA15APY100206UT	Tree Planting	Upper Monocacy River	02140303	1224312.58	741457.71	0.88
SHA15APY100210UT	Tree Planting	Upper Monocacy River	02140303	1203167.91	722539.67	0.28
SHA15APY100255UT	Tree Planting	Upper Monocacy River	02140303	1190517.49	690164.54	0.22
SHA15APY100417UT	Tree Planting	Upper Monocacy River	02140303	1190843.04	689961.85	0.04
SHA15APY100432UT	Tree Planting	Upper Monocacy River	02140303	1225211.93	746261.97	0.12
SHA15APY100433UT	Tree Planting	Upper Monocacy River	02140303	1224888.56	745542.97	0.11
SHA14RST160390	Bio-Swale	Western Branch	02131103	1383657.31	450257.36	0.46
SHA14RST160391	Bio-Swale	Western Branch	02131103	1384437.94	450391.07	0.50
SHA14RST160394	Bio-Swale	Western Branch	02131103	1385757.93	450232.54	0.65
SHA14RST160396	Bio-Swale	Western Branch	02131103	1386597.02	449817.14	0.48
SHA14RST160397	Bio-Swale	Western Branch	02131103	1387280.55	449620.98	0.58
SHA14RST160398	Bio-Swale	Western Branch	02131103	1387718.42	449568.63	0.27
SHA14RST160399	Bio-Swale	Western Branch	02131103	1387985.23	449539.16	0.60
SHA14RST160400	Bio-Swale	Western Branch	02131103	1388866.45	449440.09	0.91
SHA14RST160410	Bio-Swale	Western Branch	02131103	1389593.28	449358.69	0.46
SHA14RST160411	Bio-Swale	Western Branch	02131103	1390190.31	449278.19	0.73
SHA15RST160319	Bio-Swale	Western Branch	02131103	1355119.89	455167.25	0.74
SHA15RST160886	Bio-Swale	Western Branch	02131103	1361081.68	446923.86	0.99

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA13APY160087UT	Tree Planting	Western Branch	02131103	1354626.52	456128.88	0.51
SHA13APY160088UT	Tree Planting	Western Branch	02131103	1355479.59	446885.83	0.58
SHA13APY160089UT	Tree Planting	Western Branch	02131103	1355781.65	447105.99	0.21
SHA12RST080506	Bioretention	Wicomico River	02140106	1324266.16	257532.79	0.62
SHA14RST080517	Bioretention	Wicomico River	02140106	1325854.37	267807.16	0.44
SHA12RST080504	Bio-Swale	Wicomico River	02140106	1323686.19	256379.84	0.44
SHA12RST080505	Bio-Swale	Wicomico River	02140106	1324010.08	256938.03	0.33
SHA14RST080507	Bio-Swale	Wicomico River	02140106	1324867.84	260900.65	0.48
SHA14RST080508	Bio-Swale	Wicomico River	02140106	1325016.26	261866.53	0.50
SHA14RST080512	Bio-Swale	Wicomico River	02140106	1325383.51	264292.54	0.36
SHA14RST080513	Bio-Swale	Wicomico River	02140106	1325475.81	264871.79	0.44
SHA14RST080515	Bio-Swale	Wicomico River	02140106	1325815.61	267170.55	0.29
SHA14RST080516	Bio-Swale	Wicomico River	02140106	1325853.70	267715.68	0.28
SHA14RST080518	Bioretention	Zekiah Swamp	02140108	1325028.85	271599.81	0.19
SHA13RST080520	Bio-Swale	Zekiah Swamp	02140108	1323634.76	273712.44	0.26
SHA13RST080521	Bio-Swale	Zekiah Swamp	02140108	1323373.89	274070.06	0.45
SHA13RST080522	Bio-Swale	Zekiah Swamp	02140108	1321794.36	276216.00	0.31
SHA13RST080523	Bio-Swale	Zekiah Swamp	02140108	1321474.23	276644.87	0.21
SHA13RST080524	Bio-Swale	Zekiah Swamp	02140108	1321410.30	276729.72	0.23
SHA13RST082136	Bio-Swale	Zekiah Swamp	02140108	1358998.06	322984.29	0.52
SHA13RST082138	Bio-Swale	Zekiah Swamp	02140108	1352047.74	327819.04	0.25
SHA13RST082139	Bio-Swale	Zekiah Swamp	02140108	1351975.93	328826.72	0.43
SHA13RST082140	Bio-Swale	Zekiah Swamp	02140108	1348894.87	340145.49	0.16
SHA13RST082141	Bio-Swale	Zekiah Swamp	02140108	1348774.81	340499.27	0.98
SHA14RST080519	Bio-Swale	Zekiah Swamp	02140108	1324979.83	271698.93	0.80

Table 2-2b: Fiscal Years 2011 to 2015 Capital Impervious Restoration Practices						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
SHA14RST082133	Bio-Swale	Zekiah Swamp	02140108	1364234.35	321993.99	0.65
SHA14RST082134	Bio-Swale	Zekiah Swamp	2140108	1363853.17	322019.66	0.62
SHA14RST082135	Bio-Swale	Zekiah Swamp	02140108	1362540.63	322125.22	0.43
SHA12APY080010UT	Tree Planting	Zekiah Swamp	02140108	1347093.63	344336.50	0.16
SHA12APY080011UT	Tree Planting	Zekiah Swamp	02140108	1347496.31	343789.14	0.50
					Complete BMP Acreage Total	**969.56**

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16RST150023	Retrofit	Anacostia River	02140205	1291753.50	530812.73	7.50
SHA16RST160101	Retrofit	Anacostia River	02140205	1340561.18	435834.55	5.36
SHA16RST160702	Retrofit	Anacostia River	02140205	1340270.33	483867.63	2.35
SHA16ALN150010UR	Stream Restoration	Anacostia River	02140205	1306211.04	517192.68	51.71
SHA16APY150001UT	Tree Planting	Anacostia River	02140205	1314376.65	501450.75	0.33
SHA16APY150002UT	Tree Planting	Anacostia River	02140205	1314809.58	501781.97	0.70
SHA16APY150144UT	Tree Planting	Anacostia River	02140205	1300059.35	490713.45	0.11
SHA16APY150147UT	Tree Planting	Anacostia River	02140205	1324898.31	513604.78	0.31
SHA16APY150148UT	Tree Planting	Anacostia River	02140205	1300188.88	490811.14	0.03
SHA16APY150149UT	Tree Planting	Anacostia River	02140205	1319958.37	529288.19	4.43
SHA16APY150158UT	Tree Planting	Anacostia River	02140205	1332301.74	525315.04	0.16
SHA16APY150159UT	Tree Planting	Anacostia River	02140205	1332488.11	525690.82	0.13
SHA16APY160097UT	Tree Planting	Anacostia River	02140205	1344289.05	482962.69	0.10
SHA16APY160124UT	Tree Planting	Anacostia River	02140205	1350090.32	465603.52	0.47
SHA16APY160140UT	Tree Planting	Anacostia River	02140205	1348417.34	459054.65	0.06
SHA16APY160158UT	Tree Planting	Anacostia River	02140205	1347917.89	458150.41	0.08
SHA16APY160159UT	Tree Planting	Anacostia River	02140205	1347648.36	459045.36	0.12
SHA16APY160163UT	Tree Planting	Anacostia River	02140205	1350378.74	471527.44	0.17
SHA16APY160164UT	Tree Planting	Anacostia River	02140205	1348178.26	459189.15	0.12
SHA16APY160190UT	Tree Planting	Anacostia River	02140205	1342617.84	487820.13	0.06
SHA16APY160207UT	Tree Planting	Anacostia River	02140205	1343001.37	488819.54	0.06
SHA16APY160213UT	Tree Planting	Anacostia River	02140205	1342498.64	487865.35	0.25
SHA16RST210210	Bio-Swale	Antietam Creek	02140502	1104420.23	723898.36	0.07
SHA16RST210211	Bio-Swale	Antietam Creek	02140502	1104244.43	723982.08	0.19
SHA16APY210078UT	Tree Planting	Antietam Creek	02140502	1122714.25	705135.25	0.12

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY210080UT	Tree Planting	Antietam Creek	02140502	1120441.61	705261.48	0.05
SHA16APY210116UT	Tree Planting	Antietam Creek	02140502	1125310.64	654089.00	0.33
SHA16APY210117UT	Tree Planting	Antietam Creek	02140502	1124402.89	649168.45	0.28
SHA16APY210118UT	Tree Planting	Antietam Creek	02140502	1124393.76	648528.91	0.04
SHA16APY210119UT	Tree Planting	Antietam Creek	02140502	1124454.50	647975.22	0.23
SHA16APY210120UT	Tree Planting	Antietam Creek	02140502	1124777.43	646754.06	0.05
SHA16APY210121UT	Tree Planting	Antietam Creek	02140502	1125557.91	641732.33	1.77
SHA16APY210122UT	Tree Planting	Antietam Creek	02140502	1125068.72	640371.24	0.32
SHA16APY210124UT	Tree Planting	Antietam Creek	02140502	1125000.15	637664.48	0.86
SHA16APY210131UT	Tree Planting	Antietam Creek	02140502	1129472.57	665684.80	0.05
SHA16APY210137UT	Tree Planting	Antietam Creek	02140502	1129573.51	665530.89	0.50
SHA16APY210138UT	Tree Planting	Antietam Creek	02140502	1129270.36	664531.78	1.03
SHA16APY210139UT	Tree Planting	Antietam Creek	02140502	1128101.12	661260.13	0.08
SHA16APY210141UT	Tree Planting	Antietam Creek	02140502	1127822.96	660341.97	0.08
SHA16APY210158UT	Tree Planting	Antietam Creek	02140502	1124714.73	646944.04	0.07
SHA16APY210176UT	Tree Planting	Antietam Creek	02140502	1124980.69	646708.38	0.84
SHA16APY210177UT	Tree Planting	Antietam Creek	02140502	1124408.81	649758.80	0.04
SHA16APY210178UT	Tree Planting	Antietam Creek	02140502	1125853.07	654618.27	0.99
SHA16APY210187UT	Tree Planting	Antietam Creek	02140502	1128002.56	660929.52	0.04
SHA16APY210188UT	Tree Planting	Antietam Creek	02140502	1125269.24	653594.32	0.13
SHA16APY210196UT	Tree Planting	Antietam Creek	02140502	1127906.23	660623.60	0.05
SHA16APY210199UT	Tree Planting	Antietam Creek	02140502	1124759.56	638467.71	0.22
SHA16APY210210UT	Tree Planting	Antietam Creek	02140502	1132158.17	699287.40	0.19
SHA16APY210223UT	Tree Planting	Antietam Creek	02140502	1127928.40	696199.80	0.63
SHA16APY210310UT	Tree Planting	Antietam Creek	02140502	1127817.24	702917.68	0.13

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY210312UT	Tree Planting	Antietam Creek	02140502	1133463.13	698524.96	0.18
SHA16APY210320UT	Tree Planting	Antietam Creek	02140502	1127286.94	703350.29	0.11
SHA16APY210321UT	Tree Planting	Antietam Creek	02140502	1127086.13	703513.63	0.12
SHA16APY210323UT	Tree Planting	Antietam Creek	02140502	1131934.89	699859.73	0.17
SHA16APY210379UT	Tree Planting	Antietam Creek	02140502	1122874.97	704948.30	0.14
SHA16APY210417UT	Tree Planting	Antietam Creek	02140502	1125265.65	645879.60	0.13
SHA16APY210421UT	Tree Planting	Antietam Creek	02140502	1125400.21	653805.43	0.08
SHA16APY210424UT	Tree Planting	Antietam Creek	02140502	1131380.49	700153.73	0.14
SHA16APY120027UT	Tree Planting	Atkisson Reservoir	02130703	1468229.97	697271.58	0.40
SHA16APY120082UT	Tree Planting	Atkisson Reservoir	02130703	1474209.20	695591.80	0.28
SHA16APY120144UT	Tree Planting	Atkisson Reservoir	02130703	1475136.21	695606.09	1.78
SHA16APY120154UT	Tree Planting	Atkisson Reservoir	02130703	1474634.54	695512.04	0.51
SHA16APY120171UT	Tree Planting	Atkisson Reservoir	02130703	1478642.48	695463.91	0.85
SHA16APY120173UT	Tree Planting	Atkisson Reservoir	02130703	1461184.92	700032.76	1.75
SHA16APY120230UT	Tree Planting	Atkisson Reservoir	02130703	1473728.48	695648.81	0.21
SHA16APY120231UT	Tree Planting	Atkisson Reservoir	02130703	1457772.95	696725.58	0.70
SHA16APY120235UT	Tree Planting	Atkisson Reservoir	02130703	1483720.49	685529.81	0.23
SHA16APY030333UT	Tree Planting	Back River	02130901	1453876.81	590811.49	0.09
SHA16APY030335UT	Tree Planting	Back River	02130901	1450188.43	620926.78	0.08
SHA16RST021571	Grass Swale	Baltimore Harbor	02130903	1416480.67	556430.00	0.30
SHA16RST021575	Grass Swale	Baltimore Harbor	02130903	1416465.57	552561.36	0.25
SHA16RST021576	Grass Swale	Baltimore Harbor	02130903	1412953.56	543764.81	0.97
SHA16RST021577	Grass Swale	Baltimore Harbor	02130903	1412831.95	542953.48	0.40
SHA16RST021579	Grass Swale	Baltimore Harbor	02130903	1413265.49	536152.60	1.14
SHA16RST021580	Grass Swale	Baltimore Harbor	02130903	1413343.40	535403.58	0.56

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16RST021583	Grass Swale	Baltimore Harbor	02130903	1414977.89	529830.10	0.76
SHA16RST021584	Grass Swale	Baltimore Harbor	02130903	1415210.52	529200.48	0.55
SHA16RST021585	Grass Swale	Baltimore Harbor	02130903	1415475.54	528551.78	1.06
SHA16RST021586	Grass Swale	Baltimore Harbor	02130903	1416257.89	526813.71	0.35
SHA16RST021587	Grass Swale	Baltimore Harbor	02130903	1416424.68	526441.34	0.42
SHA16RST020547	Retrofit	Baltimore Harbor	02130903	1413802.79	532307.32	18.14
SHA16APY020391UT	Tree Planting	Baltimore Harbor	02130903	1419247.60	560805.64	1.64
SHA16APY030322UT	Tree Planting	Bird River	02130803	1454338.28	625785.66	0.17
SHA16APY030323UT	Tree Planting	Bird River	02130803	1474673.34	619766.37	0.68
SHA16APY030336UT	Tree Planting	Bird River	02130803	1454157.06	625593.08	0.04
SHA16APY030337UT	Tree Planting	Bird River	02130803	1455761.80	627230.50	0.14
SHA16APY120083UT	Tree Planting	Broad Creek	02120205	1487879.68	735551.12	0.46
SHA16APY120117UT	Tree Planting	Broad Creek	02120205	1487370.52	734716.68	0.43
SHA16APY120032UT	Tree Planting	Bynum Run	02130704	1489651.02	695151.83	0.39
SHA16APY120066UT	Tree Planting	Bynum Run	02130704	1485328.79	696986.01	0.07
SHA16APY120067UT	Tree Planting	Bynum Run	02130704	1485289.28	697191.08	0.06
SHA16APY120068UT	Tree Planting	Bynum Run	02130704	1485146.18	697784.18	0.04
SHA16APY120100UT	Tree Planting	Bynum Run	02130704	1485207.67	697541.86	0.04
SHA16APY120101UT	Tree Planting	Bynum Run	02130704	1485252.17	697374.94	0.06
SHA16APY120108UT	Tree Planting	Bynum Run	02130704	1485343.04	696281.10	0.19
SHA16APY120112UT	Tree Planting	Bynum Run	02130704	1486729.00	695890.12	0.55
SHA16RST150026	Retrofit	Cabin John Creek	02140207	1268867.05	506302.09	2.69
SHA16RST150029	Retrofit	Cabin John Creek	02140207	1268327.78	505812.90	1.43
SHA16APY150051UT	Tree Planting	Cabin John Creek	02140207	1267677.49	483012.01	0.11
SHA16APY150084UT	Tree Planting	Cabin John Creek	02140207	1262118.11	485812.93	0.07

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY150085UT	Tree Planting	Cabin John Creek	02140207	1262502.05	485608.35	0.04
SHA16APY150136UT	Tree Planting	Cabin John Creek	02140207	1267750.05	482856.98	0.13
SHA16RST210193	Bio-Swale	Conococheague Creek	02140504	1101947.03	724390.85	0.17
SHA16RST210194	Bio-Swale	Conococheague Creek	02140504	1102198.40	724389.83	0.30
SHA16RST210195	Bio-Swale	Conococheague Creek	02140504	1101891.33	724391.44	0.07
SHA16RST210196	Bio-Swale	Conococheague Creek	02140504	1101781.35	724391.03	0.17
SHA16RST210197	Bio-Swale	Conococheague Creek	02140504	1100129.07	724393.53	0.32
SHA16RST210198	Bio-Swale	Conococheague Creek	02140504	1100029.91	724393.78	0.13
SHA16RST210206	Bio-Swale	Conococheague Creek	02140504	1094411.06	724149.91	0.19
SHA16RST210207	Bio-Swale	Conococheague Creek	02140504	1094325.84	724113.83	0.19
SHA16APY210393UT	Tree Planting	Conococheague Creek	02140504	1101392.76	724138.66	0.56
SHA16APY210422UT	Tree Planting	Conococheague Creek	02140504	1122412.67	701088.00	0.10
SHA16APY120233UT	Tree Planting	Deer Creek	02120202	1469397.87	732201.07	0.44
SHA16APY120234UT	Tree Planting	Deer Creek	02120202	1470115.38	732688.61	0.35
SHA16APY120236UT	Tree Planting	Deer Creek	02120202	1470026.50	732504.82	0.02
SHA16APY120237UT	Tree Planting	Deer Creek	02120202	1469769.21	732382.73	0.10
SHA16APY030144UT	Tree Planting	Gwynns Falls	02130905	1385364.49	596991.77	0.20
SHA16APY030188UT	Tree Planting	Gwynns Falls	02130905	1382048.20	624426.83	0.09
SHA16APY030207UT	Tree Planting	Gwynns Falls	02130905	1384425.47	596246.69	0.37
SHA16APY030219UT	Tree Planting	Gwynns Falls	02130905	1381718.75	624479.16	0.09
SHA16APY030234UT	Tree Planting	Gwynns Falls	02130905	1383446.77	597295.53	0.78
SHA16APY030238UT	Tree Planting	Gwynns Falls	02130905	1385284.64	596314.19	0.05
SHA16APY030312UT	Tree Planting	Gwynns Falls	02130905	1385199.37	596668.49	0.50
SHA16APY030313UT	Tree Planting	Gwynns Falls	02130905	1385513.07	596655.19	0.51
SHA16APY030324UT	Tree Planting	Gwynns Falls	02130905	1383999.85	612630.15	1.01

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY030330UT	Tree Planting	Jones Falls	02130904	1407535.73	636257.67	0.13
SHA16APY030331UT	Tree Planting	Jones Falls	02130904	1407395.62	635961.64	0.09
SHA16APY030332UT	Tree Planting	Jones Falls	02130904	1407127.16	636500.89	0.16
SHA16APY030274UT	Tree Planting	Liberty Reservoir	02130907	1360290.34	659093.35	0.20
SHA16APY030338UT	Tree Planting	Liberty Reservoir	02130907	1358378.97	656915.88	0.25
SHA16APY120042UT	Tree Planting	Little Gunpowder Falls	02130804	1464427.64	682118.20	0.03
SHA16APY120043UT	Tree Planting	Little Gunpowder Falls	02130804	1464159.44	682301.00	0.10
SHA16APY120146UT	Tree Planting	Little Gunpowder Falls	02130804	1464516.13	681950.35	0.30
SHA16APY120156UT	Tree Planting	Little Gunpowder Falls	02130804	1463906.55	682435.56	0.46
SHA16RST130531	Bio-Swale	Little Patuxent River	02131105	1343664.79	591125.39	0.27
SHA16RST130619	Micro-Bioretention	Little Patuxent River	02131105	1364737.88	573025.38	0.57
SHA16RST130620	Micro-Bioretention	Little Patuxent River	02131105	1365271.06	570266.74	0.31
SHA16APY030281UT	Tree Planting	Loch Raven Reservoir	02130805	1394901.91	662229.99	0.11
SHA16APY030283UT	Tree Planting	Loch Raven Reservoir	02130805	1394904.66	663464.00	0.10
SHA16APY030308UT	Tree Planting	Loch Raven Reservoir	02130805	1407910.96	656089.26	0.30
SHA16APY030340UT	Tree Planting	Loch Raven Reservoir	02130805	1395189.07	662783.26	0.03
SHA16APY030341UT	Tree Planting	Loch Raven Reservoir	02130805	1395253.57	662843.91	0.01
SHA16RST100319	Bio-Swale	Lower Monocacy River	02140302	1205265.46	632546.84	0.24
SHA16RST100320	Bio-Swale	Lower Monocacy River	02140302	1206547.92	632003.33	0.32
SHA16RST100321	Bio-Swale	Lower Monocacy River	02140302	1207318.51	631673.53	0.27
SHA16RST100322	Bio-Swale	Lower Monocacy River	02140302	1209737.48	630440.46	0.31
SHA16RST100323	Bio-Swale	Lower Monocacy River	02140302	1211368.36	630323.28	0.62
SHA16RST100324	Bio-Swale	Lower Monocacy River	02140302	1212132.04	630332.50	0.33
SHA16RST100325	Bio-Swale	Lower Monocacy River	02140302	1212673.94	630341.20	0.36
SHA16RST100326	Bio-Swale	Lower Monocacy River	02140302	1213038.64	630343.90	0.68

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16RST100327	Bio-Swale	Lower Monocacy River	02140302	1213748.17	630296.20	0.41
SHA16RST100328	Bio-Swale	Lower Monocacy River	02140302	1214332.80	630218.14	0.59
SHA16RST100329	Bio-Swale	Lower Monocacy River	02140302	1215166.87	630095.26	0.58
SHA16RST100330	Bio-Swale	Lower Monocacy River	02140302	1216061.39	629949.48	0.68
SHA16RST100331	Bio-Swale	Lower Monocacy River	02140302	1216918.44	629725.17	0.65
SHA16RST100332	Bio-Swale	Lower Monocacy River	02140302	1217732.23	629471.98	0.53
SHA16RST100333	Bio-Swale	Lower Monocacy River	02140302	1218400.68	629256.00	0.71
SHA16RST100334	Bio-Swale	Lower Monocacy River	02140302	1219098.71	629039.44	0.46
SHA16RST100335	Bio-Swale	Lower Monocacy River	02140302	1219833.84	628801.17	0.81
SHA16RST021222	Bio-Swale	Magothy River	02131001	1446837.28	506302.66	0.79
SHA16RST021232	Bio-Swale	Magothy River	02131001	1451102.12	499895.69	0.28
SHA16APY210202UT	Tree Planting	Marsh Run	02140503	1102786.74	706925.36	0.28
SHA16APY210203UT	Tree Planting	Marsh Run	02140503	1102235.44	707001.12	0.25
SHA16APY080026UT	Tree Planting	Mattawoman Creek	02140111	1348346.90	359902.55	0.16
SHA16APY080107UT	Tree Planting	Mattawoman Creek	02140111	1348226.79	360456.05	0.19
SHA16APY160123UT	Tree Planting	Mattawoman Creek	02140111	1297339.43	353544.35	0.04
SHA16APY160138UT	Tree Planting	Mattawoman Creek	02140111	1309637.14	361048.44	0.11
SHA16APY160143UT	Tree Planting	Mattawoman Creek	02140111	1297773.96	353994.80	0.03
SHA16APY160149UT	Tree Planting	Mattawoman Creek	02140111	1297109.90	353375.78	0.02
SHA16APY160156UT	Tree Planting	Mattawoman Creek	02140111	1307776.96	362360.18	0.06
SHA16RST130621	Micro-Bioretention	Patapsco River L N Br	02130906	1368406.02	566432.36	0.47
SHA16RST130622	Micro-Bioretention	Patapsco River L N Br	02130906	1368709.61	566353.46	0.29
SHA16RST130623	Micro-Bioretention	Patapsco River L N Br	02130906	1369661.69	566076.33	0.39
SHA16RST130624	Micro-Bioretention	Patapsco River L N Br	02130906	1371129.79	561766.16	0.30
SHA16RST130625	Micro-Bioretention	Patapsco River L N Br	02130906	1374330.55	561366.94	0.16

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16RST130627	Micro-Bioretention	Patapsco River L N Br	02130906	1377354.40	558686.65	0.49
SHA16RST130628	Micro-Bioretention	Patapsco River L N Br	02130906	1377847.19	558140.21	0.31
SHA16RST130629	Micro-Bioretention	Patapsco River L N Br	02130906	1379061.15	556810.39	0.47
SHA16RST130630	Micro-Bioretention	Patapsco River L N Br	02130906	1379739.30	556062.22	0.49
SHA16RST130631	Micro-Bioretention	Patapsco River L N Br	02130906	1384161.52	552371.03	0.11
SHA16RST130632	Micro-Bioretention	Patapsco River L N Br	02130906	1384542.58	552113.48	0.29
SHA16APY030142UT	Tree Planting	Patapsco River L N Br	02130906	1403186.21	577127.01	0.21
SHA16APY030154UT	Tree Planting	Patapsco River L N Br	02130906	1397645.09	564688.77	0.12
SHA16APY030171UT	Tree Planting	Patapsco River L N Br	02130906	1401671.16	576276.54	0.25
SHA16APY030208UT	Tree Planting	Patapsco River L N Br	02130906	1402437.64	577149.79	0.30
SHA16APY030209UT	Tree Planting	Patapsco River L N Br	02130906	1404085.65	578445.78	0.29
SHA16APY030214UT	Tree Planting	Patapsco River L N Br	02130906	1403122.67	577992.89	0.14
SHA16APY030225UT	Tree Planting	Patapsco River L N Br	02130906	1402269.05	577111.46	0.30
SHA16APY030228UT	Tree Planting	Patapsco River L N Br	02130906	1403072.28	576534.84	0.27
SHA16APY030244UT	Tree Planting	Patapsco River L N Br	02130906	1402977.65	576797.05	0.11
SHA16APY030342UT	Tree Planting	Patapsco River L N Br	02130906	1402902.01	576952.93	0.04
SHA16APY020065UT	Tree Planting	Patuxent River lower	02131101	1427976.05	389410.53	0.14
SHA16APY020096UT	Tree Planting	Patuxent River lower	02131101	1427369.92	388006.66	0.38
SHA16APY020187UT	Tree Planting	Patuxent River lower	02131101	1426336.94	386418.45	0.17
SHA16APY080007UT	Tree Planting	Patuxent River lower	02131101	1375466.69	316308.36	0.49
SHA16APY080060UT	Tree Planting	Patuxent River lower	02131101	1376153.45	314000.06	0.29
SHA16APY080061UT	Tree Planting	Patuxent River lower	02131101	1372039.62	319340.24	0.19
SHA16RST020337	Retrofit	Patuxent River middle	02131102	1400944.50	413922.11	1.93
SHA16APY020068UT	Tree Planting	Patuxent River middle	02131102	1397189.16	416341.81	0.12
SHA16APY020069UT	Tree Planting	Patuxent River middle	02131102	1418766.19	406084.56	0.09

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY020073UT	Tree Planting	Patuxent River middle	02131102	1414980.61	407855.39	0.45
SHA16APY020074UT	Tree Planting	Patuxent River middle	02131102	1426615.06	402480.92	0.16
SHA16APY020075UT	Tree Planting	Patuxent River middle	02131102	1428673.41	408222.13	0.15
SHA16APY020078UT	Tree Planting	Patuxent River middle	02131102	1424520.57	420117.61	0.09
SHA16APY020081UT	Tree Planting	Patuxent River middle	02131102	1415679.85	407367.68	0.95
SHA16APY020082UT	Tree Planting	Patuxent River middle	02131102	1413417.61	408501.90	0.33
SHA16APY020083UT	Tree Planting	Patuxent River middle	02131102	1419595.00	405898.18	0.20
SHA16APY020086UT	Tree Planting	Patuxent River middle	02131102	1424383.67	420351.97	0.09
SHA16APY020087UT	Tree Planting	Patuxent River middle	02131102	1426691.62	413616.97	0.05
SHA16APY020095UT	Tree Planting	Patuxent River middle	02131102	1419178.44	405997.28	0.31
SHA16APY020099UT	Tree Planting	Patuxent River middle	02131102	1418889.93	406067.87	0.08
SHA16APY020103UT	Tree Planting	Patuxent River middle	02131102	1424613.83	419897.71	0.05
SHA16APY020104UT	Tree Planting	Patuxent River middle	02131102	1427356.11	407633.71	0.21
SHA16APY020109UT	Tree Planting	Patuxent River middle	02131102	1426662.69	411915.35	0.46
SHA16APY020111UT	Tree Planting	Patuxent River middle	02131102	1421418.27	406230.34	0.52
SHA16APY020113UT	Tree Planting	Patuxent River middle	02131102	1425451.37	417063.89	0.09
SHA16APY020114UT	Tree Planting	Patuxent River middle	02131102	1420169.77	405844.16	0.51
SHA16APY020120UT	Tree Planting	Patuxent River middle	02131102	1426668.16	411290.65	0.19
SHA16APY020153UT	Tree Planting	Patuxent River middle	02131102	1423025.87	421504.21	0.04
SHA16APY020274UT	Tree Planting	Patuxent River middle	02131102	1414588.59	408030.49	0.19
SHA16APY020386UT	Tree Planting	Patuxent River middle	02131102	1426913.48	407581.98	0.09
SHA16APY020393UT	Tree Planting	Patuxent River middle	02131102	1423844.01	421017.17	0.16
SHA16APY020394UT	Tree Planting	Patuxent River middle	02131102	1423954.35	420856.41	0.06
SHA16APY020395UT	Tree Planting	Patuxent River middle	02131102	1424009.39	420786.16	0.03
SHA16APY020396UT	Tree Planting	Patuxent River middle	02131102	1424111.41	420660.81	0.12

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16RST160170	Retrofit	Patuxent River upper	02131104	1355421.36	521281.40	0.11
SHA16RST160171	Retrofit	Patuxent River upper	02131104	1355574.52	521464.11	0.14
SHA16APY160125UT	Tree Planting	Patuxent River upper	02131104	1355621.76	521259.02	0.30
SHA16APY160139UT	Tree Planting	Patuxent River upper	02131104	1344102.26	522264.56	0.24
SHA16RST160189	Retrofit	Piscataway Creek	02140203	1346623.30	397714.19	0.61
SHA16RST160190	Retrofit	Piscataway Creek	02140203	1346761.01	392907.93	0.36
SHA16APY160134UT	Tree Planting	Piscataway Creek	02140203	1310439.35	366993.66	0.19
SHA16RST080767	Bio-Swale	Port Tobacco River	02140109	1315064.57	290858.26	0.26
SHA16RST080772	Bio-Swale	Port Tobacco River	02140109	1315241.42	292685.73	0.50
SHA16RST080777	Bio-Swale	Port Tobacco River	02140109	1315486.27	295237.39	0.82
SHA16RST080780	Bio-Swale	Port Tobacco River	02140109	1315676.22	297331.77	0.96
SHA16RST080785	Bio-Swale	Port Tobacco River	02140109	1315883.96	299476.12	0.37
SHA16RST080786	Bio-Swale	Port Tobacco River	02140109	1315926.45	299955.41	0.32
SHA16RST080788	Bio-Swale	Port Tobacco River	02140109	1316040.99	301129.27	0.37
SHA16RST080796	Bio-Swale	Port Tobacco River	02140109	1317198.11	307797.61	0.25
SHA16RST080797	Bio-Swale	Port Tobacco River	02140109	1317310.14	308341.86	0.44
SHA16APY210123UT	Tree Planting	Potomac River FR Cnty	02140301	1126787.95	632134.24	0.54
SHA16APY210125UT	Tree Planting	Potomac River FR Cnty	02140301	1125292.29	636710.62	0.59
SHA16APY210128UT	Tree Planting	Potomac River FR Cnty	02140301	1127539.10	630292.90	0.08
SHA16APY210129UT	Tree Planting	Potomac River FR Cnty	02140301	1127421.27	629425.52	0.34
SHA16APY210142UT	Tree Planting	Potomac River FR Cnty	02140301	1127093.31	628477.20	0.10
SHA16APY210143UT	Tree Planting	Potomac River FR Cnty	02140301	1127007.58	628256.78	0.17
SHA16APY210144UT	Tree Planting	Potomac River FR Cnty	02140301	1126888.39	627961.49	0.22
SHA16APY210145UT	Tree Planting	Potomac River FR Cnty	02140301	1126546.19	627053.38	0.21
SHA16APY210146UT	Tree Planting	Potomac River FR Cnty	02140301	1122835.39	620447.81	0.26

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY210147UT	Tree Planting	Potomac River FR Cnty	02140301	1122668.10	619979.80	0.04
SHA16APY210148UT	Tree Planting	Potomac River FR Cnty	02140301	1122623.80	619862.78	0.06
SHA16APY210149UT	Tree Planting	Potomac River FR Cnty	02140301	1122250.70	618976.52	0.13
SHA16APY210150UT	Tree Planting	Potomac River FR Cnty	02140301	1120366.24	615271.76	0.30
SHA16APY210151UT	Tree Planting	Potomac River FR Cnty	02140301	1119380.09	611318.88	0.15
SHA16APY210152UT	Tree Planting	Potomac River FR Cnty	02140301	1118954.60	609743.42	0.11
SHA16APY210153UT	Tree Planting	Potomac River FR Cnty	02140301	1114917.13	607456.82	0.24
SHA16APY210155UT	Tree Planting	Potomac River FR Cnty	02140301	1119616.87	612514.76	0.06
SHA16APY210156UT	Tree Planting	Potomac River FR Cnty	02140301	1119532.34	612172.02	0.33
SHA16APY210157UT	Tree Planting	Potomac River FR Cnty	02140301	1120437.51	615866.90	0.16
SHA16APY210201UT	Tree Planting	Potomac River FR Cnty	02140301	1119014.92	609859.04	0.04
SHA16APY210418UT	Tree Planting	Potomac River FR Cnty	02140301	1126638.48	627328.05	0.08
SHA16APY210419UT	Tree Planting	Potomac River FR Cnty	02140301	1126787.09	627673.27	0.17
SHA16APY210420UT	Tree Planting	Potomac River FR Cnty	02140301	1122724.73	620141.25	0.13
SHA16APY210423UT	Tree Planting	Potomac River FR Cnty	02140301	1127532.05	630611.20	0.09
SHA16RST080500	Bioretention	Potomac River L tidal	02140101	1322281.21	255025.23	0.46
SHA16RST080750	Bio-Swale	Potomac River L tidal	02140101	1319613.90	279174.69	0.83
SHA16RST080764	Bio-Swale	Potomac River L tidal	02140101	1320607.51	277820.86	0.48
SHA16APY160133UT	Tree Planting	Potomac River M tidal	02140102	1296577.05	352999.99	0.04
SHA16APY160236UT	Tree Planting	Potomac River M tidal	02140102	1296862.78	353200.34	0.04
SHA16APY150065UT	Tree Planting	Potomac River MO Cnty	02140202	1260193.58	521848.73	0.11
SHA16APY150091UT	Tree Planting	Potomac River MO Cnty	02140202	1245551.13	497592.75	0.05
SHA16APY150093UT	Tree Planting	Potomac River MO Cnty	02140202	1245243.57	497783.42	0.01
SHA16APY150094UT	Tree Planting	Potomac River MO Cnty	02140202	1245130.13	497854.46	0.01
SHA16APY150135UT	Tree Planting	Potomac River MO Cnty	02140202	1261679.54	530902.99	1.10

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY150141UT	Tree Planting	Potomac River MO Cnty	02140202	1245951.74	497351.40	0.03
SHA16APY160127UT	Tree Planting	Potomac River U tidal	02140201	1313264.43	413796.73	0.07
SHA16APY160128UT	Tree Planting	Potomac River U tidal	02140201	1312516.88	413011.51	0.06
SHA16APY160132UT	Tree Planting	Potomac River U tidal	02140201	1346648.10	422736.86	0.51
SHA16APY160142UT	Tree Planting	Potomac River U tidal	02140201	1312796.02	413725.36	0.13
SHA16APY160145UT	Tree Planting	Potomac River U tidal	02140201	1349869.61	427490.48	0.04
SHA16APY160150UT	Tree Planting	Potomac River U tidal	02140201	1349440.20	427283.05	0.40
SHA16APY160160UT	Tree Planting	Potomac River U tidal	02140201	1312874.66	413348.06	0.30
SHA16APY160165UT	Tree Planting	Potomac River U tidal	02140201	1312440.75	413181.72	0.10
SHA16APY160174UT	Tree Planting	Potomac River U tidal	02140201	1329045.13	425398.24	0.08
SHA16APY160230UT	Tree Planting	Potomac River U tidal	02140201	1312455.11	413332.32	0.09
SHA16APY160231UT	Tree Planting	Potomac River U tidal	02140201	1312449.94	413252.44	0.03
SHA16APY160232UT	Tree Planting	Potomac River U tidal	02140201	1312986.59	413199.61	0.17
SHA16RST150021	Retrofit	Rock Creek	02140206	1291010.18	526599.21	2.56
SHA16RST150342	Retrofit	Rock Creek	02140206	1289986.04	525354.20	2.78
SHA16RST150343	Retrofit	Rock Creek	02140206	1290942.58	526011.39	2.50
SHA16ALN150009UR	Stream Restoration	Rock Creek	02140206	1283957.54	525615.68	60.03
SHA16APY150074UT	Tree Planting	Rocky Gorge Dam	02131107	1295252.76	545822.39	0.03
SHA16APY150075UT	Tree Planting	Rocky Gorge Dam	02131107	1295302.74	546082.91	0.07
SHA16APY150155UT	Tree Planting	Rocky Gorge Dam	02131107	1333400.42	530678.73	0.07
SHA16APY150156UT	Tree Planting	Rocky Gorge Dam	02131107	1333544.16	530929.86	0.10
SHA16APY150157UT	Tree Planting	Rocky Gorge Dam	02131107	1332386.14	526676.33	0.32
SHA16APY150017UT	Tree Planting	Seneca Creek	02140208	1242569.09	549425.25	0.20
SHA16APY150052UT	Tree Planting	Seneca Creek	02140208	1237858.03	557213.05	0.07
SHA16APY150057UT	Tree Planting	Seneca Creek	02140208	1239776.69	552350.11	0.10

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY150058UT	Tree Planting	Seneca Creek	02140208	1232018.71	569608.51	0.05
SHA16APY150062UT	Tree Planting	Seneca Creek	02140208	1239027.50	555160.10	0.22
SHA16APY150063UT	Tree Planting	Seneca Creek	02140208	1207101.51	531006.78	0.20
SHA16APY150064UT	Tree Planting	Seneca Creek	02140208	1251278.62	538672.32	0.06
SHA16APY150066UT	Tree Planting	Seneca Creek	02140208	1251868.76	536297.95	0.24
SHA16APY150072UT	Tree Planting	Seneca Creek	02140208	1231768.61	570480.33	0.10
SHA16APY150073UT	Tree Planting	Seneca Creek	02140208	1239295.52	552517.88	0.24
SHA16APY150086UT	Tree Planting	Seneca Creek	02140208	1237224.65	558009.55	0.16
SHA16APY150087UT	Tree Planting	Seneca Creek	02140208	1237283.57	557759.57	1.02
SHA16APY150088UT	Tree Planting	Seneca Creek	02140208	1237418.60	558423.11	0.13
SHA16APY150089UT	Tree Planting	Seneca Creek	02140208	1237090.86	558712.04	0.04
SHA16APY150090UT	Tree Planting	Seneca Creek	02140208	1236067.10	559855.92	0.18
SHA16APY150109UT	Tree Planting	Seneca Creek	02140208	1232500.62	546253.93	0.04
SHA16APY150113UT	Tree Planting	Seneca Creek	02140208	1243401.14	556695.71	0.44
SHA16APY150137UT	Tree Planting	Seneca Creek	02140208	1237961.68	557049.39	0.07
SHA16APY150138UT	Tree Planting	Seneca Creek	02140208	1237054.47	557715.00	0.15
SHA16APY150139UT	Tree Planting	Seneca Creek	02140208	1236966.11	557783.47	0.15
SHA16APY150140UT	Tree Planting	Seneca Creek	02140208	1236933.75	557902.14	0.03
SHA16APY150142UT	Tree Planting	Seneca Creek	02140208	1251266.35	538575.75	0.04
SHA16APY150143UT	Tree Planting	Seneca Creek	02140208	1240995.21	529677.29	0.51
SHA16APY150145UT	Tree Planting	Seneca Creek	02140208	1236844.41	557377.63	0.18
SHA16APY150146UT	Tree Planting	Seneca Creek	02140208	1240940.85	529452.09	0.06
SHA16RST021238	Bio-Swale	Severn River	02131002	1452953.08	497021.88	0.67
SHA16RST021239	Bio-Swale	Severn River	02131002	1453614.66	495994.68	0.46
SHA16RST021241	Bio-Swale	Severn River	02131002	1455031.70	493786.57	0.65

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16RST021244	Bio-Swale	Severn River	02131002	1455640.08	492844.95	0.33
SHA16RST021588	Grass Swale	Severn River	02131002	1415345.23	511308.09	0.53
SHA16RST021591	Grass Swale	Severn River	02131002	1414369.05	509165.69	0.60
SHA16RST021592	Grass Swale	Severn River	02131002	1417291.09	506019.80	0.40
SHA16RST021593	Grass Swale	Severn River	02131002	1417615.10	505588.78	0.23
SHA16RST021617	Grass Swale	Severn River	02131002	1415941.31	511761.74	0.55
SHA16RST021223	Other filtering	Severn River	02131002	1451983.34	498527.34	0.58
SHA16RST021225	Other filtering	Severn River	02131002	1452212.24	498171.50	0.56
SHA16RST021237	Other filtering	Severn River	02131002	1452607.44	497557.71	0.29
SHA16RST021240	Other filtering	Severn River	02131002	1454108.52	495224.27	0.46
SHA16RST0200013UO	Outfall Stabilization	Severn River	02131002	1417422.84	523307.64	2.00
SHA16RST020090	Retrofit	Severn River	02131002	1412617.93	510265.24	2.45
SHA16RST020221	Retrofit	Severn River	02131002	1418936.85	504058.38	4.46
SHA16RST020438	Retrofit	Severn River	02131002	1414976.76	508445.02	10.19
SHA16ALN020004UR	Step Pool Storm Conveyance	Severn River	02131002	1417239.86	523287.28	4.50
SHA16ALN020002UR	Stream Restoration	Severn River	02131002	1417239.86	523287.28	4.50
SHA16APY020281UT	Tree Planting	Severn River	02131002	1456221.01	490655.82	0.08
SHA16APY020309UT	Tree Planting	Severn River	02131002	1456407.63	491455.06	0.18
SHA16APY020311UT	Tree Planting	Severn River	02131002	1457129.48	490863.15	0.42
SHA16APY020313UT	Tree Planting	Severn River	02131002	1457019.82	491373.42	0.14
SHA16APY020314UT	Tree Planting	Severn River	02131002	1456098.47	490818.48	0.15
SHA16APY020315UT	Tree Planting	Severn River	02131002	1456197.31	491418.54	0.23
SHA16APY020316UT	Tree Planting	Severn River	02131002	1462282.64	494270.62	0.22
SHA16APY020320UT	Tree Planting	Severn River	02131002	1468586.28	496134.75	0.12
SHA16APY020322UT	Tree Planting	Severn River	02131002	1461066.99	493827.28	0.16

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY020323UT	Tree Planting	Severn River	02131002	1457427.19	490254.23	0.06
SHA16APY020324UT	Tree Planting	Severn River	02131002	1441658.73	480191.79	0.13
SHA16RST020163	Retrofit	South River	02131003	1422665.76	490012.09	1.40
SHA16RST020252	Retrofit	South River	02131003	1439401.26	480675.17	3.34
SHA16RST020262	Retrofit	South River	02131003	1440637.47	479910.63	4.73
SHA16RST020266	Retrofit	South River	02131003	1440181.90	479799.26	1.47
SHA16RST020269	Retrofit	South River	02131003	1438172.45	480023.12	6.87
SHA16ALN020003UR	Stream Restoration	South River	02131003	1439457.83	478723.62	23.00
SHA16APY020067UT	Tree Planting	South River	02131003	1414029.46	469048.82	0.15
SHA16APY020071UT	Tree Planting	South River	02131003	1438832.20	451422.28	0.23
SHA16APY020085UT	Tree Planting	South River	02131003	1438996.75	451806.13	0.16
SHA16APY020098UT	Tree Planting	South River	02131003	1411059.12	470920.34	0.14
SHA16APY020388UT	Tree Planting	South River	02131003	1442758.16	476147.62	0.11
SHA16APY020389UT	Tree Planting	South River	02131003	1443066.03	475745.92	0.15
SHA16RST100299	Bio-Swale	Upper Monocacy River	02140303	1198921.25	656805.86	0.72
SHA16RST100300	Bio-Swale	Upper Monocacy River	02140303	1199270.44	657984.43	0.73
SHA16RST100301	Bio-Swale	Upper Monocacy River	02140303	1199685.15	658825.51	0.87
SHA16RST100304	Bio-Swale	Upper Monocacy River	02140303	1200159.89	659999.46	0.80
SHA16RST100306	Bio-Swale	Upper Monocacy River	02140303	1200030.95	663643.38	0.92
SHA16RST100309	Bio-Swale	Upper Monocacy River	02140303	1199950.91	666353.75	0.32
SHA16RST100310	Bio-Swale	Upper Monocacy River	02140303	1199574.54	668369.27	1.54
SHA16RST100311	Bio-Swale	Upper Monocacy River	02140303	1198839.61	669749.76	0.40
SHA16RST100312	Bio-Swale	Upper Monocacy River	02140303	1198230.56	670685.25	0.44
SHA16RST100313	Bio-Swale	Upper Monocacy River	02140303	1197869.70	671231.80	0.40
SHA16RST100314	Bio-Swale	Upper Monocacy River	02140303	1197509.53	671784.32	0.42

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16RST100315	Bio-Swale	Upper Monocacy River	02140303	1197145.18	672344.04	0.33
SHA16RST100316	Bio-Swale	Upper Monocacy River	02140303	1196805.65	672863.05	0.45
SHA16RST100461	Bio-Swale	Upper Monocacy River	02140303	1196529.25	673287.64	0.19
SHA16RST100463	Bio-Swale	Upper Monocacy River	02140303	1194967.87	675679.41	0.09
SHA16RST100464	Bio-Swale	Upper Monocacy River	02140303	1193919.05	677284.26	0.60
SHA16RST100465	Bio-Swale	Upper Monocacy River	02140303	1193609.20	677757.00	0.39
SHA16RST100466	Bio-Swale	Upper Monocacy River	02140303	1193087.41	678994.12	0.56
SHA16RST100467	Bio-Swale	Upper Monocacy River	02140303	1192932.49	679660.85	0.75
SHA16RST100468	Bio-Swale	Upper Monocacy River	02140303	1192654.77	681458.23	0.33
SHA16RST100469	Bio-Swale	Upper Monocacy River	02140303	1192508.90	682410.80	1.20
SHA16RST100474	Bio-Swale	Upper Monocacy River	02140303	1190970.33	688530.19	0.67
SHA16RST100475	Bio-Swale	Upper Monocacy River	02140303	1190947.48	689536.92	0.71
SHA16RST100476	Bio-Swale	Upper Monocacy River	02140303	1190846.10	690902.57	0.80
SHA16RST100479	Bio-Swale	Upper Monocacy River	02140303	1190565.01	692526.95	0.26
SHA16RST100480	Bio-Swale	Upper Monocacy River	02140303	1190465.81	693060.22	0.74
SHA16RST100481	Bio-Swale	Upper Monocacy River	02140303	1190279.92	694112.75	0.48
SHA16RST100302	Micro-Bioretention	Upper Monocacy River	02140303	1199958.59	659399.35	0.33
SHA16RST100303	Micro-Bioretention	Upper Monocacy River	02140303	1199994.07	659490.44	0.49
SHA16RST100305	Micro-Bioretention	Upper Monocacy River	02140303	1200319.80	661602.49	1.71
SHA16RST100462	Other filtering	Upper Monocacy River	02140303	1195488.40	674884.14	0.44
SHA16RST100470	Other filtering	Upper Monocacy River	02140303	1191871.55	685192.05	0.77
SHA16RST100471	Other filtering	Upper Monocacy River	02140303	1191712.17	685632.16	0.48
SHA16RST100472	Other filtering	Upper Monocacy River	02140303	1191273.99	686838.18	0.18
SHA16RST100473	Other filtering	Upper Monocacy River	02140303	1191054.44	687712.27	0.94
SHA16RST100477	Other filtering	Upper Monocacy River	02140303	1190701.68	691767.08	0.96

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA16APY020077UT	Tree Planting	West Chesapeake Bay	02131005	1425217.36	417765.16	0.62
SHA16APY020092UT	Tree Planting	West Chesapeake Bay	02131005	1428897.18	408297.18	0.16
SHA16APY020112UT	Tree Planting	West Chesapeake Bay	02131005	1424951.71	418586.65	0.27
SHA16APY020116UT	Tree Planting	West Chesapeake Bay	02131005	1422416.62	422017.48	0.41
SHA16APY020392UT	Tree Planting	West Chesapeake Bay	02131005	1422786.97	421783.99	0.30
SHA16APY020070UT	Tree Planting	West River	02131004	1435440.10	446302.87	0.06
SHA16APY020076UT	Tree Planting	West River	02131004	1435021.10	444371.62	0.12
SHA16APY020084UT	Tree Planting	West River	02131004	1435268.39	445988.95	0.24
SHA16RST161120	Bio-Swale	Western Branch	02131103	1358040.97	419327.94	1.63
SHA16RST161121	Bio-Swale	Western Branch	02131103	1358754.79	419112.63	0.51
SHA16RST160210	Retrofit	Western Branch	02131103	1357628.35	466123.94	1.94
SHA16APY160121UT	Tree Planting	Western Branch	02131103	1355278.51	446296.66	0.29
SHA16APY160137UT	Tree Planting	Western Branch	02131103	1386398.95	417210.28	0.03
SHA16APY160195UT	Tree Planting	Western Branch	02131103	1373903.35	439867.78	0.17
SHA16APY160198UT	Tree Planting	Western Branch	02131103	1392105.74	444578.82	0.16
SHA16APY160209UT	Tree Planting	Western Branch	02131103	1355925.15	436143.15	0.12
SHA16APY160227UT	Tree Planting	Western Branch	02131103	1386228.50	417774.51	0.13
SHA16APY160228UT	Tree Planting	Western Branch	02131103	1350807.03	427720.58	0.36
SHA16APY160233UT	Tree Planting	Western Branch	02131103	1383694.26	417622.72	0.07
SHA16APY160234UT	Tree Planting	Western Branch	02131103	1383891.62	417699.10	0.08
SHA16APY160235UT	Tree Planting	Western Branch	02131103	1386488.51	417095.45	0.04
SHA16RST080510	Bio-Swale	Wicomico River	02140106	1325157.87	262796.90	0.35
SHA16RST080756	Bio-Swale	Zekiah Swamp	02140108	1317300.56	282309.40	0.67
SHA16RST080758	Bio-Swale	Zekiah Swamp	02140108	1316482.36	283417.53	0.43
SHA16RST080760	Bio-Swale	Zekiah Swamp	02140108	1315787.65	284431.88	1.14

Table 2-2c: Fiscal Year 2016 Capital Impervious Restoration Practices						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
SHA16APY080110UT	Tree Planting	Zekiah Swamp	02140108	1348117.45	346248.34	0.35
					Complete BMP Acreage Total	**362.55**

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA17ALN150003UR	Stream Restoration	Anacostia River	02140205	1317983.52	506679.65	32.00
SHA17ALN150004UR	Stream Restoration	Anacostia River	02140205	1315621.77	509256.08	32.00
SHA17RST210606	Bio-Swale	Antietam Creek	02140502	1103812.74	706909.30	0.37
SHA17RST210609	Bio-Swale	Antietam Creek	02140502	1120320.82	704716.46	0.36
SHA17RST210610	Bio-Swale	Antietam Creek	02140502	1120458.82	704612.54	0.30
SHA17RST210612	Bio-Swale	Antietam Creek	02140502	1122085.80	704995.12	1.17
SHA17RST210613	Bio-Swale	Antietam Creek	02140502	1122896.23	705047.95	0.27
SHA17RST210614	Bio-Swale	Antietam Creek	02140502	1123013.07	705047.17	0.45
SHA17RST210615	Bio-Swale	Antietam Creek	02140502	1123871.47	704974.17	0.57
SHA17RST210616	Bio-Swale	Antietam Creek	02140502	1127239.56	703237.00	0.46
SHA17RST210617	Bio-Swale	Antietam Creek	02140502	1128828.24	701939.54	1.07
SHA17RST210618	Bio-Swale	Antietam Creek	02140502	1135136.44	696819.57	0.50
SHA17RST210619	Bio-Swale	Antietam Creek	02140502	1135573.35	696234.79	0.85
SHA17RST030230	Retrofit	Back River	02130901	1457440.68	607056.69	2.91
SHA17RST030744	Submerged Gravel Wetland	Back River	02130901	1457290.00	607565.00	1.30
SHA17RST021616	Grass Swale	Baltimore Harbor	02130903	1415934.40	527534.89	1.30
SHA17RST020232	Retrofit	Baltimore Harbor	02130903	1413940.36	547657.52	5.17
SHA17APY020390UT	Tree Planting	Baltimore Harbor	02130903	1427887.56	534590.40	0.33
SHA17APY020411UT	Tree Planting	Baltimore Harbor	02130903	1413393.52	547176.01	1.70
SHA17APY020413UT	Tree Planting	Baltimore Harbor	02130903	1412729.65	544648.12	0.07
SHA17RST030181	Retrofit	Bird River	02130803	1470528.43	622662.34	1.83
SHA17RST030186	Retrofit	Bird River	02130803	1471221.82	623374.10	1.09
SHA17RST120103	Retrofit	Bynum Run	02130704	1501128.34	683596.84	1.15
SHA17RST120104	Retrofit	Bynum Run	02130704	1501775.81	683988.26	3.36
SHA17APY100112UI	Impervious Surface Elimination (to Pervious)	Catoctin Creek	02140305	1155603.47	642999.39	0.34

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA17APY100142UI	Impervious Surface Elimination (to Pervious)	Catoctin Creek	02140305	1147957.04	636153.60	0.15
SHA17RST210595	Bio-Swale	Conococheague Creek	02140504	1087615.90	714296.62	0.52
SHA17RST210596	Bio-Swale	Conococheague Creek	02140504	1088394.13	713878.32	0.70
SHA17RST120055	Retrofit	Deer Creek	02120202	1523890.32	690266.69	0.57
SHA17RST120136	Retrofit	Deer Creek	02120202	1527475.28	689123.31	1.56
SHA17APY060104UI	Impervious Surface Elimination (to Pervious)	Double Pipe Creek	02140304	1342411.27	725914.31	0.09
SHA17APY060111UI	Impervious Surface Elimination (to Pervious)	Double Pipe Creek	02140304	1280147.75	687233.18	0.04
SHA17APY060115UI	Impervious Surface Elimination (to Pervious)	Double Pipe Creek	02140304	1280188.35	687151.53	0.02
SHA17APY080108UT	Tree Planting	Gilbert Swamp	02140107	1364861.17	293814.26	0.20
SHA17APY080109UT	Tree Planting	Gilbert Swamp	02140107	1366906.01	292908.93	0.09
SHA17APY080111UT	Tree Planting	Gilbert Swamp	02140107	1364534.26	293906.43	0.04
SHA17APY080112UT	Tree Planting	Gilbert Swamp	02140107	1366648.65	292934.15	0.16
SHA17APY080113UT	Tree Planting	Gilbert Swamp	02140107	1360869.16	294275.71	0.32
SHA17APY030163UT	Tree Planting	Gwynns Falls	02130905	1364422.79	643377.95	0.06
SHA17RST210564	Bio-Swale	Licking Creek	02140506	1017113.57	725310.09	0.44
SHA17RST210565	Bio-Swale	Licking Creek	02140506	1017218.33	725200.99	0.48
SHA17RST210591	Bio-Swale	Little Conococheague	02140505	1052766.45	723674.32	0.32
SHA17RST210592	Bio-Swale	Little Conococheague	02140505	1052910.66	723645.48	0.43
SHA17RST210593	Bio-Swale	Little Conococheague	02140505	1051600.85	723922.81	1.48
SHA17RST210594	Bio-Swale	Little Conococheague	02140505	1051769.78	723991.30	0.25
SHA17APY130102UI	Impervious Surface Elimination (to Pervious)	Little Patuxent River	02131105	1339343.85	538964.08	0.26
SHA17APY130106UI	Impervious Surface Elimination (to Pervious)	Little Patuxent River	02131105	1372283.99	548311.72	0.23
SHA17RST210523	Bio-Swale	Little Tonoloway Creek	02140509	978870.16	750542.92	0.87
SHA17RST210524	Bio-Swale	Little Tonoloway Creek	02140509	978586.63	749976.28	0.21
SHA17RST210525	Bio-Swale	Little Tonoloway Creek	02140509	978344.01	749495.77	0.43

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA17RST210526	Bio-Swale	Little Tonoloway Creek	02140509	978245.10	749265.59	0.14
SHA17RST210529	Bio-Swale	Little Tonoloway Creek	02140509	978172.43	747988.85	0.40
SHA17RST210530	Bio-Swale	Little Tonoloway Creek	02140509	979008.00	746067.63	0.39
SHA17RST030737	Grass Swale	Loch Raven Reservoir	02130805	1408550.00	657700.00	0.44
SHA17RST030267	Retrofit	Loch Raven Reservoir	02130805	1425781.45	636180.26	1.91
SHA17APY100101UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1172861.63	647350.77	0.13
SHA17APY100120UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1211157.43	630359.77	1.06
SHA17APY100121UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1209534.71	630551.56	0.92
SHA17APY100128UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1210189.16	630396.59	0.35
SHA17APY100131UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1188837.13	633157.07	0.09
SHA17APY100133UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1189674.61	636743.38	0.62
SHA17APY100140UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1239022.52	632245.60	0.23
SHA17APY100141UI	Impervious Surface Elimination (to Pervious)	Lower Monocacy River	02140302	1221390.31	610524.65	0.03
SHA17RST122047	Bioretention	Lower Winters Run	02130702	1508150.00	651150.00	0.30
SHA17RST120094	Retrofit	Lower Winters Run	02130702	1497852.06	645674.78	2.27
SHA17RST210597	Bio-Swale	Marsh Run	02140503	1096800.91	707332.94	1.00
SHA17RST210598	Bio-Swale	Marsh Run	02140503	1097695.09	707350.64	0.45
SHA17RST210599	Bio-Swale	Marsh Run	02140503	1098218.03	707361.70	0.38
SHA17RST210600	Bio-Swale	Marsh Run	02140503	1099417.01	707381.19	0.29
SHA17RST210601	Bio-Swale	Marsh Run	02140503	1100110.70	707392.84	0.56
SHA17RST210602	Bio-Swale	Marsh Run	02140503	1100924.61	707331.73	0.50
SHA17RST210603	Bio-Swale	Marsh Run	02140503	1101803.71	707196.11	0.17
SHA17RST210604	Bio-Swale	Marsh Run	02140503	1101916.51	707176.73	0.62
SHA17RST210605	Bio-Swale	Marsh Run	02140503	1103225.40	706977.02	0.48
SHA17APY130101UI	Impervious Surface Elimination (to Pervious)	Middle Patuxent River	02131106	1326334.99	599951.08	0.04

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA17APY080114UT	Tree Planting	Nanjemoy Creek	02140110	1246062.97	299467.23	0.28
SHA17APY130108UI	Impervious Surface Elimination (to Pervious)	Patapsco River L N Br	02130906	1364987.29	594620.63	0.05
SHA17ALN130005UR	Stream Restoration	Patapsco River L N Br	02130906	1388451.97	569071.41	2.25
SHA17ALN130006UR	Stream Restoration	Patapsco River L N Br	02130906	1396012.82	563711.16	3.00
SHA17APY020412UT	Tree Planting	Patapsco River L N Br	02130906	1386946.86	549450.54	0.08
SHA17APY080034UT	Tree Planting	Patuxent River lower	02131101	1372659.14	318813.58	0.35
SHA17APY080059UT	Tree Planting	Patuxent River lower	02131101	1372284.05	319403.33	0.10
SHA17APY020080UT	Tree Planting	Patuxent River middle	02131102	1427887.71	396571.12	0.27
SHA17APY020089UT	Tree Planting	Patuxent River middle	02131102	1420846.57	406004.39	0.12
SHA17APY020091UT	Tree Planting	Patuxent River middle	02131102	1417002.45	406299.05	0.05
SHA17APY020115UT	Tree Planting	Patuxent River middle	02131102	1417175.68	406256.86	0.12
SHA17APY020117UT	Tree Planting	Patuxent River middle	02131102	1427622.64	405211.91	0.10
SHA17APY020121UT	Tree Planting	Patuxent River middle	02131102	1427638.44	406071.14	0.15
SHA17APY020138UT	Tree Planting	Patuxent River middle	02131102	1423184.63	407077.12	0.07
SHA17APY020297UT	Tree Planting	Patuxent River middle	02131102	1397324.37	416199.59	0.24
SHA17APY020387UT	Tree Planting	Patuxent River middle	02131102	1427124.02	407518.42	0.17
SHA17APY020066UT	Tree Planting	Patuxent River upper	02131104	1409283.28	471598.14	2.27
SHA17APY020072UT	Tree Planting	Patuxent River upper	02131104	1403743.86	469924.16	0.06
SHA17APY020108UT	Tree Planting	Patuxent River upper	02131104	1404098.07	469927.29	0.18
SHA17RST1600004UO	Outfall Stabilization	Piscataway Creek	02140203	1309665.17	366556.32	2.00
SHA17RST1600005UO	Outfall Stabilization	Piscataway Creek	02140203	1312146.04	369322.72	2.00
SHA17RST1600006UO	Outfall Stabilization	Piscataway Creek	02140203	1315502.81	378498.92	2.00
SHA17RST1600007UO	Outfall Stabilization	Piscataway Creek	02140203	1315077.02	379504.39	2.00
SHA17RST160737	Retrofit	Piscataway Creek	02140203	1345433.46	401212.82	19.87
SHA17ALN160011UR	Stream Restoration	Piscataway Creek	02140203	1312178.09	369455.20	3.00

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA17ALN160013UR	Stream Restoration	Piscataway Creek	02140203	1315025.08	379534.27	1.75
SHA17RST1600001UO	Outfall Stabilization	Potomac River U tidal	02140201	1314585.07	393850.53	2.00
SHA17RST1600002UO	Outfall Stabilization	Potomac River U tidal	02140201	1314494.10	393129.07	2.00
SHA17RST1600003UO	Outfall Stabilization	Potomac River U tidal	02140201	1314655.31	393166.98	2.00
SHA17ALN160009UR	Stream Restoration	Potomac River U tidal	02140201	1314657.40	393194.22	4.00
SHA17ALN160010UR	Stream Restoration	Potomac River U tidal	02140201	1314612.32	393907.68	0.50
SHA17ALN160012UR	Stream Restoration	Potomac River U tidal	02140201	1314479.66	393161.46	1.50
SHA17ALN160014UR	Stream Restoration	Potomac River U tidal	02140201	1314480.70	393115.36	1.25
SHA17RST210562	Bioretention	Potomac River WA Cnty	02140501	1022543.94	720072.13	0.29
SHA17RST210563	Bioretention	Potomac River WA Cnty	02140501	1024012.92	718150.91	0.30
SHA17RST210533	Bio-Swale	Potomac River WA Cnty	02140501	979735.57	745297.00	0.22
SHA17RST210534	Bio-Swale	Potomac River WA Cnty	02140501	980169.93	745067.72	0.09
SHA17RST210548	Bio-Swale	Potomac River WA Cnty	02140501	989726.00	740538.05	0.56
SHA17RST210549	Bio-Swale	Potomac River WA Cnty	02140501	990117.00	740374.27	0.20
SHA17RST210550	Bio-Swale	Potomac River WA Cnty	02140501	990901.12	740082.30	0.51
SHA17RST210551	Bio-Swale	Potomac River WA Cnty	02140501	991123.14	740013.53	0.21
SHA17RST210552	Bio-Swale	Potomac River WA Cnty	02140501	991837.13	739795.69	0.26
SHA17RST210553	Bio-Swale	Potomac River WA Cnty	02140501	992399.46	739652.36	0.23
SHA17RST210554	Bio-Swale	Potomac River WA Cnty	02140501	994823.07	738825.28	0.25
SHA17RST210555	Bio-Swale	Potomac River WA Cnty	02140501	995268.79	738606.05	0.25
SHA17RST210556	Bio-Swale	Potomac River WA Cnty	02140501	995921.80	738403.58	0.22
SHA17RST210558	Bio-Swale	Potomac River WA Cnty	02140501	997176.70	738165.48	0.25
SHA17RST210559	Bio-Swale	Potomac River WA Cnty	02140501	997138.41	738133.34	0.34
SHA17RST210560	Bio-Swale	Potomac River WA Cnty	02140501	1025853.16	716072.47	0.34
SHA17RST210561	Bio-Swale	Potomac River WA Cnty	02140501	1025876.60	716108.67	0.32

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA17RST210566	Bio-Swale	Potomac River WA Cnty	02140501	1018850.23	723284.46	0.13
SHA17RST210567	Bio-Swale	Potomac River WA Cnty	02140501	1018932.38	723185.06	0.13
SHA17RST210568	Bio-Swale	Potomac River WA Cnty	02140501	1019315.64	722711.78	0.37
SHA17RST210569	Bio-Swale	Potomac River WA Cnty	02140501	1019492.13	722534.17	0.09
SHA17RST210571	Bio-Swale	Potomac River WA Cnty	02140501	1021067.87	721276.91	0.05
SHA17RST210572	Bio-Swale	Potomac River WA Cnty	02140501	1022363.19	720245.17	0.83
SHA17RST210573	Bio-Swale	Potomac River WA Cnty	02140501	1023945.97	718236.93	1.23
SHA17RST210574	Bio-Swale	Potomac River WA Cnty	02140501	1024623.01	717332.28	0.09
SHA17RST210575	Bio-Swale	Potomac River WA Cnty	02140501	1023303.38	719164.72	0.86
SHA17RST210576	Bio-Swale	Potomac River WA Cnty	02140501	998490.98	737831.06	0.77
SHA17RST210577	Bio-Swale	Potomac River WA Cnty	02140501	1000660.44	737340.20	0.67
SHA17RST210578	Bio-Swale	Potomac River WA Cnty	02140501	1002522.81	736697.14	0.58
SHA17RST210579	Bio-Swale	Potomac River WA Cnty	02140501	1002982.39	736390.94	0.57
SHA17RST210580	Bio-Swale	Potomac River WA Cnty	02140501	1004188.35	735342.26	0.79
SHA17RST210581	Bio-Swale	Potomac River WA Cnty	02140501	1004416.92	735141.53	0.80
SHA17RST210582	Bio-Swale	Potomac River WA Cnty	02140501	1004926.94	734699.23	0.39
SHA17RST210583	Bio-Swale	Potomac River WA Cnty	02140501	1013722.18	728155.85	0.20
SHA17RST210584	Bio-Swale	Potomac River WA Cnty	02140501	1013839.02	728041.05	0.38
SHA17RST210585	Bio-Swale	Potomac River WA Cnty	02140501	1014212.85	727661.50	0.36
SHA17RST210586	Bio-Swale	Potomac River WA Cnty	02140501	1014309.28	727564.26	0.17
SHA17RST210587	Bio-Swale	Potomac River WA Cnty	02140501	1014605.73	727300.63	0.17
SHA17RST210588	Bio-Swale	Potomac River WA Cnty	02140501	1014678.94	727232.15	0.63
SHA17RST210589	Bio-Swale	Potomac River WA Cnty	02140501	1015518.46	726593.50	0.63
SHA17RST210590	Bio-Swale	Potomac River WA Cnty	02140501	1015701.99	726466.46	0.43
SHA17APY060102UI	Impervious Surface Elimination (to Pervious)	S Branch Patapsco	02130908	1295626.67	648854.56	0.17

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA17APY060103UI	Impervious Surface Elimination (to Pervious)	S Branch Patapsco	02130908	1302884.96	645646.34	1.07
SHA17APY060113UI	Impervious Surface Elimination (to Pervious)	S Branch Patapsco	02130908	1291383.65	650625.00	0.06
SHA17APY130105UI	Impervious Surface Elimination (to Pervious)	S Branch Patapsco	02130908	1326975.37	605202.74	0.20
SHA17ALN060001UR	Stream Restoration	S Branch Patapsco	02130908	1344103.47	615094.86	1.25
SHA17RST021594	Grass Swale	Severn River	02131002	1418331.25	504635.77	0.29
SHA17APY020145UT	Tree Planting	Severn River	02131002	1403932.72	514807.28	0.57
SHA17APY020146UT	Tree Planting	Severn River	02131002	1404617.48	514570.89	0.59
SHA17APY020308UT	Tree Planting	Severn River	02131002	1467921.02	495318.30	0.34
SHA17APY020321UT	Tree Planting	Severn River	02131002	1467799.54	495663.66	0.21
SHA17APY020345UT	Tree Planting	Severn River	02131002	1413926.45	508941.37	0.46
SHA17APY020348UT	Tree Planting	Severn River	02131002	1400965.86	519227.47	0.36
SHA17APY020349UT	Tree Planting	Severn River	02131002	1399336.66	522028.80	0.33
SHA17RST021595	Grass Swale	South River	02131003	1421984.21	500613.55	0.25
SHA17RST021596	Grass Swale	South River	02131003	1422395.97	499056.21	0.53
SHA17RST021597	Grass Swale	South River	02131003	1422406.39	498257.99	0.76
SHA17RST021598	Grass Swale	South River	02131003	1422283.17	497404.00	0.51
SHA17RST021599	Grass Swale	South River	02131003	1422055.24	496724.61	0.66
SHA17RST021600	Grass Swale	South River	02131003	1421776.17	496029.25	0.34
SHA17RST021601	Grass Swale	South River	02131003	1421578.10	495288.93	0.80
SHA17RST021602	Grass Swale	South River	02131003	1421582.82	494649.45	0.22
SHA17RST021603	Grass Swale	South River	02131003	1421705.99	494019.64	0.71
SHA17RST021604	Grass Swale	South River	02131003	1421859.54	493268.08	0.42
SHA17RST021605	Grass Swale	South River	02131003	1422265.11	491291.23	0.48
SHA17RST021606	Grass Swale	South River	02131003	1422668.94	489607.99	0.64
SHA17RST021607	Grass Swale	South River	02131003	1423029.91	489047.20	0.52

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
SHA17RST021610	Grass Swale	South River	02131003	1425857.32	487586.83	0.39
SHA17RST021611	Grass Swale	South River	02131003	1426345.90	487110.86	0.79
SHA17RST021612	Grass Swale	South River	02131003	1426756.26	486635.59	0.28
SHA17RST021614	Grass Swale	South River	02131003	1427940.05	485439.76	0.83
SHA17RST021615	Grass Swale	South River	02131003	1428611.53	485085.89	0.41
SHA17RST020525	Retrofit	South River	02131003	1441305.70	476492.76	0.91
SHA17APY020097UT	Tree Planting	South River	02131003	1414410.37	469055.89	0.55
SHA17APY020118UT	Tree Planting	South River	02131003	1439250.47	452342.54	0.02
SHA17APY020119UT	Tree Planting	South River	02131003	1413779.97	469329.85	0.40
SHA17APY020135UT	Tree Planting	South River	02131003	1440213.23	478709.67	0.30
SHA17APY020420UT	Tree Planting	South River	02131003	1439179.16	452208.77	0.03
SHA17RST210545	Bio-Swale	Tonoloway Creek	02140507	986637.94	743122.60	0.29
SHA17APY060018UI	Impervious Surface Elimination (to Pervious)	Upper Monocacy River	02140303	1271855.99	737889.98	0.16
SHA17APY060107UI	Impervious Surface Elimination (to Pervious)	Upper Monocacy River	02140303	1267298.85	730361.71	0.19
SHA17APY020079UT	Tree Planting	West Chesapeake Bay	02131005	1428137.25	395429.27	0.09
SHA17APY080025UT	Tree Planting	Zekiah Swamp	02140108	1348062.91	347107.26	0.19
SHA17APY080062UT	Tree Planting	Zekiah Swamp	02140108	1347851.87	345915.36	0.04
SHA17RST021608	Grass Swale	South River	02131003	1424354.05	488308.13	0.47
					Complete BMP Acreage Total	**205.64**
2017 Planned Practices						
TBD	Impervious Surface Elimination (to Pervious)	TBD	TBD	TBD	TBD	0.00
TBD	New Stormwater	TBD	TBD	TBD	TBD	0.00
TBD	Outfall Stabilization	TBD	TBD	TBD	TBD	0.00
TBD	Redevelopment Credit	TBD	TBD	TBD	TBD	57.00
TBD	Retrofit	TBD	TBD	TBD	TBD	0.00

Table 2-2d: Fiscal Year 2017 Capital Impervious Restoration Practices						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
TBD	Stream Restoration	TBD	TBD	TBD	TBD	0.00
TBD	Tree Planting	TBD	TBD	TBD	TBD	0.00
					Planned BMP Acreage Total	**57.00**
					Grand Total BMP Acreage Total	**262.64**

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18RST150601	Retrofit	Anacostia River	02140205	1326965.38	516262.65	8.81
SHA18RST160177	Retrofit	Anacostia River	02140205	1328706.61	493676.76	1.58
SHA18RST160656	Retrofit	Anacostia River	02140205	1330083.13	493444.69	0.20
SHA18APY160183UT	Tree Planting	Anacostia River	02140205	1341384.68	435694.31	0.08
SHA18APY160187UT	Tree Planting	Anacostia River	02140205	1338985.16	481710.48	0.28
SHA18APY160201UT	Tree Planting	Anacostia River	02140205	1342659.32	487339.25	0.16
SHA18APY160202UT	Tree Planting	Anacostia River	02140205	1344977.37	481883.43	0.27
SHA18APY160208UT	Tree Planting	Anacostia River	02140205	1342465.87	487046.45	0.16
SHA18RST210017	Retrofit	Antietam Creek	02140502	1115674.44	731055.88	7.12
SHA18APY210204UT	Tree Planting	Antietam Creek	02140502	1106688.69	706118.94	0.11
SHA18APY210206UT	Tree Planting	Antietam Creek	02140502	1115374.68	704453.96	0.53
SHA18APY210214UT	Tree Planting	Antietam Creek	02140502	1127445.89	702905.17	0.11
SHA18APY210221UT	Tree Planting	Antietam Creek	02140502	1126236.30	697692.70	1.46
SHA18APY210222UT	Tree Planting	Antietam Creek	02140502	1127153.02	696890.39	0.18
SHA18APY210224UT	Tree Planting	Antietam Creek	02140502	1128992.36	695267.51	0.46
SHA18APY210225UT	Tree Planting	Antietam Creek	02140502	1123067.15	700520.52	0.09
SHA18APY210227UT	Tree Planting	Antietam Creek	02140502	1130554.85	694084.54	0.12
SHA18APY210229UT	Tree Planting	Antietam Creek	02140502	1137446.58	739392.25	0.13
SHA18APY210230UT	Tree Planting	Antietam Creek	02140502	1152693.63	747802.01	0.93
SHA18APY210231UT	Tree Planting	Antietam Creek	02140502	1151321.76	744069.60	0.47
SHA18APY210235UT	Tree Planting	Antietam Creek	02140502	1141079.72	741053.93	0.36
SHA18APY210236UT	Tree Planting	Antietam Creek	02140502	1140359.14	740498.43	0.35
SHA18APY210237UT	Tree Planting	Antietam Creek	02140502	1157712.75	746831.28	0.46
SHA18APY210238UT	Tree Planting	Antietam Creek	02140502	1154828.38	745500.98	0.39
SHA18APY210239UT	Tree Planting	Antietam Creek	02140502	1155624.60	745794.33	0.13

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY210240UT	Tree Planting	Antietam Creek	02140502	1154197.58	745044.81	0.43
SHA18APY210241UT	Tree Planting	Antietam Creek	02140502	1153492.32	744509.76	0.50
SHA18APY210243UT	Tree Planting	Antietam Creek	02140502	1152914.75	744187.35	0.28
SHA18APY210245UT	Tree Planting	Antietam Creek	02140502	1151087.58	741850.96	0.68
SHA18APY210246UT	Tree Planting	Antietam Creek	02140502	1150728.46	739732.57	0.26
SHA18APY210249UT	Tree Planting	Antietam Creek	02140502	1150410.52	738090.53	0.71
SHA18APY210252UT	Tree Planting	Antietam Creek	02140502	1151245.77	732391.45	0.76
SHA18APY210255UT	Tree Planting	Antietam Creek	02140502	1153526.76	724372.68	0.27
SHA18APY210262UT	Tree Planting	Antietam Creek	02140502	1137972.82	739873.01	0.21
SHA18APY210263UT	Tree Planting	Antietam Creek	02140502	1140012.27	740231.81	0.21
SHA18APY210267UT	Tree Planting	Antietam Creek	02140502	1144775.31	743009.62	0.41
SHA18APY210269UT	Tree Planting	Antietam Creek	02140502	1146863.06	743764.37	0.41
SHA18APY210270UT	Tree Planting	Antietam Creek	02140502	1148863.94	744017.65	0.60
SHA18APY210274UT	Tree Planting	Antietam Creek	02140502	1132879.67	719911.72	0.89
SHA18APY210275UT	Tree Planting	Antietam Creek	02140502	1135752.00	720176.63	0.22
SHA18APY210276UT	Tree Planting	Antietam Creek	02140502	1137330.84	720277.74	0.13
SHA18APY210277UT	Tree Planting	Antietam Creek	02140502	1138035.05	720278.32	0.26
SHA18APY210278UT	Tree Planting	Antietam Creek	02140502	1139295.25	720340.20	1.15
SHA18APY210291UT	Tree Planting	Antietam Creek	02140502	1125474.29	669647.74	0.37
SHA18APY210295UT	Tree Planting	Antietam Creek	02140502	1118159.14	666553.08	0.29
SHA18APY210297UT	Tree Planting	Antietam Creek	02140502	1156861.03	727826.10	0.08
SHA18APY210298UT	Tree Planting	Antietam Creek	02140502	1168246.06	728788.99	0.09
SHA18APY210303UT	Tree Planting	Antietam Creek	02140502	1157032.87	727941.98	0.13
SHA18APY210318UT	Tree Planting	Antietam Creek	02140502	1120642.00	703748.04	0.04
SHA18APY210324UT	Tree Planting	Antietam Creek	02140502	1135287.79	720059.10	0.32

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY210328UT	Tree Planting	Antietam Creek	02140502	1143236.23	720491.30	0.30
SHA18APY210330UT	Tree Planting	Antietam Creek	02140502	1144097.32	720519.34	0.24
SHA18APY210332UT	Tree Planting	Antietam Creek	02140502	1145479.13	720432.38	0.31
SHA18APY210333UT	Tree Planting	Antietam Creek	02140502	1152184.36	722095.15	0.41
SHA18APY210340UT	Tree Planting	Antietam Creek	02140502	1150598.69	739078.98	0.54
SHA18APY210341UT	Tree Planting	Antietam Creek	02140502	1150915.07	743448.38	1.37
SHA18APY210342UT	Tree Planting	Antietam Creek	02140502	1151113.64	744308.22	1.13
SHA18APY210347UT	Tree Planting	Antietam Creek	02140502	1152009.19	745974.11	1.71
SHA18APY210349UT	Tree Planting	Antietam Creek	02140502	1159142.94	747748.96	0.59
SHA18APY210350UT	Tree Planting	Antietam Creek	02140502	1159576.99	748267.11	0.19
SHA18APY210351UT	Tree Planting	Antietam Creek	02140502	1157846.96	747036.99	0.04
SHA18APY210353UT	Tree Planting	Antietam Creek	02140502	1155835.80	745900.25	0.13
SHA18APY210354UT	Tree Planting	Antietam Creek	02140502	1125033.94	669474.40	0.15
SHA18APY210366UT	Tree Planting	Antietam Creek	02140502	1110409.85	657317.99	0.10
SHA18APY210369UT	Tree Planting	Antietam Creek	02140502	1145343.28	743293.55	0.40
SHA18APY210370UT	Tree Planting	Antietam Creek	02140502	1146126.49	743552.06	0.48
SHA18APY210375UT	Tree Planting	Antietam Creek	02140502	1140783.26	740826.16	0.09
SHA18APY210376UT	Tree Planting	Antietam Creek	02140502	1139738.15	740066.44	0.20
SHA18APY210377UT	Tree Planting	Antietam Creek	02140502	1138930.24	739812.69	0.13
SHA18APY210392UT	Tree Planting	Antietam Creek	02140502	1167973.76	728545.18	0.05
SHA18APY210397UT	Tree Planting	Antietam Creek	02140502	1129667.17	694682.30	0.08
SHA18APY210398UT	Tree Planting	Antietam Creek	02140502	1125336.74	698472.57	0.09
SHA18APY210399UT	Tree Planting	Antietam Creek	02140502	1125175.10	698643.54	0.12
SHA18APY210414UT	Tree Planting	Antietam Creek	02140502	1102808.39	661541.47	0.89
SHA18APY210415UT	Tree Planting	Antietam Creek	02140502	1102721.18	662567.71	1.57

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY120195UT	Tree Planting	Atkisson Reservoir	02130703	1454273.49	689089.59	0.24
SHA18APY120212UT	Tree Planting	Atkisson Reservoir	02130703	1497064.58	676026.81	0.14
SHA18APY120213UT	Tree Planting	Atkisson Reservoir	02130703	1497423.58	675449.84	0.27
SHA18APY120220UT	Tree Planting	Atkisson Reservoir	02130703	1474348.94	695045.80	0.36
SHA18APY120223UT	Tree Planting	Atkisson Reservoir	02130703	1479356.99	695597.55	0.24
SHA18APY120228UT	Tree Planting	Atkisson Reservoir	02130703	1457417.33	686764.22	0.13
SHA18APY030359UT	Tree Planting	Back River	02130901	1465989.57	602270.82	0.06
SHA18APY030380UT	Tree Planting	Back River	02130901	1465734.91	574866.52	0.46
SHA18RST020235	Retrofit	Baltimore Harbor	02130903	1413501.70	533481.73	7.24
SHA18RST020363	Retrofit	Baltimore Harbor	02130903	1414327.53	533146.64	6.87
SHA18RST020566	Retrofit	Baltimore Harbor	02130903	1414357.89	560753.20	4.61
SHA18APY020124UT	Tree Planting	Baltimore Harbor	02130903	1415673.86	549909.27	0.05
SHA18APY020167UT	Tree Planting	Baltimore Harbor	02130903	1421443.14	561492.34	0.18
SHA18APY020177UT	Tree Planting	Baltimore Harbor	02130903	1428770.94	535039.41	0.15
SHA18APY020190UT	Tree Planting	Baltimore Harbor	02130903	1413066.72	531670.88	0.05
SHA18APY020191UT	Tree Planting	Baltimore Harbor	02130903	1413287.44	531396.42	0.14
SHA18APY020200UT	Tree Planting	Baltimore Harbor	02130903	1413870.61	538995.59	0.05
SHA18APY020201UT	Tree Planting	Baltimore Harbor	02130903	1415989.35	551324.97	0.13
SHA18APY020211UT	Tree Planting	Baltimore Harbor	02130903	1404875.68	542104.37	0.66
SHA18APY020212UT	Tree Planting	Baltimore Harbor	02130903	1413177.81	539651.02	0.27
SHA18APY020213UT	Tree Planting	Baltimore Harbor	02130903	1412038.62	542400.65	0.15
SHA18APY020214UT	Tree Planting	Baltimore Harbor	02130903	1413753.57	541178.09	0.26
SHA18APY020216UT	Tree Planting	Baltimore Harbor	02130903	1413472.55	541154.78	0.30
SHA18APY020217UT	Tree Planting	Baltimore Harbor	02130903	1403952.68	541523.96	0.05
SHA18APY020218UT	Tree Planting	Baltimore Harbor	02130903	1446791.73	537439.14	0.22

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY020220UT	Tree Planting	Baltimore Harbor	02130903	1411892.38	541489.78	0.18
SHA18APY020222UT	Tree Planting	Baltimore Harbor	02130903	1412388.34	541009.21	0.70
SHA18APY020224UT	Tree Planting	Baltimore Harbor	02130903	1407666.00	542707.78	0.38
SHA18APY020226UT	Tree Planting	Baltimore Harbor	02130903	1414139.82	546637.15	0.15
SHA18APY020227UT	Tree Planting	Baltimore Harbor	02130903	1424432.77	543350.27	0.16
SHA18APY020228UT	Tree Planting	Baltimore Harbor	02130903	1412919.62	538784.86	0.37
SHA18APY020229UT	Tree Planting	Baltimore Harbor	02130903	1401600.65	540028.62	0.29
SHA18APY020230UT	Tree Planting	Baltimore Harbor	02130903	1413270.91	537969.01	0.20
SHA18APY020231UT	Tree Planting	Baltimore Harbor	02130903	1412988.08	537778.91	0.05
SHA18APY020232UT	Tree Planting	Baltimore Harbor	02130903	1413760.87	532787.16	0.30
SHA18APY020239UT	Tree Planting	Baltimore Harbor	02130903	1416841.50	559379.15	0.12
SHA18APY020240UT	Tree Planting	Baltimore Harbor	02130903	1422177.00	561108.70	0.05
SHA18APY020243UT	Tree Planting	Baltimore Harbor	02130903	1419563.64	561123.35	0.41
SHA18APY020247UT	Tree Planting	Baltimore Harbor	02130903	1413749.70	560013.42	0.09
SHA18APY020259UT	Tree Planting	Baltimore Harbor	02130903	1417296.39	560112.46	0.82
SHA18APY020260UT	Tree Planting	Baltimore Harbor	02130903	1424467.42	556320.74	0.25
SHA18APY020261UT	Tree Planting	Baltimore Harbor	02130903	1416262.60	555182.46	0.10
SHA18APY020383UT	Tree Planting	Baltimore Harbor	02130903	1400949.03	539736.80	0.17
SHA18APY120199UT	Tree Planting	Broad Creek	02120205	1509169.06	736989.65	0.12
SHA18APY120200UT	Tree Planting	Broad Creek	02120205	1488625.43	738995.62	1.00
SHA18APY120202UT	Tree Planting	Broad Creek	02120205	1511943.16	734238.55	0.25
SHA18APY120203UT	Tree Planting	Broad Creek	02120205	1511433.01	735134.55	0.17
SHA18APY120204UT	Tree Planting	Broad Creek	02120205	1491132.97	742441.91	0.50
SHA18APY120205UT	Tree Planting	Broad Creek	02120205	1488333.80	737472.47	0.21
SHA18APY120206UT	Tree Planting	Broad Creek	02120205	1487204.28	734720.92	0.42

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY120207UT	Tree Planting	Broad Creek	02120205	1485531.36	734323.34	0.41
SHA18APY120210UT	Tree Planting	Broad Creek	02120205	1503499.67	740049.56	0.09
SHA18APY120215UT	Tree Planting	Broad Creek	02120205	1500229.41	741551.36	0.29
SHA18APY120216UT	Tree Planting	Broad Creek	02120205	1494535.34	744588.39	0.09
SHA18APY120222UT	Tree Planting	Broad Creek	02120205	1488324.59	737731.11	0.17
SHA18APY120224UT	Tree Planting	Broad Creek	02120205	1511608.44	734838.32	0.09
SHA18APY120225UT	Tree Planting	Broad Creek	02120205	1489353.58	740602.43	1.70
SHA18APY120226UT	Tree Planting	Broad Creek	02120205	1485066.59	734197.10	0.25
SHA18APY120229UT	Tree Planting	Broad Creek	02120205	1508769.65	737539.29	0.07
SHA18RST210001	Retrofit	Conococheague Creek	02140504	1087040.79	723337.77	3.43
SHA18RST210213	Retrofit	Conococheague Creek	02140504	1094292.80	714871.44	1.43
SHA18APY030367UT	Tree Planting	Deer Creek	02120202	1411962.87	744316.69	0.53
SHA18APY030368UT	Tree Planting	Deer Creek	02120202	1411378.01	745320.49	0.60
SHA18APY030369UT	Tree Planting	Deer Creek	02120202	1410963.79	746026.26	0.22
SHA18APY030370UT	Tree Planting	Deer Creek	02120202	1410289.26	747213.19	0.22
SHA18APY120196UT	Tree Planting	Deer Creek	02120202	1499075.31	697049.39	0.14
SHA18APY120201UT	Tree Planting	Deer Creek	02120202	1535585.53	696599.54	0.51
SHA18APY120209UT	Tree Planting	Deer Creek	02120202	1536082.01	696829.91	0.24
SHA18APY120197UT	Tree Planting	Little Gunpowder Falls	02130804	1483149.14	665332.53	0.24
SHA18APY020130UT	Tree Planting	Little Patuxent River	02131105	1398526.53	492831.00	0.19
SHA18APY020328UT	Tree Planting	Little Patuxent River	02131105	1373822.90	529654.33	0.10
SHA18APY020330UT	Tree Planting	Little Patuxent River	02131105	1369669.95	520500.63	0.10
SHA18APY020335UT	Tree Planting	Little Patuxent River	02131105	1369986.82	529700.53	0.09
SHA18RST210200	Retrofit	Little Tonoloway Creek	02140509	962393.46	742257.32	1.56
SHA18APY030366UT	Tree Planting	Loch Raven Reservoir	02130805	1412974.17	742999.17	1.05

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY030371UT	Tree Planting	Loch Raven Reservoir	02130805	1406155.13	686045.28	0.29
SHA18APY030372UT	Tree Planting	Loch Raven Reservoir	02130805	1405674.81	685625.38	0.27
SHA18APY030373UT	Tree Planting	Loch Raven Reservoir	02130805	1405938.50	666317.23	0.82
SHA18APY030374UT	Tree Planting	Loch Raven Reservoir	02130805	1407064.85	703334.43	1.46
SHA18APY030375UT	Tree Planting	Loch Raven Reservoir	02130805	1414908.99	741840.93	0.12
SHA18APY030376UT	Tree Planting	Loch Raven Reservoir	02130805	1406126.96	665298.59	0.42
SHA18APY070077UT	Tree Planting	Lower Susquehanna River	02120201	1573536.57	710789.67	0.35
SHA18APY070109UT	Tree Planting	Lower Susquehanna River	02120201	1573983.38	710147.49	0.30
SHA18APY120221UT	Tree Planting	Lower Winters Run	02130702	1485849.22	661130.45	0.22
SHA18APY020277UT	Tree Planting	Magothy River	02131001	1449786.76	529350.37	0.15
SHA18APY020306UT	Tree Planting	Magothy River	02131001	1431962.73	527450.31	0.11
SHA18RST210015	Retrofit	Marsh Run	02140503	1101402.26	708726.51	1.85
SHA18APY210315UT	Tree Planting	Marsh Run	02140503	1099528.60	706805.35	0.04
SHA18APY210316UT	Tree Planting	Marsh Run	02140503	1098968.81	706644.40	0.05
SHA18RST082828	Bioretention	Mattawoman Creek	02140111	1258848.12	324820.00	0.73
SHA18RST082832	Bioretention	Mattawoman Creek	02140111	1258671.49	322330.00	0.25
SHA18RST082831	Micro-Bioretention	Mattawoman Creek	02140111	1259314.42	322526.00	0.29
SHA18RST082833	Micro-Bioretention	Mattawoman Creek	02140111	1259340.25	321640.00	0.29
SHA18RST160453	Retrofit	Mattawoman Creek	02140111	1308021.29	362094.45	1.83
SHA18RST082830	Submerged Gravel Wetland	Mattawoman Creek	02140111	1258517.94	324878.00	0.46
SHA18RST082829	Wet pond	Mattawoman Creek	02140111	1259360.86	324444.00	4.93
SHA18APY070091UT	Tree Planting	Northeast River	02130608	1606764.19	724226.89	0.17
SHA18APY070092UT	Tree Planting	Northeast River	02130608	1600434.50	739572.27	0.29
SHA18APY070093UT	Tree Planting	Northeast River	02130608	1600850.91	739000.79	0.17
SHA18APY070099UT	Tree Planting	Northeast River	02130608	1605815.27	730800.93	0.10

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY070100UT	Tree Planting	Northeast River	02130608	1600112.86	740234.71	0.13
SHA18APY070101UT	Tree Planting	Northeast River	02130608	1600378.27	739861.67	0.12
SHA18APY070103UT	Tree Planting	Northeast River	02130608	1602579.43	735615.50	0.21
SHA18APY070104UT	Tree Planting	Northeast River	02130608	1599701.26	741579.60	0.33
SHA18APY070105UT	Tree Planting	Northeast River	02130608	1603711.93	734119.21	0.51
SHA18APY070106UT	Tree Planting	Northeast River	02130608	1606774.33	727188.24	0.14
SHA18APY070107UT	Tree Planting	Northeast River	02130608	1607063.44	724950.45	0.44
SHA18APY070111UT	Tree Planting	Northeast River	02130608	1606401.09	728976.70	0.19
SHA18APY070062UT	Tree Planting	Octoraro Creek	02120203	1571560.95	739412.10	0.37
SHA18APY070094UT	Tree Planting	Octoraro Creek	02120203	1572662.28	735536.33	0.10
SHA18APY070095UT	Tree Planting	Octoraro Creek	02120203	1573051.67	734085.08	0.12
SHA18APY070096UT	Tree Planting	Octoraro Creek	02120203	1570659.74	741948.02	0.25
SHA18APY070097UT	Tree Planting	Octoraro Creek	02120203	1570024.60	742435.73	0.54
SHA18APY070098UT	Tree Planting	Octoraro Creek	02120203	1576584.04	745476.41	0.18
SHA18APY070102UT	Tree Planting	Octoraro Creek	02120203	1579287.99	746566.25	0.44
SHA18APY070108UT	Tree Planting	Octoraro Creek	02120203	1570790.27	742974.93	0.12
SHA18APY070110UT	Tree Planting	Octoraro Creek	02120203	1573111.67	733752.72	0.12
SHA18APY070112UT	Tree Planting	Octoraro Creek	02120203	1571347.76	745114.22	0.80
SHA18APY020136UT	Tree Planting	Patapsco River L N Br	02130906	1395380.34	540577.97	0.26
SHA18APY020137UT	Tree Planting	Patapsco River L N Br	02130906	1395737.34	540454.42	0.09
SHA18APY020154UT	Tree Planting	Patapsco River L N Br	02130906	1397820.19	558243.68	0.14
SHA18APY020174UT	Tree Planting	Patapsco River L N Br	02130906	1400908.69	534487.04	0.05
SHA18APY020179UT	Tree Planting	Patapsco River L N Br	02130906	1401599.39	536595.23	0.09
SHA18APY020182UT	Tree Planting	Patapsco River L N Br	02130906	1398786.24	561253.59	0.06
SHA18APY020356UT	Tree Planting	Patapsco River L N Br	02130906	1399486.46	541674.64	0.11

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY020360UT	Tree Planting	Patapsco River L N Br	02130906	1398890.67	561939.86	0.04
SHA18APY020361UT	Tree Planting	Patapsco River L N Br	02130906	1390092.66	549611.86	0.26
SHA18APY020364UT	Tree Planting	Patapsco River L N Br	02130906	1395356.01	540213.86	0.08
SHA18APY020366UT	Tree Planting	Patapsco River L N Br	02130906	1399512.75	558675.76	0.20
SHA18APY020367UT	Tree Planting	Patapsco River L N Br	02130906	1384119.54	541776.78	0.20
SHA18APY020368UT	Tree Planting	Patapsco River L N Br	02130906	1400384.42	539921.86	0.42
SHA18APY020369UT	Tree Planting	Patapsco River L N Br	02130906	1384062.54	542516.34	0.27
SHA18APY020371UT	Tree Planting	Patapsco River L N Br	02130906	1384634.06	542150.51	0.31
SHA18APY020372UT	Tree Planting	Patapsco River L N Br	02130906	1390021.49	546821.58	0.26
SHA18APY020375UT	Tree Planting	Patapsco River L N Br	02130906	1400622.23	540140.59	0.15
SHA18APY020377UT	Tree Planting	Patapsco River L N Br	02130906	1384525.93	542830.92	0.15
SHA18APY020379UT	Tree Planting	Patapsco River L N Br	02130906	1385433.08	543937.10	0.60
SHA18APY020380UT	Tree Planting	Patapsco River L N Br	02130906	1384851.17	542716.28	0.35
SHA18APY020381UT	Tree Planting	Patapsco River L N Br	02130906	1400903.08	540195.48	0.08
SHA18APY020406UT	Tree Planting	Patapsco River L N Br	02130906	1398922.80	543105.71	0.15
SHA18APY030347UT	Tree Planting	Patapsco River L N Br	02130906	1392023.65	575102.56	0.14
SHA18APY020192UT	Tree Planting	Patuxent River middle	02131102	1409840.98	400730.63	0.07
SHA18APY020284UT	Tree Planting	Patuxent River middle	02131102	1408070.20	406266.09	0.07
SHA18APY020285UT	Tree Planting	Patuxent River middle	02131102	1408600.97	404353.81	0.08
SHA18APY020298UT	Tree Planting	Patuxent River middle	02131102	1396882.30	416416.57	0.21
SHA18APY020300UT	Tree Planting	Patuxent River middle	02131102	1397978.63	416272.37	0.08
SHA18APY020304UT	Tree Planting	Patuxent River upper	02131104	1409170.61	472346.64	0.10
SHA18APY160200UT	Tree Planting	Patuxent River upper	02131104	1393820.57	448316.47	0.07
SHA18RST161088	Wet pond	Patuxent River upper	02131104	1391478.65	448790.66	4.73
SHA18RST150082	Retrofit	Potomac River MO Cnty	02140202	1261307.90	530644.55	6.94

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY160173UT	Tree Planting	Potomac River U tidal	02140201	1329070.54	424967.19	0.07
SHA18APY160185UT	Tree Planting	Potomac River U tidal	02140201	1321904.75	416400.74	0.19
SHA18APY160211UT	Tree Planting	Potomac River U tidal	02140201	1342485.78	419829.98	0.12
SHA18APY210413UT	Tree Planting	Potomac River WA Cnty	02140501	1100983.54	664162.28	5.34
SHA18APY210416UT	Tree Planting	Potomac River WA Cnty	02140501	1100397.42	660707.01	0.80
SHA18RST150204	Retrofit	Seneca Creek	02140208	1239758.68	553680.51	9.87
SHA18RST150205	Retrofit	Seneca Creek	02140208	1239535.45	553432.53	5.23
SHA18RST150354	Retrofit	Seneca Creek	02140208	1251041.28	540141.10	1.39
SHA18RST020044	Retrofit	Severn River	02131002	1402548.96	515891.76	2.00
SHA18RST020049	Retrofit	Severn River	02131002	1403816.51	514870.40	4.03
SHA18RST020253	Retrofit	Severn River	02131002	1471789.51	495371.81	2.79
SHA18RST020254	Retrofit	Severn River	02131002	1471410.36	495397.18	3.59
SHA18RST020287	Retrofit	Severn River	02131002	1467822.97	495909.84	2.10
SHA18APY020126UT	Tree Planting	Severn River	02131002	1403206.60	514928.56	0.26
SHA18APY020157UT	Tree Planting	Severn River	02131002	1399419.90	522402.24	0.46
SHA18APY020158UT	Tree Planting	Severn River	02131002	1400003.78	521759.54	0.34
SHA18APY020160UT	Tree Planting	Severn River	02131002	1419001.54	520890.01	0.04
SHA18APY020163UT	Tree Planting	Severn River	02131002	1461077.79	494309.78	0.19
SHA18APY020164UT	Tree Planting	Severn River	02131002	1460925.62	493863.41	0.11
SHA18APY020166UT	Tree Planting	Severn River	02131002	1413656.28	510288.73	0.04
SHA18APY020169UT	Tree Planting	Severn River	02131002	1417356.99	524466.75	0.07
SHA18APY020170UT	Tree Planting	Severn River	02131002	1417500.63	524024.55	0.20
SHA18APY020171UT	Tree Planting	Severn River	02131002	1417589.67	520136.84	0.10
SHA18APY020172UT	Tree Planting	Severn River	02131002	1417715.55	519568.18	0.32
SHA18APY020278UT	Tree Planting	Severn River	02131002	1445131.21	481723.97	0.28

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY020279UT	Tree Planting	Severn River	02131002	1444851.38	480723.05	0.20
SHA18APY020280UT	Tree Planting	Severn River	02131002	1418958.21	520559.02	0.32
SHA18APY020307UT	Tree Planting	Severn River	02131002	1474735.98	495062.26	0.18
SHA18APY020310UT	Tree Planting	Severn River	02131002	1460240.83	493092.24	0.20
SHA18APY020312UT	Tree Planting	Severn River	02131002	1444383.70	480395.21	0.05
SHA18APY020319UT	Tree Planting	Severn River	02131002	1444639.38	480641.95	0.13
SHA18APY020325UT	Tree Planting	Severn River	02131002	1415230.39	511063.95	0.21
SHA18APY020326UT	Tree Planting	Severn River	02131002	1398868.34	522665.92	0.49
SHA18APY020331UT	Tree Planting	Severn River	02131002	1416755.64	511994.97	0.17
SHA18APY020332UT	Tree Planting	Severn River	02131002	1416945.52	511784.64	0.23
SHA18APY020333UT	Tree Planting	Severn River	02131002	1418642.32	521226.14	0.07
SHA18APY020344UT	Tree Planting	Severn River	02131002	1414848.39	511046.57	0.10
SHA18APY020400UT	Tree Planting	Severn River	02131002	1413940.14	509097.32	0.09
SHA18APY020404UT	Tree Planting	Severn River	02131002	1416777.02	512750.82	0.63
SHA18RST020270	Retrofit	South River	02131003	1428304.83	479899.97	2.58
SHA18RST020404	Retrofit	South River	02131003	1412345.42	470328.15	6.02
SHA18APY020133UT	Tree Planting	South River	02131003	1439905.91	479366.31	0.26
SHA18APY020134UT	Tree Planting	South River	02131003	1439809.80	478932.44	0.11
SHA18APY020189UT	Tree Planting	South River	02131003	1440966.95	479745.74	0.13
SHA18APY020196UT	Tree Planting	South River	02131003	1440778.85	477798.04	0.10
SHA18APY020267UT	Tree Planting	South River	02131003	1442203.14	475498.32	0.19
SHA18APY020273UT	Tree Planting	South River	02131003	1412943.41	469979.27	0.29
SHA18APY020282UT	Tree Planting	South River	02131003	1433896.09	480425.77	0.64
SHA18APY020283UT	Tree Planting	South River	02131003	1441111.87	477091.20	0.06
SHA18APY020288UT	Tree Planting	South River	02131003	1441337.37	477012.09	0.06

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA18APY020289UT	Tree Planting	South River	02131003	1442614.57	475374.22	0.26
SHA18APY020290UT	Tree Planting	South River	02131003	1441394.01	480122.17	0.08
SHA18APY020291UT	Tree Planting	South River	02131003	1441450.75	476721.61	0.06
SHA18APY020293UT	Tree Planting	South River	02131003	1438511.67	479964.49	0.34
SHA18APY020295UT	Tree Planting	South River	02131003	1431436.75	480072.76	0.26
SHA18APY020296UT	Tree Planting	South River	02131003	1442247.00	475857.18	0.13
SHA18APY120198UT	Tree Planting	Swan Creek	02130706	1551785.77	696286.53	0.78
SHA18APY120208UT	Tree Planting	Swan Creek	02130706	1536626.14	697021.20	0.19
SHA18APY120211UT	Tree Planting	Swan Creek	02130706	1537270.11	697196.94	0.15
SHA18APY120214UT	Tree Planting	Swan Creek	02130706	1551880.61	670403.83	0.61
SHA18APY120217UT	Tree Planting	Swan Creek	02130706	1538440.39	697362.69	0.34
SHA18APY120218UT	Tree Planting	Swan Creek	02130706	1538745.64	697377.27	0.09
SHA18APY120219UT	Tree Planting	Swan Creek	02130706	1541396.92	696861.49	0.27
SHA18APY020276UT	Tree Planting	West Chesapeake Bay	02131005	1432087.84	409590.49	0.29
SHA18APY020302UT	Tree Planting	West River	02131004	1436648.67	437073.14	0.29
SHA18RST161268	Bioretention	Western Branch	02131103	1365723.32	405690.44	0.20
SHA18RST161269	Bioretention	Western Branch	02131103	1365950.25	406173.52	0.99
SHA18RST161270	Bioretention	Western Branch	02131103	1366481.66	406919.02	1.32
SHA18RST161271	Bioretention	Western Branch	02131103	1368066.77	406334.92	1.05
SHA18RST160062	Retrofit	Western Branch	02131103	1358815.57	447042.84	2.84
SHA18RST160160	Retrofit	Western Branch	02131103	1339987.21	434224.09	1.25
SHA18APY160176UT	Tree Planting	Western Branch	02131103	1357632.24	438052.61	1.35
SHA18APY160182UT	Tree Planting	Western Branch	02131103	1353743.53	463436.83	1.28
SHA18APY160184UT	Tree Planting	Western Branch	02131103	1353512.77	463610.99	0.04
SHA18APY160196UT	Tree Planting	Western Branch	02131103	1356772.32	466621.12	0.26

Table 2-2e: Fiscal Year 2018 Capital Impervious Restoration Practices						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
SHA18RST161089	Wet pond	Western Branch	02131103	1386793.54	418213.30	2.67
					Complete BMP Acreage Total	**199.2**
2018 Planned Credit						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
TBD	New Stormwater	TBD	TBD	TBD	TBD	0.00
TBD	Retrofit	TBD	TBD	TBD	TBD	15.00
TBD	Stream Restoration	TBD	TBD	TBD	TBD	7.70
TBD	Urban Tree Planting	TBD	TBD	TBD	TBD	10.00
TBD	Outfall Stabilization	TBD	TBD	TBD	TBD	0.00
TBD	Impervious Surface Elimination	TBD	TBD	TBD	TBD	0.00
TBD	Redevelopment Credit	TBD	TBD	TBD	TBD	11.49
					Planned BMP Acreage Total	**44.19**
					Grand Total BMP Acreage Total	**243.39**

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY150002UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299628.74	520234.72	0.05
SHA19APY150005UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1339115.84	522150.83	0.03
SHA19APY150006UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299206.71	513909.86	0.04
SHA19APY150007UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299368.01	512725.04	0.03
SHA19APY150008UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1300276.23	521570.29	0.05
SHA19APY150009UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299746.88	520510.16	0.03
SHA19APY150011UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299118.12	515944.22	0.04
SHA19APY150012UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299527.64	519140.64	0.03
SHA19APY150013UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299245.99	513644.78	0.03
SHA19APY150015UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1298987.86	515248.57	0.04
SHA19APY150016UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1338521.49	522718.28	0.22
SHA19APY150017UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1298979.77	514990.82	0.04
SHA19APY150018UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299989.56	521084.90	0.03
SHA19APY150019UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299353.60	512978.84	0.03
SHA19APY150021UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299543.97	517405.44	0.03
SHA19APY150022UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299620.76	517666.13	0.04
SHA19APY150023UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299638.94	518349.36	0.08
SHA19APY150024UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1338787.71	522291.72	0.05
SHA19APY150025UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1338737.67	522516.20	0.07
SHA19APY150026UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1338821.94	522416.61	0.02
SHA19APY150027UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299408.87	512289.22	0.02
SHA19APY150028UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299212.56	516236.03	0.06
SHA19APY150029UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299400.59	516872.43	0.03
SHA19APY150030UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299114.30	514295.04	0.03
SHA19APY150031UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299587.24	518801.55	0.03

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY150032UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299309.62	516604.08	0.05
SHA19APY150033UI	Impervious Surface Elimination (to Pervious)	Anacostia River	02140205	1299067.13	514547.53	0.05
SHA19APY120245UT	Tree Planting	Atkisson Reservoir	02130703	1483278.54	695866.99	0.18
SHA19APY120246UT	Tree Planting	Atkisson Reservoir	02130703	1483971.21	695857.94	0.31
SHA19RST021559	Grass Swale	Baltimore Harbor	02130903	1425476.08	556005.41	0.20
SHA19RST021562	Grass Swale	Baltimore Harbor	02130903	1423566.12	556326.04	0.48
SHA19RST021563	Grass Swale	Baltimore Harbor	02130903	1424170.92	556139.86	0.13
SHA19APY020002UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1439370.04	553603.25	0.33
SHA19APY020004UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1439787.66	552467.52	0.45
SHA19APY020005UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1438611.11	555835.03	0.05
SHA19APY020006UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1413873.80	560272.99	0.10
SHA19APY020009UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1440336.67	552021.92	0.01
SHA19APY020010UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1413992.92	532091.26	0.08
SHA19APY020011UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1413887.13	561465.49	0.04
SHA19APY020015UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1413900.21	561362.51	0.03
SHA19APY020017UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1438538.30	556958.30	0.33
SHA19APY020020UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1414191.95	532528.49	0.09
SHA19APY020023UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1438942.38	554846.19	0.27
SHA19APY020026UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1413818.45	560390.77	0.04
SHA19APY020028UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1443588.00	548951.58	0.15
SHA19APY020029UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1440344.21	551888.68	0.03
SHA19APY020033UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1440270.87	551939.73	0.04
SHA19APY020034UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1414325.74	532773.60	0.07
SHA19APY020036UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1413813.61	561617.08	0.07
SHA19APY020037UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1442635.37	550004.43	0.55

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY020038UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1413810.87	531706.76	0.24
SHA19APY020040UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1441142.73	551338.47	0.67
SHA19APY020043UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1438734.42	555527.87	0.01
SHA19APY020044UI	Impervious Surface Elimination (to Pervious)	Baltimore Harbor	02130903	1438325.31	558299.05	0.04
SHA19RST021556	Submerged Gravel Wetland	Baltimore Harbor	02130903	1426536.54	560889.12	0.70
SHA19RST021557	Submerged Gravel Wetland	Baltimore Harbor	02130903	1428381.84	534596.03	0.32
SHA19RST021560	Submerged Gravel Wetland	Baltimore Harbor	02130903	1424073.45	556335.05	0.67
SHA19RST021561	Submerged Gravel Wetland	Baltimore Harbor	02130903	1424203.16	556321.90	0.49
SHA19RST021564	Submerged Gravel Wetland	Baltimore Harbor	02130903	1425015.72	556692.61	1.40
SHA19RST021565	Submerged Gravel Wetland	Baltimore Harbor	02130903	1424696.09	543510.79	0.94
SHA19RST021566	Submerged Gravel Wetland	Baltimore Harbor	02130903	1423854.07	561271.02	1.06
SHA19RST021567	Submerged Gravel Wetland	Baltimore Harbor	02130903	1425282.86	543184.31	1.23
SHA19RST021568	Submerged Gravel Wetland	Baltimore Harbor	02130903	1425107.96	543034.61	1.40
SHA19RST021569	Submerged Gravel Wetland	Baltimore Harbor	02130903	1422821.53	561012.70	0.91
SHA19RST0300019UO	Outfall Stabilization	Bird River	02130803	1458359.13	624766.44	2.00
SHA19RST0300020UO	Outfall Stabilization	Bird River	02130803	1458638.90	624675.73	2.00
SHA19APY100061UT	Tree Planting	Catoctin Creek	02140305	1162485.01	658738.14	0.19
SHA19APY100068UT	Tree Planting	Catoctin Creek	02140305	1151689.46	667277.43	0.17
SHA19APY100070UT	Tree Planting	Catoctin Creek	02140305	1147686.47	670364.36	0.07
SHA19APY100074UT	Tree Planting	Catoctin Creek	02140305	1142212.11	678419.48	0.17
SHA19APY100075UT	Tree Planting	Catoctin Creek	02140305	1142070.30	679115.90	0.19
SHA19APY100102UT	Tree Planting	Catoctin Creek	02140305	1163315.54	657975.86	0.81
SHA19APY100112UT	Tree Planting	Catoctin Creek	02140305	1141157.91	681109.30	0.03
SHA19APY100248UT	Tree Planting	Catoctin Creek	02140305	1169646.69	651748.88	0.06
SHA19APY100256UT	Tree Planting	Catoctin Creek	02140305	1155385.35	616365.59	0.50

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY100257UT	Tree Planting	Catoctin Creek	02140305	1152574.19	616110.71	0.27
SHA19APY100260UT	Tree Planting	Catoctin Creek	02140305	1167112.80	657128.23	0.64
SHA19APY100261UT	Tree Planting	Catoctin Creek	02140305	1166691.27	657881.43	0.70
SHA19APY100262UT	Tree Planting	Catoctin Creek	02140305	1165282.63	659713.38	0.93
SHA19APY100263UT	Tree Planting	Catoctin Creek	02140305	1154933.76	641643.48	0.58
SHA19APY100264UT	Tree Planting	Catoctin Creek	02140305	1144587.11	635384.03	1.29
SHA19APY100269UT	Tree Planting	Catoctin Creek	02140305	1162724.55	662887.94	0.16
SHA19APY100270UT	Tree Planting	Catoctin Creek	02140305	1160695.27	665401.56	0.70
SHA19APY100271UT	Tree Planting	Catoctin Creek	02140305	1149721.98	675687.12	0.25
SHA19APY100272UT	Tree Planting	Catoctin Creek	02140305	1145626.18	679174.11	0.45
SHA19APY100273UT	Tree Planting	Catoctin Creek	02140305	1151373.54	639418.32	0.66
SHA19APY100279UT	Tree Planting	Catoctin Creek	02140305	1148237.81	636408.58	0.31
SHA19APY100280UT	Tree Planting	Catoctin Creek	02140305	1161260.94	660030.81	0.16
SHA19APY100298UT	Tree Planting	Catoctin Creek	02140305	1150431.53	639033.17	0.78
SHA19APY100303UT	Tree Planting	Catoctin Creek	02140305	1141788.26	678682.23	0.22
SHA19APY100304UT	Tree Planting	Catoctin Creek	02140305	1141878.60	678094.33	0.24
SHA19APY100305UT	Tree Planting	Catoctin Creek	02140305	1142853.64	677473.62	0.16
SHA19APY100306UT	Tree Planting	Catoctin Creek	02140305	1162225.65	658972.25	0.18
SHA19APY100308UT	Tree Planting	Catoctin Creek	02140305	1141346.19	615038.46	0.14
SHA19APY100309UT	Tree Planting	Catoctin Creek	02140305	1167093.17	654209.28	0.27
SHA19APY100310UT	Tree Planting	Catoctin Creek	02140305	1168334.19	652800.85	0.22
SHA19APY100314UT	Tree Planting	Catoctin Creek	02140305	1160398.63	660624.08	0.25
SHA19APY100317UT	Tree Planting	Catoctin Creek	02140305	1157169.55	616272.35	0.06
SHA19APY100318UT	Tree Planting	Catoctin Creek	02140305	1154628.45	671480.19	0.25
SHA19APY100319UT	Tree Planting	Catoctin Creek	02140305	1148133.57	636612.00	0.30

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY100320UT	Tree Planting	Catoctin Creek	02140305	1146180.89	635782.18	0.25
SHA19APY100321UT	Tree Planting	Catoctin Creek	02140305	1147369.99	636074.17	0.30
SHA19APY100322UT	Tree Planting	Catoctin Creek	02140305	1153361.35	640298.44	0.57
SHA19APY100323UT	Tree Planting	Catoctin Creek	02140305	1152006.26	639724.53	0.63
SHA19APY100324UT	Tree Planting	Catoctin Creek	02140305	1138864.37	632235.03	1.30
SHA19APY100325UT	Tree Planting	Catoctin Creek	02140305	1137620.71	631459.81	0.48
SHA19APY100326UT	Tree Planting	Catoctin Creek	02140305	1140153.76	632647.27	0.41
SHA19APY100327UT	Tree Planting	Catoctin Creek	02140305	1142233.49	633673.99	0.16
SHA19APY100328UT	Tree Planting	Catoctin Creek	02140305	1140619.10	632522.91	0.05
SHA19APY100329UT	Tree Planting	Catoctin Creek	02140305	1151874.76	665890.55	0.07
SHA19APY100339UT	Tree Planting	Catoctin Creek	02140305	1167349.91	656668.98	0.23
SHA19APY100340UT	Tree Planting	Catoctin Creek	02140305	1163383.88	662082.82	0.25
SHA19APY100342UT	Tree Planting	Catoctin Creek	02140305	1152530.70	673259.83	0.10
SHA19APY100343UT	Tree Planting	Catoctin Creek	02140305	1168611.83	654128.70	0.11
SHA19APY100344UT	Tree Planting	Catoctin Creek	02140305	1154739.04	616056.60	0.28
SHA19APY100345UT	Tree Planting	Catoctin Creek	02140305	1153983.14	615982.43	0.06
SHA19APY100346UT	Tree Planting	Catoctin Creek	02140305	1156742.92	616233.77	0.16
SHA19APY100351UT	Tree Planting	Catoctin Creek	02140305	1158663.08	667945.88	0.66
SHA19APY100352UT	Tree Planting	Catoctin Creek	02140305	1159506.17	666903.05	0.26
SHA19APY100353UT	Tree Planting	Catoctin Creek	02140305	1159684.43	666694.09	0.23
SHA19APY100354UT	Tree Planting	Catoctin Creek	02140305	1160040.24	666240.36	0.66
SHA19APY100355UT	Tree Planting	Catoctin Creek	02140305	1148295.39	636912.50	0.07
SHA19APY100356UT	Tree Planting	Catoctin Creek	02140305	1146652.33	635890.71	0.25
SHA19APY100365UT	Tree Planting	Catoctin Creek	02140305	1156082.97	616433.56	0.10
SHA19APY100367UT	Tree Planting	Catoctin Creek	02140305	1166006.48	658813.65	0.48

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY100368UT	Tree Planting	Catoctin Creek	02140305	1154621.56	641191.75	0.09
SHA19APY100369UT	Tree Planting	Catoctin Creek	02140305	1162116.89	663660.20	0.13
SHA19APY100370UT	Tree Planting	Catoctin Creek	02140305	1162002.40	663798.82	0.16
SHA19APY100371UT	Tree Planting	Catoctin Creek	02140305	1162412.86	663284.62	0.16
SHA19APY100372UT	Tree Planting	Catoctin Creek	02140305	1162582.50	663087.07	0.16
SHA19APY100373UT	Tree Planting	Catoctin Creek	02140305	1162262.02	663490.43	0.19
SHA19APY100374UT	Tree Planting	Catoctin Creek	02140305	1145925.37	678915.31	0.19
SHA19APY100376UT	Tree Planting	Catoctin Creek	02140305	1147777.78	636286.85	0.20
SHA19APY100377UT	Tree Planting	Catoctin Creek	02140305	1163123.35	662412.37	0.13
SHA19APY100378UT	Tree Planting	Catoctin Creek	02140305	1162986.30	662585.59	0.12
SHA19APY100379UT	Tree Planting	Catoctin Creek	02140305	1159056.98	667453.73	0.25
SHA19APY100380UT	Tree Planting	Catoctin Creek	02140305	1146391.73	678521.62	0.10
SHA19APY100383UT	Tree Planting	Catoctin Creek	02140305	1140490.77	632698.97	0.13
SHA19APY100384UT	Tree Planting	Catoctin Creek	02140305	1142095.85	633772.14	0.38
SHA19APY100385UT	Tree Planting	Catoctin Creek	02140305	1140820.72	632792.55	0.19
SHA19APY100386UT	Tree Planting	Catoctin Creek	02140305	1137192.34	630996.72	0.28
SHA19APY100389UT	Tree Planting	Catoctin Creek	02140305	1155109.18	663807.82	0.15
SHA19APY100390UT	Tree Planting	Catoctin Creek	02140305	1150456.53	668042.52	0.28
SHA19APY100393UT	Tree Planting	Catoctin Creek	02140305	1149948.23	638836.76	0.17
SHA19APY100398UT	Tree Planting	Catoctin Creek	02140305	1167361.17	656935.68	0.05
SHA19APY100404UT	Tree Planting	Catoctin Creek	02140305	1159380.63	667054.93	0.05
SHA19APY100405UT	Tree Planting	Catoctin Creek	02140305	1139701.06	632628.25	0.08
SHA19APY060153UT	Tree Planting	Double Pipe Creek	02140304	1269405.23	721675.55	1.42
SHA19APY060154UT	Tree Planting	Double Pipe Creek	02140304	1270240.07	721770.16	0.38
SHA19APY060155UT	Tree Planting	Double Pipe Creek	02140304	1271047.08	721742.85	0.48

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY060156UT	Tree Planting	Double Pipe Creek	02140304	1273931.18	721357.08	0.78
SHA19APY060157UT	Tree Planting	Double Pipe Creek	02140304	1273698.11	721237.65	0.46
SHA19APY060158UT	Tree Planting	Double Pipe Creek	02140304	1274408.59	720916.30	0.80
SHA19APY060159UT	Tree Planting	Double Pipe Creek	02140304	1292356.12	685332.06	0.41
SHA19APY060160UT	Tree Planting	Double Pipe Creek	02140304	1293162.06	707054.91	1.57
SHA19APY060163UT	Tree Planting	Double Pipe Creek	02140304	1295255.98	706229.97	1.79
SHA19APY060164UT	Tree Planting	Double Pipe Creek	02140304	1300989.65	702692.86	0.29
SHA19APY060165UT	Tree Planting	Double Pipe Creek	02140304	1289305.69	709776.49	0.63
SHA19APY060166UT	Tree Planting	Double Pipe Creek	02140304	1271580.88	691449.90	0.32
SHA19APY060167UT	Tree Planting	Double Pipe Creek	02140304	1277515.19	688241.87	1.19
SHA19APY060168UT	Tree Planting	Double Pipe Creek	02140304	1278811.31	687919.41	0.74
SHA19APY060169UT	Tree Planting	Double Pipe Creek	02140304	1310197.64	699566.87	0.53
SHA19APY060170UT	Tree Planting	Double Pipe Creek	02140304	1299332.67	687397.82	0.29
SHA19APY060171UT	Tree Planting	Double Pipe Creek	02140304	1300457.24	688233.70	0.70
SHA19APY060172UT	Tree Planting	Double Pipe Creek	02140304	1335671.50	720308.76	0.35
SHA19APY060173UT	Tree Planting	Double Pipe Creek	02140304	1336908.00	721755.94	0.24
SHA19APY060176UT	Tree Planting	Double Pipe Creek	02140304	1292610.38	685460.87	1.01
SHA19APY060177UT	Tree Planting	Double Pipe Creek	02140304	1288820.22	684550.78	0.10
SHA19APY060178UT	Tree Planting	Double Pipe Creek	02140304	1288238.64	684450.23	0.40
SHA19APY060189UT	Tree Planting	Double Pipe Creek	02140304	1336448.37	721182.58	0.17
SHA19APY060190UT	Tree Planting	Double Pipe Creek	02140304	1309311.22	699798.17	0.19
SHA19APY060191UT	Tree Planting	Double Pipe Creek	02140304	1290827.61	708566.59	0.10
SHA19APY060192UT	Tree Planting	Double Pipe Creek	02140304	1285069.57	712364.78	2.29
SHA19APY060193UT	Tree Planting	Double Pipe Creek	02140304	1283538.98	713829.67	1.02
SHA19APY060195UT	Tree Planting	Double Pipe Creek	02140304	1288933.41	709811.06	3.77

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY060199UT	Tree Planting	Double Pipe Creek	02140304	1301768.51	702625.77	0.54
SHA19APY060200UT	Tree Planting	Double Pipe Creek	02140304	1302154.81	702138.47	2.91
SHA19APY060201UT	Tree Planting	Double Pipe Creek	02140304	1294138.20	706936.03	0.13
SHA19APY060203UT	Tree Planting	Double Pipe Creek	02140304	1342218.92	725906.02	0.13
SHA19APY060204UT	Tree Planting	Double Pipe Creek	02140304	1341887.59	725478.41	0.31
SHA19APY060205UT	Tree Planting	Double Pipe Creek	02140304	1340809.55	724818.37	0.24
SHA19APY060206UT	Tree Planting	Double Pipe Creek	02140304	1294523.36	685286.28	0.13
SHA19APY060207UT	Tree Planting	Double Pipe Creek	02140304	1295638.32	685536.33	1.30
SHA19APY060210UT	Tree Planting	Double Pipe Creek	02140304	1290720.63	708396.68	0.54
SHA19APY060211UT	Tree Planting	Double Pipe Creek	02140304	1290291.05	708643.34	0.50
SHA19APY060212UT	Tree Planting	Double Pipe Creek	02140304	1302644.92	701687.10	1.31
SHA19APY060213UT	Tree Planting	Double Pipe Creek	02140304	1280362.33	686456.58	1.07
SHA19APY060214UT	Tree Planting	Double Pipe Creek	02140304	1279961.36	687110.71	0.27
SHA19APY060215UT	Tree Planting	Double Pipe Creek	02140304	1279598.07	687487.64	0.56
SHA19APY060221UT	Tree Planting	Double Pipe Creek	02140304	1290356.62	685174.08	0.87
SHA19APY060222UT	Tree Planting	Double Pipe Creek	02140304	1291374.48	685486.63	0.65
SHA19APY060226UT	Tree Planting	Double Pipe Creek	02140304	1296681.18	705679.36	0.43
SHA19APY060233UT	Tree Planting	Double Pipe Creek	02140304	1341189.16	724967.07	0.39
SHA19APY060235UT	Tree Planting	Double Pipe Creek	02140304	1280184.21	715928.24	0.61
SHA19APY060236UT	Tree Planting	Double Pipe Creek	02140304	1278490.93	717008.74	2.53
SHA19APY060237UT	Tree Planting	Double Pipe Creek	02140304	1276673.42	718789.65	1.10
SHA19APY060238UT	Tree Planting	Double Pipe Creek	02140304	1276169.81	719394.76	0.43
SHA19APY060239UT	Tree Planting	Double Pipe Creek	02140304	1275808.63	719831.82	0.59
SHA19APY060240UT	Tree Planting	Double Pipe Creek	02140304	1275364.32	720286.88	0.37
SHA19APY060241UT	Tree Planting	Double Pipe Creek	02140304	1276275.09	719587.88	1.98

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY060242UT	Tree Planting	Double Pipe Creek	02140304	1274753.03	720982.89	0.57
SHA19APY060243UT	Tree Planting	Double Pipe Creek	02140304	1272065.95	721887.78	0.08
SHA19APY060244UT	Tree Planting	Double Pipe Creek	02140304	1271887.62	721918.90	0.05
SHA19APY060245UT	Tree Planting	Double Pipe Creek	02140304	1271720.78	721939.86	0.05
SHA19APY060246UT	Tree Planting	Double Pipe Creek	02140304	1272514.39	691038.33	0.55
SHA19APY060247UT	Tree Planting	Double Pipe Creek	02140304	1334682.12	718951.63	0.13
SHA19APY060248UT	Tree Planting	Double Pipe Creek	02140304	1286568.18	684203.52	0.66
SHA19APY060250UT	Tree Planting	Double Pipe Creek	02140304	1307231.25	693613.15	0.26
SHA19APY060251UT	Tree Planting	Double Pipe Creek	02140304	1291423.16	707948.44	0.64
SHA19APY060252UT	Tree Planting	Double Pipe Creek	02140304	1337647.50	722369.13	0.36
SHA19APY060253UT	Tree Planting	Double Pipe Creek	02140304	1341816.01	725570.16	0.19
SHA19APY060254UT	Tree Planting	Double Pipe Creek	02140304	1282482.90	714539.46	0.64
SHA19APY060255UT	Tree Planting	Double Pipe Creek	02140304	1294485.93	706930.97	0.42
SHA19APY060256UT	Tree Planting	Double Pipe Creek	02140304	1343432.73	726952.78	0.26
SHA19APY060259UT	Tree Planting	Double Pipe Creek	02140304	1340261.51	724449.67	0.15
SHA19APY060260UT	Tree Planting	Double Pipe Creek	02140304	1339664.11	724055.67	0.09
SHA19APY060263UT	Tree Planting	Double Pipe Creek	02140304	1270821.77	691630.80	0.67
SHA19APY060264UT	Tree Planting	Double Pipe Creek	02140304	1341462.80	725285.16	0.09
SHA19APY060175UT	Tree Planting	Liberty Reservoir	02130907	1309895.25	642991.57	1.31
SHA19APY060179UT	Tree Planting	Liberty Reservoir	02130907	1312318.19	651545.08	0.40
SHA19APY060180UT	Tree Planting	Liberty Reservoir	02130907	1313236.94	648410.29	1.29
SHA19APY060181UT	Tree Planting	Liberty Reservoir	02130907	1311202.07	643206.68	2.43
SHA19APY060182UT	Tree Planting	Liberty Reservoir	02130907	1316554.00	685507.12	0.23
SHA19APY060183UT	Tree Planting	Liberty Reservoir	02130907	1316810.77	686378.35	1.01
SHA19APY060184UT	Tree Planting	Liberty Reservoir	02130907	1316995.97	686980.32	0.32

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY060185UT	Tree Planting	Liberty Reservoir	02130907	1317147.59	687431.72	0.52
SHA19APY060186UT	Tree Planting	Liberty Reservoir	02130907	1317308.13	687919.90	0.21
SHA19APY060187UT	Tree Planting	Liberty Reservoir	02130907	1319743.69	699737.68	0.70
SHA19APY060188UT	Tree Planting	Liberty Reservoir	02130907	1321997.93	701529.99	0.39
SHA19APY060194UT	Tree Planting	Liberty Reservoir	02130907	1321533.66	689807.39	0.12
SHA19APY060196UT	Tree Planting	Liberty Reservoir	02130907	1315615.14	683147.11	0.59
SHA19APY060197UT	Tree Planting	Liberty Reservoir	02130907	1316050.60	684287.85	1.77
SHA19APY060198UT	Tree Planting	Liberty Reservoir	02130907	1316417.03	685136.86	0.39
SHA19APY060202UT	Tree Planting	Liberty Reservoir	02130907	1317379.46	688169.20	0.20
SHA19APY060228UT	Tree Planting	Liberty Reservoir	02130907	1337544.29	629385.93	0.13
SHA19APY060229UT	Tree Planting	Liberty Reservoir	02130907	1337910.24	629429.98	0.05
SHA19APY060230UT	Tree Planting	Liberty Reservoir	02130907	1311938.16	652746.80	0.88
SHA19APY060231UT	Tree Planting	Liberty Reservoir	02130907	1318354.25	698575.13	0.14
SHA19APY060232UT	Tree Planting	Liberty Reservoir	02130907	1322539.39	701683.43	0.06
SHA19APY060249UT	Tree Planting	Liberty Reservoir	02130907	1294757.86	661557.74	0.11
SHA19RST130048	Retrofit	Little Patuxent River	02131105	1370095.25	531637.08	1.65
SHA19RST130072	Retrofit	Little Patuxent River	02131105	1365868.72	568673.39	9.64
SHA19RST130073	Retrofit	Little Patuxent River	02131105	1366391.44	568050.79	1.74
SHA19RST130120	Retrofit	Little Patuxent River	02131105	1371189.09	531625.31	1.53
SHA19RST130173	Retrofit	Little Patuxent River	02131105	1352340.06	560114.49	0.19
SHA19ALN210019UR	Stream Restoration	Little Tonoloway Creek	02140509	975669.61	745768.80	8.00
SHA19RST100035	Retrofit	Lower Monocacy River	02140302	1224599.32	680118.01	6.16
SHA19RST100036	Retrofit	Lower Monocacy River	02140302	1224112.43	677033.57	2.93
SHA19RST100037	Retrofit	Lower Monocacy River	02140302	1223305.53	675949.81	1.03
SHA19RST100171	Retrofit	Lower Monocacy River	02140302	1258174.17	619287.60	9.65

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19ALN100005UR	Stream Restoration	Lower Monocacy River	02140302	1225285.03	678064.92	24.00
SHA19ALN100007UR	Stream Restoration	Lower Monocacy River	02140302	1235087.82	609679.93	19.50
SHA19APY060174UT	Tree Planting	Lower Monocacy River	02140302	1284365.61	653331.63	0.17
SHA19APY100096UT	Tree Planting	Lower Monocacy River	02140302	1202818.74	633104.06	0.27
SHA19APY100249UT	Tree Planting	Lower Monocacy River	02140302	1208170.96	632865.34	0.10
SHA19APY100258UT	Tree Planting	Lower Monocacy River	02140302	1179183.10	624239.88	0.24
SHA19APY100259UT	Tree Planting	Lower Monocacy River	02140302	1181888.91	625633.37	0.62
SHA19APY100267UT	Tree Planting	Lower Monocacy River	02140302	1171413.22	620110.06	0.18
SHA19APY100302UT	Tree Planting	Lower Monocacy River	02140302	1173464.57	640085.38	0.08
SHA19APY100307UT	Tree Planting	Lower Monocacy River	02140302	1212033.11	603394.18	0.33
SHA19APY100312UT	Tree Planting	Lower Monocacy River	02140302	1194420.27	604177.23	0.08
SHA19APY100313UT	Tree Planting	Lower Monocacy River	02140302	1194306.94	603992.99	0.29
SHA19APY100338UT	Tree Planting	Lower Monocacy River	02140302	1175932.80	622232.13	0.14
SHA19APY100366UT	Tree Planting	Lower Monocacy River	02140302	1178651.92	623920.71	0.19
SHA19APY100388UT	Tree Planting	Lower Monocacy River	02140302	1180538.37	616824.45	0.13
SHA19APY100411UT	Tree Planting	Lower Monocacy River	02140302	1180049.62	639881.98	0.04
SHA19APY100412UT	Tree Planting	Lower Monocacy River	02140302	1180284.26	639724.86	0.07
SHA19APY100413UT	Tree Planting	Lower Monocacy River	02140302	1179870.11	640007.00	0.05
SHA19RST080063	Retrofit	Mattawoman Creek	02140111	1346585.69	359095.66	5.55
SHA19RST080064	Retrofit	Mattawoman Creek	02140111	1348049.88	360510.53	1.32
SHA19RST130027	Retrofit	Middle Patuxent River	02131106	1342039.45	553642.55	13.96
SHA19APY130120UT	Tree Planting	Middle Patuxent River	02131106	1316285.83	586102.38	0.16
SHA19APY130206UT	Tree Planting	Middle Patuxent River	02131106	1305994.41	605276.94	0.04
SHA19APY160004UI	Impervious Surface Elimination (to Pervious)	Oxon Creek	02140204	1321117.51	416347.83	0.17
SHA19APY020016UI	Impervious Surface Elimination (to Pervious)	Patapsco River L N Br	02130906	1399172.04	543725.36	0.19

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19RST130077	Retrofit	Patapsco River L N Br	02130906	1366899.63	567057.23	2.53
SHA19RST130205	Retrofit	Patapsco River L N Br	02130906	1381659.56	554421.11	1.55
SHA19RST130206	Retrofit	Patapsco River L N Br	02130906	1381364.14	554030.54	0.91
SHA19RST130220	Retrofit	Patapsco River L N Br	02130906	1373788.31	561261.58	1.86
SHA19APY130053UT	Tree Planting	Patapsco River L N Br	02130906	1344341.17	611070.68	4.63
SHA19APY130193UT	Tree Planting	Patapsco River L N Br	02130906	1344931.83	609172.84	13.95
SHA19APY130194UT	Tree Planting	Patapsco River L N Br	02130906	1343745.85	608712.07	1.91
SHA19APY130195UT	Tree Planting	Patapsco River L N Br	02130906	1342842.53	609197.71	4.77
SHA19APY130196UT	Tree Planting	Patapsco River L N Br	02130906	1342678.03	608203.36	4.81
SHA19APY130212UT	Tree Planting	Patapsco River L N Br	02130906	1384683.62	566017.28	4.87
SHA19APY130213UT	Tree Planting	Patapsco River L N Br	02130906	1384355.64	567220.58	4.61
SHA19APY150010UI	Impervious Surface Elimination (to Pervious)	Patuxent River upper	02131104	1339443.45	521978.15	0.16
SHA19APY160015UI	Impervious Surface Elimination (to Pervious)	Piscataway Creek	02140203	1315110.18	380004.10	0.17
SHA19RST080018	Retrofit	Port Tobacco River	02140109	1317750.08	323230.43	6.76
SHA19ALN100006UR	Stream Restoration	Potomac River FR Cnty	02140301	1133278.26	610350.17	31.50
SHA19APY100265UT	Tree Planting	Potomac River FR Cnty	02140301	1166311.48	597725.35	1.16
SHA19APY100266UT	Tree Planting	Potomac River FR Cnty	02140301	1169634.72	614662.25	1.55
SHA19APY100268UT	Tree Planting	Potomac River FR Cnty	02140301	1139412.98	614334.56	0.80
SHA19APY100274UT	Tree Planting	Potomac River FR Cnty	02140301	1164271.09	594249.96	0.62
SHA19APY100275UT	Tree Planting	Potomac River FR Cnty	02140301	1166804.40	599345.23	0.73
SHA19APY100276UT	Tree Planting	Potomac River FR Cnty	02140301	1167233.87	601616.88	0.83
SHA19APY100277UT	Tree Planting	Potomac River FR Cnty	02140301	1167409.90	602515.41	0.75
SHA19APY100278UT	Tree Planting	Potomac River FR Cnty	02140301	1168259.34	607002.55	1.61
SHA19APY100294UT	Tree Planting	Potomac River FR Cnty	02140301	1168986.49	608450.92	0.18
SHA19APY100295UT	Tree Planting	Potomac River FR Cnty	02140301	1132773.22	607549.54	0.14

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY100296UT	Tree Planting	Potomac River FR Cnty	02140301	1179973.42	615567.45	0.19
SHA19APY100297UT	Tree Planting	Potomac River FR Cnty	02140301	1180335.91	616221.79	0.22
SHA19APY100300UT	Tree Planting	Potomac River FR Cnty	02140301	1130900.60	611245.01	0.12
SHA19APY100301UT	Tree Planting	Potomac River FR Cnty	02140301	1131049.85	610367.36	0.11
SHA19APY100316UT	Tree Planting	Potomac River FR Cnty	02140301	1169990.87	617822.18	0.25
SHA19APY100331UT	Tree Planting	Potomac River FR Cnty	02140301	1169708.60	615679.46	0.67
SHA19APY100332UT	Tree Planting	Potomac River FR Cnty	02140301	1169485.76	613639.89	0.94
SHA19APY100333UT	Tree Planting	Potomac River FR Cnty	02140301	1166842.97	600487.76	0.08
SHA19APY100334UT	Tree Planting	Potomac River FR Cnty	02140301	1168518.56	608281.05	1.11
SHA19APY100335UT	Tree Planting	Potomac River FR Cnty	02140301	1166670.62	598655.10	0.18
SHA19APY100337UT	Tree Planting	Potomac River FR Cnty	02140301	1166564.31	598279.07	0.08
SHA19APY100347UT	Tree Planting	Potomac River FR Cnty	02140301	1169475.57	615071.18	0.37
SHA19APY100348UT	Tree Planting	Potomac River FR Cnty	02140301	1169405.09	614375.28	0.20
SHA19APY100349UT	Tree Planting	Potomac River FR Cnty	02140301	1169316.24	613829.11	0.17
SHA19APY100350UT	Tree Planting	Potomac River FR Cnty	02140301	1169152.73	612960.84	0.31
SHA19APY100357UT	Tree Planting	Potomac River FR Cnty	02140301	1130654.26	609078.29	0.07
SHA19APY100375UT	Tree Planting	Potomac River FR Cnty	02140301	1166911.98	599811.23	0.20
SHA19APY100387UT	Tree Planting	Potomac River FR Cnty	02140301	1180261.20	616317.06	0.18
SHA19APY100394UT	Tree Planting	Potomac River FR Cnty	02140301	1131145.68	611909.19	0.11
SHA19APY100395UT	Tree Planting	Potomac River FR Cnty	02140301	1131093.62	610719.41	0.12
SHA19APY100396UT	Tree Planting	Potomac River FR Cnty	02140301	1130890.82	610996.25	0.08
SHA19APY100399UT	Tree Planting	Potomac River FR Cnty	02140301	1138105.51	614304.75	0.17
SHA19APY100400UT	Tree Planting	Potomac River FR Cnty	02140301	1131088.44	610039.41	0.16
SHA19APY100406UT	Tree Planting	Potomac River FR Cnty	02140301	1133022.96	607541.63	0.05
SHA19APY100407UT	Tree Planting	Potomac River FR Cnty	02140301	1132801.33	607716.94	0.13

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY100408UT	Tree Planting	Potomac River FR Cnty	02140301	1132397.18	608055.96	0.04
SHA19APY100409UT	Tree Planting	Potomac River FR Cnty	02140301	1131023.50	611232.60	0.04
SHA19APY100410UT	Tree Planting	Potomac River FR Cnty	02140301	1131083.45	611252.33	0.06
SHA19APY100414UT	Tree Planting	Potomac River FR Cnty	02140301	1133826.45	611855.96	0.09
SHA19APY100415UT	Tree Planting	Potomac River FR Cnty	02140301	1134045.65	612036.38	0.05
SHA19RST080019	Retrofit	Potomac River L tidal	02140101	1323507.13	255598.50	0.48
SHA19APY150001UI	Impervious Surface Elimination (to Pervious)	Potomac River MO Cnty	02140202	1239014.72	528773.34	0.03
SHA19APY150003UI	Impervious Surface Elimination (to Pervious)	Potomac River MO Cnty	02140202	1238521.25	528695.73	0.18
SHA19APY150014UI	Impervious Surface Elimination (to Pervious)	Potomac River MO Cnty	02140202	1237988.54	528474.53	0.07
SHA19APY150020UI	Impervious Surface Elimination (to Pervious)	Potomac River MO Cnty	02140202	1240074.79	528712.73	0.03
SHA19APY160001UI	Impervious Surface Elimination (to Pervious)	Potomac River U tidal	02140201	1319845.99	414862.82	0.02
SHA19APY160002UI	Impervious Surface Elimination (to Pervious)	Potomac River U tidal	02140201	1320397.58	415413.42	0.24
SHA19APY160007UI	Impervious Surface Elimination (to Pervious)	Potomac River U tidal	02140201	1314724.44	392329.60	0.30
SHA19APY160008UI	Impervious Surface Elimination (to Pervious)	Potomac River U tidal	02140201	1319833.95	414932.42	0.09
SHA19APY160010UI	Impervious Surface Elimination (to Pervious)	Potomac River U tidal	02140201	1321627.48	416932.08	0.13
SHA19APY160012UI	Impervious Surface Elimination (to Pervious)	Potomac River U tidal	02140201	1319320.16	414653.54	0.02
SHA19RST060149	Retrofit	S Branch Patapsco	02130908	1310150.11	641447.84	1.90
SHA19APY060161UT	Tree Planting	S Branch Patapsco	02130908	1310638.43	641971.57	0.91
SHA19APY060162UT	Tree Planting	S Branch Patapsco	02130908	1310630.76	642517.69	0.23
SHA19APY060219UT	Tree Planting	S Branch Patapsco	02130908	1296008.27	648642.23	0.55
SHA19APY060257UT	Tree Planting	S Branch Patapsco	02130908	1303656.57	645340.76	0.38
SHA19APY060258UT	Tree Planting	S Branch Patapsco	02130908	1302529.78	645788.99	0.45
SHA19APY160005UI	Impervious Surface Elimination (to Pervious)	Seneca Creek	02140208	1253352.87	540002.04	0.15
SHA19APY160011UI	Impervious Surface Elimination (to Pervious)	Seneca Creek	02140208	1252700.51	540691.79	0.22
SHA19APY020013UI	Impervious Surface Elimination (to Pervious)	Severn River	02131002	1398953.20	520932.38	0.02

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY020014UI	Impervious Surface Elimination (to Pervious)	Severn River	02131002	1447870.27	484890.33	0.15
SHA19APY020022UI	Impervious Surface Elimination (to Pervious)	Severn River	02131002	1399221.97	522808.34	0.17
SHA19APY020024UI	Impervious Surface Elimination (to Pervious)	Severn River	02131002	1448474.72	484840.09	0.09
SHA19APY020027UI	Impervious Surface Elimination (to Pervious)	Severn River	02131002	1399136.20	522106.39	0.04
SHA19APY020032UI	Impervious Surface Elimination (to Pervious)	Severn River	02131002	1399186.87	522531.18	0.04
SHA19APY020035UI	Impervious Surface Elimination (to Pervious)	Severn River	02131002	1458402.88	491839.14	0.19
SHA19APY020012UI	Impervious Surface Elimination (to Pervious)	South River	02131003	1437918.71	466438.48	0.12
SHA19APY020021UI	Impervious Surface Elimination (to Pervious)	South River	02131003	1441641.07	473599.56	0.09
SHA19APY020025UI	Impervious Surface Elimination (to Pervious)	South River	02131003	1439599.08	469541.83	0.10
SHA19APY020030UI	Impervious Surface Elimination (to Pervious)	South River	02131003	1440082.71	470516.58	0.09
SHA19APY020039UI	Impervious Surface Elimination (to Pervious)	South River	02131003	1438090.41	466458.27	0.06
SHA19RST100038	Retrofit	Upper Monocacy River	02140303	1215015.55	662113.23	10.13
SHA19APY060208UT	Tree Planting	Upper Monocacy River	02140303	1268151.01	731690.88	0.64
SHA19APY060209UT	Tree Planting	Upper Monocacy River	02140303	1268535.15	732126.72	0.06
SHA19APY060216UT	Tree Planting	Upper Monocacy River	02140303	1274265.35	740088.52	0.11
SHA19APY060217UT	Tree Planting	Upper Monocacy River	02140303	1274541.01	740255.02	0.20
SHA19APY060218UT	Tree Planting	Upper Monocacy River	02140303	1274989.09	740512.98	0.31
SHA19APY060223UT	Tree Planting	Upper Monocacy River	02140303	1269421.70	733626.06	0.22
SHA19APY060224UT	Tree Planting	Upper Monocacy River	02140303	1269568.29	733869.10	0.11
SHA19APY060225UT	Tree Planting	Upper Monocacy River	02140303	1269700.89	734090.49	0.19
SHA19APY060227UT	Tree Planting	Upper Monocacy River	02140303	1256169.90	729489.62	0.10
SHA19APY060234UT	Tree Planting	Upper Monocacy River	02140303	1276312.38	741568.67	0.10
SHA19APY060261UT	Tree Planting	Upper Monocacy River	02140303	1275628.27	740888.71	0.41
SHA19APY060262UT	Tree Planting	Upper Monocacy River	02140303	1276139.54	741356.92	0.07
SHA19APY100289UT	Tree Planting	Upper Monocacy River	02140303	1196997.36	717607.22	0.12

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices

Unique BMP Number	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA19APY100290UT	Tree Planting	Upper Monocacy River	02140303	1223507.77	741746.96	0.17
SHA19APY100291UT	Tree Planting	Upper Monocacy River	02140303	1223148.40	739613.77	0.09
SHA19APY100292UT	Tree Planting	Upper Monocacy River	02140303	1205667.26	725400.13	0.10
SHA19APY100293UT	Tree Planting	Upper Monocacy River	02140303	1212781.82	730618.71	0.89
SHA19APY100315UT	Tree Planting	Upper Monocacy River	02140303	1200297.29	662593.96	0.15
SHA19APY100336UT	Tree Planting	Upper Monocacy River	02140303	1189905.21	699040.40	0.10
SHA19APY100358UT	Tree Planting	Upper Monocacy River	02140303	1213101.13	732246.20	0.69
SHA19APY100359UT	Tree Planting	Upper Monocacy River	02140303	1213774.79	732897.52	1.13
SHA19APY100360UT	Tree Planting	Upper Monocacy River	02140303	1215535.08	734612.82	0.60
SHA19APY100361UT	Tree Planting	Upper Monocacy River	02140303	1214603.17	734779.59	0.16
SHA19APY100362UT	Tree Planting	Upper Monocacy River	02140303	1220234.53	739943.60	0.17
SHA19APY100363UT	Tree Planting	Upper Monocacy River	02140303	1220742.87	739614.80	1.15
SHA19APY100364UT	Tree Planting	Upper Monocacy River	02140303	1221526.18	741067.71	0.72
SHA19APY100391UT	Tree Planting	Upper Monocacy River	02140303	1196770.26	717585.60	0.11
SHA19APY100401UT	Tree Planting	Upper Monocacy River	02140303	1215100.66	734282.65	0.24
SHA19APY100402UT	Tree Planting	Upper Monocacy River	02140303	1215189.32	734851.56	0.14
SHA19APY100416UT	Tree Planting	Upper Monocacy River	02140303	1199808.86	651853.03	0.16
SHA19APY160003UI	Impervious Surface Elimination (to Pervious)	Western Branch	02131103	1385528.99	467644.79	0.84
SHA19APY160006UI	Impervious Surface Elimination (to Pervious)	Western Branch	02131103	1364226.46	481443.59	0.08
SHA19APY160009UI	Impervious Surface Elimination (to Pervious)	Western Branch	02131103	1363483.45	480947.82	0.04
SHA19APY160014UI	Impervious Surface Elimination (to Pervious)	Western Branch	02131103	1364732.40	481784.54	0.03
SHA19APY160016UI	Impervious Surface Elimination (to Pervious)	Western Branch	02131103	1363792.50	481170.59	0.16
SHA19ALN160015UR	Stream Restoration	Western Branch	02131103	1368148.28	403835.77	107.60
SHA19RST080066	Retrofit	Zekiah Swamp	02140108	1348548.80	355972.43	0.89
SHA19RST080067	Retrofit	Zekiah Swamp	02140108	1348565.07	355644.83	0.70

Table 2-2f: Fiscal Year 2019 Capital Impervious Restoration Practices						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
SHA19RST080068	Retrofit	Zekiah Swamp	02140108	1348656.52	354344.50	0.14
SHA19RST080069	Retrofit	Zekiah Swamp	02140108	1348229.30	352190.82	1.70
SHA19RST080070	Retrofit	Zekiah Swamp	02140108	1348157.03	351049.63	0.78
SHA19RST080071	Retrofit	Zekiah Swamp	02140108	1348134.36	350642.52	0.00
SHA19RST080074	Retrofit	Zekiah Swamp	02140108	1347627.30	345783.62	2.18
					Complete BMP Acreage Total	**457.45**
2019 Planned Credit						
Unique BMP Number	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
TBD	Impervious Surface Elimination (to Pervious)	TBD	TBD	TBD	TBD	0.00
TBD	New Stormwater	TBD	TBD	TBD	TBD	40.12
TBD	Outfall Stabilization	TBD	TBD	TBD	TBD	2.00
TBD	Redevelopment Credit	TBD	TBD	TBD	TBD	10.00
TBD	Retrofit	TBD	TBD	TBD	TBD	13.77
TBD	Stream Restoration	TBD	TBD	TBD	TBD	0.00
TBD	Tree Planting	TBD	TBD	TBD	TBD	35.10
					Planned BMP Acreage Total	**100.99**
					Grand Total BMP Acreage Total	**558.44**

Table 2-2g – Fiscal Year 2020 Capital Impervious Restoration Practices

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20RST150013	Retrofit	Anacostia River	02140205	1299642.35	520566.99	4.56
SHA20RST150015	Retrofit	Anacostia River	02140205	1299859.49	518167.12	1.44
SHA20RST150389	Retrofit	Anacostia River	02140205	1315010.55	528293.90	3.23
SHA20RST150390	Retrofit	Anacostia River	02140205	1314036.57	527086.85	3.67
SHA20RST160176	Retrofit	Anacostia River	02140205	1323859.01	492668.29	3.46
SHA20RST160501	Retrofit	Anacostia River	02140205	1341075.99	484432.13	13.85
SHA20RST120014	Retrofit	Atkisson Reservoir	02130703	1490958.69	681028.14	3.17
SHA20RST030175	Retrofit	Back River	02130901	1458745.21	610535.79	4.29
SHA20RST020474	Retrofit	Baltimore Harbor	02130903	1412086.73	542709.65	1.00
SHA20ALN070002UR	Stream Restoration	Big Elk Creek	02130606	1640462.25	733576.34	33.50
SHA20RST030222	Retrofit	Bird River	02130803	1454186.74	623996.32	14.33
SHA20RST030246	Retrofit	Bird River	02130803	1462004.90	624170.80	0.85
SHA20RST030257	Retrofit	Bird River	02130803	1449245.67	624798.09	0.20
SHA20RST150216	Retrofit	Brighton Dam	02131108	1255564.42	591161.23	18.52
SHA20RST120069	Retrofit	Bynum Run	02130704	1493644.03	691521.89	6.97
SHA20RST120073	Retrofit	Bynum Run	02130704	1495253.32	693263.91	6.12
SHA20RST120101	Retrofit	Bynum Run	02130704	1499837.52	682617.00	2.51
SHA20RST120102	Retrofit	Bynum Run	02130704	1505100.82	685342.29	2.22
SHA20ALN120008UR	Stream Restoration	Bynum Run	02130704	1491899.52	690793.11	13.50
SHA20RST1500002UO	Outfall Stabilization	Cabin John Creek	02140207	1268527.25	505241.63	2.00
SHA20ALN150018UR	Stream Restoration	Cabin John Creek	02140207	1273139.50	501470.73	37.00
SHA20ALN100009UR	Stream Restoration	Catoctin Creek	02140305	1162056.88	662099.83	25.00
SHA20ALN120007UR	Stream Restoration	Deer Creek	02120202	1533020.25	716279.45	33.00
SHA20ALN060002UR	Stream Restoration	Double Pipe Creek	02140304	1309578.07	698127.46	24.00
SHA20RST0700001UO	Outfall Stabilization	Furnace Bay	02130609	1591395.03	700363.19	2.00

Table 2-2g – Fiscal Year 2020 Capital Impervious Restoration Practices

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20RST0700008UO	Outfall Stabilization	Furnace Bay	02130609	1585872.88	698645.84	2.00
SHA20RST030129	Retrofit	Gwynns Falls	02130905	1369649.50	632978.32	8.46
SHA20RST030130	Retrofit	Gwynns Falls	02130905	1372016.94	636626.27	10.30
SHA20RST030171	Retrofit	Gwynns Falls	02130905	1372577.24	636852.69	0.34
SHA20RST030261	Retrofit	Gwynns Falls	02130905	1361104.12	648452.72	0.88
SHA20RST030263	Retrofit	Gwynns Falls	02130905	1365005.66	642938.66	0.00
SHA20RST030277	Retrofit	Jones Falls	02130904	1394306.18	628493.02	9.57
SHA20ALN030012UR	Stream Restoration	Jones Falls	02130904	1406746.77	636453.27	12.00
SHA20RST030260	Retrofit	Liberty Reservoir	02130907	1357982.10	657513.58	4.94
SHA20ALN060003UR	Stream Restoration	Liberty Reservoir	02130907	1323374.89	641018.08	15.00
SHA20RST0700005UO	Outfall Stabilization	Little Elk Creek	02130605	1635364.46	708844.52	2.00
SHA20ALN020006UR	Stream Restoration	Little Gunpowder Falls	02130804	1448381.64	670414.96	60.00
SHA20ALN030011UR	Stream Restoration	Little Gunpowder Falls	02130804	1459023.20	674170.48	30.00
SHA20RST0200000UO	Outfall Stabilization	Little Patuxent River	02131105	1371943.07	531063.28	2.00
SHA20RST0200001UO	Outfall Stabilization	Little Patuxent River	02131105	1391421.44	517816.90	2.00
SHA20RST0200009UO	Outfall Stabilization	Little Patuxent River	02131105	1401342.29	496131.57	2.00
SHA20RST0200010UO	Outfall Stabilization	Little Patuxent River	02131105	1400960.53	496219.90	2.00
SHA20RST0200027UO	Outfall Stabilization	Little Patuxent River	02131105	1377047.24	523439.77	2.00
SHA20RST0200030UO	Outfall Stabilization	Little Patuxent River	02131105	1401343.58	496132.71	2.00
SHA20RST0200031UO	Outfall Stabilization	Little Patuxent River	02131105	1375979.15	525501.27	2.00
SHA20RST0200032UO	Outfall Stabilization	Little Patuxent River	02131105	1405302.37	485387.24	2.00
SHA20RST0300001UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1408975.01	707158.00	2.00
SHA20RST0300002UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1407954.13	705651.03	2.00
SHA20RST0300003UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1404904.77	702335.90	2.00
SHA20RST0300004UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1404136.77	701974.83	2.00

Table 2-2g – Fiscal Year 2020 Capital Impervious Restoration Practices

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20RST0300005UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1404008.10	701283.09	2.00
SHA20RST0300006UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1403925.70	700538.11	2.00
SHA20RST0300007UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1407735.38	679060.02	2.00
SHA20RST0300008UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1407532.41	672821.71	2.00
SHA20RST0300009UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1407436.53	672483.76	2.00
SHA20RST0300010UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1409601.46	724930.29	2.00
SHA20RST0300011UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1409085.14	724487.17	2.00
SHA20RST0300012UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1409405.74	724682.24	2.00
SHA20RST0300013UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1409011.67	724440.06	2.00
SHA20RST0300014UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1405640.79	719781.95	2.00
SHA20RST0300015UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1405247.62	718797.20	2.00
SHA20RST0300016UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1405596.33	719580.47	2.00
SHA20RST0300017UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1406231.05	712462.56	2.00
SHA20RST0300018UO	Outfall Stabilization	Loch Raven Reservoir	02130805	1406845.32	711121.42	2.00
SHA20RST030107	Retrofit	Loch Raven Reservoir	02130805	1424117.43	734822.04	1.53
SHA20RST030334	Retrofit	Loch Raven Reservoir	02130805	1422300.07	636760.74	3.25
SHA20ALN020007UR	Stream Restoration	Lower Gunpowder Falls	02130802	1462900.25	655751.93	26.00
SHA20RST0700007UO	Outfall Stabilization	Lwr Susquehanna River	02120201	1574980.62	694613.15	2.00
SHA20RST120009	Retrofit	Lower Winters Run	02130702	1504684.46	660899.59	4.21
SHA20RST0200020UO	Outfall Stabilization	Magothy River	02131001	1446643.50	506693.48	2.00
SHA20RST1300002UO	Outfall Stabilization	Middle Patuxent River	02131106	1325609.00	595050.00	2.00
SHA20RST1300003UO	Outfall Stabilization	Middle Patuxent River	02131106	1325721.00	598396.00	2.00
SHA20RST1300004UO	Outfall Stabilization	Middle Patuxent River	02131106	1317163.00	580251.00	2.00
SHA20RST1300005UO	Outfall Stabilization	Middle Patuxent River	02131106	1318505.00	575547.00	2.00
SHA20RST1300007UO	Outfall Stabilization	Middle Patuxent River	02131106	1323644.00	564414.00	2.00

Table 2-2g – Fiscal Year 2020 Capital Impervious Restoration Practices

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20RST0700002UO	Outfall Stabilization	Northeast River	02130608	1594184.42	701587.94	2.00
SHA20RST0700003UO	Outfall Stabilization	Northeast River	02130608	1598555.15	703788.57	2.00
SHA20RST0700004UO	Outfall Stabilization	Northeast River	02130608	1608657.30	708760.27	2.00
SHA20RST1600008UO	Outfall Stabilization	Oxon Creek	02140204	1330418.95	435980.29	2.00
SHA20RST1600009UO	Outfall Stabilization	Oxon Creek	02140204	1330160.01	435902.02	2.00
SHA20RST1600010UO	Outfall Stabilization	Oxon Creek	02140204	1329916.70	435834.75	2.00
SHA20RST1300001UO	Outfall Stabilization	Patapsco River L N Br	02130906	1379131.00	556419.00	2.00
SHA20RST1300006UO	Outfall Stabilization	Patapsco River L N Br	02130906	1370464.00	564343.00	2.00
SHA20RST1300008UO	Outfall Stabilization	Patapsco River L N Br	02130906	1377254.96	559205.18	2.00
SHA20RST020095	Retrofit	Patapsco River L N Br	02130906	1386881.34	548664.79	51.31
SHA20RST020096	Retrofit	Patapsco River L N Br	02130906	1389757.48	547051.95	2.98
SHA20RST020752	Retrofit	Patapsco River L N Br	02130906	1400413.56	540161.91	12.43
SHA20RST020852	Retrofit	Patapsco River L N Br	02130906	1398958.81	561844.04	1.75
SHA20RST030126	Retrofit	Patapsco River L N Br	02130906	1390547.43	577217.95	2.12
SHA20RST0200014UO	Outfall Stabilization	Patuxent River lower	02131101	1428585.94	393168.29	2.00
SHA20RST0200015UO	Outfall Stabilization	Patuxent River lower	02131101	1428544.44	392211.02	2.00
SHA20RST0200016UO	Outfall Stabilization	Patuxent River lower	02131101	1426868.86	387137.86	2.00
SHA20RST0200017UO	Outfall Stabilization	Patuxent River lower	02131101	1426117.37	386078.45	2.00
SHA20RST0200018UO	Outfall Stabilization	Patuxent River lower	02131101	1425949.85	385854.19	2.00
SHA20RST0200019UO	Outfall Stabilization	Patuxent River middle	02131102	1427199.21	398692.86	2.00
SHA20RST0200021UO	Outfall Stabilization	Patuxent River middle	02131102	1406275.02	409988.19	2.00
SHA20RST0200022UO	Outfall Stabilization	Patuxent River middle	02131102	1406778.06	409717.69	2.00
SHA20RST0200023UO	Outfall Stabilization	Patuxent River middle	02131102	1407052.03	408967.04	2.00
SHA20RST0200024UO	Outfall Stabilization	Patuxent River middle	02131102	1403200.58	412324.49	2.00
SHA20RST0200025UO	Outfall Stabilization	Patuxent River middle	02131102	1404204.17	411615.66	2.00

Table 2-2g – Fiscal Year 2020 Capital Impervious Restoration Practices

Unique BMP #	BMP Type	8-Digit Watershed Name	8-Digit Watershed Code	Northing	Easting	Impervious Treated (acres)
SHA20RST0200026UO	Outfall Stabilization	Patuxent River middle	02131102	1405877.16	410817.72	2.00
SHA20RST0200033UO	Outfall Stabilization	Patuxent River middle	02131102	1407250.55	408760.50	2.00
SHA20RST0200034UO	Outfall Stabilization	Patuxent River middle	02131102	1407356.52	408562.76	2.00
SHA20RST0200035UO	Outfall Stabilization	Patuxent River middle	02131102	1409032.13	403285.83	2.00
SHA20RST020763	Retrofit	Patuxent River upper	02131104	1410033.02	470974.37	2.60
SHA20RST160428	Retrofit	Patuxent River upper	02131104	1392655.83	473086.51	0.00
SHA20RST1600011UO	Outfall Stabilization	Piscataway Creek	02140203	1346158.22	388970.73	2.00
SHA20RST1600018UO	Outfall Stabilization	Piscataway Creek	02140203	1315080.15	379898.92	2.00
SHA20RST1600019UO	Outfall Stabilization	Piscataway Creek	02140203	1309701.79	366596.08	2.00
SHA20RST1600020UO	Outfall Stabilization	Piscataway Creek	02140203	1315078.59	380520.80	2.00
SHA20RST1500001UO	Outfall Stabilization	Potomac River MO Cnty	02140202	1262923.25	475758.41	2.00
SHA20RST1500006UO	Outfall Stabilization	Potomac River MO Cnty	02140202	1253485.25	523764.44	2.00
SHA20RST1500007UO	Outfall Stabilization	Potomac River MO Cnty	02140202	1247013.38	530566.63	2.00
SHA20RST1500008UO	Outfall Stabilization	Potomac River MO Cnty	02140202	1246976.63	530608.94	2.00
SHA20RST150065	Retrofit	Potomac River MO Cnty	02140202	1257785.42	530272.17	1.51
SHA20RST150070	Retrofit	Potomac River MO Cnty	02140202	1258879.03	530013.94	7.36
SHA20RST150641	Retrofit	Potomac River MO Cnty	02140202	1245328.92	524872.27	1.39
SHA20RST1600027UO	Outfall Stabilization	Potomac River U tidal	02140201	1312940.41	407190.76	2.00
SHA20RST160729	Retrofit	Potomac River U tidal	02140201	1336680.83	418583.91	5.00
SHA20RST1500004UO	Outfall Stabilization	Rock Creek	02140206	1292594.25	513323.69	2.00
SHA20RST1500003UO	Outfall Stabilization	Rocky Gorge Dam	02131107	1293514.17	542223.56	2.00
SHA20RST1500005UO	Outfall Stabilization	Rocky Gorge Dam	02131107	1295159.88	545605.38	2.00
SHA20RST150363	Retrofit	Rocky Gorge Dam	02131107	1296979.09	539507.87	3.16
SHA20RST150609	Retrofit	Rocky Gorge Dam	02131107	1332795.37	528438.39	1.98
SHA20RST150610	Retrofit	Rocky Gorge Dam	02131107	1332784.38	528860.69	1.39

Table 2-2g – Fiscal Year 2020 Capital Impervious Restoration Practices						
Unique BMP #	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
SHA20RST1500009UO	Outfall Stabilization	Seneca Creek	02140208	1239106.75	535692.63	2.00
SHA20RST1500010UO	Outfall Stabilization	Seneca Creek	02140208	1235908.75	536570.00	2.00
SHA20RST150206	Retrofit	Seneca Creek	02140208	1208131.92	531068.46	0.57
SHA20RST150312	Retrofit	Seneca Creek	02140208	1248602.70	544585.49	14.60
SHA20RST150313	Retrofit	Seneca Creek	02140208	1245495.97	548442.02	5.89
SHA20RST0200002UO	Outfall Stabilization	Severn River	02131002	1397271.24	522629.62	2.00
SHA20RST0200003UO	Outfall Stabilization	Severn River	02131002	1398163.76	522655.21	2.00
SHA20RST0200004UO	Outfall Stabilization	Severn River	02131002	1399261.14	522121.88	2.00
SHA20RST0200005UO	Outfall Stabilization	Severn River	02131002	1401650.25	516847.92	2.00
SHA20RST0200006UO	Outfall Stabilization	Severn River	02131002	1408484.44	513254.08	2.00
SHA20RST0200007UO	Outfall Stabilization	Severn River	02131002	1408509.90	513101.75	2.00
SHA20RST0200008UO	Outfall Stabilization	Severn River	02131002	1414785.31	508572.38	2.00
SHA20RST0200011UO	Outfall Stabilization	Severn River	02131002	1414990.51	508419.49	2.00
SHA20RST0200012UO	Outfall Stabilization	Severn River	02131002	1415011.43	508409.22	2.00
SHA20RST0200028UO	Outfall Stabilization	Severn River	02131002	1410792.78	506823.77	2.00
SHA20RST0200029UO	Outfall Stabilization	Severn River	02131002	1410805.21	506816.52	2.00
SHA20RST0200036UO	Outfall Stabilization	Severn River	02131002	1411084.23	511324.71	2.00
SHA20RST020035	Retrofit	Severn River	02131002	1401769.10	516801.50	17.22
SHA20RST020056	Retrofit	Severn River	02131002	1405371.03	514680.77	1.67
SHA20RST020521	Retrofit	Severn River	02131002	1446318.34	481612.46	2.74
SHA20RST020167	Retrofit	South River	02131003	1431066.91	483516.52	15.73
SHA20RST020171	Retrofit	South River	02131003	1421431.87	495586.99	2.02
SHA20RST020762	Retrofit	South River	02131003	1411260.41	471970.78	1.04
SHA20RST0700006UO	Outfall Stabilization	Upper Elk River	02130603	1641704.62	706587.47	2.00
SHA20RST1600012UO	Outfall Stabilization	Western Branch	02131103	1383487.94	422507.09	2.00

Table 2-2g – Fiscal Year 2020 Capital Impervious Restoration Practices						
Unique BMP #	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
SHA20RST1600013UO	Outfall Stabilization	Western Branch	02131103	1383394.41	422756.84	2.00
SHA20RST1600014UO	Outfall Stabilization	Western Branch	02131103	1383483.72	422837.36	2.00
SHA20RST1600015UO	Outfall Stabilization	Western Branch	02131103	1380591.88	428608.30	2.00
SHA20RST1600016UO	Outfall Stabilization	Western Branch	02131103	1377355.68	433834.90	2.00
SHA20RST1600017UO	Outfall Stabilization	Western Branch	02131103	1360380.60	447409.83	2.00
SHA20RST1600021UO	Outfall Stabilization	Western Branch	02131103	1364771.96	448771.13	2.00
SHA20RST1600022UO	Outfall Stabilization	Western Branch	02131103	1363564.09	448917.90	2.00
SHA20RST1600023UO	Outfall Stabilization	Western Branch	02131103	1363638.86	448960.00	2.00
SHA20RST1600024UO	Outfall Stabilization	Western Branch	02131103	1377623.81	449555.79	2.00
SHA20RST1600025UO	Outfall Stabilization	Western Branch	02131103	1389399.12	449279.01	2.00
SHA20RST1600026UO	Outfall Stabilization	Western Branch	02131103	1389936.31	449225.08	2.00
SHA20RST160127	Retrofit	Western Branch	02131103	1360775.15	447427.75	0.00
					Complete BMP Acreage Total	**799.33**
2020 Planned Credit						
Unique BMP #	**BMP Type**	**8-Digit Watershed Name**	**8-Digit Watershed Code**	**Northing**	**Easting**	**Impervious Treated (acres)**
TBD	Impervious Surface Elimination (to Pervious)	TBD	TBD	TBD	TBD	0.00
TBD	New Stormwater	TBD	TBD	TBD	TBD	140.50
TBD	Outfall Stabilization	TBD	TBD	TBD	TBD	4.30
TBD	Redevelopment Credit	TBD	TBD	TBD	TBD	10.00
TBD	Retrofit	TBD	TBD	TBD	TBD	0.00
TBD	Stream Restoration	TBD	TBD	TBD	TBD	36.40
TBD	Tree Planting	TBD	TBD	TBD	TBD	45.00
					Planned BMP Acreage Total	**236.20**
					Grand Total BMP Acreage Total	**1035.53**

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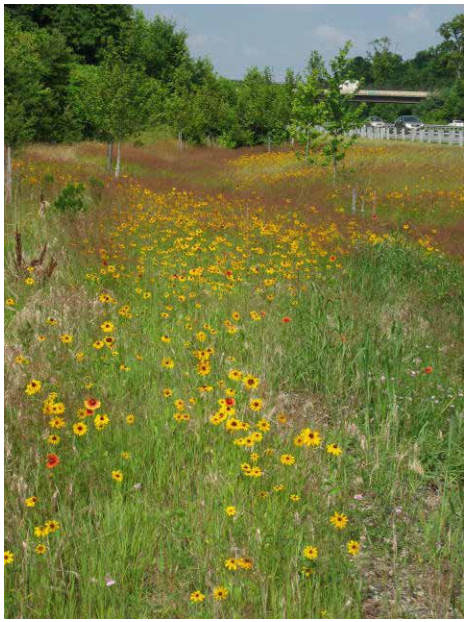
SHA
State Highway Administration
Maryland Department of Transportation

Part III

Coordinated TMDL Implementation Plan







III. COORDINATED TMDL IMPLEMENTATION PLAN

A. WATER QUALITY STANDARDS AND DESIGNATED USES

While the impervious restoration requirements discussed in **Part II** of this Plan focus on offsetting the impacts of urbanization to uncontrolled stormwater runoff, TMDLs focus on offsetting the impacts of pollutants to waterway designated uses. Both these perspectives address the quality of Maryland surface waters. The Federal Clean Water Act (CWA) established requirements for each State to develop programs to address water pollution including:

- Establishment of WQSs;
- Implementation of water quality monitoring programs;
- Identification and reporting of impaired waters; and
- Development of maximum allowable pollutant loads that when met and not exceeded will restore WQSs to impaired waters, called TMDL documents.

WQSs are based on the concept of designating and maintaining specifically defined uses for each waterbody. **Table 3-1** lists the designated uses for waterways in Maryland. TMDLs are based upon these uses.

One means for the EPA to enforce these standards is through the NPDES program, which regulates discharges from point sources. MDE is the delegated authority to issue NPDES discharge permits within Maryland and also to develop WQSs for Maryland including the water quality criteria that define the parameters to ensure designated uses are met.

Table 3-1: Designated Uses in Maryland

	Use Classes							
Designated Uses	**I**	**I-P**	**II**	**II-P**	**III**	**III-P**	**IV**	**IV-P**
Growth and Propagation of Fish (not trout), other aquatic life and wildlife	✓	✓	✓	✓	✓	✓	✓	✓
Water Contact Sports	✓	✓	✓	✓	✓	✓	✓	✓
Leisure activities involving direct contact with surface water	✓	✓	✓	✓	✓	✓	✓	✓
Fishing	✓	✓	✓	✓	✓	✓	✓	✓
Agricultural Water Supply	✓	✓	✓	✓	✓	✓	✓	✓
Industrial Water Supply	✓	✓	✓	✓	✓	✓	✓	✓
Propagation and Harvesting of Shellfish			✓	✓				
Seasonal Migratory Fish Spawning and Nursery Use			✓	✓				
Seasonal Shallow-water Submerged Aquatic Vegetation Use			✓	✓				
Open-Water Fish and Shellfish Use			✓	✓				
Seasonal Deep-Water Fish and Shellfish Use			✓	✓				
Seasonal Deep-Channel Refuge Use			✓	✓				
Growth and Propagation of Trout					✓	✓		
Capable of Supporting Adult Trout for a Put and Take Fishery							✓	✓
Public Water Supply		✓		✓		✓		✓

Source: http://www.mde.state.md.us/programs/Water/TMDL/Water%20Quality%20Standards/Pages/programs/waterprograms/tmdl/wqstandards/wqs_designated_uses.aspx

MS4 Permit Requirements

The SHA MS4 Permit requires coordination with county MS4 jurisdictions concerning watershed assessments and development of a coordinated TMDL implementation plan for each watershed that SHA has a WLA. **Part IV, SHA Watershed TMDL Implementation Plans** contains implementation plans specific to each local TMDL watershed. It includes a brief description of each watershed including SHA facilities and land uses, SHA TMDLs within the watershed, SHA visual inventory of ROW, summary of county assessment review, and SHA pollutant reduction strategies.

Requirements from the SHA MS4 Permit specific to watershed assessments and coordinated TMDL implementation plans are copied below and include *Part III.E.1* and *2.b* of the Permit (See **Part I, Program Introduction** for complete wording from *Part III.*E of the SHA MS4 Permit).

Watershed Assessments (Permit Part III.E.1)

SHA shall coordinate watershed assessments with surrounding jurisdictions, which shall include, but not be limited to the evaluation of available State and county watershed assessments, SHA data, visual watershed inspections targeting SHA rights-of-way and facilities, and approved stormwater WLAs to:

- *Determine current water quality conditions;*
- *Include the results of visual inspections targeting SHA rights-of-way and facilities conducted in areas identified as priority for restoration;*
- *Identify and rank water quality problems for restoration associated with SHA rights-of-way and facilities;*
- *Using the watershed assessments established under section a. above to achieve water quality goals by identifying all structural and nonstructural water quality improvement projects to be implemented; and*
- *Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater WLAs.*

Coordinated TMDL Implementation Plans (Permit Part III.2.b)

Within one year of permit issuance, a coordinated TMDL implementation plan shall be submitted to MDE for approval that addresses all EPA approved stormwater WLAs (prior to the effective date of the permit) and requirements of Part VI.A., Chesapeake Bay Restoration by 2025 for SHA's storm sewer system. Both specific WLAs and aggregate WLAs which SHA is a part of shall be addressed in the TMDL implementation plans. Any subsequent stormwater WLAs for SHA's storm sewer system shall be addressed by the coordinated TMDL implementation plan within one year of EPA approval. Upon approval by MDE, this implementation plan will be enforceable under this permit. As part of the coordinated TMDL implementation plan, SHA shall:

- *Include the final date for meeting applicable WLAs and a detailed schedule for implementing all structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;*
- *Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;*
- *Evaluate and track the implementation of the coordinated implementation plan through monitoring or modeling to document the progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and*

- *Develop an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, program enhancements, new and additional programs, and alternative BMPs where EPA approved TMDL stormwater WLAs are not being met according to the benchmarks and deadlines established as part of the SHA's watershed* assessments.

B. WATERSHED ASSESSMENT COORDINATION

According to the USGS (2016):

> *A watershed is an area of land where all water that falls on it and drains off it flows to a common outlet. A watershed is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel. The word watershed is sometimes used interchangeably with drainage basin or catchment. The watershed consists of surface water--lakes, streams, reservoirs, and wetlands--and all the underlying ground water. Larger watersheds contain many smaller watersheds. Watersheds are important because the streamflow and the water quality of a river are affected by things, human-induced or not, happening in the land area "above" the river-outflow point.*

The 8-digit scale is the most common management scale for watersheds across the state, and therefore is the scale at which most of Maryland's local TMDLs are developed. In some cases, a subwatershed has its own TMDL. See **Figure 3-1** for an illustration of an 8-digit watershed example in Maryland.

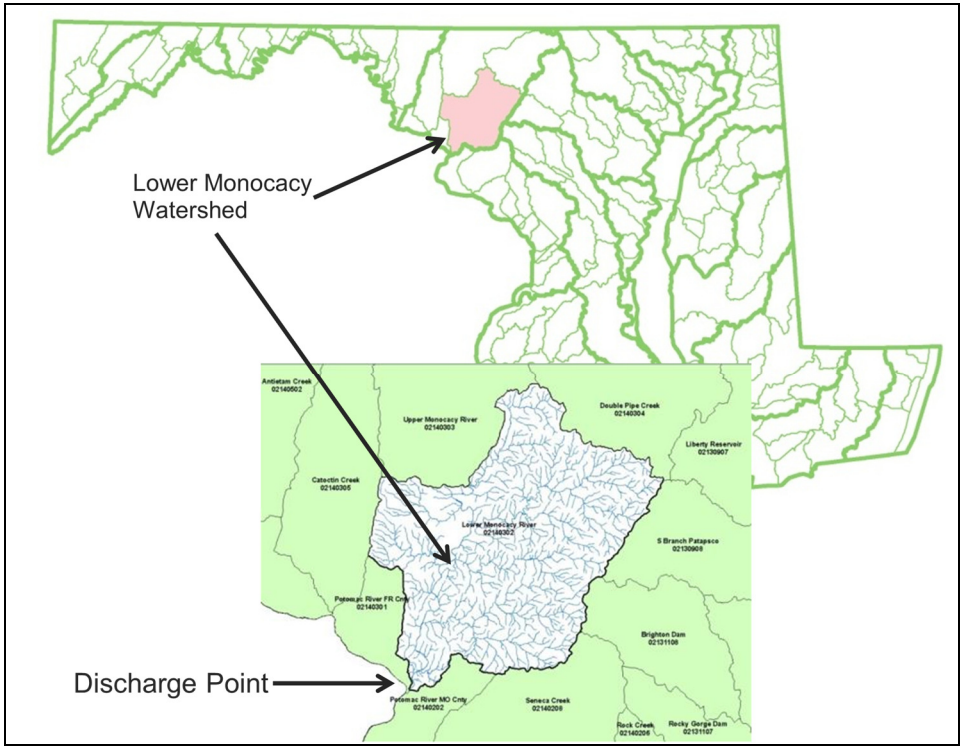


Figure 3-1: Maryland 8-digit Watershed Example

County Watershed Assessments

Each MS4 county is required to perform detailed assessments of local watersheds as a part of its MS4 permit requirements. These assessments determine current water quality conditions and include visual inspections; identify and rank water quality problems for restoration; prioritize and rank structural and non-structural improvement projects; and set pollutant reduction benchmarks and deadlines that demonstrate progress toward meeting applicable WQSs. SHA is not required to duplicate this effort, but is required to

coordinate with the MS4 jurisdictions to obtain and review watershed assessments.

Relying on assessments performed by other jurisdictions avoids redundant analysis and places the responsibility for developing the assessments with the jurisdictions that have close connection to local communities and watershed groups. Currently, completed assessments are not available for all watersheds because deadlines for developing them vary. Also, methods for performing these assessments vary from one jurisdiction to another. The amount and level of detail for watershed assessment evaluations included in **Part IV, SHA Watershed Implementation Plans** also varies by watershed.

Watershed assessment evaluations conducted by SHA focus on issues that SHA can improve through practices targeting SHA ROW or infrastructure, and because SHA property is typically a fraction of land within each of these watersheds, pertinent information has been limited at times. This information is used by SHA to determine priority areas for BMP implementation and to identify potential project sites or partnership project opportunities. Summaries of these evaluations are included in **Part IV** of this Plan under each individual watershed section. SHA watershed assessment evaluations focus on the following:

- Impacts to SHA infrastructure such as failing outfalls and downstream channels;
- Older developed areas with little SWM and available opportunities to install retrofits;
- Degraded streams;
- Priority watershed issues such as improvements within a drinking water reservoir, special protection areas or Tier II catchments;
- Identification of areas most in need of restoration;
- Description of preferred structural and non-structural BMPs to use within the watershed;
- Potential project sites for BMPs; and,
- In watersheds with PCB TMDLs, identifying locations of any known PCB sources.

In addition to using information from the county watershed assessments, SHA also undertakes other activities to identify potential project sites and prioritize BMP implementation including:

- On-going coordination meetings with each of the MS4 counties to discuss potential partnerships with the mutual goal of improving water quality;
- Perform visual watershed inspections as described below;
- Model SHA load reductions within the watershed based on SHA land uses and ROW; and,
- Maximize existing impervious treatment within new roadway projects (practical design initiative).

C. VISUAL INSPECTIONS TARGETING SHA ROW

SHA has recently developed a process to methodically review each watershed for potential restoration projects within SHA ROW to meet the load reductions for current pollutant WLAs. Although these watersheds have previously been reviewed for all practice types, this new process adds a grid system to coordinate and track efforts of many teams systematically to ensure each watershed is thoroughly assessed. The method is currently being used for searches for new stormwater control structures and retrofits but will be expanded to include tree planting and stream restoration sites. The watershed review process includes two phases to visually inspect each watershed and identify all structural and non-structural water quality improvement projects to be implemented.

Desktop Evaluation

Phase one is a desktop evaluation of the watershed using available county watershed assessments and SHA data. SHA has created a grid system of 1.5 mile square cells to track the progress of the visual watershed inspections, allowing prioritized areas to be targeted first. With this grid system, many spatial data sets are reviewed to determine the most effective use of each potential restoration site. The sites are documented geographically and stored in GIS. Viable sites are prioritized and those located within watersheds with the most pollutant reduction needs move forward to the second phase, which is to perform field investigations. Data reviewed includes:

- Aerial imagery;
- Street view mapping;
- Environmental features delineations such as critical area boundary, wetlands buffers, floodplain limits;
- County data such as utilities, storm drain systems, contour and topographic mapping;
- SHA ROW boundaries;
- Current SHA stormwater control and restoration practice locations; and,
- Drainage area boundaries.

Figure 3-2 illustrates the 1.5 mile grid system for the Anacostia River watershed and **Figure 3-3** is grid cell 224 showing ranking of sites for structural stormwater controls.

Field Investigations

Phase two is a field investigation of each viable site resulting from the watershed desktop evaluation. SHA inspects and assesses each site in the field to capture existing site conditions and water quality problems and constraints. This information is used to determine potential restoration BMPs as well as estimated restoration credit quantities.

SHA will continue to prioritize visual inspections in the highest need watersheds. **Figure 3-4** is an example field investigation summary map that documents observations from the field analysis. A standardized field inspection form is used.

D. BENCHMARKS AND DETAILED COSTS

Benchmarks and deadlines demonstrating progress toward meeting all applicable stormwater WLAs are provided in each watershed discussion in **Part IV, SHA Watershed TMDL Implementation Plans**.

Generalized cost information is included for each WIP that includes an overall estimated cost for the proposed practices. This information is also included in **Part IV, SHA Watershed TMDL Implementation Plans**. Detailed costs for specific construction projects are available on SHA's website (www.roads.maryland.gov) under Contractors Information Center.

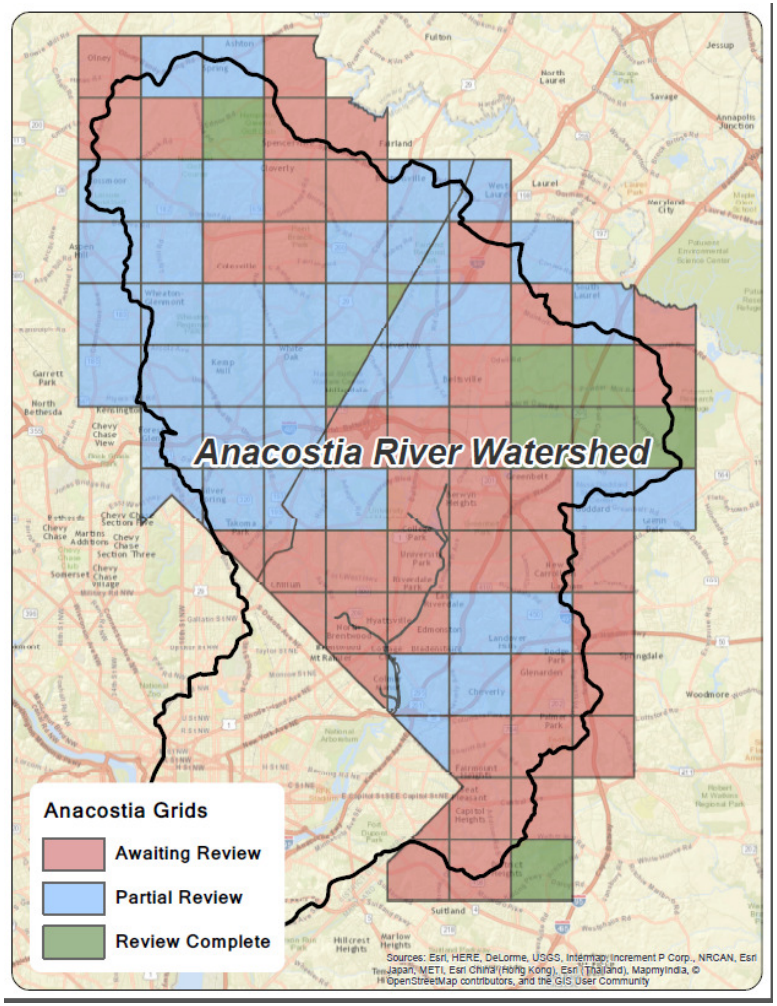


Figure 3-2: Example 1.5 Mile Grid System for Anacostia River Watershed

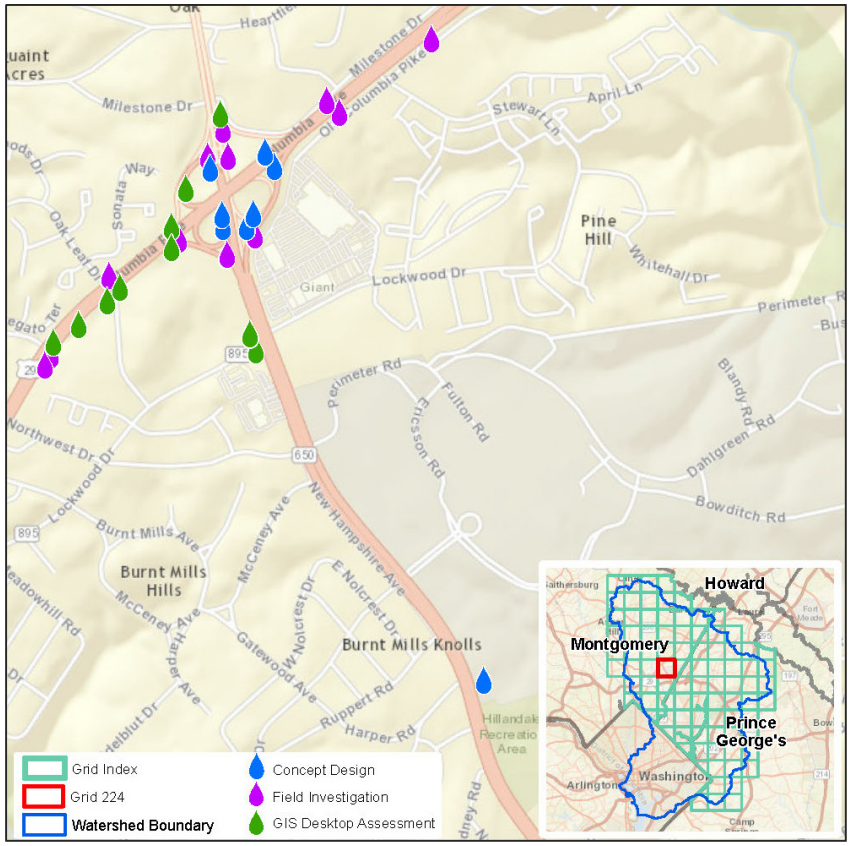


Figure 3-3: Anacostia River Grid #224 – New Stormwater Site Search

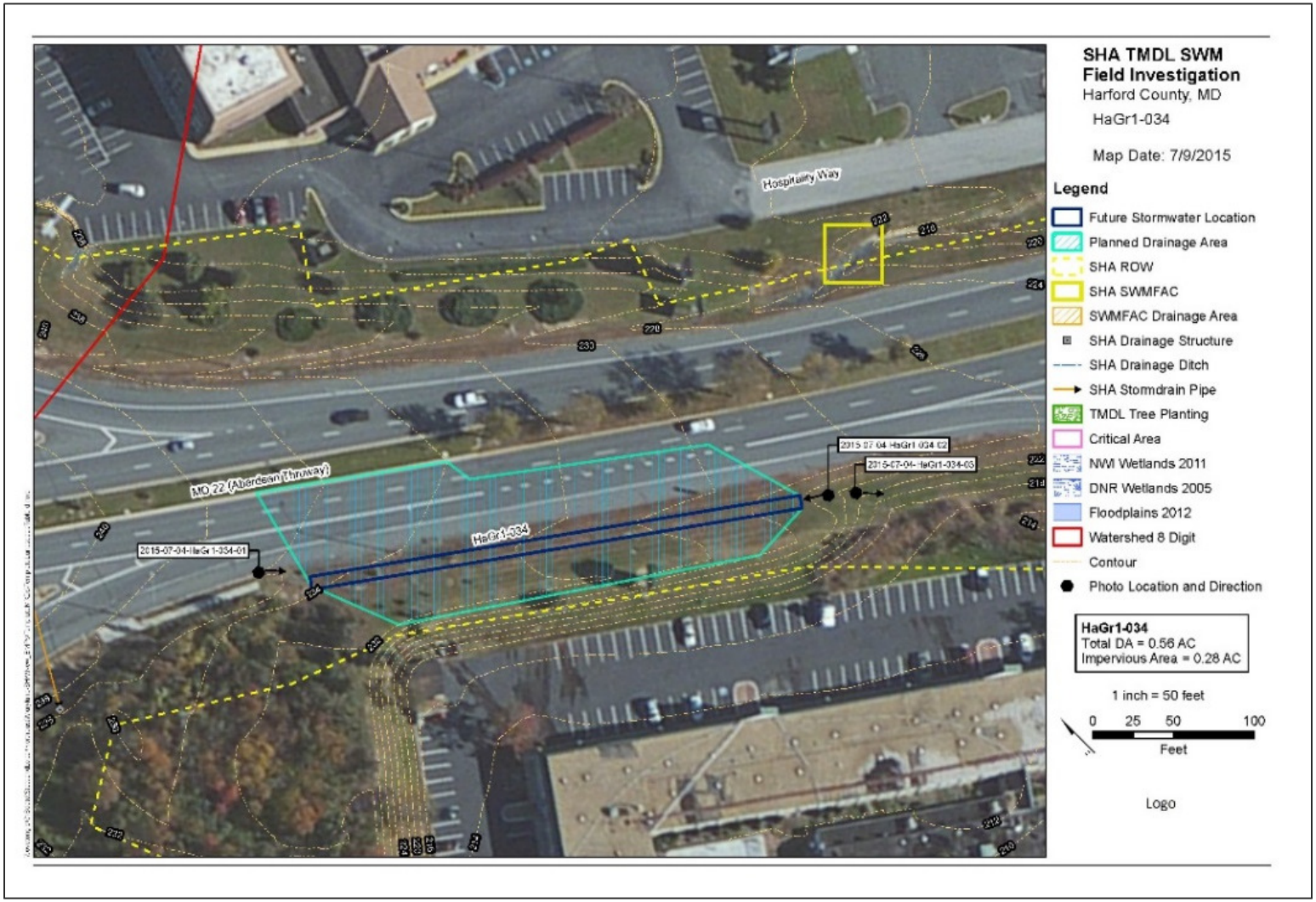


Figure 3-4: Example Field Investigation Summary Map

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E. POLLUTION REDUCTION STRATEGIES

E.1. SHA TMDL Responsibilities

TMDLs define the maximum pollutant loading that can be discharged to a waterbody and still meet water quality criteria for maintaining designated uses. **Figure 3-5** illustrates the concept of maximum loading. The green area on the bar depicts the maximum load that maintains a healthy water environment for the particular pollutant under consideration. When this load is exceeded, the waterway is considered impaired as illustrated by the red portion of the bar. The example waterway is in need of restoration through implementation of practices to reduce the pollutant loading to or below the WLA.

Generally the formula for a TMDL is:

$$TMDL = \sum WLA + \sum LA + MOS$$

Where:

TMDL = total maximum daily load
WLA = wasteload allocation for point sources;
LA = load allocation for non-point sources; and
MOS = margin of safety.

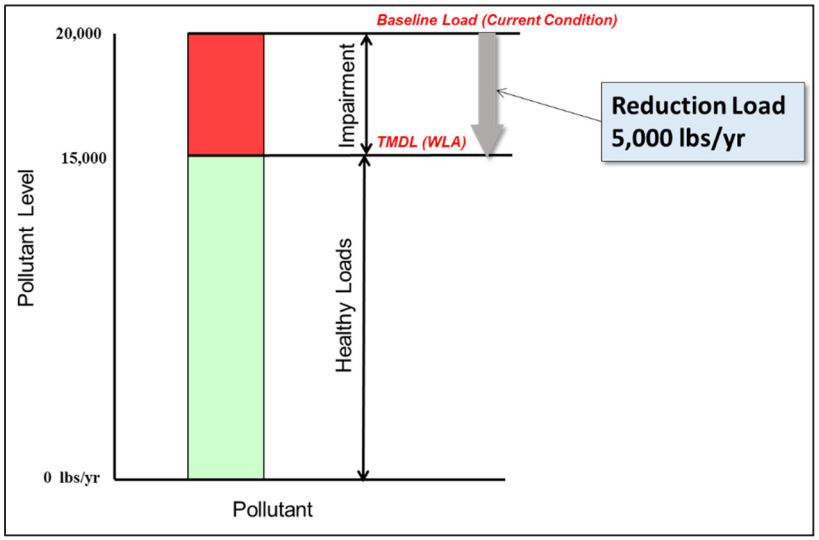


Figure 3-5: Example Wasteload Allocation and Reduction Requirement

Pollutants for SHA Focus

Upon issuance of the MS4 Permit, SHA was named in TMDLs for five different pollutants within the MS4 coverage area including

- Bacteria,
- PCBs,
- Phosphorus,
- Sediment, and
- Trash.

The SHA MS4 Permit covers eleven Maryland counties that cross 84 8-digit watersheds representing larger rivers or streams. There are 39 EPA approved TMDL documents that assign SHA to either an individual WLA or an aggregate WLA. Each watershed may be covered by one or more TMDL documents, so there is not a direct correlation between the number of TMDL documents and the number

of watersheds affected. Lists of the TMDL documents addressed by this plan for each pollutant are included in **Sections E.2** through **E.5.**

Figure 3-6 shows a map of SHA TMDL responsibilities by watershed. **Tables 3-2** and **3-3** on the following pages summarize SHA's reduction requirements and projected progress in meeting pollution reduction wasteload targets within each of the local watersheds by the listed end dates. There are instances where the projected progress does not equal 100 percent by the end date listed. In these cases, discussion is added to the reduction strategy sections to analyze the conditions that preclude SHA from meeting the target reductions with currently available modeling methods, loading, reduction efficiencies, or practices.

Lists of proposed practices and costs to achieve the required reductions are included in **Part IV, SHA Watershed TMDL Implementation Plans.**

Modeling Parameters

MDE requires that pollutant modeling follow the guidance in MDE 2014a and if other methods are employed, they must be approved by MDE. SHA developed a restoration modeling protocol that describes the methods used for modeling pollutant load reductions for local TMDLs with SHA responsibility. This protocol will be submitted to MDE as an appendix with the SHA's MS4 annual report. Once approved, this protocol will be available on the SHA website.

Different modeling methods are used depending upon the pollutants and current reduction practices in use. Brief descriptions of modeling methods are included in the following sections, but the SHA restoration modeling protocol should be consulted for detailed descriptions.

Aggregated Loads

WLAs may be assigned to each MS4 jurisdiction separately or as an aggregated WLA that combines all urban stormwater permits into one required allocation and reduction target. In cases where SHA's requirement is part of an aggregated target, SHA has 'disaggregated' the SHA reduction target based on the percent of SHA ROW within the watershed area. This is in accordance with MDE (2014a).

Available Reduction Practices

SHA reserves the right to implement new BMPs, activities, and other practices that are not currently available to achieve local TMDL load reduction requirements. In the future, there may be new expert panels developed to study the effects of implementation of new or existing BMPs on various pollutants. SHA will modify reduction strategies as necessary based on new, approved treatment guidance and will include revised strategies in updates to this implementation plan.

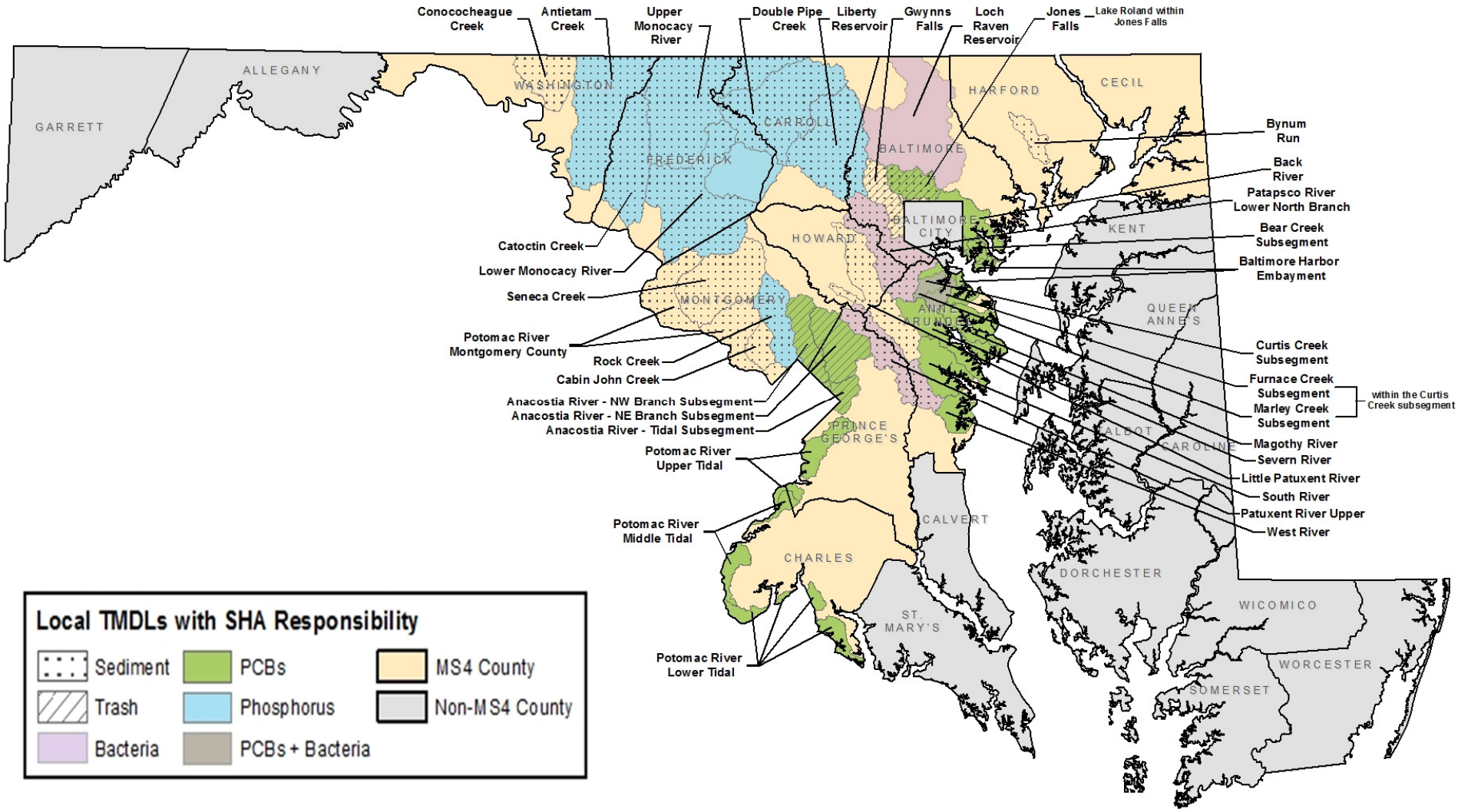


Figure 3-6: SHA TMDL Responsibilities in Local Watersheds

Table 3-2: SHA Nutrient, Sediment, PCB and Trash Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	WLA Type	Baseline Year	Unit	SHA Baseline	SHA WLA	SHA % Reduction Target	SHA Reduction Target	Modeled Reduction Achieved	% Progress Towards Reduction Target	Target Year
Nutrient and Sediment TMDLs														
Antietam Creek	02140502	WA	Phosphorus	09/25/2013	Individual	2000	EOS-lbs/yr	1,473	1,158	21.4%	315	443	141%	2040
			Sediment	12/18/2008	Aggregate by County	2000	EOS-lbs/yr	1,085,521	454,833	58.1%	630,688	414,938	66%	2045
Bynum Run	02130704	HA	Sediment	09/30/2011	Individual	2005	EOS-lbs/yr	463,600	374,000	19.3%	89,600	185,444	207%	2032
Cabin John Creek	02140207	MO	Sediment	09/30/2011	Individual	2005	EOS-lbs/yr	695,600	539,600	22.9%	156,000	301,881	194%	2041
Catoctin Creek	02140305	FR	Phosphorus	09/24/2013	Individual	2009	EOS-lbs/yr	2,052	1,876	9.0%	176	632	359%	2025
			Sediment	07/31/2009	Aggregate by County	2000	EOS-lbs/yr	373,396	190,058	49.1%	183,338	454,082	248%	2025
Conococheague Creek	02140504	WA	Sediment	11/24/2008	Aggregate by County	2000	EOS-lbs/yr	796,351	435,604	45.3%	360,747	153,873	43%	2045
Double Pipe Creek	02140304	FR	Phosphorus	04/26/2013	Individual	2009	EOS-lbs/yr	1,935	653	66.0%	1,282	699	55%	2045
		CL												
		FR	Sediment	02/20/2009	Aggregate by County	2000	EOS-lbs/yr	466,832	305,861	46.8%	160,971	430,368	267%	2025
		CL								33.8%				
Gwynns Falls	02130905	BA	Sediment	3/10/2010; WLA revised 8/31/2015	Individual	2005	EOS-lbs/yr	1,297,800	825,000	36.4%	472,800	218,445	46%	2045
Jones Falls	02130904	BA	Sediment	09/29/2011	Individual	2005	EOS-lbs/yr	418,200	327,400	21.7%	90,800	129,164	142%	2043
Liberty Reservoir	02130907	BA	Phosphorus	05/07/2014	Individual	2009	EOS-lbs/yr	1,231	677	45.0%	554	789	142%	2036
		CL												
		BA	Sediment		Individual	2009	EOS-lbs/yr	1,000,000	550,000	45.0%	450,000	532,711	118%	2040
		CL												
Little Patuxent River	02131105	AA	Sediment	09/30/2011	Individual	2005	EOS-lbs/yr	2,742,600	1,751,600	36.1%	991,000	900,852	91%	2042
		HO												

Table 3-2: SHA Nutrient, Sediment, PCB and Trash Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	WLA Type	Baseline Year	Unit	SHA Baseline	SHA WLA	SHA % Reduction Target	SHA Reduction Target	Modeled Reduction Achieved	% Progress Towards Reduction Target	Target Year
Nutrient and Sediment TMDLs Continued														
Lower Monocacy River	02140302	CL	Phosphorus	05/22/2013	Individual	2009	EOS-lbs/yr	5,650	4,222	25.0%	1,428	1,777	124%	2040
		FR												
		MO												
		FR	Sediment	03/17/2009	Aggregate by County	2000	EOS-lbs/yr	1,041,056	407,912	60.8%	633,145	1,016,125	160%	2036
		MO												
Patapsco LN Branch	02130906	AA	Sediment	09/30/2011	Individual	2005	EOS-lbs/yr	3,118,600	2,557,200	18.0%	561,400	563,543	100%	2041
		BA												
		HO												
Patuxent River Upper	02131104	AA	Sediment	09/30/2011	Individual	2005	EOS-lbs/yr	1,429,600	1,266,600	11.4%	163,000	178,868	110%	2040
		HO												
		PG												
Potomac River MO County	02140202	MO	Sediment	09/28/2011	Individual	2005	EOS-lbs/yr	789,400	503,400	36.2%	286,000	330,812	116%	2040
Rock Creek	02140206	MO	Sediment	09/29/2011	Individual	2005	EOS-lbs/yr	1,738,800	1,080,000	37.9%	658,800	834,171	127%	2025
			Phosphorus	09/23/2013	Individual	2009	EOS-lbs/yr	1,142	773	32.0%	369	1,300	352%	2025
Seneca Creek	02140208	MO	Sediment	09/30/2011	Individual	2005	EOS-lbs/yr	1,276,800	703,400	44.9%	573,400	540,989	94%	2042
Upper Monocacy River	02140303	FR	Phosphorus	05/07/2013	Individual	2009	EOS-lbs/yr	2,469	2,404	3.0%	65	832	1280%	2025
		CL												
		FR	Sediment		Aggregate by County	2000	EOS-lbs/yr	386,811	200,467	49.0%	186,344	467,084	251%	2034
		CL												

Table 3-2: SHA Nutrient, Sediment, PCB and Trash Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	WLA Type	Baseline Year	Unit	SHA Baseline	SHA WLA	SHA % Reduction Target	SHA Reduction Target	Modeled Reduction Achieved	% Progress Towards Reduction Target	Target Year
PCB TMDLs														
Anacostia River Tidal	02140205	PG	PCBs	10/31/2007	Aggregate by County	2005	g/yr	-	-	-	-	-	-	N/A
Back River Oligohaline Tidal	MD-BACOH	BA	PCBs	10/01/2012	Aggregate by County	2001	g/yr	24.2	11.3	53.4%	12.9	1.7	13.4%	2045
Baltimore Harbor	02130903	AA	PCBs	10/01/2012	Aggregate by County	2004	g/yr	8.7	0.8	91.1%	7.9	0.1	1.0%	2038
		BA						0.4	0.0	91.4%	0.4	0.1	30.0%	2038
Bear Creek	MD-PATMH-BEAR-CREEK	BA	PCBs	10/01/2012	Aggregate by County	2004	g/yr	13.7	1.2	91.5%	12.5	0.7	5.9%	2038
Bush River Oligohaline	MD-BSHOH-02130701	HA	PCBs	08/02/2016	Aggregate by County	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Curtis Creek/Bay	MD-PATMH-CURTIS_BAY_CREEK	AA	PCBs	10/01/2012	Aggregate by County	2004	g/yr	45.1	2.9	93.5%	42.2	3.1	7.4%	2038
Lake Roland	MD-02130904-Lake_Roland	BA	PCBs	09/30/2013	Aggregate by County	2010	g/yr	1.2	0.8	29.3%	0.3	1.0	333.3%	2025
Magothy River Mesohaline	MD-MAGM-02131001	AA	PCBs	03/16/2015	Aggregate by County	2010	g/yr	-	-	0.0%	-	-	-	N/A
NE Branch Anacostia River	02140205	MO	PCBs	09/30/2011	Aggregate by County	2005	g/yr	5.1	0.1	98.6%	5.0	0.4	7.0%	2045
		PG						31.6	0.4		31.1	0.4	1.2%	2045
NW Branch Anacostia River	02140205	MO	PCBs	09/30/2011	Aggregate by County	2005	g/yr	5.8	0.1	98.1%	5.7	0.6	10.2%	2045
		PG						4.8	0.1		4.7	0.1	1.7%	2045
Potomac River Lower Tidal	02140101	CH	PCBs	10/31/2007	Aggregate by County	2005	g/yr	-	-	5.0%	-	-	-	N/A
Potomac River Middle Tidal	02140102	CH	PCBs	10/31/2007	Aggregate by County	2005	g/yr	-	-	5.0%	-	-	-	N/A
		PG												
Potomac River Upper Tidal	02140201	CH	PCBs	10/31/2007	Aggregate by County	2005	g/yr	-	-	5.0%	-	-	-	N/A
		PG						-	-	-	-	-	-	N/A
Severn River Mesohaline	MD-SEVMH-02131002	AA	PCBs	07/19/2016	Aggregate by County	2010	g/yr	-	-	0.0%	-	-	-	N/A

Table 3-2: SHA Nutrient, Sediment, PCB and Trash Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	WLA Type	Baseline Year	Unit	SHA Baseline	SHA WLA	SHA % Reduction Target	SHA Reduction Target	Modeled Reduction Achieved	% Progress Towards Reduction Target	Target Year
South River Mesohaline	MD-SOUMH-02131003	AA	PCBs	04/27/2015	Aggregate by County	2010	g/yr	-	-	0.0%	-	-	-	N/A
West and Rhode Rivers Mesohaline	MD-WST-RHDMH-02131004	AA	PCBs	01/08/2016	Aggregate by County	2010	g/yr	-	-	0.0%	-	-	-	N/A
Note: SHA does not have a PCB WLA reduction responsibility for the following watersheds presented in this table: Anacostia River-Tidal portion, Magothy River Mesohaline, Potomac River Lower Tidal, Potomac River Middle Tidal, Potomac River Upper Tidal-Charles County Branch, Potomac River Upper Tidal-Prince George's County portion, Severn River Mesohaline, South River Mesohaline and West and Rhode Rivers Mesohaline. **Table 1-1** indicates that these watersheds list SHA for PCB responsibility and the reasons there are no reduction requirements for SHA are mentioned in **Section E.4.** SHA will address the Bush River TMDL within a year after the TMDL approval date of 8/2/2016.															
Trash TMDLs														
Anacostia	02140205	MO	Trash	9/21/2010	Individual	2009	Lbs/ Yr	74,380	6,044	100.0%	6,044	6,268	104%	2045
		PG						140,559	14,134	100.0%	14,134	14,204	100%	2045
Patapsco - - Gwynns Falls	MD-PATMH-0213095	BA	Trash & Debris	01/05/2015	Individual	2011	Lbs/ Yr	108,819	2,415	100.0%	2,415	2,470	102%	2026
Patapsco - Jones Falls	MD-PATMH-02130904	BA	Trash & Debris	01/05/2015	Individual	2011	Lbs /Yrs	51,081	1,490	100.0%	1,490	1,496	100%	2026

Table 3-3: SHA Bacteria Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	WLA Type	Baseline Year	Unit	SHA Baseline	SHA WLA	SHA % Reduction Target	SHA Reduction Target	Modeled Reduction Achieved (%)	% Progress Towards Reduction Target	Target Year
Baltimore Harbor - Marley Creek	MD-PATMH-MARLEY_CREEK	AA	*Enterrococci*	03/10/2011	Aggregate by County	2006	billion counts / day	780	189	75.8%	N/A	12.6%	16.7%	2050
Baltimore Harbor - Furnace Creek	MD-PATMH FURNACE_CREEK	AA	*Enterrococci*	03/10/2011	Aggregate by County	2006	billion counts /day	403	90	77.8%	N/A	5.6%	7.2%	2050
Loch Raven Reservoir	02130805	BA CL HA	*E. coli*	12/03/2009	Aggregate by County	2004	billion MPN /yr	147,869	18,273	87.6%	N/A	3.8%	4.3%	2048
Patapsco River LN Branch	02130906	AA BA CL HO	*E. coli*	12/03/2009	Aggregate by County	2003	billion MPN /yr	447,616	384,258	14.8%	N/A	3.7%	24.7%	2046
Patuxent	02131104	AA PG	*E. coli*	8/09/2011	Aggregate by County	2009	billion MPN /yr	161,833	91,116	45.3%	N/A	5.0%	11.1%	2048

E.2 Nutrient and Sediment Implementation Plan

E.2.a Nutrient and Sediment TMDLs with SHA Responsibility

There are 23 EPA approved phosphorus or sediment TMDLs with SHA responsibility spanning 17 Maryland 8-digit watersheds (**Table 3-2**). The following TMDL documents for phosphorus and sediment are addressed in this plan:

- *Total Maximum Daily Load of Phosphorus in the Antietam Creek Watershed, Washington County, Maryland*, approved by EPA September 25, 2013;
- *Total Maximum Daily Load of Phosphorus in the Catoctin Creek Watershed, Frederick County, Maryland*, approved by EPA September 24, 2013;
- *Total Maximum Daily Load of Phosphorus in the Double Pipe Creek Watershed, Frederick and Carroll Counties, Maryland*, approved by EPA April 26, 2013;
- *Total Maximum Daily Loads of Phosphorus and Sediments for Liberty Reservoir, Baltimore and Carroll Counties, Maryland*, approved by EPA May 7, 2014;
- *Total Maximum Daily Load of Phosphorus in the Lower Monocacy River Watershed, Frederick, Carroll and Montgomery Counties, Maryland*, approved by EPA May 22, 2013;
- *Total Maximum Daily Load of Phosphorus in the Upper Monocacy River Watershed, Frederick and Carroll Counties, Maryland*, approved by EPA May 7, 2013;
- *Total Maximum Daily Load of Phosphorus in the Rock Creek Watershed, Montgomery County, Maryland,* approved by EPA September 26, 2013;
- *Total Maximum Daily Load of Sediment in the Antietam Creek Watershed, Washington County, Maryland*, approved by EPA December 18, 2008;
- *Total Maximum Daily Load of Sediment in the Bynum Run Watershed, Harford County, Maryland*, approved by EPA September 30, 2011;
- *Total Maximum Daily Load of Sediment in the Cabin John Creek Watershed, Montgomery County, Maryland*, approved September 30, 2011;
- *Total Maximum Daily Load of Sediment in the Catoctin Creek Watershed, Frederick County, Maryland*, approved by EPA July 31, 2009;
- *Total Maximum Daily Load of Sediment in the Conococheague Creek Watershed, Washington County, Maryland*, approved by EPA November 24, 2008;
- *Total Maximum Daily Load of Sediment in the Double Pipe Creek Watershed, Frederick and Carroll Counties, Maryland*, approved by EPA February 20, 2009;
- *Total Maximum Daily Load of Sediment in the Gwynns Falls Watershed, Baltimore City and Baltimore County, Maryland*, approved by EPA March 10, 2010 and revised August 31, 2015;
- *Total Maximum Daily Load of Sediment in the Jones Falls Watershed, Baltimore City and Baltimore County, Maryland*, approved September 29, 2011;
- *Total Maximum Daily Load of Sediment in the Little Patuxent River Watershed, Howard and Anne Arundel Counties, Maryland*, September 30, 2011;
- *Total Maximum Daily Load of Sediment in the Lower Monocacy River Watershed, Frederick, Carroll, and Montgomery Counties, Maryland*, approved by EPA March 17, 2009;

- *Total Maximum Daily Load of Sediment in the Patapsco River Lower North Branch Watershed, Baltimore City and Baltimore, Carroll, Howard, and Anne Arundel Counties, Maryland*, approved by EPA September 30, 2011;
- *Total Maximum Daily Load of Sediment in the Patuxent River Upper Watershed, Howard, Anne Arundel, and Prince George's Counties, Maryland*, approved by EPA September 30, 2011;
- *Total Maximum Daily Load of Sediment in the Potomac River Montgomery County Watershed, Montgomery and Frederick Counties, Maryland*, approved by EPA June 19, 2012;
- *Total Maximum Daily Load of Sediment in the Rock Creek Watershed, Montgomery County, Maryland*, approved by EPA September 29, 2011;
- *Total Maximum Daily Load of Sediment in the Seneca Creek Watershed, Montgomery County, Maryland*, approved by September 30, 2011; and
- *Total Maximum Daily Load of Sediment in the Upper Monocacy River Watershed, Frederick and Carroll Counties, Maryland*, approved December 3, 2009.

Table 3-2 shows a summary of the reduction requirements for the current SHA nutrient and sediment TMDLs. Two dates are shown including the EPA approval date and the baseline year set by MDE. The TMDLs were written at different times, based on monitoring data from different years. The baseline year published on the MDE Data Center will be used for SHA implementation planning. This usually correlates to the time period when monitoring data was collected for the MDE analysis.

E.2.b Nutrient and Sediment Sources

Discussions in the TMDLs concerning nutrient and sediment sources focus on types of land use with information derived from the Chesapeake Bay Watershed Model (CBWM). Cropland and regulated urban land tend to be the most significant sources, followed by other agricultural uses and wastewater sources. Specific sources of each pollutant that could be useful for targeting controls are not included in the TMDLs, but SHA researched a number of other references and determined sources beyond land uses that are summarized in **Table 3-4**. Sources of phosphorus are manure, fertilizers used for crops, residential lawn care, and wastewater discharges. Sources of sediment include surface erosion from construction sites and cropland as well as stream erosion from high flows during storm events.

Table 3-4: Nutrient and Sediment Sources from Various References

Land Use	Nutrient Sources	Sediment Sources
Agriculture	Chemical Fertilizer Manure	Soil Erosion
Urban	Pet Waste Lawn Fertilizer Parking Lot, Roof, and Street Runoff	Construction Erosion Parking Lot, Roof, and Street Runoff
Wastewater	Municipal Industrial Failed Septic Systems CSO/ SSO Leaking Sewers	
Natural	Atmospheric Deposition	Stream Erosion Shoreline Erosion
References used to develop the table are MDE, 2014b; EPA, 2010b; Hoos et al., 2000; and Schueler, 2011.		

SHA Loading Sources

SHA-owned land is a small portion of each of the TMDL watersheds and it consists of relatively uniform land uses including roadways and

roadside vegetation. In urbanized areas, the SHA ROW may extend to include sidewalks and portions of driveways. There are also parking areas associated with SHA land such as park and ride facilities, office complexes, and maintenance facilities.

Of the land uses in **Table 3-4**, SHA is a contributor of nutrients and sediments mostly through urban and natural sources. SHA has no responsibility for agriculture and wastewater sources, other than a few septic systems at outlying facilities. Street and parking lot runoff concentrates pollutants from adjacent land and from atmospheric deposition attributed to both the airshed and vehicles. Deteriorating streets themselves can be a source of sediment. Construction erosion, even with well-maintained erosion and sediment control (ESC), is a source of sediment in urban areas. Stream erosion downstream of SHA facilities, particularly older areas without SWM, is a potential source of sediment and attached phosphorus.

E.2.c SHA Nutrient and Sediment Model Methods

Nutrient and sediment TMDLs were developed using the CBWM with edge of stream (EOS) loading rates. Throughout the years, different versions of the Bay model have been used (as indicated in **Table 3-5**) depending upon which version was active at the time the TMDL was written. The Bay model combines a suite of individual models, including a watershed model that calculates pollutant loads from point sources and runoff, an air deposition model, and an estuary model that estimates pollutant concentrations based on loading, hydrodynamics of the estuary, and pollutant transformations in the Bay.

Table 3-5: Nutrient and Sediment TMDL Watersheds and Bay Model Versions

TMDL Watershed	Pollutant	TMDL Model
Antietam Creek	Phosphorus	CBP P5.3.2
	Sediment	CBP P5
Bynum Run	Sediment	CBP P5.2
Cabin John Creek	Sediment	CBP P5.2
Catoctin Creek	Phosphorus	CBP P5.3.2
	Sediment	CBP P5
Conococheague Creek	Sediment	CBP P5
Double Pipe Creek	Phosphorus	CBP Phase 5.3.2
Gwynns Falls	Sediment	CBP P5
Jones Falls	Sediment	CBP P5
Liberty Reservoir	Phosphorus	Refined version of the CBP P5.3.2 watershed model, with CE-QUAL-W2 model of the reservoir
	Sediment	
Little Patuxent River	Sediment	CBP P5
Lower Monocacy River	Phosphorus	CBP P5.3
Patapsco LN Branch	Sediment	CBP P5
Patuxent River Upper	Sediment	CBP P5.2
Potomac River MO County	Sediment	CBP P5.2
Rock Creek	Phosphorus	CBP P5.2
	Sediment	
Seneca Creek	Sediment	CBP P5.2
Upper Monocacy River	Phosphorus	CBP P5.3.2

Baseline Loading for Nutrients and Sediment

Baseline loads represent the current level of pollutant loading being discharged by a given entity. If the loads exceed the WLA, the waterway is considered impaired and the baseline loads must be reduced to or below the WLA in order to restore the designated uses for the waterway (see **Figure 3-5**). As illustrated by **Table 3-5**, depending upon the year the TMDL was develop, different modeling methods and base data such as land use and per acre pollutant loading rates may have been used. Replicating these various baseline load calculations poses a challenge for SHA because accurate SHA data for ROW area and land use prior to 2011 is not available. Rather than try to replicate the SHA baseline loads for each individual TMDL year and then model progress baselines with new practices relative to the WLA level, SHA has chosen to focus on the required reduction load and determine the menu of new practices that bring the reduction load to zero.

Pollutant Reduction Load Calculations for Nutrients and Sediment

The first step in our modeling procedure is to determine the reduction loads for each watershed and pollutant. In order to do this, the WLA specific to SHA and the percent reduction required are needed. There are two types of WLAs for local TMDLs including individual (SHA-specific) WLAs and aggregate WLAs. Individual WLAs are specifically assigned to SHA and are published in the point source technical memorandum for each TMDL. Aggregate WLA values are published in the main report or point source technical memorandum for each TMDL and are often aggregated as urban stormwater sector including all MS4 permittees (county, municipalities, industrial, and federal and state agencies, including SHA).

SHA's required TMDL reductions for nutrients and sediment are calculated using the following formula. The required percent reduction and WLA are published in the TMDL document.

$$Reqd\ Reduction_{SHA} = \frac{WLA}{(1 - Reqd\ Reduction\ \%)} - WLA$$

Where

Reqd Reduction $_{SHA}$ = Reduction pounds required for SHA

WLA = Published WLA or SHA disaggregated WLA_{SHA} defined below

Reqd Reduction % = Published percent reduction

Aggregate WLAs are disaggregated by applying the percent of SHA land (both impervious and pervious) within SHA ROW within the local TMDL watershed to the published aggregate WLA according to the equation below.

$$WLA_{SHA} = WLA\left(\frac{A_{SHA}}{A_{TMDL}}\right)$$

Where

WLA_{SHA} = Disaggregated WLA for SHA

A_{SHA} = Area of SHA-owned land

A_{TMDL} = Area of aggregate TMDL

WLA = the maximum load of pollutants each discharger of waste is allowed to release into a particular waterway.

Nutrient and Sediment Reduction Modeling

Once the required reduction targets are derived using the above formulas, determining the menu of practices needed to reduce the targets to zero is an iterative process where the target is compared to modeled reductions from sets of restoration practices. Calculations for

nutrient and sediment TMDLs will be performed with a model developed by SHA called the Automated Modeling Tool (AMT) that uses planned, under-design and constructed restoration practice data from several production databases and follows approved modeling parameters defined in *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014a). Documentation on SHA restoration modeling methods is under development and will be submitted to MDE for review and approval along with this implementation plan. The modeling documentation will provide detail on the AMT parameters.

The AMT will be used to plan reduction scenarios and to track progress. Although this is a custom model, it draws on BMP efficiencies, loading rates and delivery factors from MDE (2014a), Maryland Assessment Scenario Tool (MAST), and published CBP BMP protocols. It is also based on CBP loading rates by land-river segment for EOS loads and can calculate reductions from different practices using the removal rates from Table 6 of MDE, 2014a.

Within each county-watershed segment, structural stormwater controls and alternative practice reductions are calculated by multiplying the removal efficiency for each specific practice type, the quantity of each practice applied to the area and a unit loading rate for land uses taken from a no-BMP scenario extracted from MAST.

For structural stormwater controls:

- The load removed in lb/unit for each BMP within the specific county or-watershed is calculated by multiplying the loading rate from the lookup table by the BMP removal rate.
- The pollutant load reduction is calculated by multiplying the unit removal above by the land use (pervious and impervious) in the BMP drainage area.

For alternative practices based on removal by linear foot of restoration (outfalls, streams), the load removed in lb/unit is given in the pollutant removal table. Only one step is required:

- The pollutant load reduction is calculated by multiplying the unit removal per LF by the length of the restoration project.

For alternative practices based on amount of load removed (inlet cleaning), the load is measured directly.

- The pollutant load reduction is calculated by multiplying the amount of material collected by the conversion factor for each pollutant.

SHA manages restoration practice data associated with planning, design, construction, inspection, maintenance and credit verification through spatial geodatabases and an MS Access database. Depending upon where the BMP is in the project development process, information may be found in different databases with different levels of data and tracking required. These sources are queried to develop input files for the AMT.

E.2.d SHA Nutrient and Sediment Reduction Strategies

To date, SHA has used a variety of structural, non-structural, and alternative BMPs in an effort to reduce nutrient and sediment in the watersheds that have a corresponding TMDL. However, we have not limited our load reduction activities to just BMP implementation. The use of nutrient credit trading will also be explored as a tool in reaching load reduction targets. When SHA partners on projects with other MS4 jurisdictions, load splitting can be used as a means to achieve WLA reductions.

BMP Implementation

As a requirement under the MS4 permit, SHA must complete the implementation of restoration efforts for 20 percent of its impervious surface area. SHA has an extensive program to plan, design, and construct BMPs that offset untreated impervious surfaces in SHA ROW as discussed in **Part II, Impervious Restoration and Chesapeake Bay TMDL Compliance**.

SHA intends to build these BMPs used for impervious restoration in watersheds that have a TMDL where possible. The AMT is then used to model the load reduction from implementation of currently constructed BMPs and BMPs planned in the future. The AMT also assesses the impact that these BMPs will have on meeting TMDL load reductions as a percent achieved. The results of this analysis are presented in **Table 3-2** and a chart of the overall practices used to achieve the results are shown in **Figures 3-7** and **3-8** on the following pages. Proposed practices to be implemented for each watershed are shown in **Part IV, SHA Watershed TMDL Implementation Plan** under the specific watersheds with phosphorus and sediment WLAs.

One of the major challenges with using a strategy of building BMPs to meet WLAs is that there can be a lack of feasible ROW for BMP placement opportunities. There are instances where SHA roadway encompasses a majority of the area in the ROW leaving very little land to construct BMPs. The visual watershed inspection process has indicated areas where BMP placement is possible and where it is not feasible do to utility relocation, land purchases, site access problems, and a host of other issues. Therefore, SHA is continually seeking new opportunities and partnerships to install BMPs.

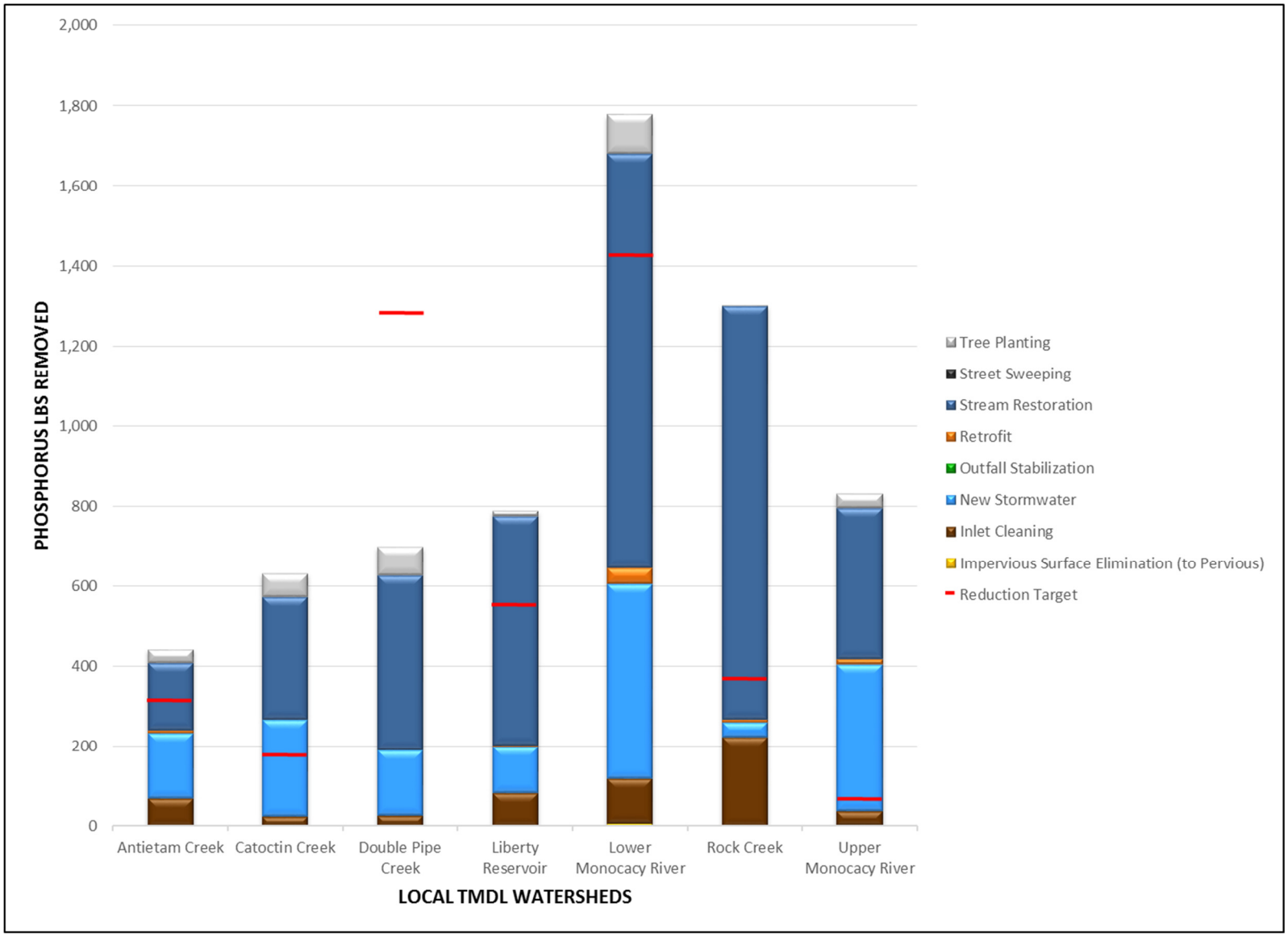


Figure 3-7: Phosphorus WLA Reductions by Watershed with Practice Menu

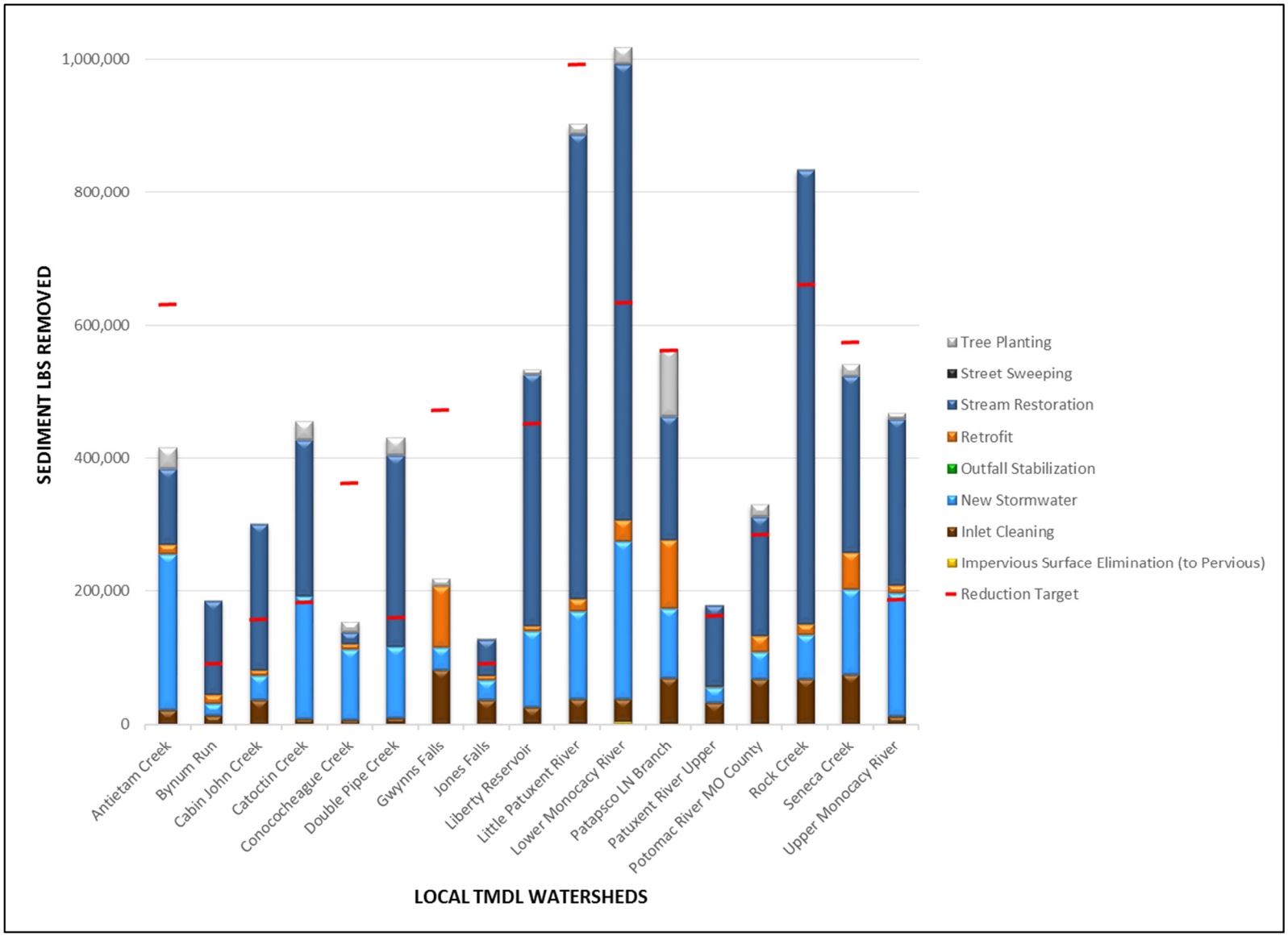


Figure 3-8: Sediment WLA Reductions by Watershed with Practice Menu

Nutrient Credit Trading

In an effort to meet the SHA WLA in watersheds with a high difficulty of BMP placement, SHA is exploring the possibility of nutrient credit trading. It is expected that MS4 jurisdictions will have the ability to purchase pounds of phosphorus, nitrogen, and sediment in a quantity that will allow them to reach their intended WLA. Once the trading program, regulations and guidance are finalized and approved by EPA, SHA intends to utilize this program as another practice to meet TMDL requirements.

Load Splitting

SHA is partnering with other willing NPDES permittees to complete programs or projects that will reduce nutrients and sediments. The goal is to produce projects that will have a WLA reduction and move each permittee closer to meeting its load reduction requirement. An agreement on how the credit pounds of phosphorus and sediment is split will be project specific.

TMDL End Dates

Currently, SHA models BMP implementation using the AMT and notes the progress towards reduction goals in **Table 3-2**. In this model, SHA considers the possible restoration practices that can be placed in the watershed based on the visual watershed inspection process. For some watersheds, 100 percent of the WLA reduction goal has been met and a year for meeting the WLA is given. For other watersheds, a year is listed next to a percentage that is less than 100 percent. This indicates that SHA will be able to reach a certain percentage of the WLA reduction goal by the estimated year.

For example, in Double Pipe Creek, SHA believes that it will be able to reach 55 percent of the WLA for phosphorus by 2045 by exhausting SHA ROW with BMPs outlined in MDE (2014a) guidance. Thus, SHA will have to explore the possibility of nutrient credit trading, internal credit trading, or load splitting efforts, which cannot be modeled at this time. SHA will review any future changes to current BMP removal rates or efficiencies presented in MDE, 2014a and determine what effect a change will have on TMDL end dates.

Internal Credit Trading

The preliminary draft guidance of the nutrient credit trading program developed by MDA and MDE established trading boundaries in which nutrients can be traded in three geographic zones. These are called Maryland Trading Regions, and trading can occur between cross-sector agencies such as regulated MS4 permittees. SHA proposes to trade within the three geographical regions between itself.

For example, in the Potomac trading region, if SHA is able to exceed its WLA for sediment reduction in Catoctin Creek by 270,744 lb/yr, SHA would like to apply the over treatment to the Seneca Creek watershed. The WLA will then be met for Seneca Creek by applying over treatment from one watershed to another watershed within the same trading region. In **Table 3-6** the watersheds are grouped into the three Maryland Trading Regions: Potomac, Western Shore/Eastern Shore Susquehanna, and Patuxent. It then sums up the pollutant load reduction achieved for watershed against its reduction target. Next, the table sums up over treatment or under treatment for all the watersheds within the trading region. At this point, the table illustrates trading regions that will exceed its reduction requirement or under treat its reduction requirement collectively as a region.

Table 3-6: Example Internal Credit Trading Analysis

Watershed Name	Watershed Number	Trading Zone	County	Pollutant	Unit	SHA Reduction Target (Lbs/Yr)	Modeled Reduction Achieved (Lbs/Yr)	% Progress	Reduction Loads Remaining (Lbs/Yr)	Extra Reduction (Lbs/Yr)
Antietam Creek	02140502	Potomac	WA	Sediment	EOS-lbs/yr	630,688	414,938	66%	215,750	0
Conococheague Creek	02140504	Potomac	WA	Sediment	EOS-lbs/yr	360,747	153,873	43%	206,874	0
Seneca Creek	02140208	Potomac	MO	Sediment	EOS-lbs/yr	573,400	540,989	94%	32,411	0
Potomac Trading Region - Sediment Treatment Remaining Total									**455,035**	
Cabin John Creek	02140207	Potomac	MO	Sediment	EOS-lbs/yr	156,000	301,881	194%	0	145,881
Catoctin Creek	02140305	Potomac	FR	Sediment	EOS-lbs/yr	183,338	454,082	248%	0	270,744
Double Pipe Creek	02140304	Potomac	FR CL	Sediment	EOS-lbs/yr	160,971	430,368	267%	0	269,397
Lower Monocacy River	02140302	Potomac	FR MO	Sediment	EOS-lbs/yr	633,145	1,016,125	160%	0	382,980
Potomac River MO County	02140202	Potomac	MO	Sediment	EOS-lbs/yr	286,000	330,812	116%	0	44,812
Rock Creek	02140206	Potomac	MO	Sediment	EOS-lbs/yr	658,800	834,171	127%	0	175,371
Upper Monocacy River	02140303	Potomac	FR CL	Sediment	EOS-lbs/yr	186,344	467,084	251%	0	280,740
Potomac Trading Region - Sediment Extra Treatment Total										**1,569,925**
Double Pipe Creek	02140304	Potomac	FR CL	Phosphorus	EOS-lbs/yr	1,282	699	55%	583	0
Potomac Trading Region - Phosphorus Treatment Remaining Total									**737**	
Antietam Creek	02140502	Potomac	WA	Phosphorus	EOS-lbs/yr	315	443	141%	0	128
Catoctin Creek	02140305	Potomac	FR	Phosphorus	EOS-lbs/yr	176	632	359%	0	456
Lower Monocacy River	02140302	Potomac	CL FR MO	Phosphorus	EOS-lbs/yr	1,428	1,777	124%	0	349

Table 3-6: Example Internal Credit Trading Analysis

Watershed Name	Watershed Number	Trading Zone	County	Pollutant	Unit	SHA Reduction Target (Lbs/Yr)	Modeled Reduction Achieved (Lbs/Yr)	% Progress	Reduction Loads Remaining (Lbs/Yr)	Extra Reduction (Lbs/Yr)
Rock Creek	02140206	Potomac	MO	Phosphorus	EOS-lbs/yr	369	1,300	352%	0	931
Upper Monocacy River	02140303	Potomac	FR CL	Phosphorus	EOS-lbs/yr	65	832	1280%	0	767
Potomac Trading Region - Phosphorus Extra Treatment Total										**2,631**
Gwynns Falls	02130905	WS/ES Susquehanna	BA	Sediment	EOS-lbs/yr	472,800	218,445	46%	254,355	0
WS/ES Susquehanna Trading Region - Sediment Treatment Remaining Total									**254,355**	
Bynum Run	02130704	WS/ES Susquehanna	HA	Sediment	EOS-lbs/yr	89,600	181,444	207%	0	95,844
Jones Falls	02130904	WS/ES Susquehanna	BA	Sediment	EOS-lbs/yr	90,800	129,164	142%	0	38,364
Liberty Reservoir	02130907	WS/ES Susquehanna	BA CL	Sediment	EOS-lbs/yr	450,000	532,711	118%	0	82,711
Patapsco LN Branch	02130906	WS/ES Susquehanna	AA	Sediment	EOS-lbs/yr	561,400	563,543	100%	0	2,143
WS/ES Susquehanna Trading Region - Sediment Extra Treatment Total										**219,062**
Liberty Reservoir	02130907	WS/ES Susquehanna	BA CL	Phosphorus	EOS-lbs/yr	554	798	142%	0	235
WS/ES Susquehanna Trading Region - Phosphorus Extra Treatment Total										**235**
Little Patuxent River	02131105	Patuxent	AA HO	Sediment	EOS-lbs/yr	991,000	900,852	91%	90,148	0
Patuxent Trading Region - Sediment Treatment Remaining Total									**90,148**	

Table 3-6: Example Internal Credit Trading Analysis

Watershed Name	Watershed Number	Trading Zone	County	Pollutant	Unit	SHA Reduction Target (Lbs/Yr)	Modeled Reduction Achieved (Lbs/Yr)	% Progress	Reduction Loads Remaining (Lbs/Yr)	Extra Reduction (Lbs/Yr)
Patuxent River Upper	02131104	Patuxent	AA	Sediment	EOS-lbs/yr	163,000	178,868	110%	0	15,868
			HO							
			PG							
Patuxent Trading Region - Sediment Extra Treatment Total										**15,868**

E.3 BACTERIA IMPLEMENTATION PLAN

E.3.a Bacteria TMDLs Affecting SHA

There are four EPA approved bacteria TMDLs with SHA responsibility spanning five Maryland 8-Digit watersheds (**Table 3-3).** The following TMDL documents for bacteria are addressed with this Plan:

- *Total Maximum Daily Loads of Bacteria for Impaired Recreational Areas in Marley Creek and Furnace Creek of Baltimore Harbor Basin in Anne Arundel County, Maryland*, approved by EPA March 10, 2011;
- *Total Maximum Daily Loads of Fecal Bacteria for Loch Raven Reservoir Watershed in Baltimore, Carroll and Harford Counties, Maryland*, approved by EPA December 3, 2009;
- *Total Maximum Daily Loads of Fecal Bacteria for Lower North Branch Patapsco River Watershed in Baltimore, Carroll, Anne Arundel, Howard Counties and Baltimore City, Maryland*, approved by EPA December 3, 2009; and
- *Total Maximum Daily Loads of Fecal Bacteria for the Patuxent River Upper Basin in Anne Arundel and Prince George's Counties, Maryland*, approved by EPA August 9, 2011.

For two of the TMDLs, the impairment and TMDL are for subwatersheds within the 8-digit watershed. In Baltimore Harbor, two of the tributary creeks are involved, and for Upper Patuxent River, the TMDL is for the lower half of the watershed.

- Baltimore Harbor (Marley and Furnace Creeks);
- Patapsco River, Lower North Branch;
- Upper Patuxent River; and
- Loch Raven Reservoir.

Table 3-3 shows a summary of the reduction requirements for the current SHA bacteria TMDLs. Two dates are shown including the EPA approval date and the baseline year set by MDE. The TMDLs were written at different times, based on monitoring data from different years. The baseline year published on the MDE Data Center will be used for SHA implementation planning. This usually correlates to the time period when monitoring data was collected for the MDE analysis.

E.3.b Bacteria Sources

Fecal indicator bacteria (FIB) are used to identify the presence of fecal matter, which indicates potential presence of pathogens associated with fecal matter. FIBs are not pathogens. A pathogen is a bacterium, virus, or other microorganism that can cause disease. MDE identified the FIB for which SHA is responsible, including:

- *E. coli*, and
- *Enterococcus.*

For most of the bacteria TMDLs, MDE has included some type of Bacterial Source Tracking (BST), which is a method of estimating the source of the bacteria by matching DNA or RNA with a library of samples from known species. BST has been used to categorize the fraction of bacteria coming from four general sources: humans, domestic pets, wildlife, or livestock. It is important to note that BST is performed on samples from the impaired water body, and thus the estimate of the fraction from each source is for the watershed as a whole, not from particular locations, jurisdictions, or permittees. The sources of bacteria in the four categories can be identified in further detail, as shown in **Table 3-7**. These have been derived from MDE's stormwater WLA bacteria guidance (MDE, 2014c) and Watershed Protection Techniques Article 17 (Schueler, 2000), which describes the sources to be addressed for load reduction in an implementation plan.

Table: 3-7 Bacteria Sources		
Sector	**MS4 Point Source**	**Non-Point Source**
Human	Sanitary sewer illicit discharge	Septic systems
	Sanitary sewer exfiltration	Sanitary sewer overflow
	Homeless populations	Combined sewer overflow (CSO)
		Recreational boating
Domestic Pets	Pets, urban areas	Pets, rural areas
Wildlife	Urban wildlife	Non-urban wildlife
Livestock		Agriculture, hobby farms
		CAFOs

The bacteria sources listed as MS4 sources are all diffuse sources that enter the storm drain system either through runoff or cross-connections. SHA, as a MS4 permittee, by definition only has point source discharges. These sources can be treated by stormwater practices or load reduction strategies. Loads from the non-point source list are either discrete sources, which can only be addressed through a load reduction approach, or diffuse rural sources that do not flow through storm drains.

The sources are significant in relation to permit conditions. The TMDL SW-WLA is the only load that must be addressed to meet the permit requirements, so that reduction of loads from livestock, sewer overflows, or septic systems would not be applicable to meet the permit requirement. Bacteria from these sources generally enter the receiving waters directly.

Bacteria concentrations in stormwater runoff are typically elevated above the primary contact recreation standards, regardless of the type of land use in the watershed (Clary et al., 2008). This type of pollution is significant because, unlike the water that goes down a sink or toilet in your home and is fed to a WWTP or septic system, stormwater runoff that is not intercepted by a BMP, is untreated and drains directly to lakes, rivers, and ultimately the Bay.

SHA Bacteria Loading Sources

SHA-owned land is a small portion of each of the TMDL watersheds. Very few of the bacteria sources listed in **Table 3-7** exist within SHA's land. However, there is some very limited potential for bacteria to originate from SHA ROW.

SHA owns only two septic systems in these watersheds; one at the Hereford shop in Loch Raven Reservoir watershed and one at a salt storage facility in Patapsco Lower North Branch watershed. SHA's Facility Maintenance Division (FMD) has standard operating procedures that includes regular inspections and maintenance for facilities with onsite septic systems. This helps to prevent sanitary overflows that may cause bacteria pollution.

SHA does not own or maintain sanitary sewers, although some of these utilities may be present with the ROW. However, there is potential for a sewage leak from one of these utilities. SHA has program that conducts regular inspections and testing for any suspected illicit discharge within the drainage system. If an illicit discharge is confirmed, the SHA works with local jurisdictions to disconnect the discharge from the drainage system.

Potential for human or animal waste contamination is minimal. There are no residents or livestock pasture lands in the ROW, so the only source of animal waste bacteria would be feral animals, adjacent residents walking pets along SHA roads, drainage washing from pasture lands, or homeless individuals. Wildlife sources are typically generated as a non-point source throughout the watershed, and are typically deterred from SHA ROW for safety reasons.

E.3.c SHA Bacteria Model Methods

Baseline Loading for Bacteria

Unlike TMDLs for nutrients and sediment, MDE's bacteria TMDLs were not prepared using a watershed model. Loads discussed in the bacteria TMDLs are based on monitoring in the impaired water body. Fate and transport from the watershed are not accounted for, including the quantity of bacteria from various sources in the watershed, die-off (or growth) in transit to the water body, potential sequestering and re-suspension from bottom sediments, or other factors.

Given the circumstances that the TMDL documents do not provide watershed loads nor loads by land use, SHA does not consider it feasible to meet the numerical TMDL goals expressed as counts/day or counts/yr. The lack of a watershed model with usable loading rates, transformations, and reduction parameters that provide a calculation of the baseline, TMDL, and WLA loads means that implementation progress cannot be measured with this approach.

Instead, SHA plans to follow the general SW-WLA implementation guidance (MDE, 2014d) to determine whether TMDL requirements have been met:

> *… it is recommended that local jurisdictions demonstrate their progress towards achieving SW-WLAs by comparing reduction percentages rather than absolute loads.*

This approach will allow SHA to use land use and treatment data to develop baseline loads consistent with the baseline TMDL dates. Demonstrating progress by percent reduced will allow SHA to plan for the TMDL based on the best and most accurate data available on land use, sources, loading rates, and removal efficiencies.

Bacteria Reduction Requirements

Required reduction calculations described in **Section E.2** are used for the determining bacteria reductions also. Maximum Practicable Reduction (MPR) is based on reductions for each of the four source categories. Human sources potentially have the highest risk of causing disease, so the maximum reduction was set at 95 percent. The domestic pet reduction was based on an estimated success of education and outreach programs, set at 75 percent. The livestock target, also 75 percent, was based on the level of sediment reductions from agricultural BMPs. Wildlife reductions were assumed to be 0 percent.

The target reduction is based on MDE's requirement to determine a TMDL which will meet WQSs. This analysis removed the practicality constraints, with a maximum allowable reduction of 98 percent for all sources. The resulting reduction requirements were higher than the MPR for Loch Raven Reservoir overall and in one subwatershed for Patapsco Lower North Branch.

Table 3-8: Comparison of Bacteria MPR with Target Load Reductions by Source

	Domestic	Human	Livestock	Wildlife	Target
MPR	75.0%	95.0%	75.0%	0.0%	
Loch Raven	94.8%	91.9%	94.6%	60.6%	76.6%
Patapsco LNB	14.0%	56.6%	11.7%	0.0%	16.0%

In the TMDL documents, MDE has recognized that:

> *…the goal of meeting water quality standards may require very high reductions that are not achievable with current technologies and management practices. … In cases where such high reductions are required to meet standards, it is*

expected that the first stage of implementation will be to carry out the MPR scenario." (MDE, 2009b; MDE, 2009c)

SHA Bacteria Reduction Modeling

MDE recommended the Watershed Treatment Model (WTM) (Caraco, 2013) as one of the models that could be used for implementation modeling for nutrients, sediment, and bacteria. It is a spreadsheet-based model that is capable of modeling loads from runoff and also other secondary sources that are associated with dry weather flows. For bacteria, it allows for input for all human sources except homeless populations, domestic pets, and livestock. Loads from wildlife are not modeled except as a contributor to runoff. It provides methods to estimate load reductions from both stormwater BMPs and source controls.

The model was selected because it was recommended by MDE, it could model almost all of the sources and controls that SHA would require, and as a spreadsheet, it is relatively easy to use. Documentation on SHA restoration modeling methods is under development and will be submitted to MDE for review and approval along with this Plan. The modeling documentation will provide detail on how the WMT was used to model bacteria loading and reductions.

The WTM models a single watershed. Loads from runoff and other sources are calculated individually, and then added to find the total untreated load for the watershed. Load reductions from source controls and stormwater BMPs are calculated individually, and then summed to find the total reduction. For stormwater BMPs, load reductions are calculated based on percent removal by BMP against the total load in the watershed. Loads to each BMP are not based on the type of land use in the treated drainage area. They are based on total drainage area and percent impervious.

Three scenarios can be modeled by the WTM:

- *Existing Loads* include current land use and treatment;
- *Loads with Future Practices* consist of current land use and proposed (future) treatment; and
- *Loads with New Development* include forecast changes in land use and the treatment associated with it. Models prepared for this analysis have not included any new development; only the first two WTM scenarios have been used.

The model consists of a number of interconnected worksheets and not all of them have been used for this analysis.

SHA manages restoration practice data associated with planning, design, construction, inspection, maintenance and credit verification through spatial geodatabases and an Microsoft Access database. Depending upon where the BMP is in the project development process, information may be found in different databases with different levels of data and tracking required. These sources are queried to develop input files for the WTM.

In addition, to implementation practice data, land use, land use loading rates, and reductions by implementation practice type are needed to utilize the WTM.

Land Use and Impervious Area Data

Land use within and adjacent to the ROW was described using the land use classifications, (i.e. residential, commercial, industrial, forest, agriculture) mapped by the MDP. SHA mapped its impervious cover using remote sensing methods. The source data for analysis was statewide orthophotography as of 2011. This impervious cover layer was overlaid on the land use, clipped to SHA ROW, resulting in a summary table of pervious and impervious area for each land use.

Bacteria Loading Rates by Land Use

The WTM uses a variation of the Simple Method (Schueler, 1987) to calculate loads from urban areas and export coefficients to calculate

rural loads. The Simple Method requires area and percent impervious for each land use to calculate annual runoff, and an Event Mean Concentration (EMC) to calculate loads. The program's default data were used for rural loads, but urban loads were calculated using EMCs reported in the National Stormwater Quality Database (NSQD) (Pitt et al., 2004). The database included stormwater runoff data from NPDES permit applications and annual monitoring reports nationwide, organized by land use. Numerous constituents were analyzed, including two pathogens, fecal coliforms and fecal strep.

EMCs used in the model are shown in **Table 3-9**, which also cross-references land use categories from MDP and the NSQD.

Table 3-9: Bacteria EMCs Used for Modeling

MDP Land Use	MDP LU Codes	NSQD Land Use	EMC
Residential	11,12,13,191,192	Residential	8,345
Open Urban	18	Open Space	7,200
Commercial / Institutional	14,16	Commercial[1]	4,300
Roadway	80	Freeways	1,700
Industrial	15	Industrial	2,500

1. NSQD has a category for institutional, but no bacteria samples were reported.

Bacteria Removal Rates by BMP Type

A literature review was conducted for reports that summarized the results of BMP performance sampling for bacteria removal. The International Stormwater BMP Database (ISWBMPDB) (Leisenring, et al., 2014) was used to develop the BMP reductions.

The ISWBMPDB consolidates a large number of studies and appears to be a good source for the data. It should be noted that monitoring data have not been collected or reported for all of the BMPs that SHA could potentially use for TMDL implementation.

Three of the four TMDLs were based on sampling for *E. coli,* therefore, the data used to develop BMP efficiencies for this assessment used *E. coli* if available and fecal coliform otherwise. Finally, for BMPs which are not represented in the ISWBMPDB, alternate sources were used and noted.

Removal efficiencies were calculated as follows:

$$Removal\ Rate = \frac{EMC_{in} - EMC_{out}}{EMC_{in}}$$

Table 3-10 shows the BMP efficiencies to be used in the WTM for bacteria in implementation planning.

Table 3-10: SWM BMP Removal Rates for Bacteria					
BMP	**MDE Codes**	**SW BMP Database Type**	**Bacteria Type**	**Bacteria Reduction**	**Note**
Bioretention (all soils)	FBIO, MMBR	Bioretention	*E. coli*	65%	1
Bioswales	ODSW, MSWB		*E. coli*	4%	1
Dry Detention Ponds	XDPD	Detention Basin	FC	60%	1
Dry Extended Detention Ponds	XDED	Detention Basin		60%	7
Impervious Surface Reduction*	NDNR, NDRR, NSCA, IMPF, IMPP			0%	3
Infiltration (all types).	IBAS, ITRN, MIBR, MIDW, MILS			90%	4
Outfall Enhancement with SPSC	SPSC			N/A	5
Permeable Pavement (all types).	APRP	Porous Pavement		58%	2
Stream Restoration	STRE			0%	3
Street Sweeping	MSS, VSS			N/A	5
Urban Filtering	FSND, FUND, FORG, FPER	Media Filter	FC	58%	1
Urban Tree Plantings	FPU			0%	3
Vegetated Open Channels	MSWG	Biofilter - Grass Swale		0%	6
Wet Ponds	PWET, PPKT, PWED, PMED, PMPS	Retention Pond	*E. coli*	95%	1
Grass Strip	--	Biofilter - Grass Strip		N/A	5
Green Roof	AGRE, AGRI			0%	3
Wetland	WSHW, WEDW, WPKT, WPWS	Wetland Basin	*E. coli*	53%	1

Notes:
1. Source is the 2014 ISWBMPDP; Median, 95% confidence inflow/outflow in MPN/100mL, *E. coli* or FC, FC preferred.
2. Permeable pavement with sand functions as a media filter.
3. Not a bacteria source
4. Source is the WTM v.3.0 Manual, 2001, based on Schueler estimate in 1987 that it's equivalent to septic systems.
5. No data available.
6. Studies not cited here indicate grass channels increase bacteria levels rather than removing them.
7. Dry ED ponds assumed to be as effective as dry ponds.

E.3.d Bacteria Reduction Strategies

SHA's bacteria reduction strategy will be an iterative process to address bacteria sources with the greatest impact on water quality, while considering difficulty of implementation and cost. SHA first started with using the WTM. Next, SHA will develop local monitoring data of stormwater outfalls in the SHA drainage system. Then, the data from the outfall monitoring effort is analyzed to identify any BMP in which water flowing from or in the BMP are not meeting bacteriological WQSs set by MDE. Source elimination will follow the analysis of the local monitoring data. In the source elimination stage SHA will seek to remove the source of the bacteria.

Watershed Treatment Modeling

The WTM was used to better understand what bacteria load reduction SHA can capture using the portfolio of BMPs that will be used to meet the required 20 percent impervious restoration goal. This model is summarized in **Section E.3**. The idea is to determine what impact the impervious surface restoration has on reducing the bacteria in the local watersheds. The expectation is where fecal bacteria are transported through our MS4 conveyance system, stormwater BMPs implemented to control urban runoff should help in reducing fecal bacteria loads in the watershed. The results of the WTM are shown earlier in **Table 3-3**.

Local Monitoring Effort

SHA will develop a protocol for monitoring stormwater outfalls and/or other BMPs that may have possible contaminated flow. This protocol is expected to be developed and approved by MDE by 2018. After the monitoring protocol is in place, SHA will start with sampling outfalls and BMPs in the watershed with a bacteria TMDL on a cost efficient schedule.

It is expected that during the local monitoring effort, SHA will be able to determine if there are any waters flowing from the MS4 drainage system where water quality is not meeting bacteriological WQSs. Once locations are identified, an effort to further investigate the source of the bacteria will be undertaken. SHA will review MDE's BST data for the identified area, and make a determination on what the potential source(s) of contaminate are. MDE's BST data tests microbial isolates collected from water samples and compares the isolates with a library from known sources to identify the host organism the bacteria came from. Once the BST data is examined a source can be identified and source elimination efforts can be focused.

Source Elimination

The effort to eliminate bacteria sources will focus on achieving load reductions for domestic pets, wildlife loads, and human waste only in Marley and Furnace Creek of the Baltimore Harbor Basin. These physical actions may include but not be limited to:

- Eliminating illicit sewer discharge connections discharging into stormwater collection systems;
- Addressing areas frequented by homeless populations; and
- Installing pet waste disposal bins on areas in SHA Row that have a high pet usage.

E.4 Polychlorinated Biphenyls (PCBs) Implementation Plan

E.4.a PCB TMDLs Affecting SHA

There are 10 EPA approved PCB TMDLs with SHA responsibility spanning 15 Maryland 8-digit watersheds (**Table 3-2).** The following TMDL documents for PCBs are addressed with this plan:

- *Total Maximum Daily Loads of Polychlorinated Biphenyls (PCBs) for Tidal Portions of the Potomac and Anacostia Rivers in the District of Columbia, Maryland , and Virginia*, approved by EPA October 31, 2007;
- *Total Maximum Daily Loads of Polychlorinated Biphenyls in the Northeast and Northwest Branches of the Nontidal Anacostia River, Montgomery and Prince George's County, Maryland*, approved by EPA September 30, 2011;
- *Total Maximum Daily Load of Polychlorinated Biphenyls in the Back River Oligohaline Tidal Chesapeake Bay Segment, Maryland*, approved by EPA October 1, 2012;
- *Total Maximum Daily Loads of Polychlorinated Biphenyls in the Baltimore Harbor, Curtis Creek/Bay, and Bear Creek Portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment, Maryland*, approved by EPA October 1, 2012;
- *Total Maximum Daily Load of Polychlorinated Biphenyls in the Bush River Oligohaline Segment, Harford County, Maryland, approved by EPA August 2, 2016*
- *Total Maximum Daily Load of Polychlorinated Biphenyls in Lake Roland of Jones Falls Watershed in Baltimore County and Baltimore City, Maryland*, approved by EPA June 30, 2014;
- *Total Maximum Daily Load of Polychlorinated Biphenyls in the Magothy River Mesohaline Chesapeake Bay Tidal Segment, Anne Arundel County, Maryland*, approved by EPA March 16, 2015.;
- *Total Maximum Daily Load of Polychlorinated Biphenyls in the Severn River, Mesohaline Chesapeake Bay Tidal Segment, Anne Arundel County, Maryland, approved by EPA July 19, 2016;*
- *Total Maximum Daily Load of Polychlorinated Biphenyls in the South River Mesohaline Chesapeake Bay Segment, Anne Arundel County, Maryland, approved by EPA April 27, 2015; and*
- *Total Maximum Daily Load of Polychlorinated Biphenyls in the West River and Rhode River, Mesohaline Segments, Anne Arundel County, Maryland, approved by EPA January 8, 2016.*

Table 3-2 shows a summary of the reduction requirements for the current SHA PCB TMDLs. Two dates are shown, the EPA approval date and the baseline year set by MDE. These TMDLs were written at different times, based on monitoring data from different years. The baseline year published on the MDE Data Center will be used for SHA's implementation planning. This usually correlates to the time period when monitoring data was collected for MDE's TMDL analysis.

SHA Proposed PCB No-Action Watersheds

SHA is proposing no action for some of the watersheds within the TMDL documents as discussed below.

For the Anacostia, Tidal Portion and Potomac River Upper Tidal-Prince Georges County's portion, SHA has not been able to determine a load reduction requirement based on the information given in the TMDL document. Instead of publishing a percentage, the MDE Data Center

says "see report." Because of the way the reductions are listed in the tables in the TMDL report, with totals added together either by tributary or by segment or jurisdiction, it is not possible to determine a load reduction for these waterbodies so that SHA's requirement could be calculated.

In the Magothy River TMDL, modeling shows that tidal flows from the Chesapeake Bay mainstem tidal influence to the river were the source of 98.7 percent of PCBs and regulated stormwater was less than 0.2 percent. Because loads from resuspension and diffusion from bottom sediments, see **Table 3-11**, are not considered to be directly controllable loads and are considered as internal within the modeling framework of the TMDL; they are not included in the tPCB baseline load and TMDL allocation. MDE stated in the Final Magothy River TMDL (MDE, 2015b) that attenuation in the Bay will meet the TMDL in 43.4 years. MDE determined that reducing watershed loads by 100 percent would not appreciably change this date, and assigned a load reduction of 0.0 percent to regulated stormwater sources.

TMDL modeling has showed that tidal flows from the Chesapeake Bay to the South River were the source of 97.8% of PCBs and regulated stormwater was less than 0.2 percent. Attenuation in the Bay will meet the TMDL in 12.3 years. Much like the Magothy River TMDL, MDE determined that reducing watershed loads by 100 percent in the South River would not appreciably change this date, and assigned a load reduction of 0.0 percent to regulated stormwater sources for PCB TMDL of the South River.

As stated in the TMDL, the Potomac River Lower Tidal, Middle Tidal, and the Charles County portion of Potomac River Upper Tidal watersheds have a reduction requirement of 5 percent, which is entirely due to the Margin of Safety (MOS). Without the MOS, no additional reduction is required. The reduction attributed to the MOS is expected to be treated through the proposed 93% reduction in atmospheric deposition of PCBs.

TMDL modeling has showed that tidal flows from the Chesapeake Bay to the Severn River Mesohaline were the source of 98.2 percent of PCBs and regulated stormwater was less than 0.4%. Attenuation in the Bay will meet the TMDL in 46.2 years. MDE determined that reducing watershed loads by 100 percent would not appreciably change this date, and assigned a load reduction of 0.0% to regulated stormwater sources.

As stated in the TMDL, modeling showed that tidal flows from the Chesapeake Bay to the West and Rhodes Rivers Mesohaline were the source of 96.8 percent of PCBs and regulated stormwater was less than 0.2%. Attenuation in the Bay will meet the TMDL in 16.8 years. MDE determined that reducing watershed loads by 100 percent would not appreciably change this date, and assigned a load reduction of 0.0 percent to regulated stormwater sources.

E.4.b PCB Sources

The objective to establish a TMDL for PCBs is to ensure that the designated use is protected in each of the impaired waterbodies. Monitoring to identify the impairment may have been performed in the water column, in sediments, or in fish tissue depending on whether the impairment was for water contact recreation or fish consumption.

PCBs do not occur naturally in the environment. Therefore, unless existing or historical anthropogenic sources are present, their natural background levels are expected to be zero. Although PCBs are no longer manufactured in the United States, they are still being released to the environment via accidental fires, leaks, or spills from PCB-containing equipment; potential leaks from hazardous waste sites that contain PCBs; illegal or improper dumping; and disposal of PCB-containing products into landfills not designed to handle hazardous waste. Once in the environment, PCBs do not readily break down and tend to cycle between various environmental media such as air, water, and soil.

Sources are not identified in detail, either by land use or other breakdowns. Two non-point sources are related to the waterbody itself: resuspension and diffusion from bottom sediments and tidal exchange with the Bay. Bottom sediments were not considered a source in any of the TMDLs, since the PCBs stayed within the waterbody. The Bay tidal influence can be either a source or sink. For the Magothy, Severn, South and West and Rhodes River TMDLs, the Bay tidal influence is the single major source of PCBs. Back River, on the other hand, exports more PCBs to the Bay than it receives.

There are three diffuse watershed sources including atmospheric deposition, non-regulated watershed runoff, and NPDES regulated stormwater. Also there are four discrete sources: contaminated sites, WWTP facilities, industrial process water and Dredged Material Containment Facilities (DMCF), which are described by name in the TMDL. **Table 3-11** shows which sources are described in the seven TMDLs.

For PCBs, studies have shown the largest sources impacting stormwater are building demolition, building remodeling, and old industrial areas. The main pathways are runoff, wheel and foot tracking, and dust dispersion from industrial areas (San Francisco Estuary Institute [SFEI], 2010).

Table 3-11: PCB Sources in Each TMDL

Source	Contaminant	TMDL Watershed								
		Baltimore Harbor	Back River	Tidal Potomac/ Anacostia River	Non-Tidal Anacostia River	Lake Roland	Magothy River	Severn River	South River	West & Rhodes River
Non-Point Sources	Bottom Sediments									
	Chesapeake Bay Mainstem Tidal Influence						o	o	o	o
	Atmospheric Deposition	o	o	o		o	o	o	o	o
	Non-regulated Watershed Runoff	o	o	o	o	o	o	o	o	o
	Contaminated Sites	o	o	o	o	o	o			
Point Sources	Municipal WWTP and CSO	o	o	o	o	o		o	o	o
	Industrial Process Water	o								
	DMCF	o								
	NPDES Regulated Stormwater	o	o	o	o	o	o	o	o	o

Significance for SHA

SHA roadways pass through or in close proximity to areas that contain facilities or industries that may contribute PCBs to the environment. Two of the controllable sources in **Table 3-11** appear to fall under SHA's responsibility: contaminated sites and NPDES-regulated stormwater. SHA has conducted research on our industrial sites and to date has not discovered any legacy contaminated sites. Thus SHA is left with stormwater as the only source to be addressed now. SHA has not completed a comprehensive investigation of all of SHA's ROW and will do so in the future as part of SHAs PCB research study.

E.4.c SHA PCB Modeling Methods

Unlike TMDLs for nutrients and sediment, MDE's PCB TMDLs were not prepared using a watershed model. SHA's modeling will focus on runoff loads and reductions from stormwater BMPs. The approach to modeling PCB reductions is based on the results of a literature review of PCB sources and treatment.

Two documents from the CBP discuss PCB sources, pathways, and treatment. (Schueler and Youngk, 2015) summarized research nationwide. They reported that PCB sampling in San Francisco Bay showed urban stormwater was the dominant pathway for PCBs to enter the Bay. The Chesapeake Bay *Toxic Contaminants Policy and Prevention Outcome* (CBP, 2015) also concluded that stormwater was a significant pathway for both particulate and dissolved PCBs. Additionally, land use is also a factor.

Baseline Loading for PCBs

Loads discussed in the PCB TMDLs are based on monitoring the impaired waterbody. Watershed loads were estimated by deriving concentrations from the monitoring data and multiplying these by estimated flow rates to the impaired waterbody. As a result, the loads reported in the TMDL do not account for fate and transport from the watershed.

While PCBs can exist in stormwater in both dissolved and particulate forms, they are generally insoluble in water. Lighter compounds may dissolve and subsequently volatize to the air and heavier compounds bind to sediment. Schueler and Youngk (2015) discussed research indicating that a large portion of the PCB load was attached to sediment, including a sampling study in the Susquehanna River basin that showed 75 percent of PCB loads were associated with particulates. CBP (2015) concluded that contaminated soils were a predominant source of PCBs in stormwater. Both these reports and others (Gilbreath et al., 2012) found that runoff from older industrial areas tended to have a higher concentration of PCBs in runoff and in sediments.

Given the understanding that removal of contaminated sediment from stormwater can be an effective method of reducing the PCB loads, the modeling approach will be to focus on stormwater BMPs that treat sediment. The basis of the modeling will be Total Suspended Solids (TSS) loading and reduction calculations based on approved rates from MAST (2016) and MDE (2014a). This approach has also been documented by Interstate Commission on the Potomac River Basin (ICPRB) in the Tidal Potomac PCB TMDL.

Six of the seven TMDLs provide sufficient information on sediment concentrations to estimate an average value by watershed. No sediment data was reported in the TMDL for the Anacostia River Northeast and Northwest Branch. In lieu of this, data from the Tidal Potomac TMDL for Anacostia will be used.

SHA is responsible for PCB TMDLs located in multiple watersheds and counties with varying baseline years. This poses a challenge for SHA because accurate data for ROW area, land use, and impervious area

prior to 2011 is unavailable. Also, with local TMDL baseline years ranging from 2000 to 2010, baseline loads are not reliable. Without a baseline, SHA is unable to track progress towards achieving SW-WLAs by comparing reduction percentages. For that reason; the same modeling approach implemented for nutrient and sediment TMDLs has been used.

PCB Reduction Requirements

The model uses a reduction target for SHA either published in the TMDL document or disaggregated. The target is compared to modeled reductions from restoration BMPs. This method is based on the assumption that like sediment, PCB is a conservative pollutant, and that loads exported from the watershed will approximate the loads in the waterbody, without significant loss or degradation in transport.

Reduction Modeling

The model is based on an Excel spreadsheet, using data derived from MAST and SHA's stormwater geodatabases. Documentation on SHA restoration modeling methods is under development and will be submitted to MDE for review and approval along with this implementation plan. The modeling documentation will provide detail on how PCB reductions were computed using this spreadsheet method. A brief description summary of process developed follows.
The model determines sediment reductions achieved by each type of practice and then multiplies the sediment reductions by a PCB concentration to determine the PCD reductions. Sediment reduction computations vary depending upon the type of restoration practice planned: stormwater control structures or inlet cleaning. Steps for determining sediment reductions for stormwater controls include:

- Sediment loading within the drainage area is determined by identifying the MAST land-river segment containing the BMP and recording the loading rate for SHA pervious and impervious land use. (MAST, 2016);
- TSS removal rates from the database are stored with each BMP, based on its type;
- Load removal (lb/ac/yr) is calculated for pervious and impervious area by multiplying land use loading rate by TSS removal rate; and
- TSS removed (lb/yr) is calculated by multiplying load removal by pervious and impervious area within the BMP drainage area.

Steps for determining sediment reductions for inlet cleaning include:

- GIS analysis of the area of SHA ROW within each shop boundary within each TMDL watershed;
- Fraction of ROW area in the TMDL watershed within each shop boundary;
- Lookup of dry weight of material collected from each shop;
- Calculation of material collected within the TMDL watershed by multiplying fraction of TMDL ROW by the total material collected; and
- Calculate TSS pounds removed using parameter from MDE Guidance (MDE, 2014a).

Computing PCB loads removed based on the sediment removal calculated in the previous steps includes:

- Add stormwater BMP and inlet cleaning pounds removed to find total sediment removed in each TMDL watershed and convert to grams;
- Multiply by PCB concentration factor of 80 ng/g (Schueler and Youngk, 2015) to find PCB load removed; and
- Multiply by 50% to account for inconsistency in BMP removal (results are in g/yr).

PCB Pollutant Loading Rates by Land Use

Loading rates for TSS were created using 2011 pollutant loading and land use acres from MAST v.5.3.2. This is the "2011 original" initial conditions background data with no BMPs. This date corresponds with the baseline date of October 21, 2010 used in developing the SHA baseline impervious accounting and restoration requirements. Loading rates have been calculated by averaging the loads for all land-river segments within a subwatershed by County for SHA MS4 Phase I/II Impervious, and SHA MS4 Phase I/II Pervious land uses. With the no-BMP scenario, loading rates for each SHA land use will stay constant for different baseline years, so these values will be valid for both the Bay TMDL and local TMDL analyses.

PCB Pollutant Removal Rates by BMP Type

The modeling approach has been to focus on stormwater BMPs that treat sediment. BMP removal rates for structural and ESD stormwater controls (ESD/Runoff Reduction (RR) and Stormwater Treatment (ST) practices), and alternative BMPs (catch basin cleaning have been created following MDE (2014a). For determining BMP efficiencies using MDE (2014a), the first version of the model assumes 1-inch of treatment for ESD/RR and ST practices. At a later time, when data on the amount of treatment and Pe for each BMP is confirmed and entered into the database, the model will be refined to use Pe to calculate reductions from greater than or less than 1-inch treatment. See **Table 3-12** for assumed PCB removal efficiencies.

Table 3-12: PCB BMP Pollutant Removal Efficiencies

MAST Description	Unit	BMP Type	TSS Removal
Structural / ESD BMPs			
Bioretention/Rain Garden	AC	RR/ESD	70%
Bioswale	AC	RR/ESD	70%
Dry Detention	AC	N/A	0%
Dry Extended Detention Pond	AC	N/A	0%
Retrofits	AC	-	65%
Urban Filtering	AC	ST	66%
Urban Infiltration	AC	RR	70%
Vegetated Open Channels	AC	RR	70%
Wet Pond	AC	ST	66%
Wetland	AC	ST	66%
Alternative BMPs			
Mechanical Street Sweeping	AC	Alt	10%
Regenerative/Vacuum Sweeping	AC	Alt	25%
Pavement Removal	AC	Alt	84%
Regenerative Stormwater Conveyance	AC	Alt	70%
Trees - Urban	AC	Alt	57%
Alternative BMPs			
Outfall Stabilization	LF	Alt	15/45
Stream Restoration - Urban, Coastal Plain	LF	Alt	15
Stream Restoration - Urban, Non-Coastal Plain	LF	Alt	45
Alternative BMPs			
Catch Basin Cleaning	TON	Alt	420

E.4.d PCB Reduction Strategies

SHA will implement an evolving management process that relies on four main PCB reducing efforts. The first strategy will be source tracking and elimination. The second effort will be to track PCBs reduction achieved from ongoing impervious restoration efforts for SHA's MS4 permit. SHA will develop a monitoring and evaluation plan to study the effects of natural attenuation in our PCB TMDL watersheds. Lastly, partnering efforts to reduce PCB concentrations in the local watersheds will be explored with other jurisdictions where it is perceived to be mutually beneficial for both parties.

WLA BMP Reduction Modeling

As a byproduct of meeting the impervious surface restoration required under the existing MS4 permit, many of the BMPs used to reduced nutrients and sediment TMDLs will provide a secondary benefit in removing PCBs associated with sediments. To model the removal of sediments that have PCBS attached to them from the watershed, SHA uses a PCB Stormwater Modeling Approach. The purpose is to determine what impact the impervious surface restoration has on reducing the PCB loads in the local watersheds. The expectation is that PCB binds to sediment in stormwater runoff and can then be transported through our MS4 conveyance system, thus stormwater BMPs implemented to control urban runoff should help in reducing PCB loads in the watershed. The results of the Stormwater Modeling Approach are shown earlier in **Table 3-3.**

Based on the low reduction achieved through the approach of building BMPs in the watersheds, SHA has concluded that a more effective way of achieving PCB load reduction is source tracking and elimination. Furthermore, MDE has specifically stated, "Reduction of PCB concentrations within stormwater runoff through BMP implementation is not deemed by MDE to be an effective strategy for removal of PCBs in the environment" (MDE, 2014e, p. 11).

Source Targeting and Elimination

According to MDE's main reports for PCB TMDLs, its noted that an effective way to meet the WLA is to implement a PCB source targeting and elimination effort. This will allow the administration to identify and eliminate PCBs at the source rather than an end of pipe situation in contaminated watersheds.

SHA will develop a protocol describing the process to implement steps that target a PCB source in the ROW. This protocol will also explain how SHA will evaluate feasibility of source elimination. SHA expects to have this protocol approved by MDE in 2018.

Monitoring and Evaluation Plan

SHA will continue to monitor the declining PCB concentrations in the local watersheds due to natural attenuation. This process will involve obtaining PCB concentration data directly from MDE and or other approved sources. SHA will to keep a record of the decline of PCB concentration decline in the water column and fish tissue.

Partnering Efforts

SHA will implement a partnering effort with other local jurisdiction to insure that PCB WLAs are met. However, at this time it has not been determined what this effort will entail. There may be a possibility to work with another agency on a public education campaign or contribute effort or money to a PCB cleanup effort in a watershed in which there is an SHA responsibility. It is anticipated that an overall reduction of PCBs released in the watershed will have a positive load reduction on SHA's WLA reduction goals.

E.5. Trash Implementation Plan

E.5.a. Trash TMDLs Affecting SHA

There are two EPA approved TMDLs for trash with WLAs assigned to SHA, and these are covering three watersheds. WLAs assigned to SHA in these separate TMDLs are listed in **Table 3-13 and 3-14** by watershed. The trash TMDLs with SHA responsibility include:

- *Total Maximum Daily Loads of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, Maryland and the District of Columbia*, approved by EPA September 21, 2010; and
- *Total Maximum Daily Loads of Trash and Debris for the Middle Branch and Northwest Branch Portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment, Baltimore City and County, Maryland*, approved by EPA January 5, 2015 (includes separate WLAs for the Gwynns Falls and Jones Falls watersheds).

These allocations are written differently than the TMDLs discussed above. Rather than meeting the WLA by reducing loading down to the WLA level, this WLA represents an amount that must be collected and removed at 100 percent annually. This does not to mean that zero trash is left in the watershed, but that the assigned loads are to be removed in their entirety each year.

Trash to be removed for WLA (attributed to point sources) is defined as any items of a size to fit within a storm drain regardless of where it is found within the watershed. According to the Anacostia TMDL (MDE, 2010a):

> *The WLAs address trash items that can typically travel through sewer systems, while the LA is assigned to larger trash and debris that are attributed to activities such as dumping.*

SHA has currently been assigned only WLAs for trash in these watersheds and not load allocations (LA). SHA trash collection typically occurs within areas that drain to the MS4 including upstream of and within storm sewer systems, grass swales and ditches, stormwater control structures, outfalls, roadway side slopes, and streams.

Table 3-13: Anacostia River Watershed SHA Trash Allocations

WLA Lbs/Day	WLA Lbs/Year	5% MOS Lbs/Yr	Total Annual Responsibility (WLA + MOS) Lbs/Yr
Anacostia River MO County			
16.6	5,756	287.8	6,044
Anacostia River PG County			
38.7	13,461	673.05	14,134
Totals for Anacostia			
55.3	**19,217**	**961**	**20,178**

Table 3-14: Patapsco River Mesohaline Tidal Bay Segment SHA Trash/Debris Allocations

WLA Lbs/Day	WLA Lbs/Year	5% MOS Lbs/Yr	Total Annual Responsibility (WLA + MOS) Lbs/Yr
Gwynns Falls, BA County			
6.3	2,300	115	2,415
Jones Falls, BA County			
3.9	1,418.7	70.9	1,490
Totals for Patapsco Mesohaline TBS			
10.2	**3,718.7**	**185.9**	**3,905**

E.5.b. SHA Trash Baseline Calculations

SHA does not own any roadways within Baltimore City and therefore only maintains a presence in Baltimore County for the Patapsco watershed, which includes both the Jones Falls and Gwynns Falls watersheds. This area is mostly encompassed within the SHA Hereford and Owings Mills maintenance shops. In the Anacostia watershed, SHA owns roadways in both Montgomery and Prince George's counties and these areas are mostly encompassed by the SHA Fairland shop in Montgomery County and the Laurel and Marlboro shops in Prince George's County.

The baseline loads for these TMDLs are the amount of litter and trash removed during the year of monitoring for the TMDL (See **Table 3-15**). SHA currently collects a substantial amount of litter and trash with pick-up along roads and in structural stormwater control structures, street sweeping, and inlet cleaning. SHA does not currently characterize trash picked up along roadsides as qualifying as either WLA or LA, but the other types of trash collection are considered to qualify as WLA collection. The SHA Office of Maintenance (OOM) tracks trash removal by maintenance shop area rather than roadway or watershed.

Trash Baseline Roadside Trash Pick-up

SHA currently performs the following activities to pick up litter and trash along roadsides:

- Maintenance Crew Clean-ups – SHA's maintenance crew is responsible to perform a number of routine activities including trash clean-up as well as mowing, plowing, and other activities to ensure safety and environmental stewardship along the ROW. Trash clean-ups are performed regularly before mowing and supplemental clean-ups occur as needed or upon public request when possible.
- Contracted Crew Clean-ups – In addition to SHA maintenance crew clean-ups, OOM also issues trash removal contracts for supplemental clean-ups along the ROW. Contractors include private companies and inmate cleaning crews. Contracts are awarded for designated roadway segments and contractors are required to pick up on a regular schedule.
- Adopt-A-Highway (AAH) – SHA's AAH program utilizes volunteer groups that pick up litter along one to three mile stretches of non-interstate roadways. The groups are encouraged to perform this community service a minimum of four times per year for a two year period. (Not used in baseline calculations.)
- Sponsor-A-Highway (SAH) – The SAH program allows corporate sponsors to fund contracted clean-ups for one-mile sections of Maryland roadways. The sponsor has an agreement with a maintenance provider to remove litter from the sponsored highway segment. Segments are typically interstate roadways.

Table 3-15: Trash TMDL Baseline Years and WLA Percentages

Watershed	County	Baseline Year	TMDL[1] (Lbs/Yr)	WLA[2] (Lbs/Yr)	% of TMDL[2]
Anacostia	Montgomery	2009	309,200	243,256	79%
	Prince George's	2009	662,013	314,055	47%
Patapsco -Jones Falls	Baltimore	2011	149,067	130,153	87%
Patapsco - Gwynns Falls	Baltimore	2011	194,348	173,067	89%
Totals			**1,314,628**	**860,531**	

1. Trash load assigned to all point and non-point sources, excluded MOS.
2. MDE assigned this wasteload allocation for all point sources

Current SHA roadside trash pick-up data does not characterize the size of material picked up, and therefore SHA cannot differentiate between WLA and LA. A significant portion of trash currently collected may qualify as LA, and should not be counted towards the trash TMDL baseline WLA. As part of this Plan, a study will be conducted to characterize trash collected by SHA within these watersheds to determine what percentage qualifies as WLA. In the interim, an assumption based on the percent of WLA to overall TMDL for the specific watersheds is used as defined in **Table 3-15**. Current SHA baseline loads for roadside trash pick-up have been reduced to equal these percentages and are included in **Table 3-17**. Increases in roadside trash pick-up needed to meet the WLA will be divided by these percentages to determine the overall pick-up needed to ensure the WLA is provided.

SHA has determined that the loads collected through roadside trash pick-up within the shop boundaries during the year of monitoring are as listed in **Table 3-17** in the column titled 'Reported Trash Pick-up per Shop'. At the time the TMDL monitoring was conducted, trash collection was (and still is) reported by truckloads.

Baseline trash loads by watershed were computed based on the assumption that trash collected within the shop area is spread evenly over the SHA ROW. This number can be computed using percent of SHA shop ROW that lies within the watershed multiplied by the number of truckloads of trash picked up for the shop area, see **Table 3-16**. This number is then translated to pounds from truckloads based on a conservative estimate of 300 lbs/truckload, and is listed per shop in **Table 3-17** in the column labeled 'Calculated Trash Pick-up per Watershed (Lbs)'.

Table 3-16: SHA Shop ROW within Watersheds

Watershed[2]	County	SHA Maintenance Shop[3]	SHA ROW Within Shop (acres)	SHA ROW within Watershed (acres)	SHA ROW within Watershed (%)
Anacostia	Montgomery	Fairland	2,740	1,210	44%
	Prince George's	Laurel	3,925	2,344	60%
		Marlboro	5,646	509	9%
Patapsco - Jones Falls	Baltimore	Hereford	2,524	856	34%
Patapsco - Gwynns Falls	Baltimore	Owings Mills	3,252	1,662	51%
Totals			**18,087**	**6,581**	

Table 3-17: SHA Baseline Roadside Trash Pick-up

Watershed[2]	County	SHA Maintenance Shop[3]	Reported Trash Pick-up per Shop[4] (Truckloads)	Calculated Trash Pick-up per Watershed (Truckloads)	Calculated Trash Pick-up per Watershed (Lbs)[1]	WLA Percent of TMDL (%)	SHA WLA Baseline Pick-up[5] (Lbs)
Anacostia	Montgomery	Fairland	505	223	78,054	79%	61,663
	Prince George's	Laurel	786	469	164,289	47%	77,216
		Marlboro	1,300	117	41,019		19,279
Patapsco - Jones Falls	Baltimore	Hereford	423	143	50,210	87%	43,683
Patapsco - Gwynns Falls	Baltimore	Owings Mills	527	269	94,267	89%	83,898
Totals			**3,541**	**1,222**	**427,839**		**285,739**

1. SHA tracks trash removal by truckload. SHA estimates 50 bags per truckload at 7 Lbs per bag, totaling 350 Lbs per truckload. Truckloads are multiplied by 350 to derive total Lbs.
2. Small portions of other shop boundaries fall within the watershed boundaries, but the area is so insignificant that the bulk of the TMDL responsibility lies with the shop identified above.
3. For locations of shop boundaries relative to the watershed, refer to the individual watershed discussions in Part IV for maps and descriptions.
4. Trash collection that should be continued annually to ensure baseline trash collection component of the TMDLs are met.
5. Amount of roadside pick-up that is considered to meet WLA removal is based upon the WLA % of total TMDL as listed in Table 3-15.

Trash Baseline Inlet Cleaning

SHA owns and operates vacuum pump trucks and routinely cleans storm drain inlets to remove sediment, gross solids, litter, and debris that accumulate inside drainage inlets and catch basins. Truckloads of debris removed are tracked and reported by SHA maintenance shop personnel. SHA estimates that on average, 300 pounds is removed from inlets (210 lbs dry weight) of which 8.9% is assumed to be trash (CWP, 2008a). See **Table 3-18** for baseline inlet cleaning trash removal reductions.

Trash Baseline Structural Stormwater Controls

MDE guidance from the TMDL Data Center, *Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Trash/Debris Total Maximum Daily Loads,* lists structural stormwater controls as an allowable trash load reduction practice (MDE, 2014f). The Patapsco Mesohaline TMDL cites 2.06 lbs/acre for transportation land use in Baltimore County while the Anacostia TMDL cites 2.22 lbs/ac. This trash land use loading is used in the TMDL models to estimate the WLAs and LAs.

There appears to be inconsistency between this loading rate and the WLA Anacostia watershed TMDL. When this rate is applied to SHA ROW within the watershed, the required WLA is much higher than the actual load being produced. In other words, SHA would be required to pick up more trash than is actually being deposited. Therefore, this rate does not seem to be well correlated to SHA land use and loading in the watershed, and cannot be used to model loads and reductions for stormwater control structures. See **Table 3-19** for these computations. Also, reduction efficiencies for structural stormwater controls have not been located that can be used along with land use loading to determine reductions achieved.

Table 3-18: SHA Baseline Inlet Cleaning for Trash Removal

Watershed	County	SHA Maintenance Shop	Reported Inlets Cleaned[1]	Calculated Baseline Inlets Cleaned[2]	Calculated Baseline Trash Removal[3] (Lbs./Yr)
Anacostia	Montgomery	Fairland	960	422	11,394
	Prince George's	Laurel	2,427	1,456	39,312
		Marlboro	1,389	125	3,375
Patapsco - Jones Falls	Baltimore	Hereford	731	249	6,723
Patapsco - Gwynns Falls	Baltimore	Owings Mills	1,777	906	24,462
Totals			**7,284**	**3,158**	**85,266**

1. Derived from 2014 inlet cleaning report. This level of inlet cleaning should be maintained to meet the TMDL baseline loads.
2. Derived by multiplying percentage of Shop ROW in watershed, as listed in Table 3-16, and multiplying by total inlets cleaned.
3. This assumes 300 pounds debris removed per inlet, of which 8.9% is trash, resulting in 27 lbs. per inlet.

Table 3-19: Comparison of TMDL Trash Loading Rates and WLA for Transportation

Watershed	County	SHA Shop[3]	SHA ROW (acres)	TMDL Roadway Loading Rates (lbs/ac)	Annual Load (lbs/yr)	WLA (lbs/yr)
Anacostia	MO	Fairland	1,210	2.22	2,686	6,044
	PG	Laurel	2,853	2.22	6,334	14,134
		Marlboro				
Patapsco - Jones Falls	BA	Hereford	856	2.06	1,763	1,490
Patapsco - Gwynns Falls	BA	Owings Mills	1,662	2.06	3,424	2,415

The absence of reduction efficiencies for stormwater controls makes it difficult to model reductions accurately. Therefore, SHA is assuming the same 27 lbs/yr per structure reduction as was used for inlet cleaning. This assumption will be adjusted as more definitive reductions are located through literature search or monitoring.

SHA has in place many structural stormwater controls and also plans to build more in conjunction with future 20 percent reduction requirements anticipated to be included in the next MS4 permit. See **Table 3-20** for estimated baseline structural stormwater control trash reductions using 27 lbs/yr assumption.

Table 3-20: SHA Baseline Structural SW Control for Trash Removal

Watershed	County	SHA Maintenance Shop	No. Structural SW Controls	Calculated Baseline Trash Removal[1] (Lbs/Yr)
Anacostia	Montgomery	Fairland	49	1,323
	Prince George's	Laurel	47	1,269
		Marlboro	4	108
Patapsco - Jones Falls	Baltimore	Hereford	25	675
Patapsco - Gwynns Falls	Baltimore	Owings Mills	17	459
Totals			**142**	**3,834**

1. Using the same trash removal as inlets (27 lbs. per SW control) until a more definitive reduction can be located through literature research.

E.5.c. SHA Trash Reduction Strategies

The trash WLAs are the amount of trash to be removed and therefore no additional computations are necessary to determine SHA reduction requirements. Meeting the WLAs will entail both maintaining current baseline levels of trash collection and increasing efforts to meet the additional WLA. SHA must continue to measure and report annually levels of trash collection by the shops to ensure new levels are being met that include both baseline and increased activities. Activities will be increased gradually until the full baseline plus WLA is being met.

SHA proposes increasing current practices beyond baselines and adding a few new ones to capture the WLA loads including the following show in **Table 3-21**:

- Increase roadside litter and trash pick-up by contracted crews and sponsor-a-highway;
- Increase inlet cleaning;
- Construct new structural stormwater controls;
- Implement litter public education program; and
- Target drainage systems and waterways.

SHA proposes to both increase existing activities and add two new activities in order to meet the trash WLAs in each watershed. The increased activity descriptions are above under Section E.5.b, SHA Trash Baseline Calculations. Descriptions of the new activities are below.

Table 3-21:– Summary of Activities to Meet SHA Trash WLAs

Watershed	County	SHA Maintenance Shop	WLA	Increased Inlet Cleaning		New Public Education Program		Drainage Systems and Waterways		New Structural SW Controls		Increased Roadside Pick-up		Total Proposed Reduction Activities (WLA)	
			(Lbs/Yr)	(Lbs/Yr)	(%)	(Lbs/Yr)	(%)	(Lbs/Yr)	(%)	(Lbs/Yr)	(%)	(Lbs/Yr)	(%)	(Lbs/Yr)	(%)
Anacostia	Montgomery	Fairland	6,044	2,670	44%	725	12%	0	0%	108	2%	2,765	46%	6,268	104%
	Prince George's	Laurel	14,134	7,343	63%	1,696	12%	525	4%	189	1%	3,784	27%	14,205	100%
		Marlboro		668	26%										
Jones Falls	Baltimore	Hereford	1,490	0	0%	179	12%	350	23%	54	4%	914	61%	1,497	100%
Gwynns Falls	Baltimore	Owings Mills	2,415	0	0%	290	12%	0	0%	0	0%	2,181	90%	2,471	102%
Totals				**10,681**		**2,890**		**875**		**351**		**9,644**		**24,441**	

Litter Education and Outreach Program

SHA currently conducts many litter awareness initiatives. In order to improve the results of the anti-littering message, SHA has initiated a research study to determine target audiences, baseline levels of awareness of the negative impacts of littering, costs associated with littering, motivations for littering, and motivations to stop littering. Based on the results of this research, SHA will develop or improve existing messages and tactics for each segment of the target audience and develop methods to measure the success of the campaign. This

serves as a source control measure to meet the trash removal requirement. New or improved activities may include:

- Updated SHA webpage for anti-littering message;
- Public outreach efforts such as storm drain stenciling, presentations to community and school groups, activity books stressing the Chesapeake Bay and local waterways, and event booths at pertinent events;
- Partnering with counties and watershed groups;
- Messaging including:
  - Radio;
  - Interpretive signage at SHA rest stops;
  - Social media feeds;
  - Bumper stickers;
  - Press releases and articles; and
- Other activities as determined to augment littering awareness.

Using a model similar to the Montgomery County Implementation Plan for the Anacostia River Watershed Trash TMDL (MC-DEP, 2012), SHA assumes that the anti-littering campaign will be effective at reducing litter by 12 percent of the WLA. To achieve this reduction, SHA estimates that the message will reach at least half of the traveling public in one way or another. The message will be at least 60 percent effective in promoting awareness and at least 40 percent of the aware audience will modify their behavior.

50% X 60% X 40%= 12%

Target Drainage Systems and Waterways

SHA is proposing to target drainage systems and waterways in each of the watersheds to augment roadside trash pick-up on an annual basis.

Trash TMDL End Dates

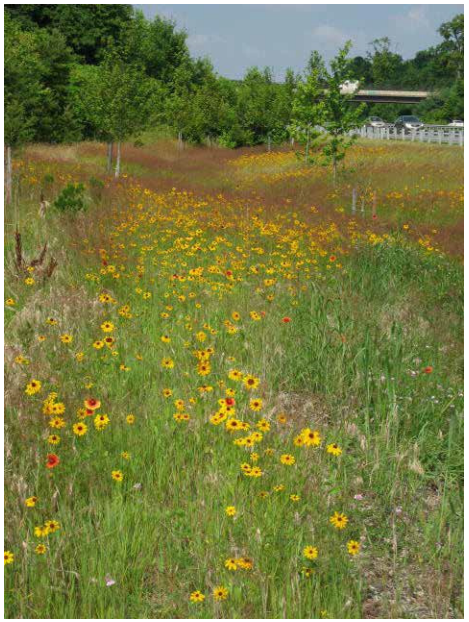
Both efforts of maintaining the current baseline and steadily increasing best practices to meet the trash loading reductions will be tracked and reported in the MS4 annual reports. Proposed end dates for meeting the reduction targets are indicated in **Table 3-2**. SHA will review new strategies and technology as they become available in order to further reduce trash loads. SHA will continue research to determine a trash load reduction for stormwater controls.

Part IV

SHA Watershed TMDL Implementation Plans







IV. SHA WATERSHED TMDL IMPLEMENTATION PLANS

A. ANACOSTIA RIVER WATERSHED

A.1. Watershed Description

The Anacostia Watershed encompasses 145 square miles across both Montgomery and Prince George's Counties, Maryland and an additional 31 square miles in Washington, DC. The watershed terminates in Washington, D.C. where the Anacostia River flows into the Potomac River, which ultimately conveys water to the Chesapeake Bay. The watershed is divided into 15 subwatersheds: Briers Mill Run, Fort Dupont Tributary, Hickey Run, Indian Creek, Little Paint Branch, Lower Beaverdam Creek, Northeast Branch, Northwest Branch, Paint Branch, Pope Branch, Sligo Creek, Still Creek, Upper Beaverdam Creek, Watts Branch, and the tidal river.

There are 1,815.3 miles of SHA roadway located within the Anacostia Watershed. The associated ROW encompasses 4,861.6 acres, of which 2,329.2 acres are impervious. SHA facilities located within the Anacostia River Watershed consist of three park and ride facilities, three salt storage facilities, one highway office, one weigh station, and one highway garage/shop. See **Figure 4-1** for a map of the watershed

A.2. SHA TMDLs within Anacostia Watershed

TMDLs requiring reduction by SHA in the Anacostia Watershed include trash and PCBs as shown in **Table 3-2** (MDE, 2010a; MDE, 2011a). The allocated trash baseline for SHA is to be reduced by 100 percent (this does not mean that trash within the watershed will be reduced to zero). The allocation is divided into separate requirements for each County.

PCBs are to be reduced in certain sub-watersheds of the Anacostia River. The Anacostia River Northeast Branch Sub-Watershed requires a 98.6 percent reduction and the Anacostia River Northwest Branch Sub-Watershed requires a 98.1% reduction. The Anacostia River Tidal Sub-Watershed is included in the Tidal Potomac PCB TMDL. However, PCB reduction requirements for this portion of the watershed have not been determined. Instead of publishing a reduction percentage, the MDE Data Center said "see report." Because of the way reductions are listed in tables in the TMDL report, with totals added together either by tributary or segments or jurisdiction, it is not possible to determine a load reduction for these waterbodies so that SHA's requirement could be calculated.

A.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-2**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional impervious treatment due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. The remaining grids needing review will be addressed in future tasks. The current results of this ongoing grid search are as follows:

101 Total Grids:

- Nine fully reviewed;
- 46 partially reviewed - in progress;
- 46 awaiting review (42 percent of total grids);

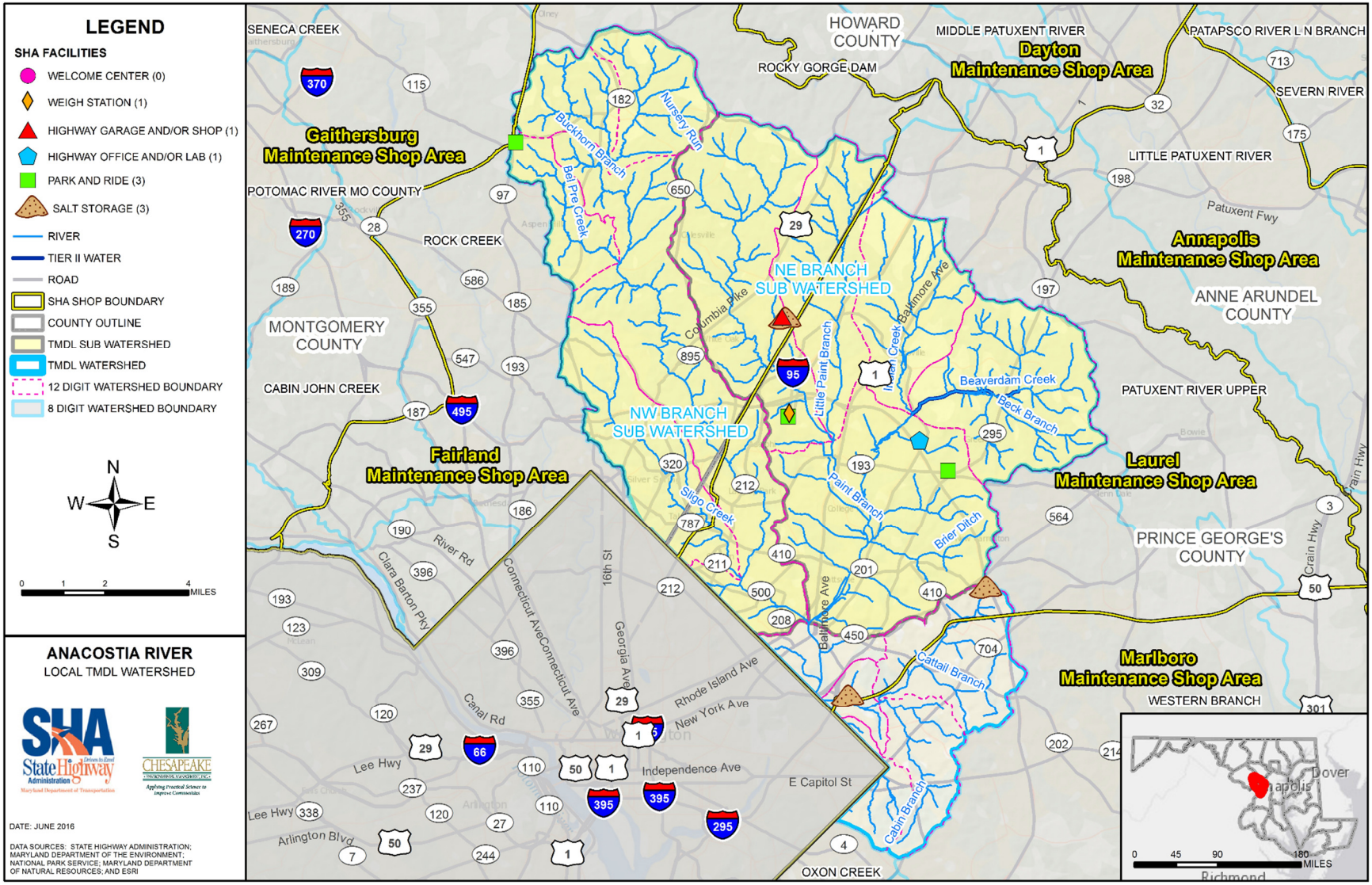


Figure 4-1: Anacostia River Watershed and SHA Facilities

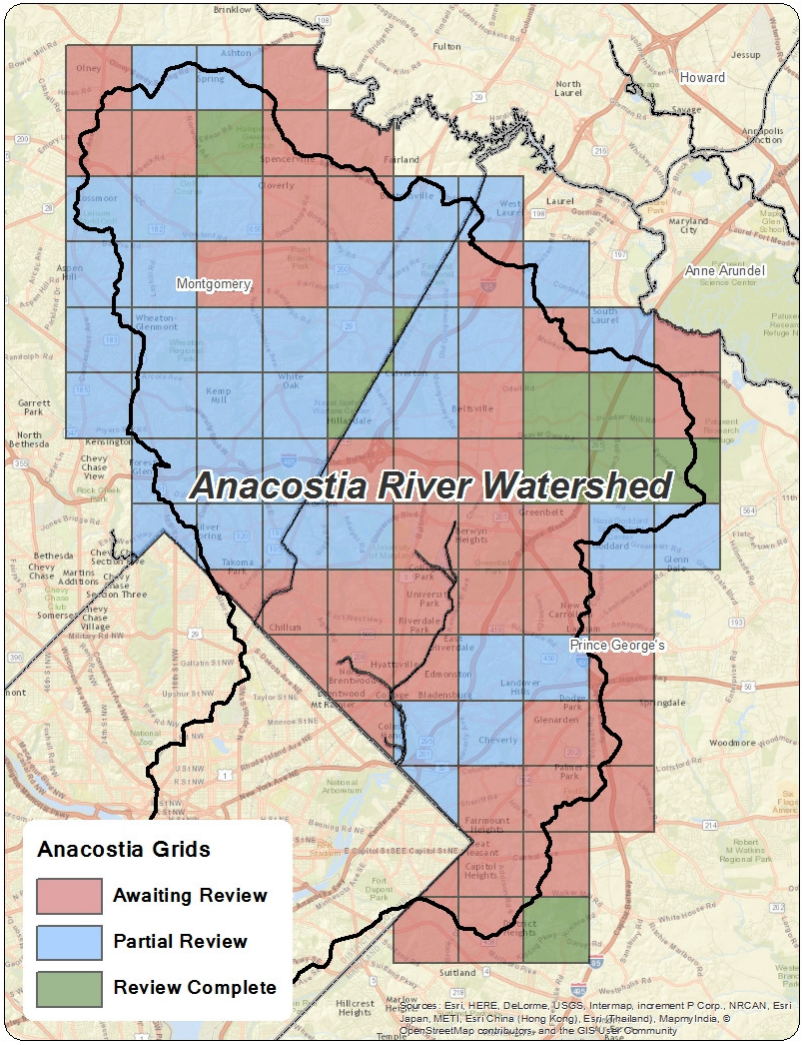


Figure 4-2: Anacostia Site Search Grids

The stormwater site search resulted in a pool of potential sites comprised the following:

- 148 locations identified as possible candidates for new stormwater BMPs;
- 28 facilities undergoing concept design and may be candidates for design contracts in the near future;
- Six retrofit of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 2,728 acres of SHA-owned pervious area. The ongoing site search has resulted in a pool of potential sites comprised of the following:

- 1.5 acres are undergoing concept design and may be candidates for planting contracts in the future; and
- 28 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 235,452 linear feet of stream channel for restoration opportunities. The site search has resulted the following:

- 71,205 linear feet recommended for future restoration potential

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

A.4. Summary of County Assessment Review

Waters within the Anacostia Watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Biochemical oxygen demand (BOD);
- Channelization;
- Chlordane;
- Chlorides;
- Debris/Floatables/Trash;
- *Enterococcus;*
- Heptachlor Epoxide;
- Lack of Riparian Buffer;
- Mercury in Fish Tissue;
- Nitrogen (Total);
- PCB in Fish Tissue;
- Phosphorus (Total);
- PCBs;
- Sulfates; and
- TSS

Both Montgomery and Prince George's Counties have conducted a watershed assessment for areas within the Anacostia River watershed. These include the 2012 Anacostia WIP produced by Montgomery County Department of Environmental Protection and the 2014 Draft Implementation Plan for the Anacostia River Watershed by the Prince George's County Department of the Environment (MC-DEP, 2012; PGC-DoE, 2014). Prince George's County also prepared a Restoration Plan for PCB-Impacted Waterbodies in Prince George's County in 2015 (PGC-DoE, 2015).

Many areas of the Anacostia watershed were developed prior to modern SWM and erosion and sediment control regulations. Impervious land cover comprises a large portion of the watershed (24 percent). Montgomery County identified 6,917 acres (18 percent) with impervious cover. Likewise, the Restoration Plan for the Anacostia River Watershed in Prince George's County identifies 15,435.3 acres (28.5 percent) of impervious cover. In Montgomery County alone, impervious cover contributes 206,312 lbs. per year of nitrogen, 20,953 lbs. per year of phosphorus, and 7,682 tons per year of sediment, to the watershed.

The subwatersheds in Prince George's County were prioritized by ranking the necessary total load reductions for each TMDL parameter. Montgomery County mapped individual stream areas for restoration opportunity prior to 2012, but may have restored several already. Montgomery County noted that according to their testing parameters, Lower Paint Branch, Little Paint Branch, Northwest Branch, and Sligo Creek received consistent "poor" ratings, and should be targeted for restoration efforts.

From 2009-2013 benthic invertebrate surveys were conducted throughout Montgomery and Prince George's Counties. Of the sampled sites, 91 percent of Montgomery County sites were rated as "fair" or "poor," while approximately 50 percent of sites in the most recent round of sampling in Prince George's County were rated as "poor" or "very poor." As a result of the studies, both counties identified several similar restoration strategies for meeting pollution reduction and improvement goals within the watershed. These include:

- Stormwater retrofit;
- Stream restoration;
- Wetland creation/restoration;
- Fish blockage removal/modification;
- Riparian reforestation/street tree planting;
- Green roof;
- Dry water pond;
- Bioswales;
- Permeable pavements/sidewalks;
- Rain gardens and rain barrels;
- Street sweeping; and

- Downspout disconnection.

Additionally, trash reduction strategies are also discussed by both Counties. Trash loading within the watershed is categorized by land use. The trash reduction strategies have been broken into 4 categories including structural, educational, municipal, and enforcement. In both counties, 68 percent of this reduction will be addressed by structural BMPs and the rest (32 percent) from outreach and enforcement activities. All trash reduction efficiencies are a percent reduction from the loading rate of the area's land use. **Table 4-1** outlines the strategies and efficiencies for each.

Table 4-1: County Preferred Trash Reduction Strategies and Efficiencies

BMP Program	Category	Unit Reduction Efficiency
SWM and ESD BMPs	Structural	95% of Drainage Area Loading Rate
Trash Interceptors	Structural	90% of Drainage Area Loading Rate
Land Use Change to Reduce Loading Rate	Municipal	Depends on Land Use
Anti-Littering Campaign	Educational	12% Reduction of Residential Land Use Loading Rate
Recycling Education and Enforcement	Educational, Municipal, and Enforcement	25% Reduction of Land Use Loading rate within Areas with Recycling Service
Plastic Bag Ban	Educational, Municipal, and Enforcement	30% of Total Load
Enforcement of Littering and Illegal Dumping	Enforcement	5% Reduction of Industrial and Commercial Land Use Loading Rate

Many of these strategies are not available to SHA since it is not a municipal entity with its own enforcement capacity. Also, SHA ROW only has a single land use category being transportation, so changes in land use categories would not be possible. Therefore, the most suitable strategies that would apply to SHA include structural and educational strategies.

PCB Reduction

Part III, Coordinated TMDL Implementation Plan outlines strategies for PCB reduction. The primary strategy for additional and targeted PCB reduction is the development of a source tracking and elimination program that traces the contamination back to its source and removes it from the system. The source tracking program identifies areas where PCB sources have been documented or are likely to exist. These areas will be assessed to target BMPs (e.g., stormwater ponds) and waterways where PCBs are most likely to have been carried by stormwater. Sediments in these BMPs and waterways will then be sampled and analyzed to determine PCB concentrations. If present above the action level, the PCB-impacted sediments will be removed from the system and the County will take credit for the PCB load reduction. Ideally, the originating source of PCBs can be immediately identified and corrected during the source removal/remediation phase.

The ROW is public space that is owned and maintained either by the County or SHA. Some of these areas may have a high density of substations and transformers that could contain PCBs, particularly in industrial, commercial, and high-density urban areas. BMPs receiving runoff from such ROW areas will be a priority focus area if there are no access restrictions involved.

Superfund sites have high potential for PCB source pollution. Prince George's County Superfund sites and their known PCB presence are listed in **Table 4-2**.

As a whole, structural and nonstructural BMPs have been implemented by the County including permit compliance, TMDL WLAs, flood mitigation, and more. Prince George's County has also engaged in street sweeping, public outreach to promote environmental awareness,

green initiatives and community involvement in protecting natural resources.

Table 4-2: Prince George's County Superfund Sites

Site Name	City	Known PCBs
Andrews Air Force Base (AFB)	Andrews AFB	X
Beltsville Agriculture Research Center (BARC)	Beltsville	X
Brandywine Defense Reutilization and Marketing Office (DRMO)	Brandywine	X
Chillum Gasoline Release	Chillum	
Chillum Perchloroethylene (PERC)	Chillum	
Laurel Chlorine Cylinder	Laurel	
Nazcon Concrete	Beltsville	
Roger's Electric Company	Cheverly	X
Windsor Manor Road	Brandywine	

A.5. SHA Pollution Reduction Strategies

Proposed practices to meet PCB reduction in the Anacostia River Northwest Branch and Northeast Branch watersheds are shown in **Table 4-3** and **4-4**, respectively. Projected PCB reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline year through 2025. For the Anacostia River Northwest Branch and Northeast Branch TMDL, the baseline is 2005.
- BMPs built between 2026 through 2045, the projected target. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Anacostia River Northwest Branch and Northeast Branch watersheds total $4,446,000 and $10,216,000, respectively. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $265,000 from the Operations Budget is estimated for annual inlet cleaning.

Proposed practices to meet trash reduction in the Anacostia River Montgomery County and Prince George's County portion of the watershed are shown in **Table 4-5** and **4-6**, respectively. Projected trash reduction efforts are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Two timeframes are included in the table:

- Reduction activities implemented after the TMDL baseline year through 2025. For the Anacostia River Montgomery and Prince George's County portions of the TMDL, the baseline is 2009.
- Reduction activities implemented between 2026 through the projected target date of 2045. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

SHA expects to spend $73,440 annually from the Operations Budget for an annual increase in inlet cleaning, yearly maintenance of a new public trash education program, stream cleanup, annual trash pickup from newly constructed stormwater facilities, and increased roadside trash pickup.

Figure 4-3 shows a map of SHA's watershed restoration practices and includes those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-3: Anacostia River NW Branch Restoration PCB BMP Implementation					
BMP	**Unit**	**2006-2025**	**2026-2035**	**Total**	**Cost**
New Stormwater	drainage area acres	16.5	9.2	25.6	$3,760,000
Retrofit	drainage area acres	43.6		43.6	$686,000
Inlet Cleaning[1]	tons	136.5	136.5	136.5	$130,000
[1] *Inlet cleaning is an annual practice.*					

Table 4-4: Anacostia River NE Branch Restoration PCB BMP Implementation					
BMP	**Unit**	**2006-2025**	**2026-2035**	**Total**	**Cost**
New Stormwater	drainage area acres	38.6	24.9	63.5	$9,052,000
Retrofit	drainage area acres	33.1		33.1	$1,164,000
Inlet Cleaning[1]	tons	140.8	140.8	140.8	$135,000
[1] *Inlet cleaning is an annual practice.*					

Table 4-5: Anacostia Montgomery County Portion Trash Activities Implementation					
BMP	**Unit**	**2010-2025**	**2026-2035**	**Total**	**Cost**
Increased Inlet Cleaning	lbs/yr	1,068	1,692	2,670	$9,900
New Public Education Program	lbs/yr	30	45	725	$2,700
New Stream Clean Up	lbs/yr	0	0	0	$0
New Structural SW Controls Pickup	lbs/yr	43	65	108	$400
Increased Roadside Pickup	lbs/yr	1,106	1,659	2,765	$10,240
These trash reducing activities are an annual practice. Projected load reductions included here are based on a combination of historical and future projections for the purposes of this implementation plan. Actual reductions will be reported each FY in the SHA MS4 annual report.					

Table 4-6: Anacostia Prince George's County Portion Trash Activities Implementation					
BMP	**Unit**	**2010-2025**	**2026-2035**	**Total**	**Cost**
Increased Inlet Cleaning	lbs/yr	2,937	4,406	7,343	$27,200
New Public Education Program	lbs/yr	678	1,017	1,696	$6,300
New Stream Clean Up	lbs/yr	210	315	525	$2,000
New Structural SW Controls Pickup	lbs/yr	75	114	189	$700
Increased Roadside Pickup	lbs/yr	1,513	2,271	3,784	$14,000
These trash reducing activities are an annual practice. Projected load reductions included here are based on a combination of historical and future projections for the purposes of this implementation plan. Actual reductions will be reported each FY in the SHA MS4 annual report.					

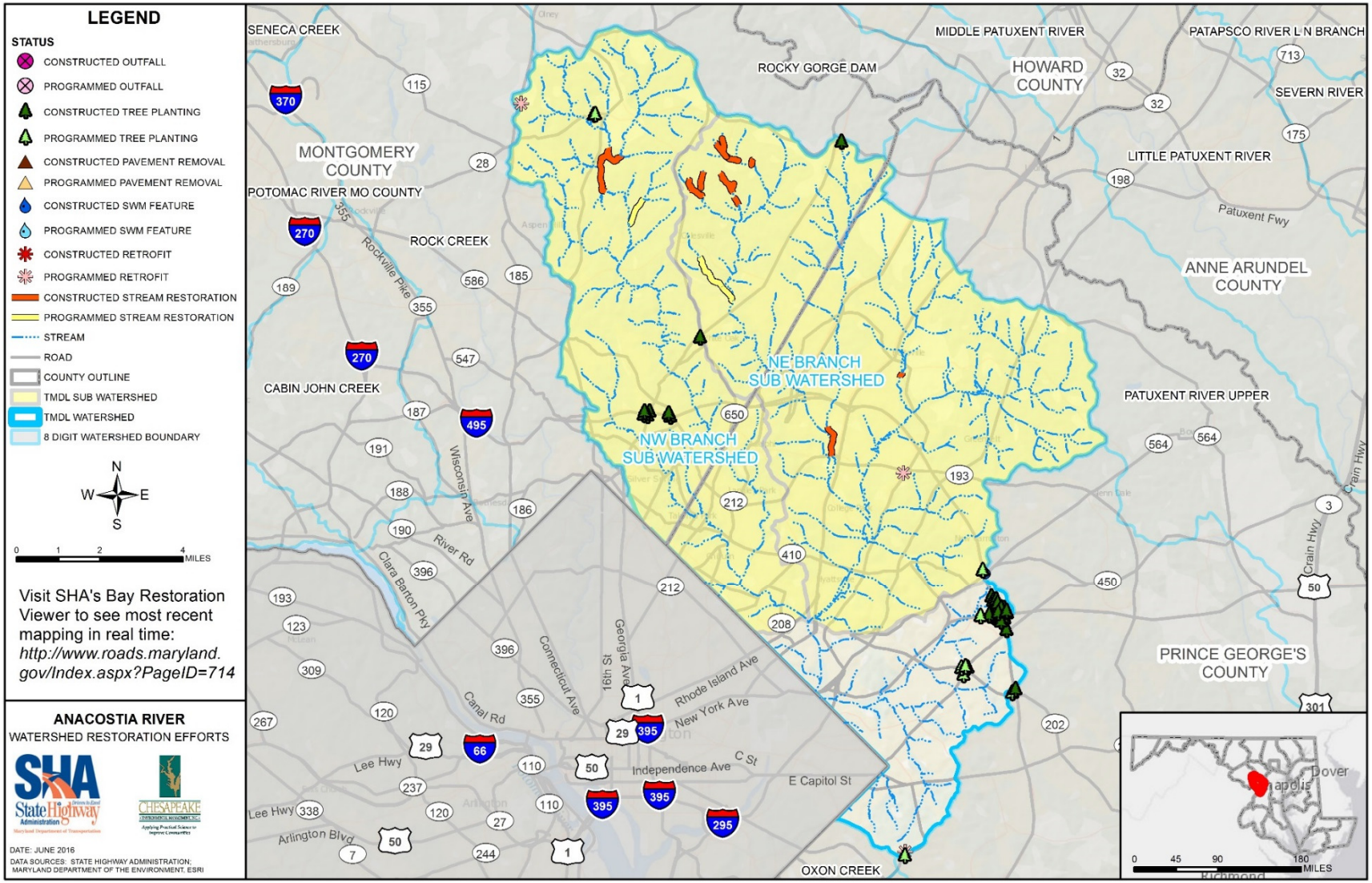


Figure 4-3: SHA Restoration Strategies within the Anacostia River Watershed

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B. ANTIETAM CREEK WATERSHED

B.1. Watershed Description

The Antietam Creek watershed encompasses 290 square miles with 185 square miles in Maryland. Approximately 75 percent of this watershed occurs in Washington County with the remainder in Franklin and Adams Counties, Pennsylvania. Antietam Creek flows about 54 miles from its headwaters in Pennsylvania's Michaux State Forest to the Potomac River near Antietam, Maryland. Major tributary creeks and streams of the Antietam Creek watershed in Maryland include Little Antietam Creek, Beaver Creek, and Marsh Run.

There are 744.4 miles of SHA roadway located within the Antietam Creek Watershed. The associated ROW encompasses 2,201.3 acres, of which 853.2 acres are impervious. SHA facilities located within the watershed consist of five park and ride facilities, four salt storage facilities, and two highway garage/shop facilities. See **Figure 4-4** for a map of the watershed.

B.2. SHA TMDLs within Antietam Creek Watershed

TMDLs requiring reduction by SHA include phosphorus and sediment (TSS) (MDE, 2013a; MDE, 2008a). Phosphorus is to be reduced by 21.4 percent and sediment is to be reduced by 58.1 percent as shown in **Table 3-2**.

B.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-5**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. The remaining grids needing review will be addressed in future tasks. The current results of this ongoing grid search are as follows:

126 Total Grids:

- 50 fully reviewed;
- 71 partially reviewed - in progress; and
- Five awaiting review (4 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 762 locations identified as possible candidates for new stormwater BMPs;
- Four facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

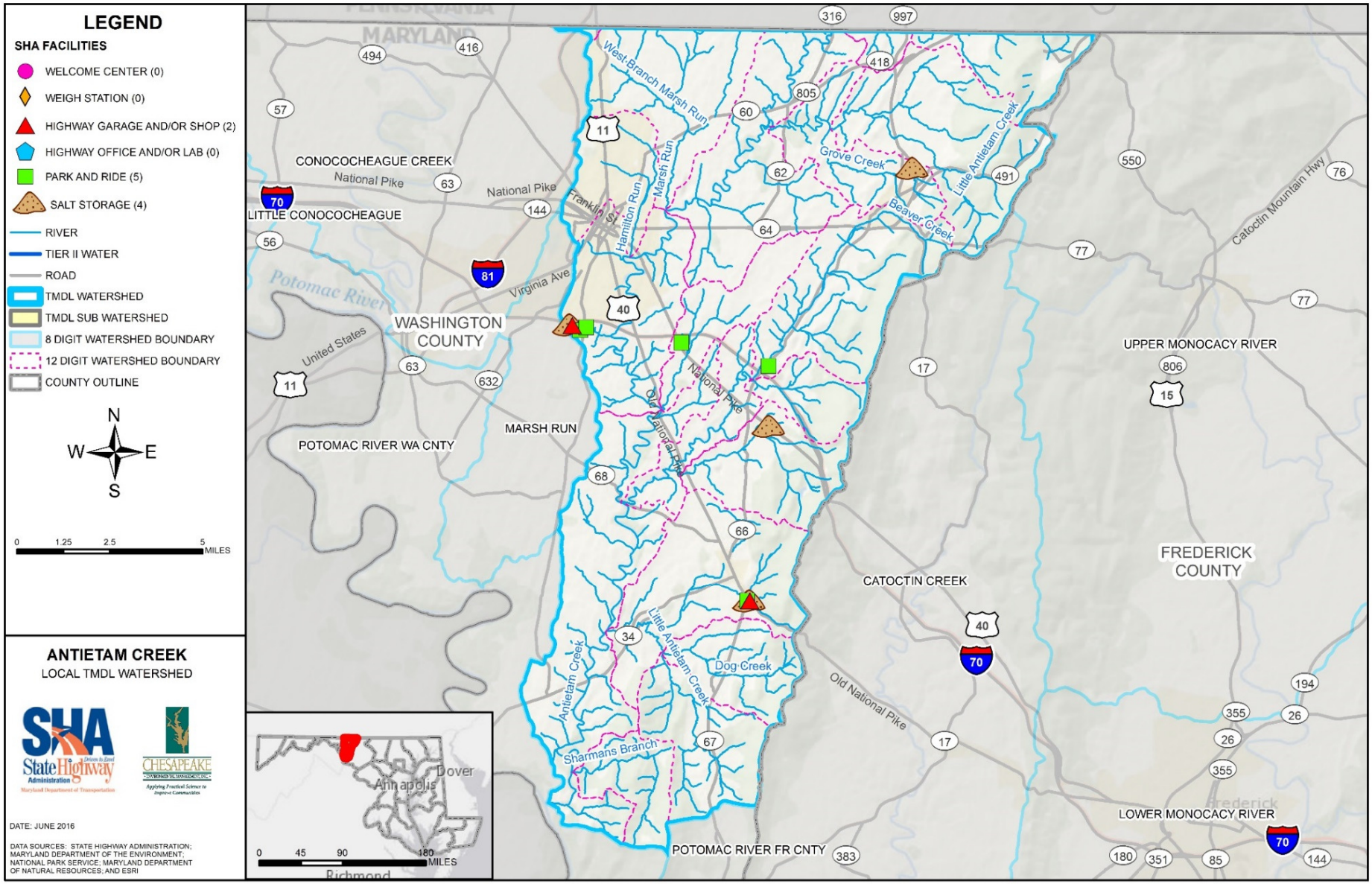


Figure 4-4: Antietam Creek Watershed

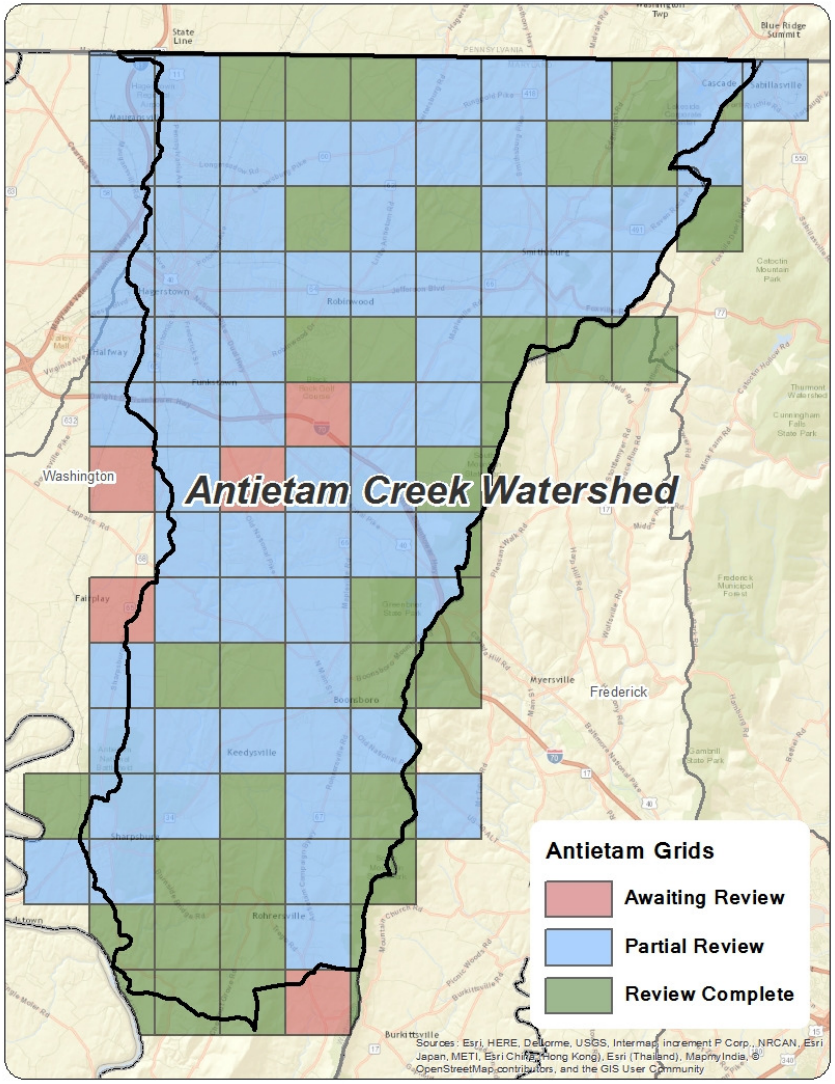


Figure 4-5: Antietam Creek Site Search Grids

The tree planting site search teams investigated 2,130 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised the following:

- 49 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 11,879 linear feet of stream channel for restoration opportunities. The site search resulted the following:

- 7,394 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on feasibility.

B.4. Summary of County Assessment Review

Waters within the Antietam Creek watershed are subject to the following impairments as noted on MDE's 303(d) List:

- BOD;
- Channelization;
- *Escherichia coli;*
- Lack of Riparian Buffer;
- Mercury in Fish Tissue;
- Nitrogen (Total);
- Nitrogenous biochemical oxygen demand (NBOD);
- PCB in Fish Tissue;
- Phosphorus (Total);
- Sulfates;
- Temperature; and
- TSS.

The 2012 *Antietam Creek Watershed Restoration Plan* was developed through a partnership (comprised of several organizations including MDE and led by the Washington County Soil Conservation

District [WCSCD]) as a comprehensive summary of the issues impacting the watershed area (WCSCD et al., 2012). Antietam Creek currently has completed TMDLs for phosphorus, TSS, and *E. coli*. However, TMDLs are still necessary for PCB in fish tissue, sulfates, and temperature (water).

The watershed has been divided into nine subwatersheds. Approximately 59% of the stream miles were classified as having Fish Index of Biotic Integrity (FIBI) and/or Benthic Index of Biotic Integrity (BIBI) in the "poor" to "very poor" category. After review and evaluation, it was determined that three of the nine watersheds be targeted for pollutant reduction implementation, ANT0277, MRS0000, and BEC0001.

Because a significant portion of the watershed is agricultural land use (42 percent), there are separate BMPs listed for agricultural practices and urban areas. The suggested BMPs for watershed restoration are shown in **Table 4-7**.

B.5. SHA Pollutant Reduction Strategies

Antietam Creek is listed for both phosphorus and sediment with each TMDL having a baseline year of 2000. Proposed practices to meet the phosphorus and sediment reductions in the Antietam Creek watershed are shown in **Table 4-8**. Projected phosphorus and sediment reductions using these practices based on modeling described in **Part III, Coordinated TMDL Implementation Plan** are shown in **Table 3-2**. Two timeframes are included in the table below:

- BMPs built after the phosphorus and sediment TMDL baseline through 2025. In this case the baselines are year 2000.
- BMPs built from 2026 through 2045, the projected target date of the sediment TMDL. 2040 is the projected target date for the phosphorus TMDL. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Antietam Creek watershed total $26,700,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $49,000 from the Operations Budget is estimated for annual inlet cleaning.

Table 4-7: Suggested BMPs in the Antietam Watershed

Agricultural BMPs	Urban BMPs
Pet Waste Runoff Campaign*	Bioretention/Rain Gardens*
Septic System Upgrades	Bio-Swale*
Grass Buffers*	Dry Detention Ponds*
Riparian Forest Buffers*	Dry Extended Detention Ponds*
Stream Protection with Fencing*	Forest Conservation (pervious only)*
Stream Protection without Fencing*	Impervious Urban Surface Reduction*
Livestock Stream Crossing	Permeable Pavement
Nutrient Management Planning*	Urban Forest Practices*
Runoff Control Systems*	Urban Filtering Practices*
Cover Crops	Urban Infiltration Practices*
Animals Waste Management	Street Sweeping*
Conservation Tillage	Urban Nutrient Management*
Retire Highly Erodible Lands	Vegetated Open Channel*
Natural Stream Designs/Armored Steam Banks*	Wet Ponds & Wetlands*
** Denotes practices that may be applicable to SHA's program*	

Figure 4-6 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-8: Antietam Creek Restoration Nutrient and Sediment BMP Implementation					
BMP	**Unit**	**2001-2025**	**2026-2045**	**Total**	**Cost**
New Stormwater	drainage area acres	220.4	148.1	368.4	$17,890,000
Retrofit	drainage area acres	29.0		29.0	$815,000
Stream Restoration	linear feet		1,500.0	1,500.0	$1,100,000
Tree Planting	acres planted	136.2	4.0	140.2	$4,713,000
Outfall Stabilization[1]	linear feet		1,000.0	1,000.0	$2,182,000
Inlet Cleaning[2]	tons	51.0	51.0	51.0	$49,000
[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits					
[2] Inlet cleaning is an annual practice.					

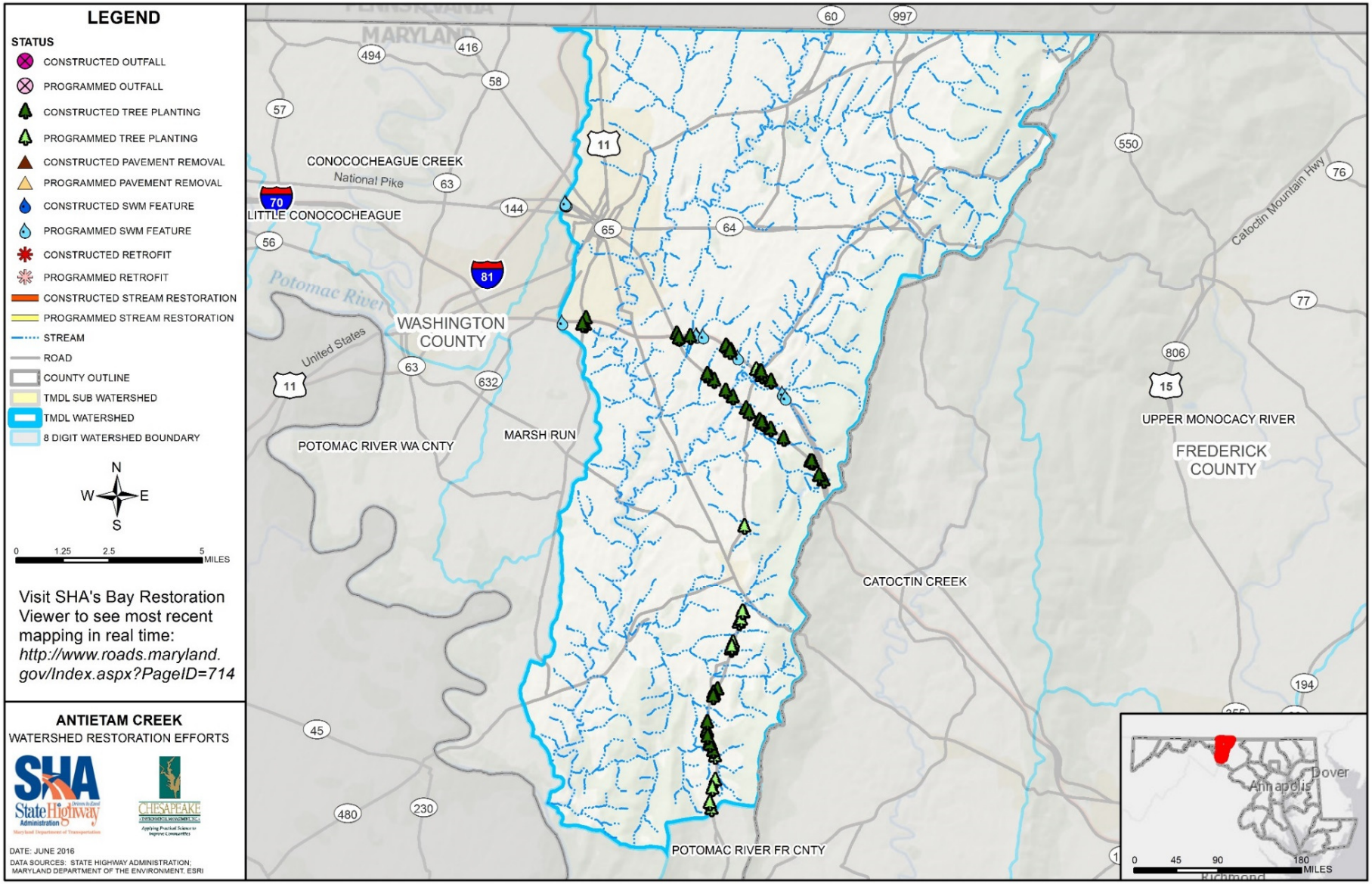


Figure 4-6: SHA Restoration Strategies within the Antietam Creek Watershed

C. BACK RIVER WATERSHED

C.1. Watershed Description

The Back River watershed encompasses 37 square miles in the western shore region of Maryland within City of Baltimore and Baltimore County. Back River drains into the Chesapeake Bay in Baltimore County. Major tributary creeks and streams of the Back River Watershed include Armistead Run, Biddison Run, Bread and Cheese Creek, Brien's Run, Chinquapin Run, Deep Creek, Duck Creek, Herring Run, Moore's Run, Northeast Creek, Redhouse Run, Stemmers Run, and Tiffany Run. The Back River Watershed is comprised of the Upper Back River (UBR) subwatershed and the Tidal Back River (TBR) subwatershed. The UBR subwatershed accounts for 78 percent of the Back River watershed and the TBR subwatershed accounts for the remaining 22 percent.

There are 869.3 miles of SHA roadway located within the Back River watershed. The associated ROW encompasses 1,532.3 acres, of which 718.4 acres are impervious. SHA facilities located within the Back River Watershed consist of three salt storage facilities, and two highway garage/shop facilities. See **Figure 4-7** for a map of the watershed.

C.2. SHA TMDLs within Back River Watershed

SHA is included in the PCB TMDL (MDE, 2012a) with a reduction requirement of 53.4 percent, as shown in **Table 3-2.**

C.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-8**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. The current results of this ongoing grid search are as follows:

40 Total Grids:

- Seven fully reviewed;
- 25 partially reviewed - in progress; and
- Eight awaiting review (20 percent of total grids).

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 81 locations identified as possible candidates for new stormwater BMPs;
- One retrofit of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

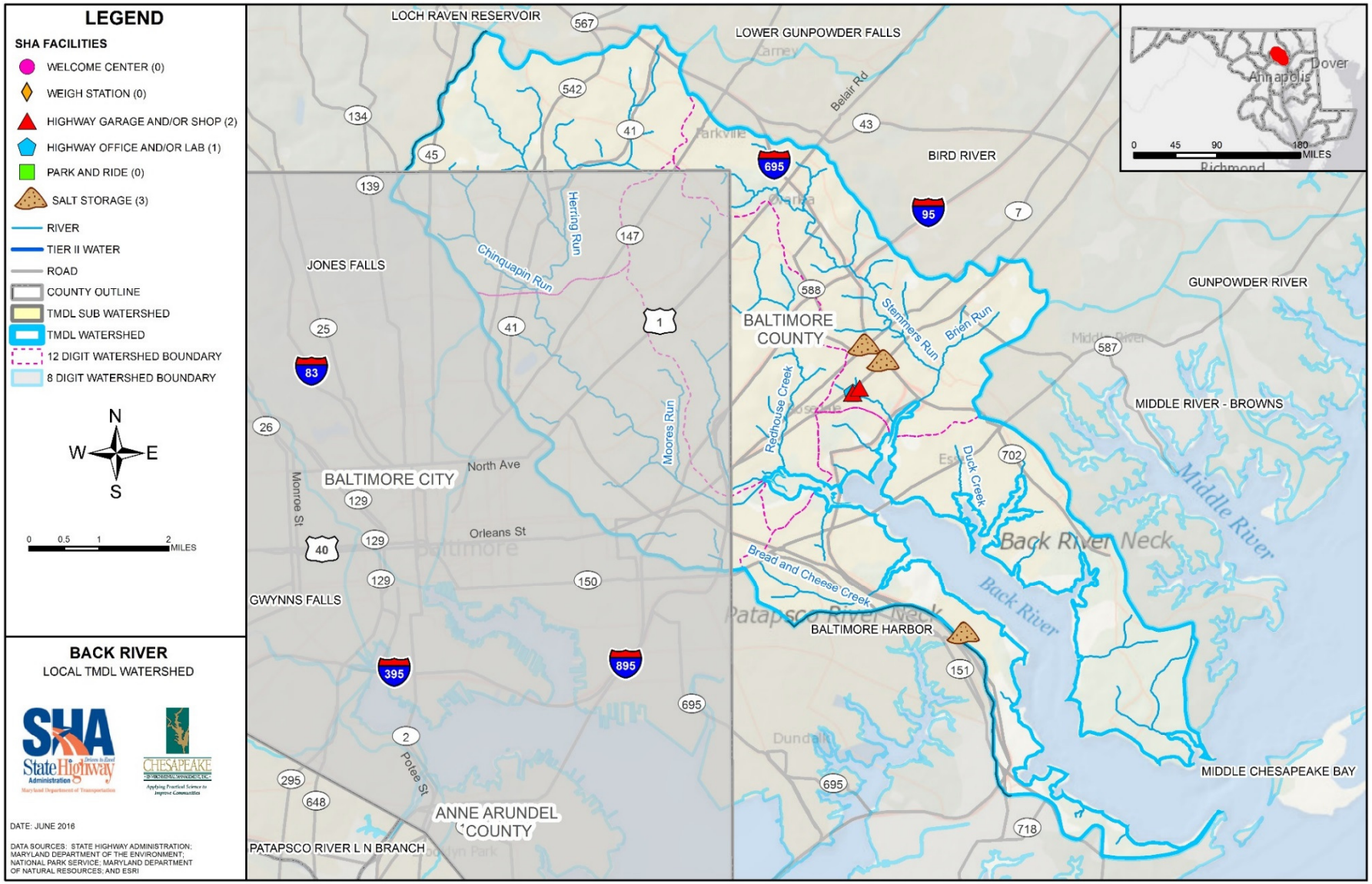


Figure 4-7: Back River Watershed

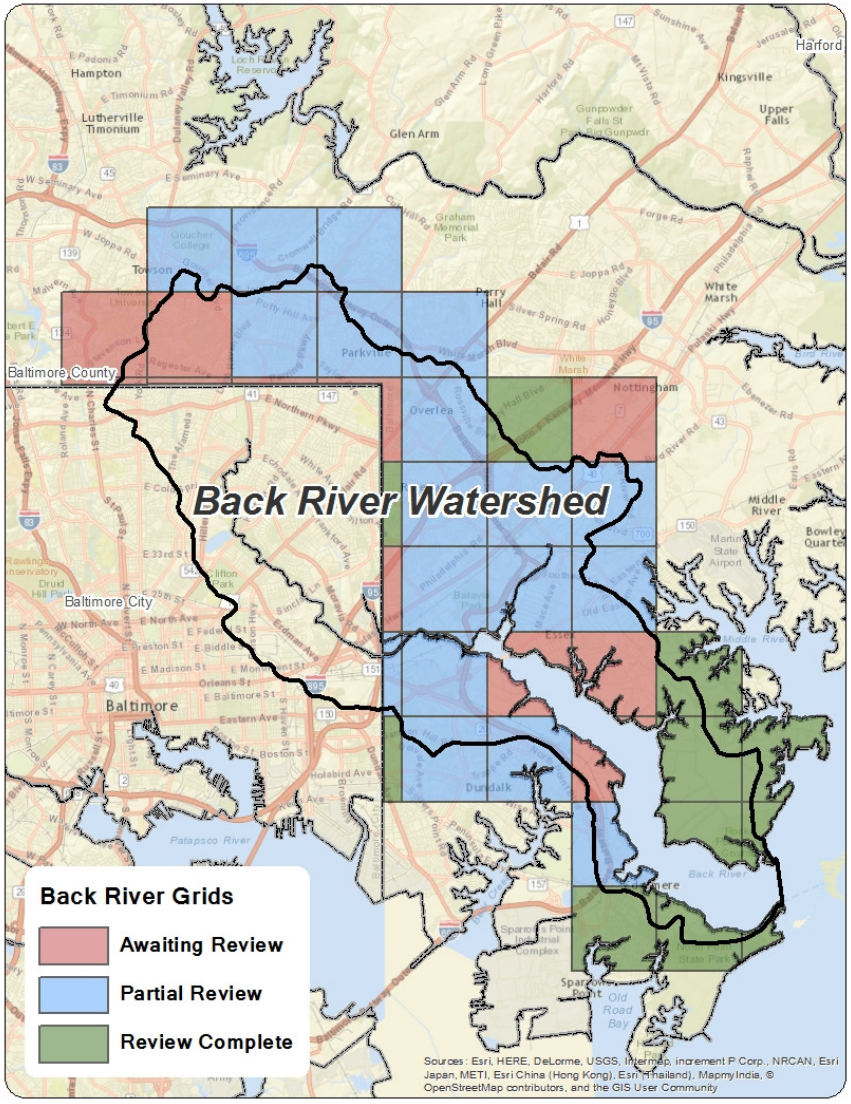


Figure 4-8: Back River Site Search Grids

The tree planting site search teams investigated 913 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 4 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 8,133 linear feet of stream channel for restoration opportunities. The site search resulted the following:

- 3,252 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on feasibility.

C.4. County Assessment Review Summary

Waters within the Back River watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Channelization;
- Chlordane;
- Chlorides;
- Fecal Coliform;
- Lack of Riparian Buffer;
- Mercury in Fish Tissue;
- Nitrogen (Total);
- PCB in Fish Tissue;
- Phosphorus (Total);
- PCBs;
- Sulfates;
- TSS; and
- Zinc.

The Baltimore County completed Small Watershed Action Plans (SWAPs) for the UBR Watershed in 2008 (BC-DEPRM, 2008a) and the TBR Watershed in 2010 (PB, 2010). Impervious land cover comprises 31 percent of the UBR watershed and 18 percent of the TBR watershed. Over 46 percent of soils within the UBR Watershed and over 25 percent of soils within the TBR watershed are considered of high runoff potential.

Baltimore County estimates that impervious urban land use is responsible for contributing 314,619 lbs. of nitrogen and 40,182 lbs. of phosphorus in the UBR watershed per year (BC-DEPRM, 2008a) and 19,444 lbs. of nitrogen and 3,117 lbs. of phosphorus in the TBR watershed per year (PB, 2010). Back River currently has completed TMDLs for nitrogen, phosphorus, TSS, chlordane, and PCBs in the Chesapeake Bay tidal segment and fecal coliform in the river mainstem (Herring Run). Back River also has Category Five impairment listings (i.e., TMDL required) for sediment, chlorides, and sulfates in 1st through 4th order streams.

The County SWAPs prioritized subwatersheds within the UBR and TBR Watersheds based on ranking criteria in order to identify which subwatersheds have the greatest need and potential for restoration. For the UBR Watershed, Chinquapin Run, Tiffany Run, Herring Run Mainstem, Armistead Run, Biddison Run, Moore's Run, and Redhouse Run were rated "very high" and West Branch Herring Run, East Branch Herring Run, and an unnamed tributary were rated "high" in terms of restoration need and potential (BC-DEPRM, 2008a). For the TBR Watershed, Deep Creek, Duck Creek, and Bread and Cheese Creek were rated "very high" and Lynch Point Cove, Back River-G, and Muddy Gut were rated "high" in terms of restoration need and potential. In the UBR Watershed, all sites assessed by Baltimore City (42) and County (25) had BIBI scores in the "poor" or "very poor" categories (PB, 2010).

For the purposes of planning, the County SWAPS suggest the following generalized restoration strategies to aid in meeting restoration goals within the Back River watershed:

- SWM for new development and redevelopment;
- Existing SWM facility conversions;
- SWM retrofits;
- Stream restoration;
- Street sweeping and storm drain inlet cleaning;
- Illicit connection detection and disconnection program and hotspot remediation;
- Sanitary sewer consent decrees;
- Downspout disconnection;
- Citizen awareness (fertilizer application and pet waste); and
- Reforestation and tree planting.

The County identified numerous potential restoration sites within each subwatershed by conducting neighborhood source assessments, hotspot site investigations, institutional site investigations, and pervious area assessments. The County also identified multiple potential stormwater conversions within each watershed: 91 for the UBR Watershed and three for the TBR Watershed. Detailed information on site locations can be found in the SWAPs.

The following potential stream restoration sties were identified within the Back River Watershed in **Table 4-9**. An additional six sites were also identified in the UBR watershed for SWM retrofit on County-owned property.

Table 4-9: Potential Stream Restoration Sites in Back River Watershed

Subwatershed	Reach	Number of Sites	Total Linear Feet	Conditions
UBR	Herring Run	24	12,675	-
UBR	Stemmers Run	30	23,488	-
UBR	Brien Run	10	8,603	-
TBR	Bread and Cheese Creek	4	2,600	Erosion, dumping, and inadequate buffers
TBR	Duck Creek	3	80	Severe dumping, inadequate buffers, and invasive vegetation
TBR	Muddy Gut	2	-	Severe dumping and disturbance (ATV Trails)
TBR	Deep Creek	4	1,315	Concrete channels, inadequate buffers, severe channel alterations, severe erosion (scouring), and severe fish barrier

C.5. SHA Pollutant Reduction Strategies

Proposed practices to meet PCB reductions in the Back River watershed are shown in **Table 4-10**. Projected PCB reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table below:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2001.
- BMPs built between 2026 through 2045, the projected target date. SHA will accomplish the percent reductions presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Back River watershed total $6,529,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $108,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-9 shows a map of SHA's restoration practices in the watershed and include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-10: SHA Practices Proposed for Back River PCB Reduction

BMP	Unit	2002-2025	2026-2045	Total	Cost
New Stormwater	drainage area acres	25.3	21.8	47.1	$5,503,000
Retrofit	drainage area acres	21.4		21.4	$1,026,000
Inlet Cleaning[1]	tons	112.9	112.9	112.9	$108,000

1. Inlet cleaning is an annual practice.

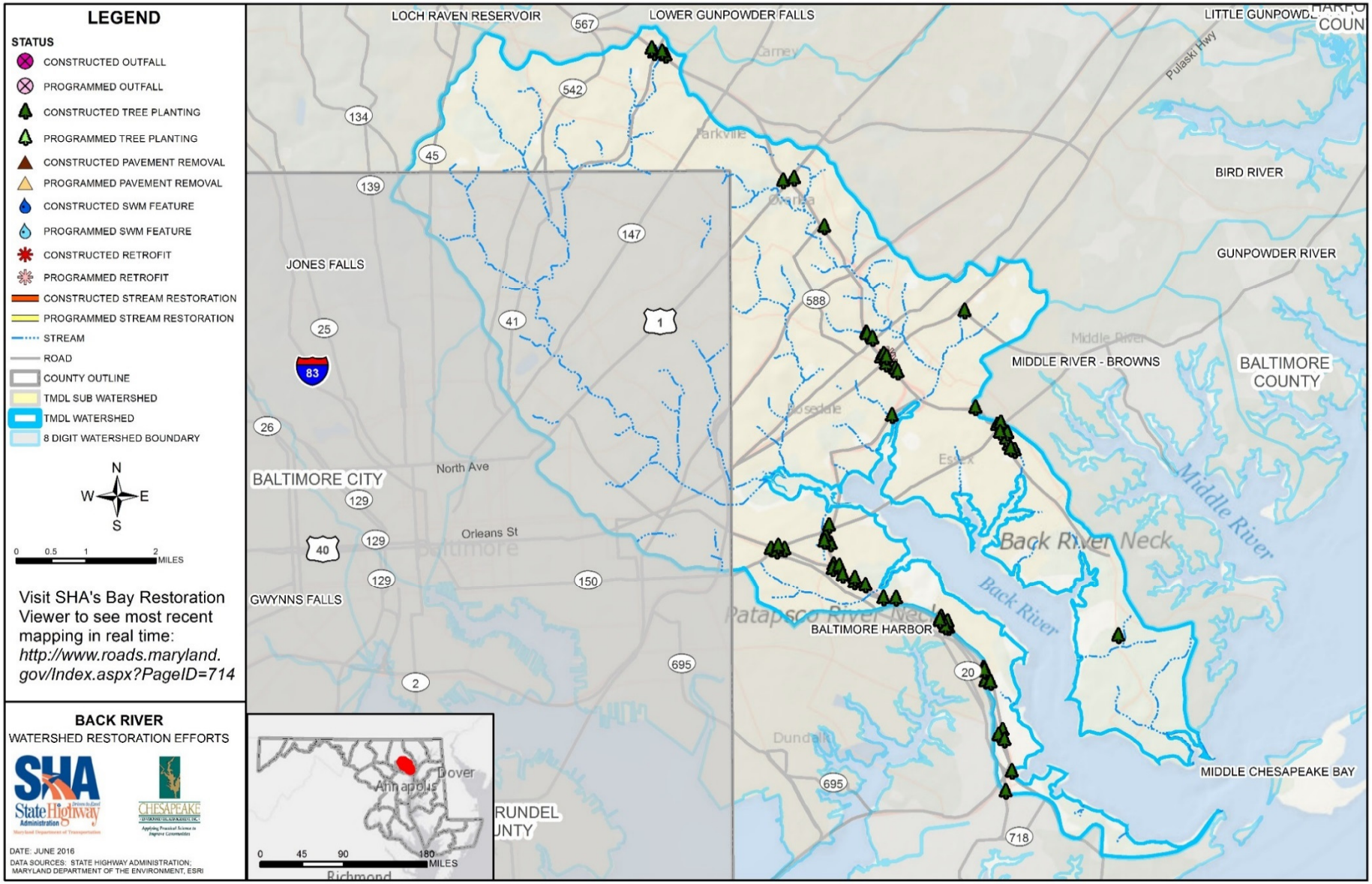


Figure 4-9: SHA Restoration Strategies within the Back River Watershed

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D. BALTIMORE HARBOR

D.1. Watershed Description

The Baltimore Harbor watershed encompasses 90 square miles within Anne Arundel County, Baltimore County, and Baltimore City. The watershed is located in the Western Shore region of Maryland south of the Back River watershed and ultimately drains into the Chesapeake Bay. Tributaries of the Baltimore Harbor watershed include Gwynns Falls, Jones Falls, Bear Creek, and Curtis Bay/Creek. The areas of focus for the TMDLs in this watershed are within the subwatersheds of Baltimore Harbor Embayment, Bear Creek, Curtis Creek, Furnace Creek, and Marley Creek in Baltimore and Anne Arundel counties.

There are 1,258 miles of SHA roadway located within the Baltimore Harbor watershed. The associated ROW encompasses 2,374 acres, of which 1,031 acres are impervious. SHA facilities located within the watershed consist of two salt storage facilities, and one highway garage/shop. See **Figure 4-10** for a map of the 8-digit Baltimore Harbor watershed with SHA facilities indicated.

D.2. SHA TMDLs within Baltimore Harbor

SHA is included in both PCBs (MDE, 2012b) and bacteria (MDE, 2011b) TMDLs. PCBs are to be reduced by 91.1% in the Baltimore Harbor Embayment, Anne Arundel County, 91.4 percent in the Baltimore Harbor Embayment, Baltimore County, 93.5 percent in the Curtis Creek subwatershed, and 91.5 percent in the Bear Creek subwatershed as shown in **Table 3-2**. Bacteria must be reduced by 75.8 percent in the Marley Creek subwatershed and 77.8 percent in the Furnace Creek subwatershed as shown in **Table 3-3**.

D.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. Within this watershed, SHA is currently evaluating grids and will continue to do so until all are completed and accepted. The grid-tracking methodology was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5 mile square system as shown in **Figure 4-11**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking methodology.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, many SHA impervious areas within these grids are already treated by SHA BMPs. The current results of this ongoing grid search are as follows:

58 Total Grids:

- 21 fully reviewed;
- 20 partially reviewed - in progress; and
- 17 awaiting review (29 percent of total grids).

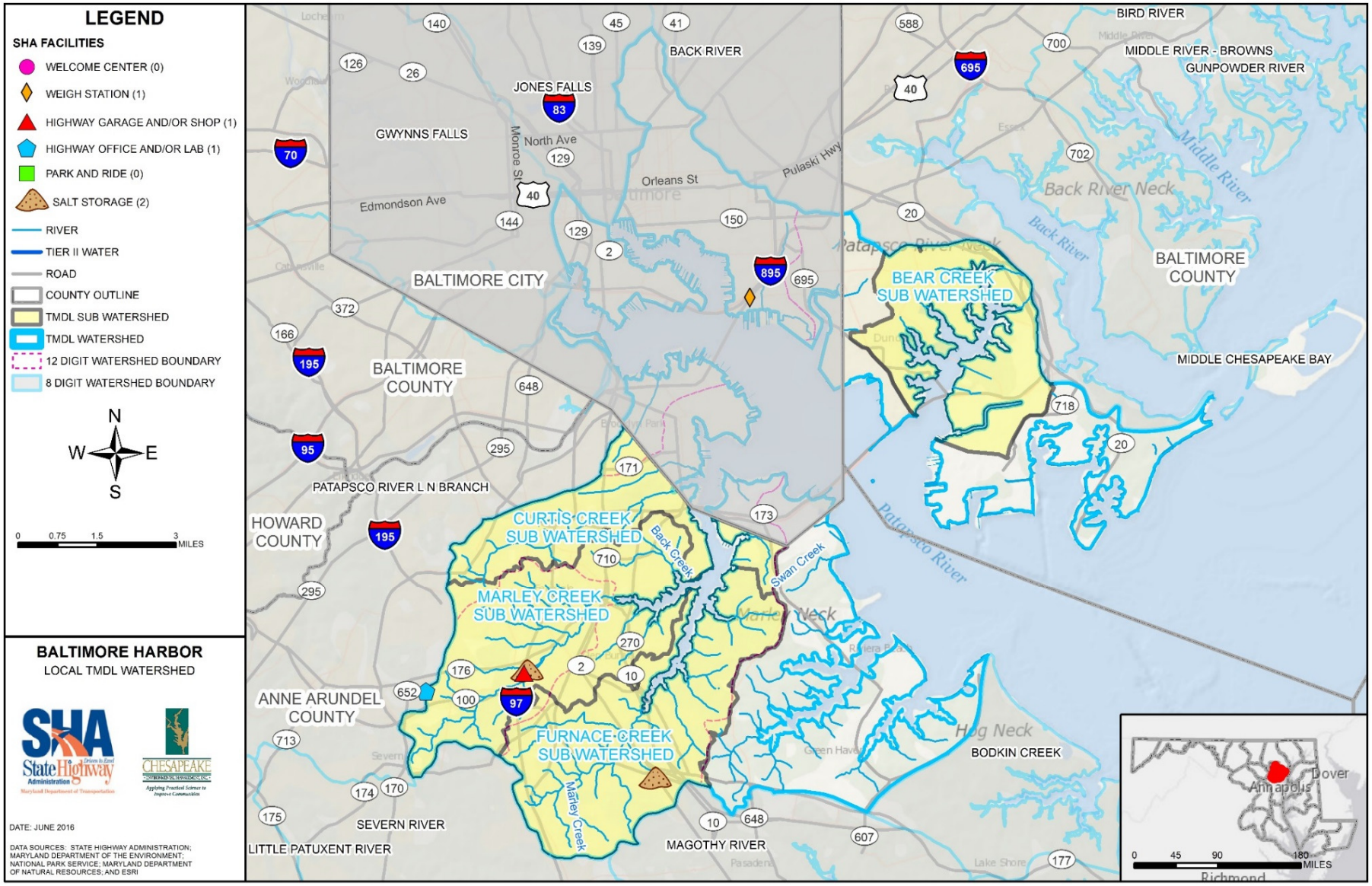


Figure 4-10: Baltimore Harbor Watershed

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 91 locations identified as possible candidates for new stormwater BMPs;
- 39 facilities undergoing concept design and may be candidates for design contracts in the near future;
- Six retrofit of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations undergoing review.

The tree planting site search teams investigated 1,119 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- Four acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- 67 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 7,615 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 5,622 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

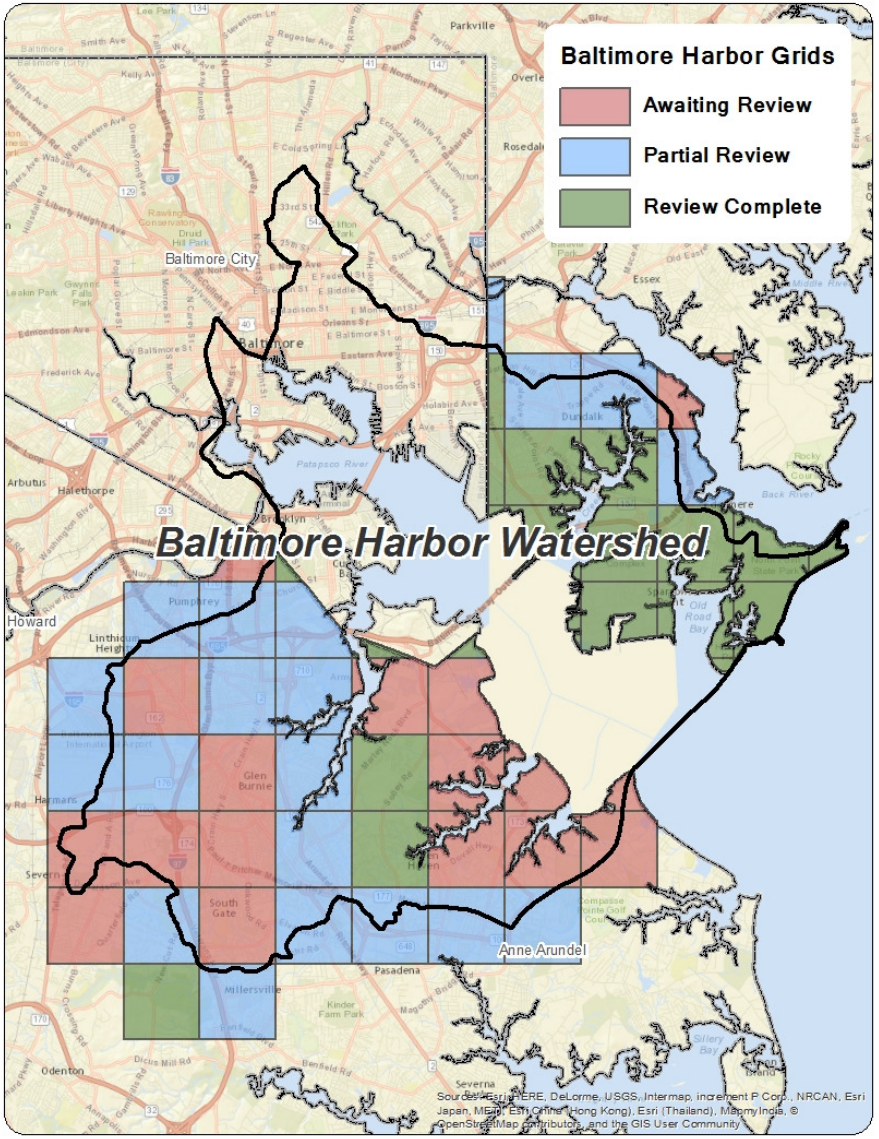


Figure 4-11: Baltimore Harbor Site Search Grids

D.4. Summary of County Assessment Reviews

Waters within the Baltimore Harbor Watershed are subject to the following impairments as noted on MDE's 303(d) List.

- Channelization;
- Chlordane – sediments;
- Chlorides;
- Lack of Riparian Buffer;
- PCB in Fish Tissue;
- Sulfates; and
- TSS;

Anne Arundel County's Department of Public Works participated in a collaborative effort to prepare the *Patapsco Tidal and Bodkin Creek Watershed Assessment* (LimnoTech & Versar, 2012). The assessment determines the condition and prioritizes watershed management activities for areas within the Baltimore Harbor watershed. Bodkin Creek watershed is also included in the County's assessment, but is not part of the Baltimore Harbor 8-digit watershed area.

The majority of soils within the Patapsco Tidal subwatersheds are highly erodible (58 percent). Residential land cover dominates the Patapsco Tidal watershed (40 percent), attributing to 30 percent impervious area over the entire watershed.

Both Patapsco Tidal and Bodkin Creek watersheds fall within the Patapsco River Mesohaline segment-shed which has Chesapeake Bay TMDLs for phosphorus, nitrogen, and TSS and a Baltimore Harbor (Anne Arundel, Baltimore, Carroll, and Howard Counties and Baltimore City) TMDL for nitrogen and phosphorus. The Patapsco River Mesohaline segment-shed also has a Category Five impairment listing (i.e., TMDL required) for Enterococcus in tidal waters upstream of the Harbor Tunnel. Approximately 16 percent of the streams evaluated in the Patapsco Tidal watershed were classified as "severely degraded" by the Maryland Physical Habitat Index. Three subwatersheds were identified to have the highest percentages of stream reaches that were either "degraded" or "severely degraded": Cabin Branch 2, Marley Creek 1, and Cabin Branch SWS.

The County identified five subwatersheds within the Patapsco Tidal watershed with more than one-third of their perennial streams rated as "high" or "medium high" for restoration need: Cabin Branch (PT3), Cabin Branch 2 (PT2), Marley Creek 1 (PT8), Marley Creek 3 (PTF), and Sawmill Creek 1 (PT7). Six subwatersheds were identified in Patapsco Tidal for BMP implementation: Marley Creek 3 (PTF), Furnace Creek (PT5), Cabin Branch (PT3), Sawmill Creek 1 (PT7), Back Creek (PTC), and Marley Creek 2 (PTE).

The County suggests the following BMPs for the Patapsco Tidal and Bodkin Creek watersheds:

- Outfall retrofits – all major outfalls characterized by the IMD as impaired;
- Stormwater pond retrofits – all ponds constructed prior to 2002 with a drainage area greater than 10 acres;
- Stream restoration – targeting degraded and severely degraded reaches;
- Street Sweeping – all closed curbed County roads;
- Inlet cleaning – vacuum cleaning stormwater curb inlets and catch basins;
- Public land reforestation; and
- ESD retrofit to the MEP – including green roofs, permeable pavement, bioretention, etc.

The County ranked several stream reaches based on priority for restoration as shown in **Table 4-11**, with the value one being the highest priority:

Table 4-11: County Identified Priority Areas for Treatment			
Priority	**Watershed**	**Subwatershed**	**Reach**
1	Patapsco Tidal	Marley Creek 3	PTF016
3	Patapsco Tidal	Rock Creek	PTB048
4	Patapsco Tidal	Cabin Branch 2	PT2026
4	Patapsco Tidal	Cabin Branch	PT3039
10	Patapsco Tidal	Marley Creek 4	PTG086
10	Patapsco Tidal	Cabin Branch	PT3010

D.5. SHA Pollutant Reduction Strategies

Proposed practices to meet PCB reduction in the Baltimore Harbor Embayment, Bear Creek, and Curtis Creek/Bay subwatersheds are shown in **Tables 4-12**, **4-13**, and **4-14**, respectively. Projected PCB reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Two timeframes are included in the tables:

- BMPs built after the TMDL baselines through 2025. In this case the baseline is 2004; and
- BMPs built between 2026 through 2038, the projected target dates. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Baltimore Harbor Embayment, Bear Creek, and Curtis Creek/Bay watersheds total $708,000, $4,549,000, and $15,992,000, respectively. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $97,000 from the Operations Budget is estimated for annual inlet cleaning.

Proposed practices to meet bacteria reduction in the Marley Creek and Furnace Creek subwatersheds are shown in **Table 4-15**. Projected bacteria reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-3**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2006.
- BMPs built between 2026 through 2050, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-3**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Marley Creek and Furnace Creek watersheds total $11,614,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category.

Figure 4-12 shows a map of SHA's restoration practices in the watersheds and includes those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-12: Baltimore Harbor Embayment Restoration PCB BMP Implementation					
BMP	**Unit**	**2005-2025**	**2026-2038**	**Total**	**Cost**
New Stormwater	drainage area acres	3.9	3.1	7.0	$708,000
Inlet Cleaning[1]	tons	7.3	7.3	7.3	$7,000
[1] Inlet cleaning is an annual practice.					

Table 4-13: Bear Creek Restoration PCB BMP Implementation					
BMP	**Unit**	**2005-2025**	**2026-2038**	**Total**	**Cost**
New Stormwater	drainage area acres	35.6	7.7	43.3	$4,549,000
Inlet Cleaning[1]	tons	16.7	16.7	16.7	$16,000
[1] Inlet cleaning is an annual practice.					

Table 4-14: Curtis Creek/Bay Restoration PCB BMP Implementation					
BMP	**Unit**	**2005-2025**	**2026-2038**	**Total**	**Cost**
New Stormwater	drainage area acres	63.3	10.7	74.0	$9,390,000
Retrofit	drainage area acres	177.6		177.6	$6,602,000
Inlet Cleaning[1]	tons	76.9	76.9	76.9	$74,000
[1] Inlet cleaning is an annual practice.					

Table 4-15: Marley and Furnace Creeks Restoration Bacteria BMP Implementation					
BMP	**Unit**	**2007 - 2025**	**2026 - 2050**	**Total**	**Cost**
New Stormwater	drainage area acres	36.2	9.2	45.4	$5,918,000
Retrofit	drainage area acres	152.0		152.0	$5,696,000

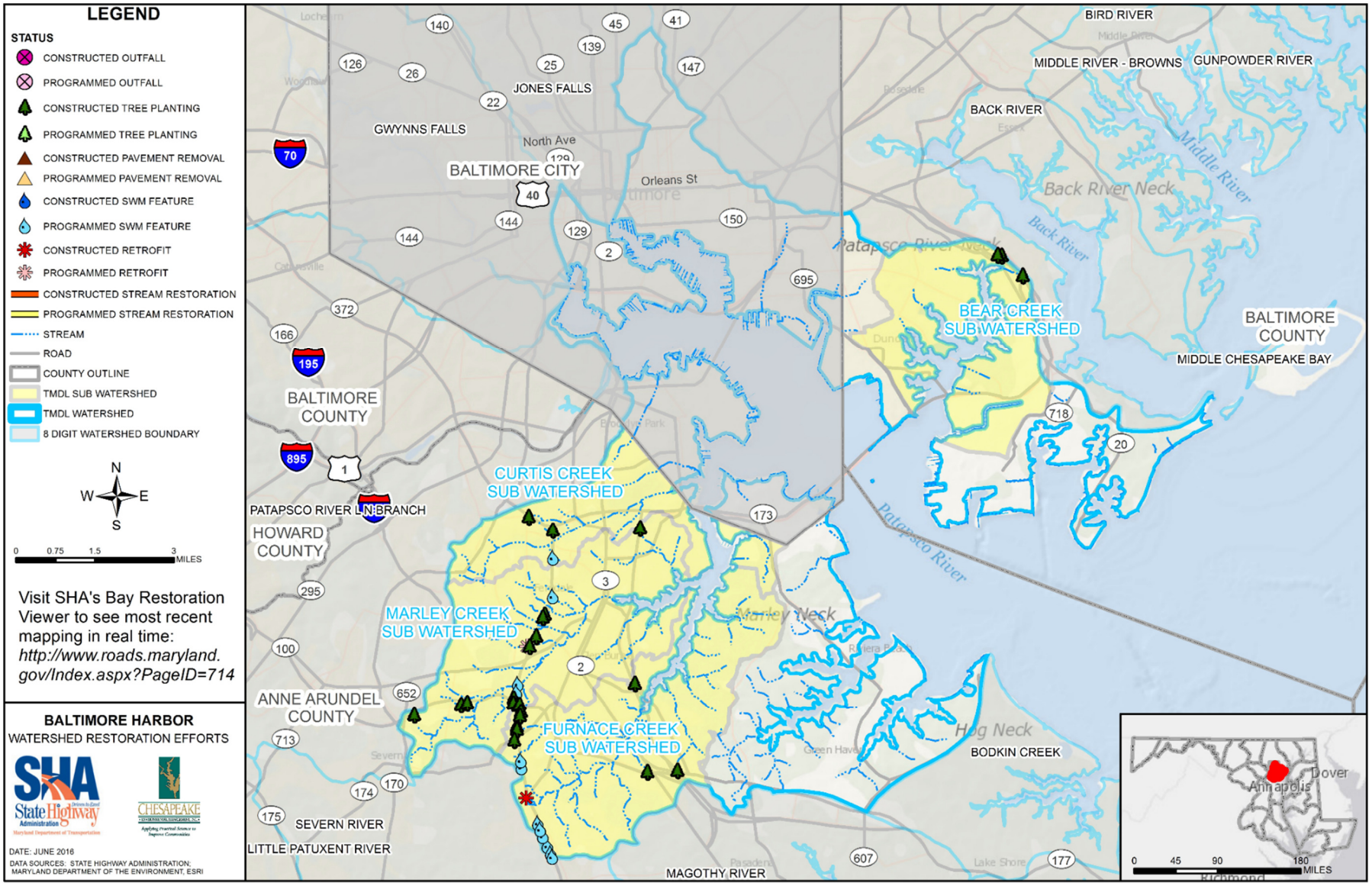


Figure 4-12: SHA Restoration Strategies within the Baltimore Harbor Watershed

E. BYNUM RUN WATERSHED

E.1. Watershed Description

The Bynum Run watershed encompasses 23 square miles solely within Harford County, Maryland. Bynum Run is a stream that originates in the town of Forest Hill and flows 14 miles in a southeasterly direction until it empties into the tidally influenced Bush River. The Bush River ultimately flows into the Chesapeake Bay.

There are 220.2 miles of SHA roadway located within the Bynum Run watershed. The associated ROW encompasses 473.8 acres, of which 211.9 acres are impervious. There are three SHA park and ride facilities located in the Bynum Run watershed. See **Figure 4-13** for a map of the watershed.

E.2. SHA TMDLs within Bynum Run Watershed

SHA is included in the sediment (TSS) TMDL (MDE, 2011c) with a reduction requirement of 22.9 percent as shown in **Table 3-2**.

E.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-14**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, many SHA impervious areas within these grids are already treated by SHA BMPs. The current results of this ongoing grid search are as follows:

23 Total Grids:

- Two fully reviewed;
- 20 partially reviewed - in progress; and
- One awaiting review (4 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 101 locations identified as possible candidates for new stormwater BMPs;
- One facility undergoing concept design that may be a candidate for design contracts in the near future;
- Four retrofits of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 282 acres of SHA-owned pervious area. Some of the reasons for sites being removed from considerations include commercial locations or existing forest. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 24 acres of tree planting potential for further investigation.

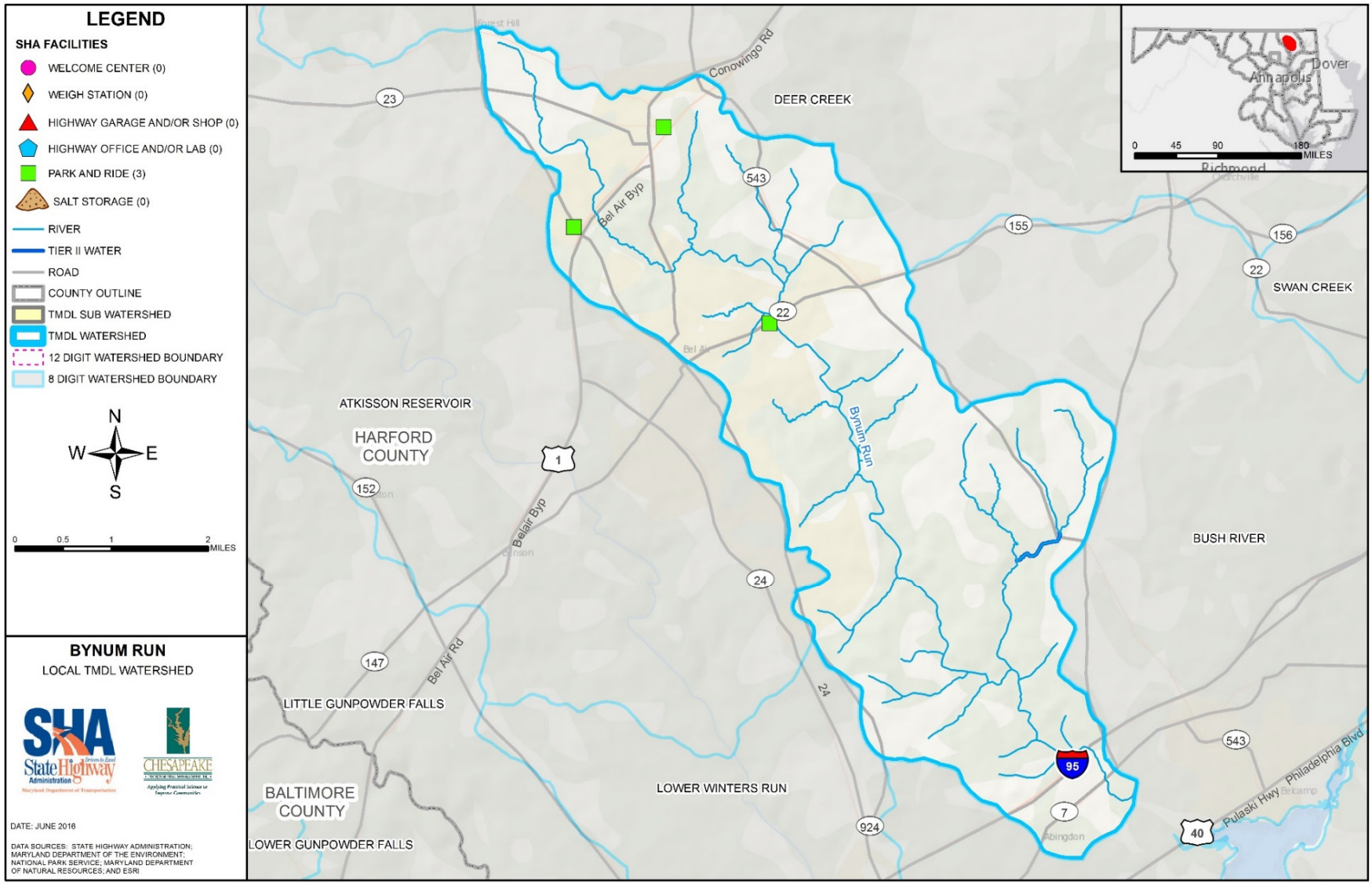


Figure 4-13: Bynum Run Watershed

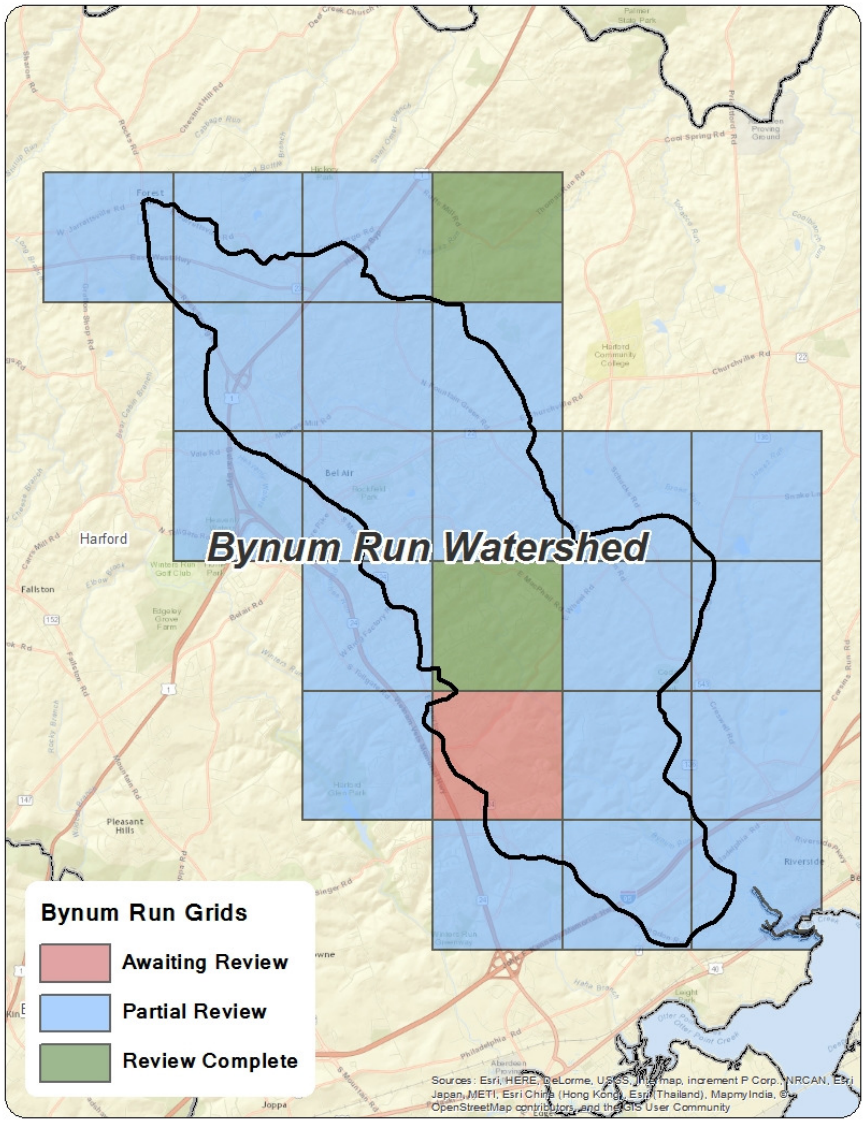


Figure 4-14: Bynum Run Site Search Grids

The stream restoration site search teams investigated 13,743 linear feet of stream channel for restoration opportunities. The site search has resulted the following:

- 9,587 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on feasibility.

E.4. County Assessment Review Summary

The waters within the Bynum Run watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Channelization;
- Mercury in Fish Tissue;
- Nitrogen (Total);
- PCB in Fish Tissue;
- Phosphorus (Total);
- Temperature, water; and
- TSS.

In 2014, the Harford County Department of Public Works prepared the *Declaration Run and Riverside Watersheds Small Watershed Action Plan* (URS, 2014a) Declaration Run is within the Bynum Run watershed, and Riverside watershed is outside the Bynum Run watershed. The County has suggested implementing the following means to achieve watershed improvements using structural BMPs:

- Stream Restoration;
- Structural Projects;
- Wetland;
- Bioretention;
- Bioswale;

- Step pool conveyance system;
- Micropool;
- Green roofs;
- Green street bump out;
- Tree box filters; and
- Upgrade infiltration basin.

Nonstructural BMPs include:

- Public education and outreach;
- Preserving existing forested areas, especially stream buffers;
- Tree planting;
- Downspout disconnection;
- Reduction of impervious surfaces; and
- Curbcuts to direct stormwater runoff to open areas.

Although field observations determined there were no stormwater hotspots within the Declaration Run subwatershed, the County suggested the following specific project sites for additional SWM. BMP implementation and retrofits shown in **Tables 4-16 4-17,** and **4-18**. These sites have been prioritized based on the following criteria:

- Property ownership;
- Access to project site;
- Drainage area;
- Contributing impervious area;
- Cost;
- Utility impacts; and
- Environmental impacts.

Table 4-16: Declaration Run Priority Restoration Stream Restoration Projects

Stream Reach ID	Proposed Project	Location	Project Priority
Declaration Run Reach 1	Remediate headcuts with riffle grade control structures or step pools	Upstream Baneberry	High
Tributary DR5	Correct minor headcut with grade control structures; Remediate slope failure at storm drain outfall	Downstream of Baneberry Drive and north of and between Arabis Court and Germander Drive	High
Declaration Run Reach 2	Outfall stabilization	Downstream of Baneberry Drive and west of Arabis Court and Foxglove Court	High
Tributary DR9 Reach 1 and 2	Stream bank stabilization; Remove failed instream SWM feature; Remediate headcuts; Remediate storm drain outfall	Downstream of Riverside Parkway and east of Church Creek Elementary School toward Church Creek Road; Downstream of Church Creek Elementary School and upstream of Church Creek Road	High

Table 4-17: Declaration Run Priority Restoration Structural Projects

Project ID	Proposed Project	Location	Project Priority
D-ES-2	Wetland	End of Oreganum Court	High
D-ES-5	Bioretention	North end of Foxglove Court	Low
D-ES-6	Bioretention	Germander Drive	Medium
D-ES-7	Bioswale and Bioretention	Germander Drive and Church Creek Road	High
D-ES-8	Wetland and Step pool conveyance system	Baneberry Drive	High
D-ES-12	Micropool and Wetland	End of Marigold Lane	Medium
D-ES-15	Bioretention	Procedure Way	High
D-NS-3	Green roofs	Liriope Court	Low
D-NS-4	Green street bump out	Church Creek Road	Medium
D-NS-7	Step pool conveyance system	Foxglove Court	Low
D-NS-8	Bioretention	Dalmation Place	High
D-NS-9	Tree box filters	Golden Rod Court	Low
D-NS-12	Bioretention or Tree box filters	Church Creek Elementary School	High
D-NS-13	Green street bump out	Church Creek Road	High
D-SWM0110 (ES-1)	Upgrade infiltration basin	Church Creek Elementary School	High

Table 4-18: Declaration Run Priority Restoration Non-Structural Projects

Project ID	Proposed Project	Location	Project Priority
D-NS-1	Downspout disconnection	Golden Rod Court Neighborhood	NA
D-NS-2	Impervious surface reduction	Wide residential driveways on Marigold Lane	NA
D-NS-5	Curb cuts in parking lots to direct stormwater runoff to open areas	Sedum Square, Horner Lane, Downs Square, Baylis Court	NA
D-NS-6	Curb cuts in parking lots to direct stormwater runoff to open areas	Magness Court, Hampton Hall Court, Talbots Square	NA

E.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Bynum Run watershed are shown in **Table 4-19**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2005.
- BMPs built between 2026 through 2032, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Bynum Run watershed total $11,052,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $31,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-15 shows a map of SHA's restoration practices in the watershed and include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-19: Bynum Run Restoration Sediment BMP Implementation

BMP	Unit	2006-2025	2026-2032	Total	Cost
New Stormwater	drainage area acres	56.1	15.3	71.4	$5,202,000
Retrofit	drainage area acres	57.0		57.0	$2,175,000
Stream Restoration	linear feet	2,700.0		2,700.0	$1,979,000
Tree Planting	acres planted	24.5		24.5	$823,000
Outfall Stabilization[1]	linear feet		400.0	400.0	$873,000
Inlet Cleaning[2]	tons	32.0	32.0	32.0	$31,000

[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits

[2] Inlet cleaning is an annual practice.

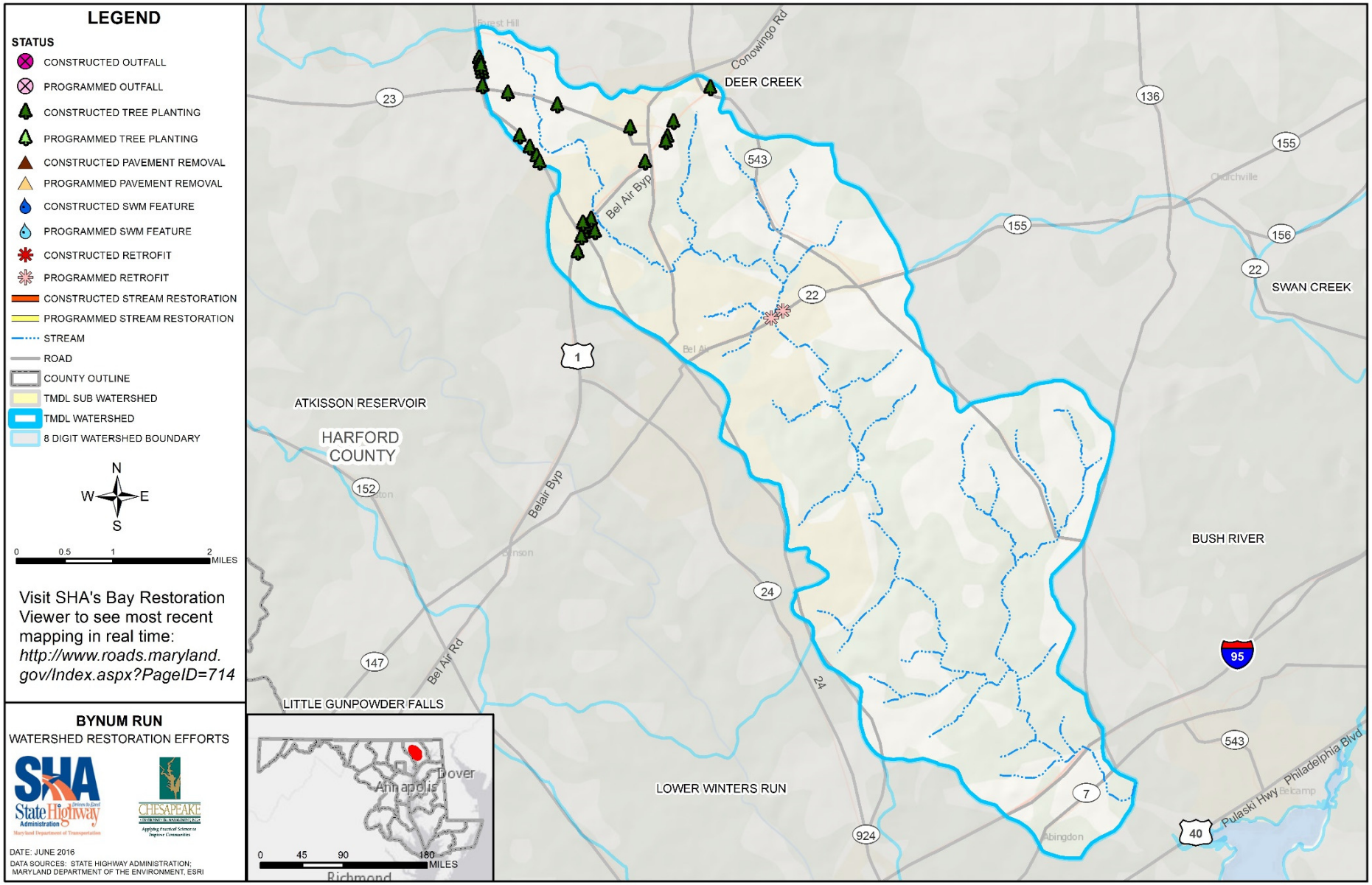


Figure 4-15: SHA Restoration Strategies within the Bynum Run Watershed

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F. CABIN JOHN CREEK WATERSHED

F.1. Watershed Description

The Cabin John watershed encompasses 26 square miles solely within southern Montgomery County, Maryland. Cabin John Creek originates in the City of Rockville and flows south approximately ten miles to its confluence with the Potomac River near Cabin John and Glen Echo. Major tributary creeks and streams of the Cabin John Watershed include Bogley Branch, Booze Creek, Buck Branch, Congressional Branch, Ken Branch, Old Farm Branch, Snakeden Branch, and Thomas Branch.

There are 353.1 miles of SHA roadway located within the Cabin John watershed. The associated ROW encompasses 862.6 acres, of which 484.8 acres are impervious. There are no SHA facilities located within the Cabin John watershed. See **Figure 4-16** for a map of the watershed.

F.2. SHA TMDLs within Cabin John Creek Watershed

SHA is included in the sediment (TSS) TMDL (MDE, 2011d) and has a reduction requirement of 22.9 percent as shown in **Table 3-2**.

F.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-17**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. The current results of this ongoing grid search are as follows:

22 Total Grids:

- One fully reviewed;
- 17 partially reviewed - in progress; and
- Four awaiting review (9 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- Eight locations identified as possible candidates for new stormwater BMPs;
- Nine facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 442 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- Zero acres of tree planting potential for further investigation.

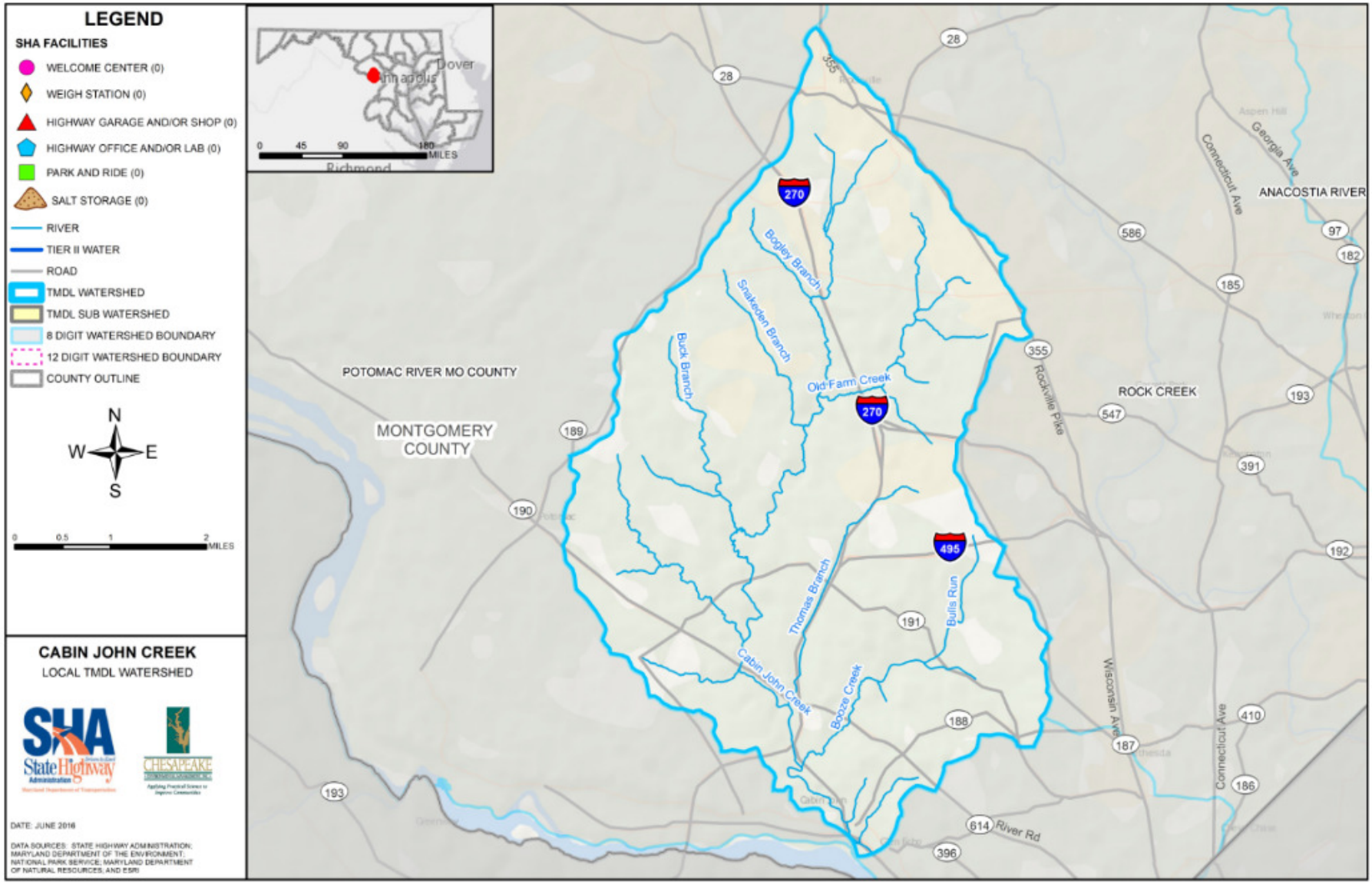


Figure 4-16: Cabin John Creek Watershed

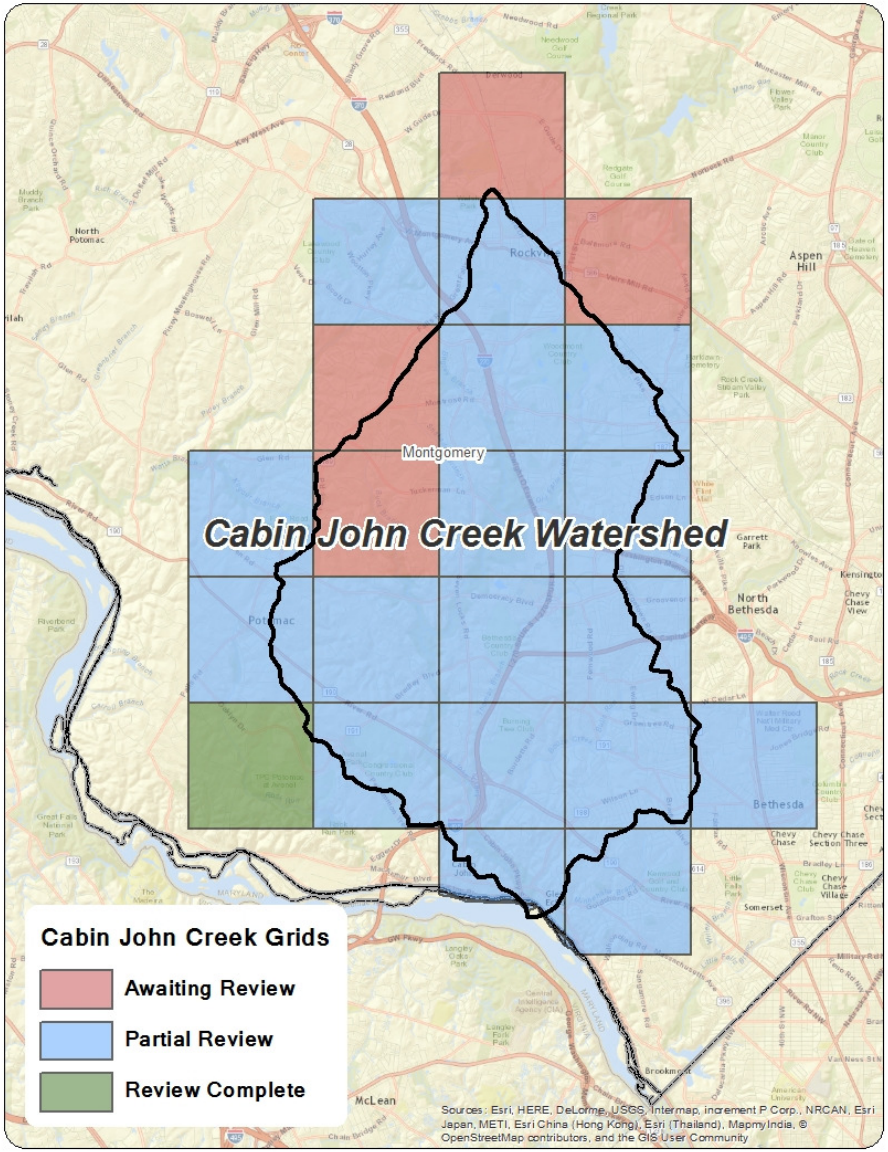


Figure 4-17: Cabin John Creek Site Search Grids

The stream restoration site search teams investigated 14,732 linear feet of stream channel for restoration opportunities. The site search resulted the following:

- 10,744 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

F.4. County Assessment Review Summary

Waters within the Cabin John Creek watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Channelization;
- Chlorides;
- Fecal Coliform;
- Phosphorus (Total);
- Sulfates; and
- Total TSS.

The *Cabin John Creek Implementation Plan* (Versar, 2012a) prepared by the Montgomery County Department of Environmental Protection, was adopted in January, 2012. The implementation plan provides a comprehensive approach for watershed restoration targeting bacteria reduction, sediment nutrient reduction, runoff management, and trash management.

The Cabin John Creek watershed comprises primarily residential land use, covering about 70 percent of the watershed. Municipal/institutional comprises 13 percent and roadway comprises approximately 7 percent. Approximately 5 percent is identified as forest, open water, or bare ground. The majority of the stream resource conditions in Cabin John Creek were assessed as 'Fair' (82.5 percent) (Cabin John Creek, Buck Branch, Bogley Branch, Old Farm Creek), the remaining 17.5 percent

were assessed as 'Poor' (Thomas Branch, Bills Run, Boole Creek). Zero stream miles were assessed as 'Good' or 'Excellent.'

MDE developed TMDLs for fecal bacteria and sediment within the Cabin John Creek watershed and nutrient WLAs for the Bay-wide TMDL. BMPs implemented by the county proposed within Cabin John Creek watershed are estimated to result in 41.9 percent load reductions for total nitrogen, 41.7 percent for total phosphorus, and 29.5 percent for TSS.

Montgomery County is focusing on county-owned land for restoration projects, and has not addressed needs on SHA ROW. Projects identified include two new stormwater ponds (Cabin John Shopping Center, Tuckerman I) and four stormwater pond retrofits (Executive Blvd, Fox Hills of Potomac, Pine Knolls, Washington Science Center). Impervious area restoration is also proposed for various sites within the watershed.

F.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Cabin John Creek watershed are shown in **Table 4-20**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2005.
- BMPs built between 2026 through 2041, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Cabin John Creek watershed total $10,301,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $11,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-18 shows a map of SHA's restoration practices in the watershed and include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-20: Cabin John Creek Restoration Sediment BMP Implementation					
BMP	**Unit**	**2001-2025**	**2026-2041**	**Total**	**Cost**
New Stormwater	drainage area acres	41.0	3.5	44.5	$4,484,000
Retrofit	drainage area acres	15.2		15.2	$368,000
Stream Restoration	linear feet	3,700.0		3,700.0	$2,712,000
Tree Planting	drainage area acres	3.5		3.5	$119,000
Outfall Stabilization[1]	linear feet	200.0	1,000.0	1,200.0	$2,618,000
Inlet Cleaning[2]	tons	11.0	11.0	11.0	$11,000
[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits					
[2] Inlet cleaning is an annual practice.					

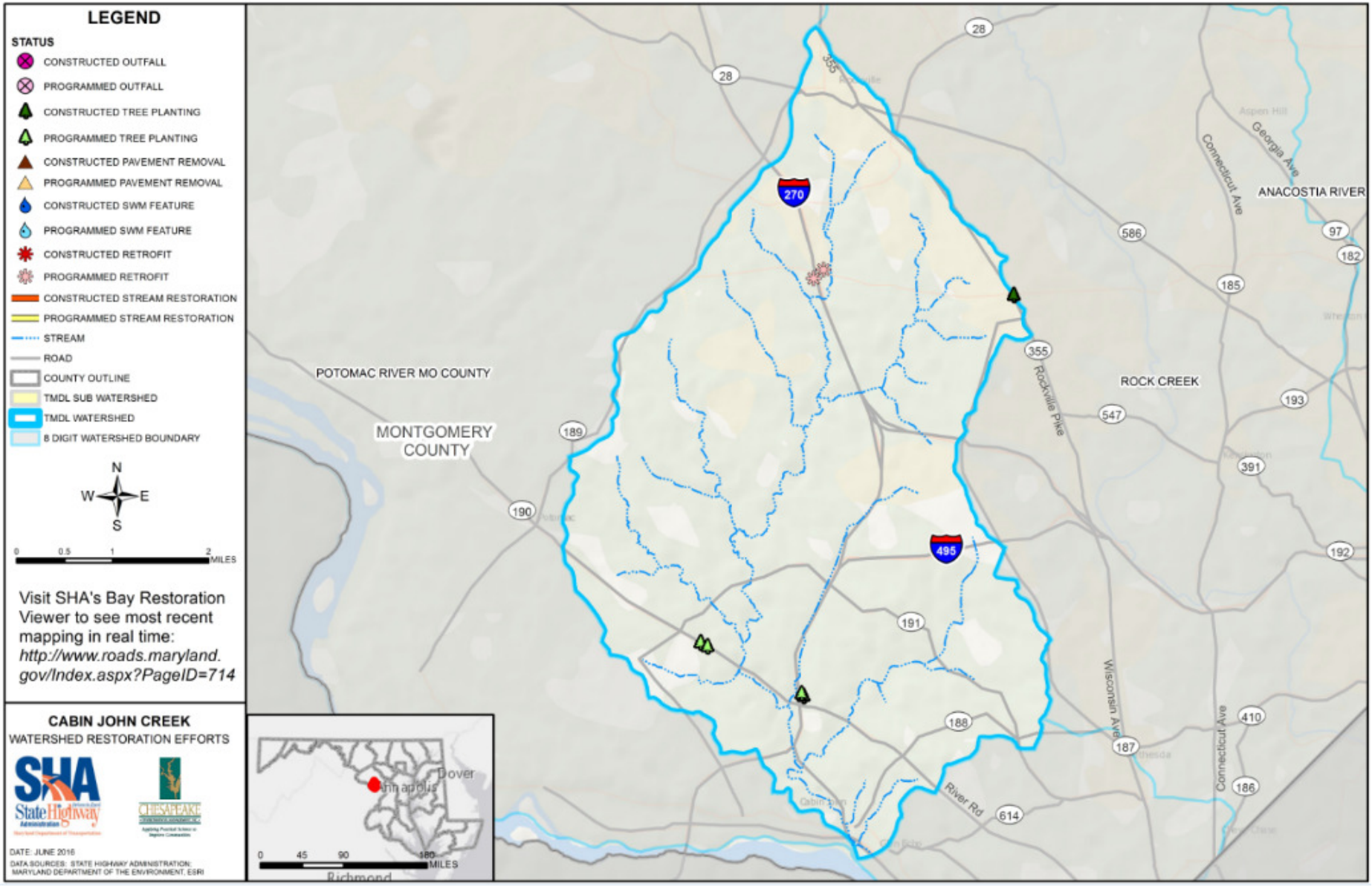


Figure 4-18: SHA Restoration Strategies within the Cabin John Creek Watershed

G. CATOCTIN CREEK WATERSHED

G.1. Watershed Description

The Catoctin Creek watershed is located within the Middle Potomac River subbasin in Frederick County, Maryland. The Catoctin Creek watershed drains an area of 120 square miles, which includes areas of forested mountain slopes, agricultural valleys, and small areas of urban development. There is a significant amount of agriculture within the watershed, which consists mostly of row crop, but also includes pasture. The largest urban centers within the watershed are the towns of Myersville and Middletown. According to the CBP's Phase 5.2 Model, the land use distribution in the watershed is approximately 43 percent agricultural, 42 percent forest/herbaceous, and 15 percent urban.

Tributary creeks and streams of the Catoctin Creek watershed include Bolivar Branch, Broad Run, Burkitts Run, Cone Branch, Deer Springs Branch, Dry Run, Grindstone Run, Harman Branch, Hollow Road Creek, Lewis Mill Branch, Little Catoctin Creek, Middle Creek, and Spruce Run.

There are 359.6 miles of SHA roadway located within the Catoctin Creek watershed. The associated ROW encompasses 1,300 acres, of which 428.7 acres are impervious. SHA facilities located within the Catoctin Creek watershed consist of two welcome centers, two park and ride facilities, and two salt storage facilities. See **Figure 4-19** for a map of the watershed.

G.2. SHA TMDLs within Catoctin Creek Watershed

SHA is included in both the phosphorus and sediment TMDLs (MDE, 2013b; MDE, 2009d) with reduction requirements of 9.0 percent and 49.1 percent, respectively, as shown in **Table 3-2**.

G.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-20**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. The current results of this ongoing grid search are as follows:

93 Total Grids:

- 60 fully reviewed;
- 29 partially reviewed - in progress; and
- Four awaiting review (three percent of total grids).

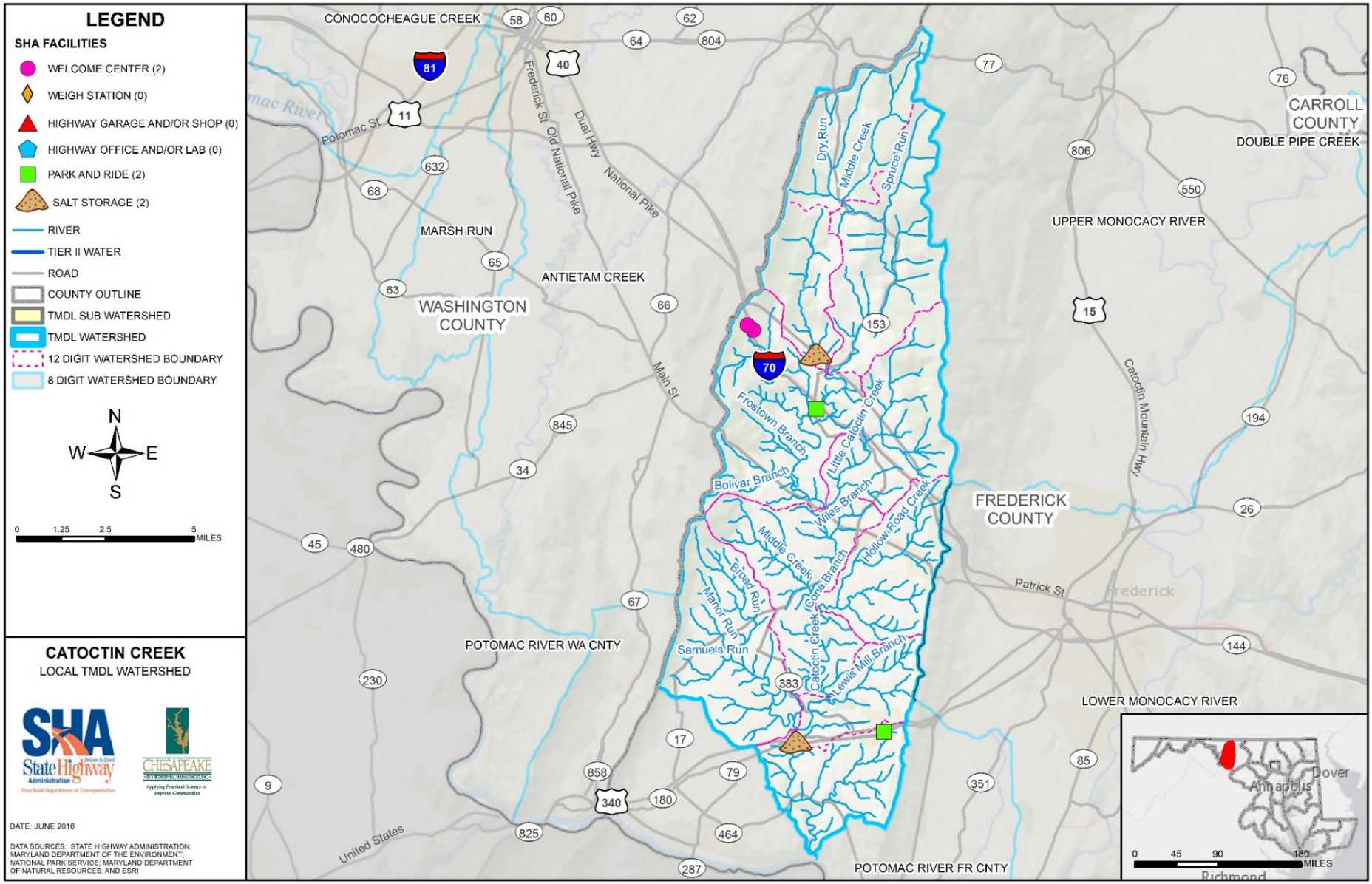


Figure 4-19: Catoctin Creek Watershed

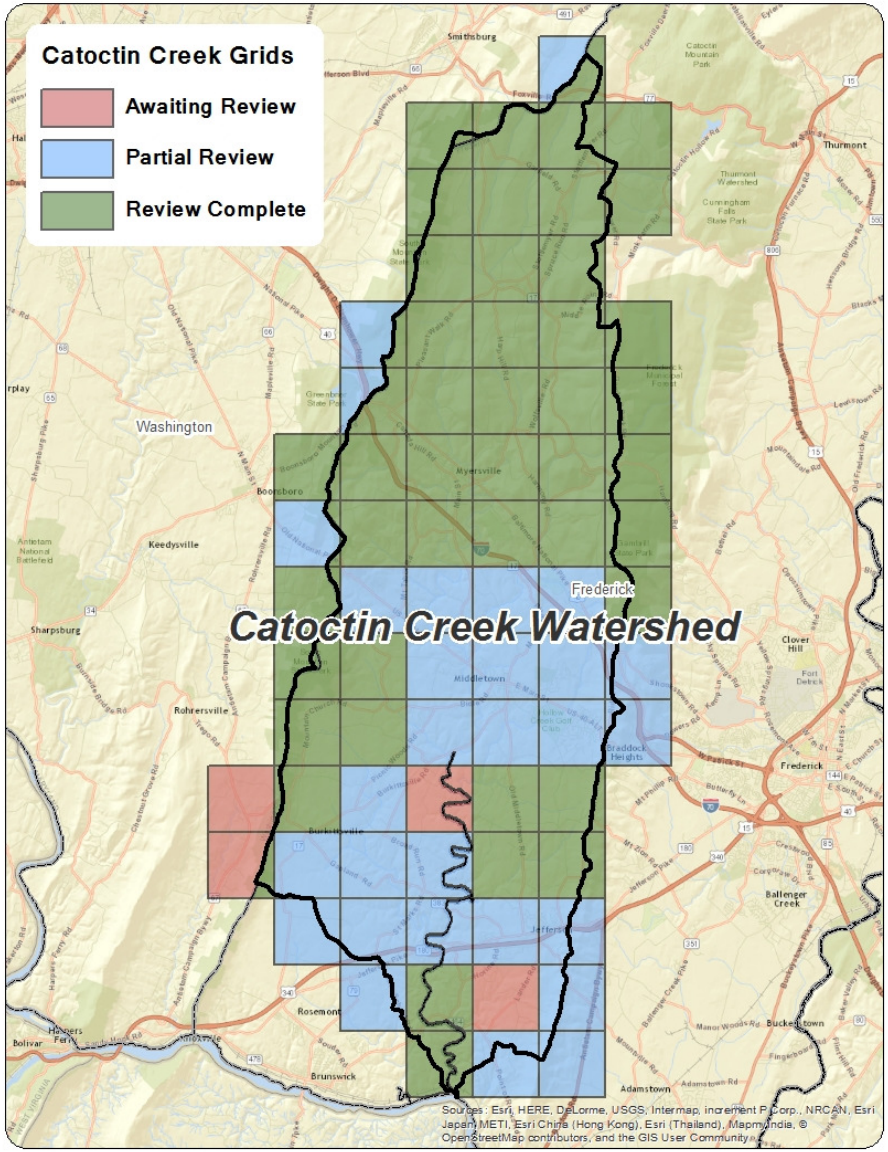


Figure 4-20: Catoctin Creek Site Search Grids

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 752 locations identified as possible candidates for new stormwater BMPs;
- One facility undergoing concept design and may be a candidate for design contracts in the near future;
- Six retrofits of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 962 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 65 acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- Two acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 10,464 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 3,528 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility

G.4. County Assessment Review Summary

Waters within the Catoctin Creek watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Fecal Coliform;
- Phosphorus (Total);
- Temperature, water; and
- TSS.

MDE prepared the *Watershed Report for Biological Impairment of the Catoctin Creek Watershed in Frederick County, Maryland Biological Stressor Identification Analysis Results and Interpretation* (BSID) in 2012 (MDE, 2012c). The following excerpts from the BSID describe land use throughout the watershed and associated potential pollutant sources:

> *Agricultural land use is prevalent in the watershed, and is an important source of pollution when rainfall carries fertilizers, manure, and pesticides into streams. The three major nutrients in fertilizers are nitrogen, phosphorus, and potassium. High concentrations of nutrients in agricultural streams were correlated with inputs from fertilizers and manure used for crops and from livestock wastes.*
>
> *The Biological Stressor Identification (BSID) analysis identified pasture/hay land use as significant in the riparian buffer zone (92%). Pasture/hay land use within the riparian buffer often results in increased incidences of livestock being allowed direct access to streams, and one of the primary sources of nutrients and ammonia to surface waters is livestock waste. The agricultural land uses in the Catoctin Creek watershed are potential sources for the elevated levels of nitrogen, phosphorus, orthophosphate, and ammonia.*
>
> *The lack of a riparian buffer has resulted in a stream ecosystem that eliminates large woody debris and allochthonous input in streams, which results in loss of optimal habitat. Loss of riparian buffers also allows increased terrestrial inputs of nutrients from agricultural sources. Due to the increased proportions of agricultural land use in Catoctin Creek, the watershed has experienced an increase of nutrients that can potentially be extremely toxic to aquatic organisms. The combined AR for riparian habitat stressors and water chemistry stressors is approximately 83 percent, suggesting that altered riparian habitat and water chemistry stressors adequately account for the biological impairment in Catoctin Creek* (MDE, 2012c).

As stated in the Catoctin Creek sediment TMDL:

> *Potential BMPs for reducing sediment loads and resulting impacts can be grouped into three general categories. The first is directed toward agricultural lands, the second to urban (developed) land, and the third applies to all land uses.*
>
> *In agricultural areas comprehensive soil conservation plans can be developed that meet criteria of the USDA-NRCS Field Office Technical Guide. Soil conservation plans help control erosion by modifying cultural practices or structural practices. Cultural practices may change from year to year and include changes to crop rotations, tillage practices, or use of cover crops. Structural practices are long-term measures that include, but are not limited to, the installation of grass waterways (in areas with concentrated flow), terraces, diversions, sediment basins, or drop structures. In addition, livestock can be controlled via stream fencing and rotational grazing.*
>
> *Sediment from urban areas can be reduced by stormwater retrofits, impervious surface reduction, and stream restoration. Stormwater retrofits include modification of existing stormwater structural practices to address water quality.*
>
> *All non-forested land uses can benefit from improved riparian buffer systems. A riparian buffer reduces the effects of upland*

sediment sources through trapping and filtering. Riparian buffer efficiencies vary depending on type (grass or forested), land use (urban or agriculture), and physiographic region.

G.5. SHA Pollutant Reduction Strategies

Catoctin Creek is listed for both phosphorus and sediment with each TMDL having a different baseline year; 2000 for sediment and 2009 for phosphorus. Proposed practices to meet phosphorus and sediment reductions in the Catoctin Creek watershed are shown in **Table 4-21**. Projected phosphorus and sediment reductions using these practices are described in **Part III, coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Three timeframes are included in the table below:

- BMPs built after the sediment TMDL baseline through 2009. In this case the baseline is 2000.
- BMPs built after the phosphorus TMDL baseline through 2025. In this case the baseline is 2009.
- BMPs built from 2026 through 2035, the projected target date SHA will accomplish the percent reductions presented in Table 3-2. The reduction may not equal 100 percent.

The total projected cost to implement SHA's structural BMPs within the Catoctin Creek watershed is $17,142,000. $17,000 as an annual cost for inlet cleaning is in addition to this. Structural BMP project costs are estimated based on the average cost per impervious acre treated based on a group of completed projects for each BMP category. Costs for inlet cleaning are derived from SHA data and include equipment, operations, and maintenance costs.

Figure 4-21 shows a map of SHA's watershed restoration strategies throughout the Catoctin Creek watershed. The practices shown only include those that are under design or constructed.

Table 4-21: Catoctin Creek Restoration Nutrient and Sediment BMP Implementation

BMP	Unit	2001 - 2009	2010 - 2025	2026 - 2035	Total	Cost
New Stormwater	drainage area acres		81.2	121.5	202.7	$8,675,000
Stream Restoration	linear feet	719.0	4,509.0		5,228.0	$3,832,000
Tree Planting	acres planted	18.2	115.5		133.7	$4,496,000
Impervious Surface Elimination	acres removed		0.5		0.5	$139,000
Inlet Cleaning[1]	tons		17.0	17.0	17.0	$17,000

[1] *Inlet cleaning is an annual practice.*

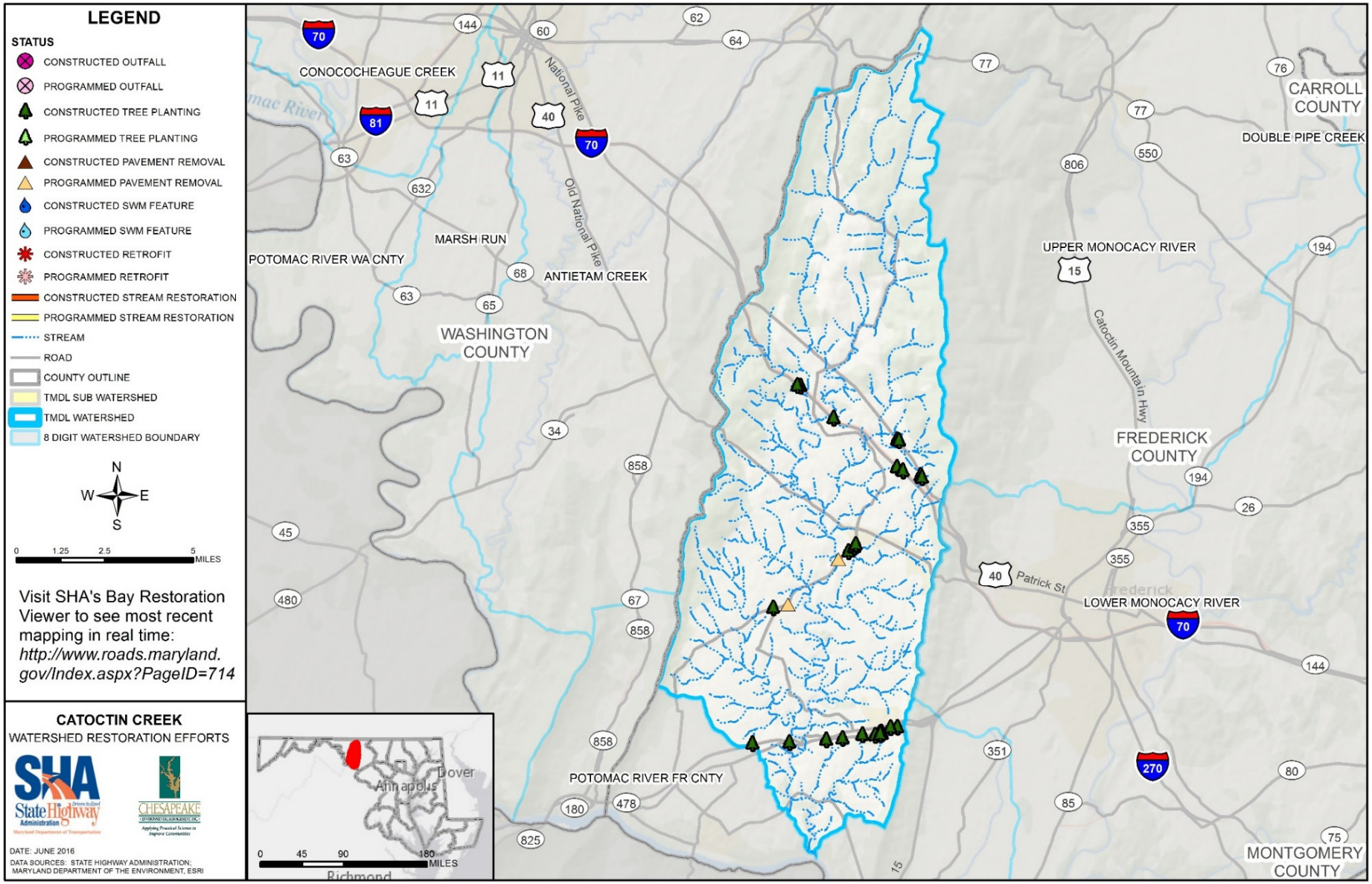


Figure 4-21: SHA Restoration Strategies within the Catoctin Creek Watershed

H. CONOCOCHEAGUE CREEK WATERSHED

H.1. Watershed Description

The Conococheague Creek watershed encompasses 65 square miles within Washington County, Maryland. The entire watershed is approximately 566 square miles, most of which is located in Pennsylvania. Conococheague Creek flows 80 miles south from its headwaters in Pennsylvania to the Potomac River near Williamsport, Maryland. Tributary creeks and streams of the Conococheague Creek watershed, within Maryland, include Meadow Brook, Rockdale Run, Rush Run, Semple Run, and Toms Run.

There are 285.6 miles of SHA roadway located within the Conococheague Creek watershed. The associated ROW encompasses 1,428.3 acres, of which 489.6 acres are impervious. SHA facilities located within the watershed consist of one park and ride facility and one salt storage facility. See **Figure 4-22** for a map of the watershed.

H.2. SHA TMDLs within Conococheague Creek

SHA is included in the sediment (TSS) TMDL (MDE, 2008b) and has a reduction requirement of 45.3 percent as shown in **Table 3-2**.

H.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-23**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool. The current results of this ongoing grid search are as follows:

46 Total Grids:

- Ten fully reviewed;
- 36 partially reviewed - in progress; and
- Zero awaiting review.

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 35 locations identified as possible candidates for new stormwater BMPs.
- 16 facilities undergoing concept design and may be candidates for design contracts in the near future.
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 1,304 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 152 acres of tree planting potential for further investigation.

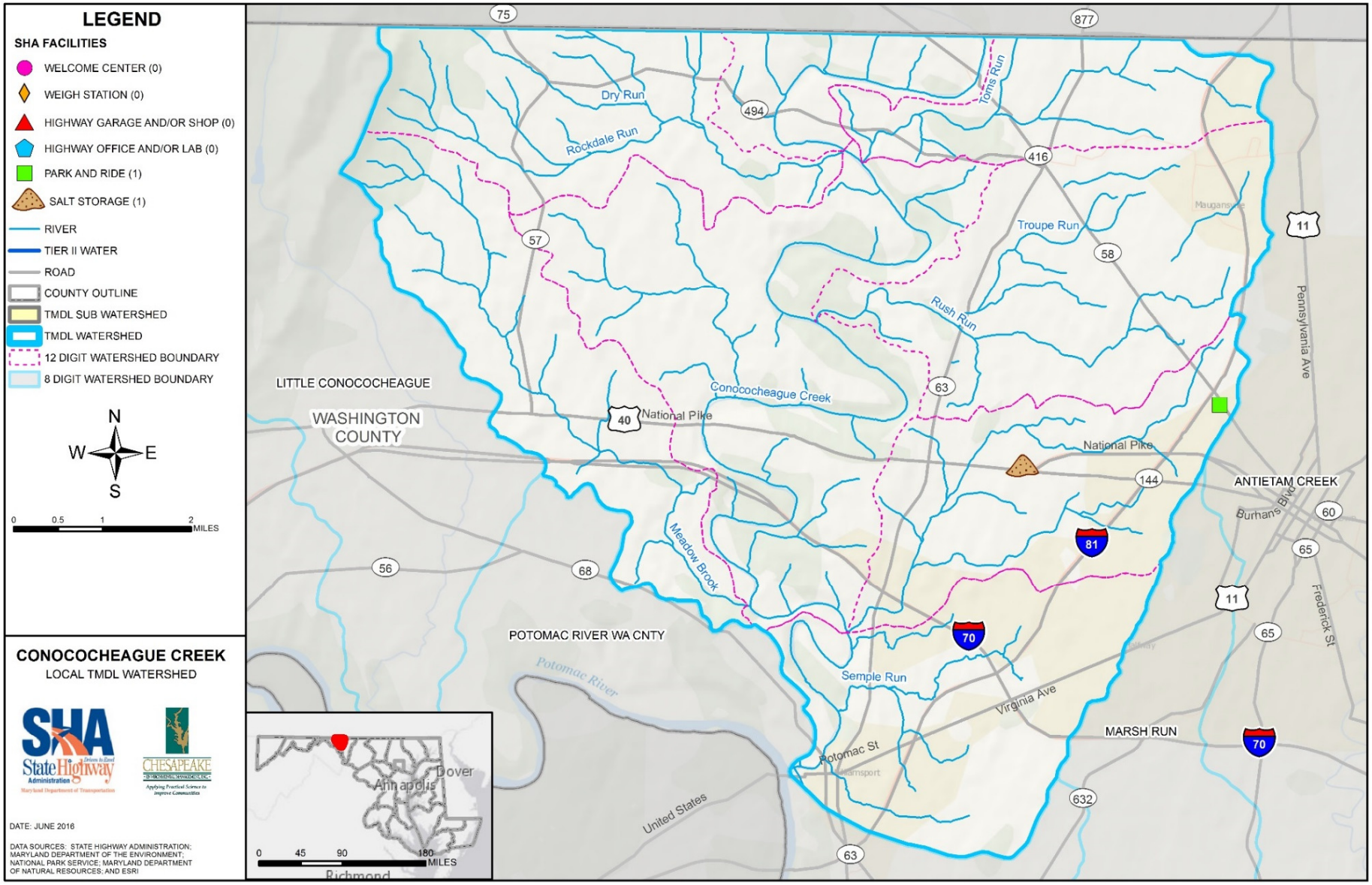


Figure 4-22: Conococheague Creek Watershed

The stream restoration site search teams have investigated 27,514 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 2,982 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

H.4. Summary of County Assessment Review

Waters within the Conococheague Creek watershed are subject to the following impairments as noted on MDE's 303(d) List:

- BOD;
- Chlorides;
- *Escherichia coli;*
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- pH, High;
- Phosphorus (Total);
- Sulfates; and
- TSS.

According to the 2014 Washington County NPDES MS4 Annual Report (WC-DPW, 2014), the *Conococheague Watershed Restoration Plan* was expected to be completed in 2015, but as of May, 2016 this report was not available online.

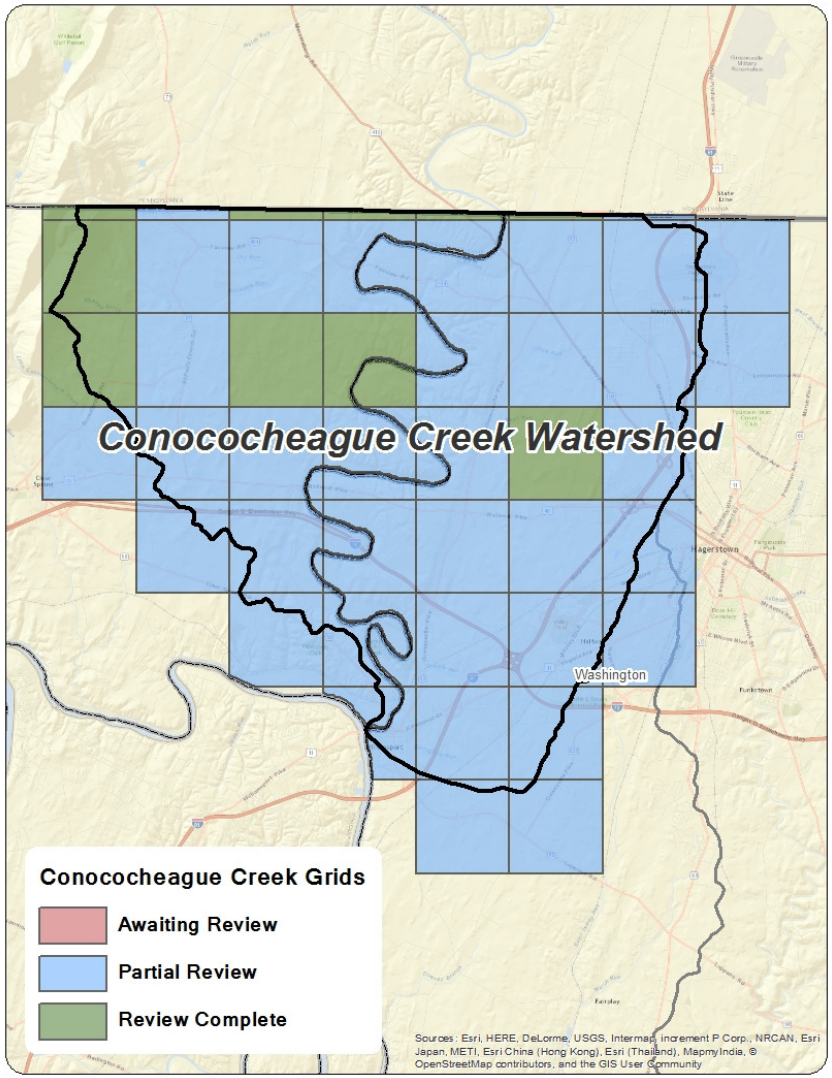


Figure 4-23: Conococheague Creek Site Search Grids

H.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Conococheague Creek watershed are shown in **Table 4-22**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2000.
- BMPs built between 2026 through 2045, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Conococheague Creek watershed total $16,775,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $16,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-24 shows a map of SHA's restoration practices in the watershed and include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-22: Conococheague Creek Restoration Sediment BMP Implementation

BMP	Unit	2001-2025	2026-2045	Total	Cost
New Stormwater	drainage area acres	166.9	8.1	175.0	$13,089,000
Retrofit	drainage area acres	12.2		12.2	$409,000
Tree Planting	acres planted	71.5		71.5	$2,404,000
Outfall Stabilization[1]	linear feet		400.0	400.0	$873,000
Inlet Cleaning[2]	tons	16.0	16.0	16.0	$16,000

[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits

[2] Inlet cleaning is an annual practice.

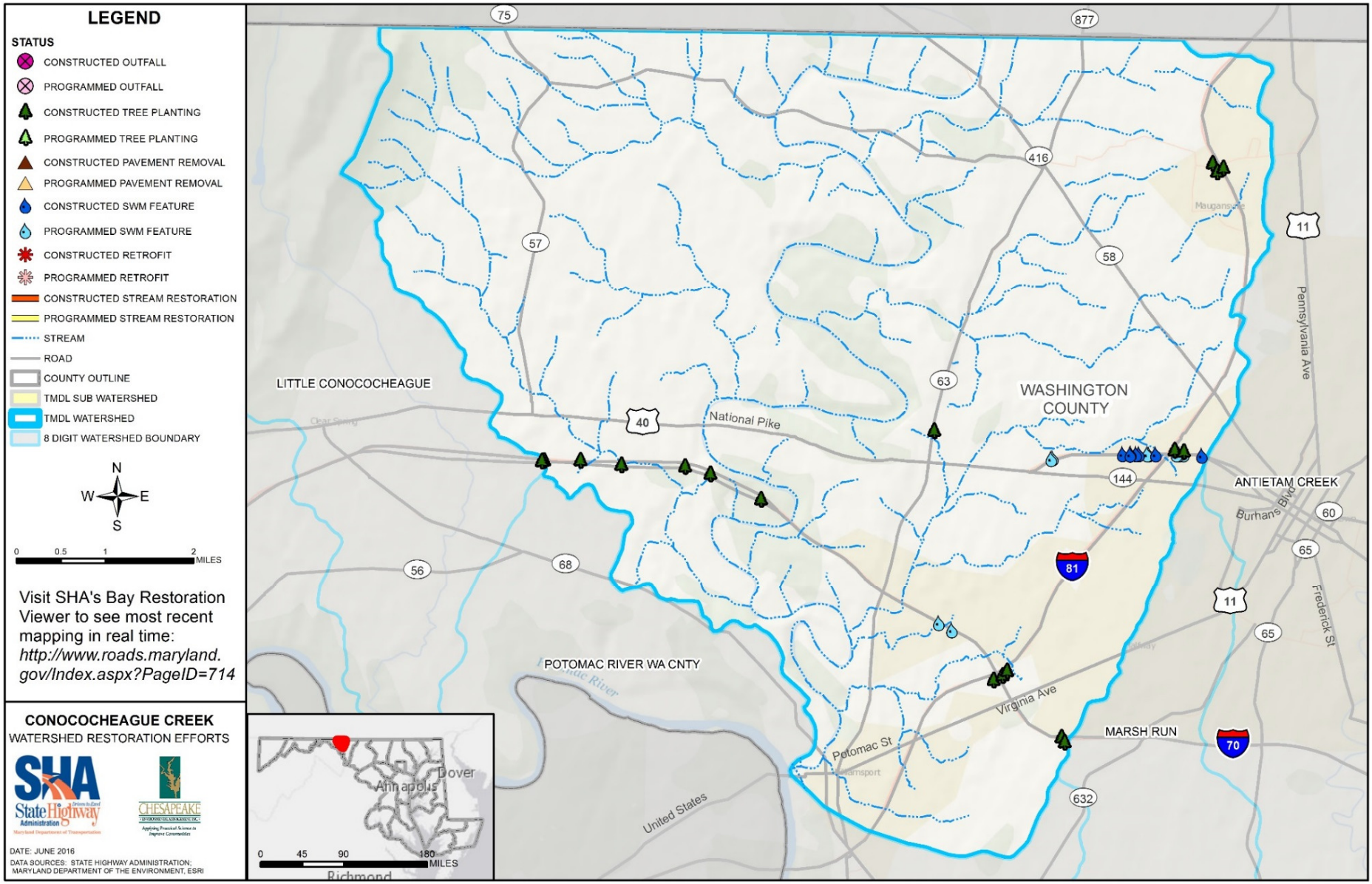


Figure 4-24: SHA Restoration Strategies within the Conococheague Creek Watershed

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I. DOUBLE PIPE CREEK WATERSHED

I.1. Watershed Description

The Double Pipe Creek watershed encompasses 193 square miles spanning Carroll and Frederick Counties, and is composed of Big Pipe Creek, which makes up 58 percent of the watershed, and Little Pipe Creek, which makes up the remaining 42 percent. The portion of the watershed within Carroll County is approximately 86 percnet of the watershed, with 14 percent within Frederick County. This watershed drains into the Monocacy River, which is a State-designated Scenic River. The headwaters of Double Pipe Creek originate in Westminster and Manchester, and flows west toward Rocky Ridge, into the Monocacy River and ultimately into the Middle Potomac River near the town of Dickerson. Tributary creeks and streams of the Double Pipe Creek watershed include Bear Branch, Big Pipe Creek, Cherry Branch, Deep Run, Dickenson Run, Little Pipe Creek, Meadow Branch, Prisetland Branch, Sams Creek, Silver Run, Turkeyfoot Run, and Wolf Pit Creek.

There are 545.2 miles of SHA roadway located within the Double Pipe Creek watershed. The associated ROW encompasses 1,107.1 acres, of which 420.2 acres are impervious. SHA facilities located within the Double Pipe Creek watershed consist of one park and ride facility, and one salt storage facility. See **Figure 4-25** for a map of the watershed.

I.2. SHA TMDLs within Double Pipe Creek

SHA is included in the phosphorus TMDL (MDE, 2013c) and sediment (TSS) TMDL (MDE, 2009e) and has reduction requirements of 66 percent for sediment and 33.8 percent and 46.8 percent for phosphorus in Carroll and Frederick Counties, respectively as shown in **Table 3-2**.

I.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-26**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. The current results of this ongoing grid search are as follows:

132 Total Grids:

- 50 fully reviewed;
- 52 partially reviewed - in progress; and
- 30 awaiting review (20 percent of total grids).

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 264 locations identified as possible candidates for new stormwater BMPs;

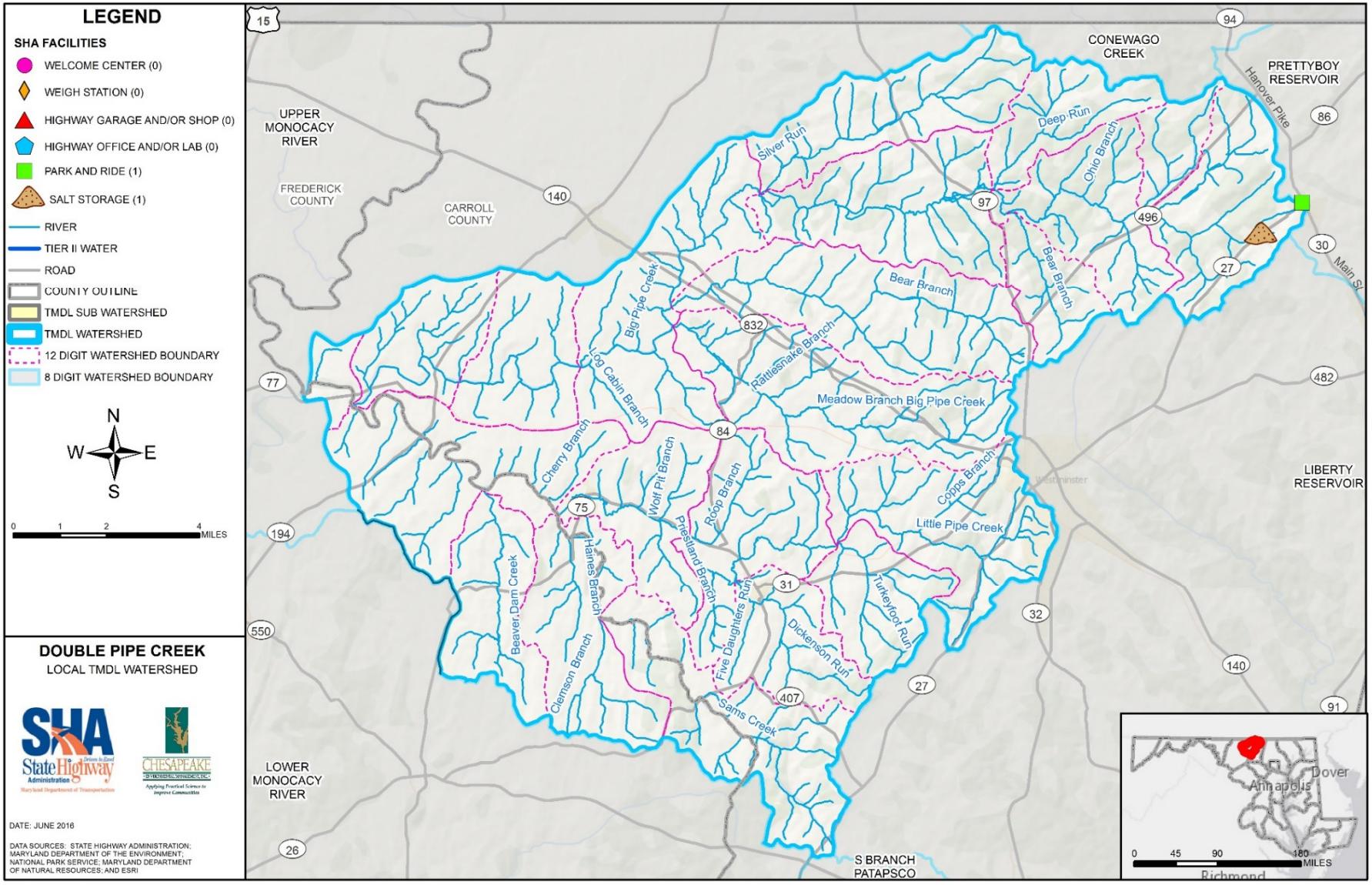


Figure 4-25: Double Pipe Creek Watershed

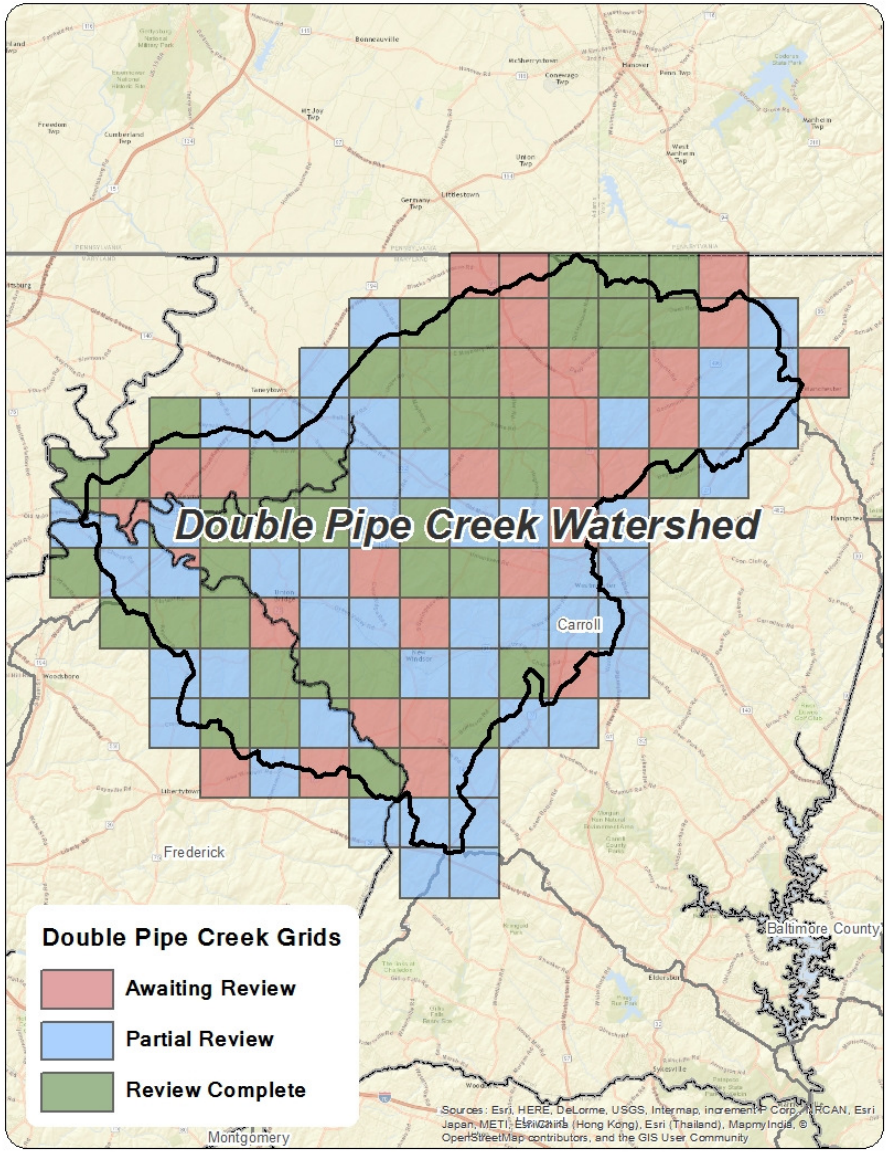


Figure 4-26: Double Pipe Creek Site Search Grids

- 18 facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 647 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 126 acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- Eight acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 22,992 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 9,513 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

I.4. Summary of County Assessment Review

Waters within the Double Pipe Creek watershed are subject to the following impairments as noted on MDE's 303(d) List:

- *Escherichia coli;*
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- Phosphorus (Total); and
- TSS.

In 2006, MDE completed a report on *Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland* (MDE, 2006). Impervious land cover comprises 2.5% of the Frederick County portion of the Double Pipe Creek watershed. According to MDE, regulated impervious developed land comprises 2.04% in the Frederick County portion, and 2.14% in the Carroll County portion. The predominant soils in this watershed are considered moderately erodible. Double Pipe Creek currently has completed TMDLs for sediment (TSS), fecal bacteria, and phosphorus. Double Pipe Creek also has a Category Five impairment listing (i.e., TMDL required) for PCBs in fish tissue.

Little data is available for this watershed, though Carroll County has scheduled a watershed assessment to begin in 2016. The Frederick County Office of Sustainability and Environmental Resources conducted Stream Corridor Assessments (SCAs) between 2008 and 2014 that include the portion of the Little Pipe Creek subwatershed of Double Pipe Creek located in that county (Versar, 2015a).

Information on water quality, erosion, physical habitat, and BIBI scores for several sites within Little Pipe Creek can be found in the SCA reports, however detailed location information is not provided.

I.5. Pollutant Reduction Strategies

Double Pipe Creek is listed for both sediment and phosphorus with each TMDL having a different baseline year; 2000 for sediment and 2009 for phosphorus. Proposed practices to meet the sediment and phosphorus reduction in the Double Pipe Creek watershed are shown in **Table 4-23**.

Projected sediment and phosphorus reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Three timeframes are included in the table below:

- BMPs built after the sediment TMDL baseline through 2009. In this case the baseline is 2000.
- BMPs built after the phosphorus TMDL baseline through 2025. In this case the baseline is 2009.
- BMPs built from 2026 through 2045, the projected target date of the phosphorus TMDL. 2025 is the projected target date for the sediment TMDL. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Double Pipe Creek watershed total $22,566,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $20,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-27 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-23: Double Pipe Creek Restoration Nutrient and Sediment BMP Implementation						
BMP	**Unit**	**2001 - 2009**	**2010 - 2025**	**2026 - 2045**	**Total**	**Cost**
New Stormwater	drainage area acres		92.4	64.3	156.7	$9,685,000
Stream Restoration	linear feet		4,400.0		4,400.0	$3,225,000
Tree Planting	acres planted		153.4	2.8	156.2	$5,250,000
Outfall Stabilization[1]	linear feet			2,000.0	2,000.0	$4,363,000
Impervious Source Elimination	acres removed		0.2		0.2	$43,000
Inlet Cleaning[2]	tons		20.0	20.0	20.0	$20,000
[1] *Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits*						
[2] *Inlet cleaning is an annual practice.*						

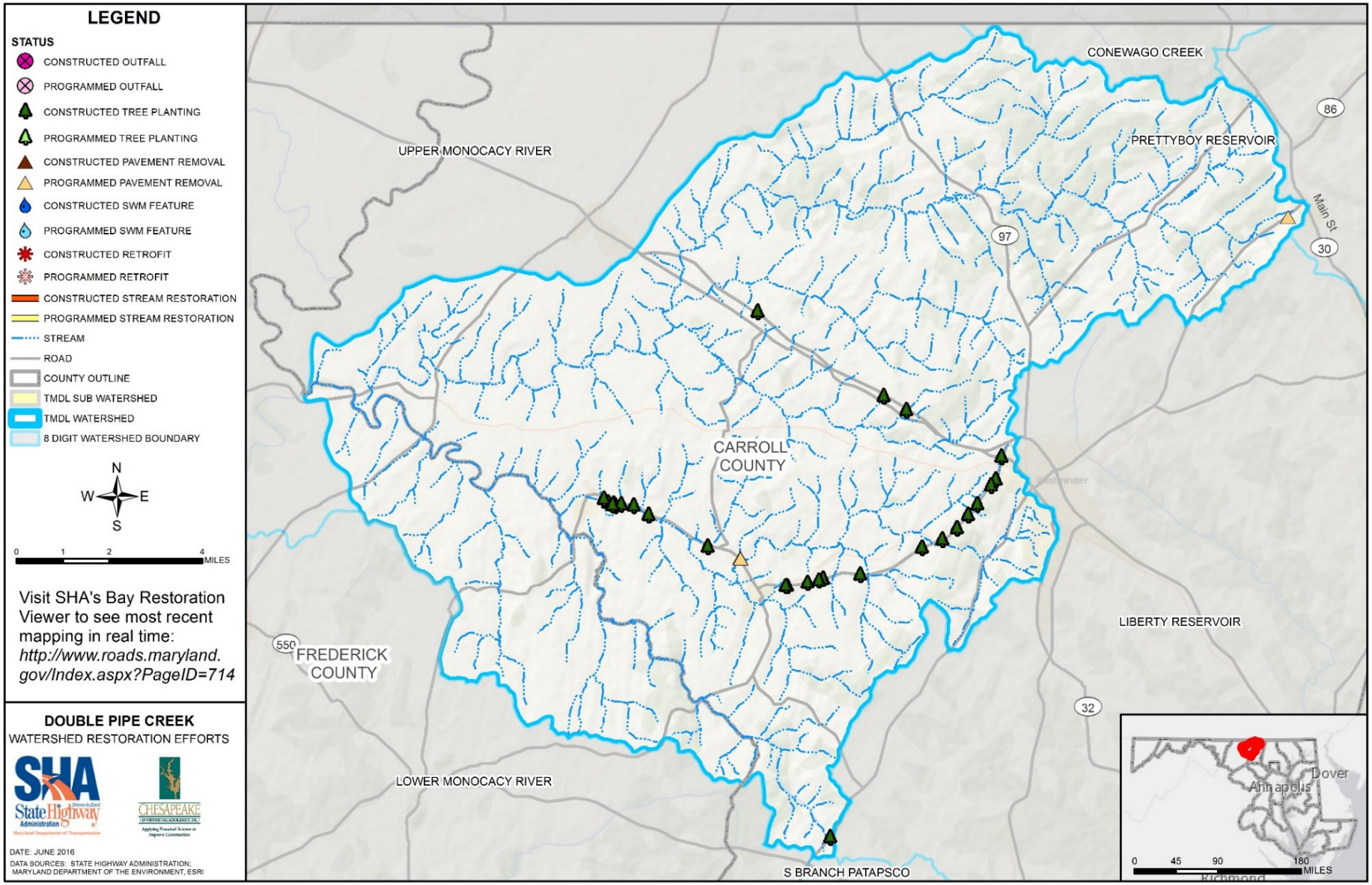


Figure 4-27: SHA Restoration Strategies within the Double Pipe Creek Watershed

J. GWYNNS FALLS WATERSHED

J.1. Watershed Description

The Gwynns Falls watershed encompasses 43 square miles within Baltimore County and the City of Baltimore. The Gwynns Falls flows from Baltimore County for 25 miles in a southeasterly direction to City of Baltimore where it empties into the Patapsco River, which runs into the Chesapeake Bay. Tributary creeks and streams of the Gwynns Falls include Dead Run, Horsehead Ranch, Maidens Choice Run, Powder Mill Branch, Red Run, and Scotts Level Run.

There are 1,055.7 miles of SHA roadway located within the Gwynns Falls watershed. The associated ROW encompasses 1,515.7 acres, of which 892.5 acres are impervious. SHA facilities located within the Gwynns Falls watershed consist of one tower, one park and ride facility, one highway garage/shop facility and two salt storage facilities. See **Figure 4-28** for a map of the watershed.

J.2. SHA TMDLs within Gwynns Falls Watershed

SHA is included in the sediment (TSS) TMDL (MDE, 2010b) and has a reduction requirement of 36.4 percent within Baltimore County as shown in **Table 3-2.**

The Gwynns Falls is also included in the Middle Branch and Northwest Branch Patapsco TMDL for Trash (MDE, 2015c). The allocated trash baseline for SHA is to be reduced by 100 percent (this does not mean that trash within the watershed will be reduced to zero).

J.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-29**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

The grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. The current results of this ongoing grid search are as follows:

40 Total Grids:

- Seven fully reviewed;
- 20 partially reviewed - in progress; and
- 13 awaiting review (20 percent of total grids).

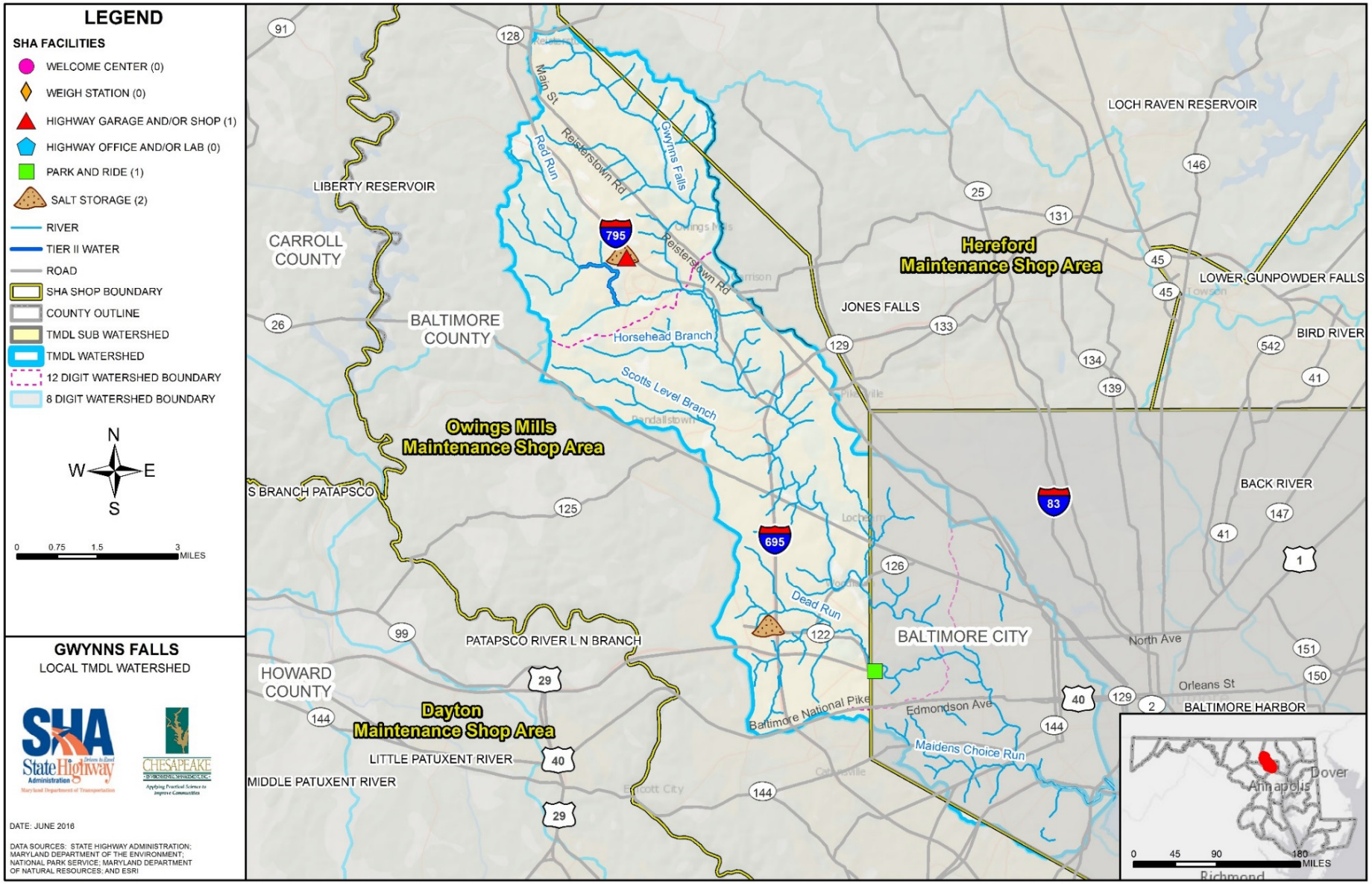


Figure 4-28: Gwynns Falls Watershed

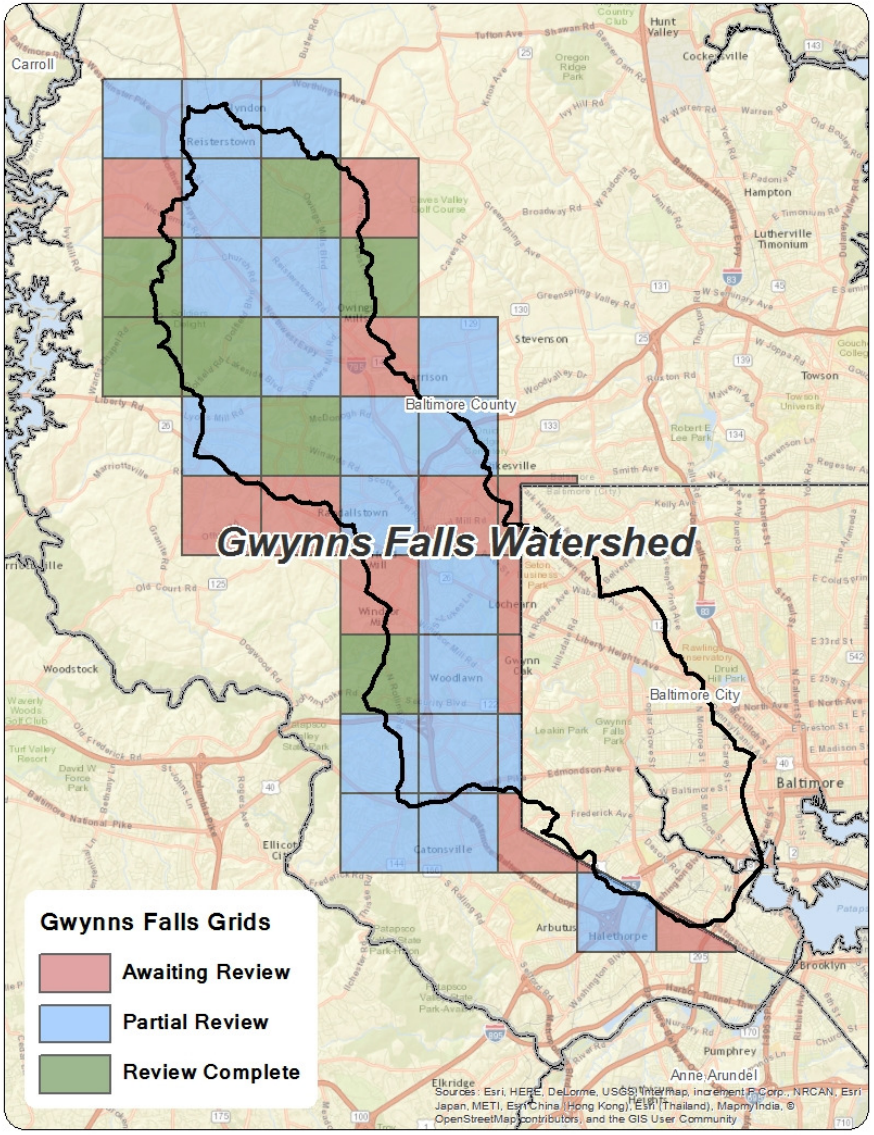


Figure 4-29: Gwynns Falls Site Search Grids

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 95 locations identified as possible candidates for new stormwater BMPs;
- One facility undergoing concept design that may be a candidate for design contracts in the near future;
- Five retrofit of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 913 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- Three acres of tree planting potential for further investigation.

The stream restoration site search teams have investigated 7,398 linear feet of stream channel for restoration opportunities. The site search has resulted in the following:

- 1,320 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

J.4. Summary of County Assessment Review

Waters within the Gwynns Falls watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Channelization;
- Chlorides;
- Fecal Coliform;
- PCB in Fish Tissue;
- Phosphorus (Total);
- Temperature;
- TSS; and
- Trash

The Baltimore County Department of Environmental Protection and Sustainability completed SWAPs for the Upper Gwynns Falls (UGF) watershed (AMT, Inc., 2011) and the Middle Gwynns Falls (MGF) watershed (PB, 2013) in an effort to guide the restoration efforts. Impervious land cover makes up 20 percent of the UGF watershed and 29 percent of the MGF watershed. Approximately 11 percent of soils within the UGF watershed and over 30 percent of the soils within the MGF watershed are considered of high runoff potential. The County estimates that impervious urban land use is responsible for contributing 39,029 lbs. of nitrogen and 6,256 lbs. of phosphorus in the UGF watershed per year and 74,468 lbs. of nitrogen, 6,502 lbs. of phosphorus, and 8,833,323 lbs. of sediment in the MGF watershed per year.

There are 28 NPDES-permitted facilities within the UGF watershed, including a SHA maintenance yard. There are five process water sources with explicit sediment limits within the watershed. The total sediment load from all process water sources within the watershed is estimated at 213.2 tons per year (AMT, Inc., 2011).

The County prioritized subwatersheds within the Gwynns Falls watershed based on ranking criteria to identify which subwatersheds have the greatest need and potential for restoration. For the UGF watershed, UGF D was rated "very high" and UGF B and Roche's Run were rated "high" in terms of restoration need and potential (AMT, Inc., 2011). For the MGF watershed, Dead Run was rated "very high" and Gwynns Falls was rated "high" in terms of restoration need and potential (PB, 2013).

For the purposes of planning, the County selected the following generalized restoration strategies to aid in meeting restoration goals within the Gwynns Falls watershed:

- Using present SWM facilities;
- Converting SWM facilities;
- SWM retrofits;
- Impervious cover removal;
- Stormwater education and outreach;
- Stream restoration;
- Community Reforestation Program (CRP);
- Street sweeping;
- Illicit connection detection/disconnection;
- Sanitary sewer consent decree;
- MS4 retrofits;
- Credits for Fertilizer Act of 2011;
- Increased State owned property restoration;
- Redevelopment of urban areas;
- Reforestation;
- Downspout disconnection; and
- Urban nutrient management.

The County identified numerous potential restoration sites within each subwatershed by conducting neighborhood source assessments, hotspot site investigations, institutional site investigations, and pervious area assessments. The County also identified multiple potential stormwater conversions within each watershed: 28 for the UGF watershed (AMT, Inc., 2011) and 15 for the MGF watershed (PB, 2013). Detailed information on site locations can be found in the SWAPs.

The County identified 42 proposed project sites for stream restoration and stabilization. Additionally, the County proposed 15 "large projects" (>$300,000) in the UGF watershed. Details on project type and site location for potential restoration projects in the UGF watershed are not included in the SWAP.

The following sites were identified as high priorities for stream restorations in the MGF watershed as shown in **Table 4-24** below.

Table 4-24: County-Identified Potential Stream Restoration Sites in Gwynns Falls Watershed

Reach	Number of Sites	Total Linear Feet	Conditions
Gwynns Falls	14	6,000	Severe bank erosion, severe buffer erosion, concrete channels, inadequate buffers, unstable aprons, unstable banks, unstable outfalls
Powder Mill Run	3	5,000	Erosion, unstable banks, inadequate buffers
Maiden Choice Run	2	2,100	Concrete channels, absent floodplains, unstable banks
Scotts Level	3	8,100	Concrete channels, absent floodplains, unstable banks

J.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Gwynns Falls watershed are shown in **Table 4-25**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2005.
- BMPs built between 2026 through 2045, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Gwynns Falls watershed total $9,436,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $184,000 from the Operations Budget is estimated for annual inlet cleaning.

Proposed practices to meet trash and debris reduction in the Middle Branch and Northwest Patapsco River - Gwynns Falls watershed are shown in **Table 4-26**. Projected trash reduction using these activities based on modeling described in **Part III** of this Plan are shown in **Table 3-2**. Two timeframes are included in the table:

- Reduction activities implemented after the TMDL baseline year through 2025. For the Middle Branch and Northwest Patapsco River - Gwynns Falls TMDL, the baseline is 2011.

- Reduction activities implemented in 2026 which is the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

SHA expects to spend $9,175 annually from the Operations Budget for yearly maintenance, a new public trash education program, and increased roadside trash pick-up. In the future, other trash reducing activities may be implemented to help meet the reduction goal.

Figure 4-30 shows a map of SHA's restoration practices in the watershed and include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-25: Gwynns Falls Restoration Sediment BMP Implementation

BMP	Unit	2006-2025	2026-2045	Total	Cost
New Stormwater	drainage area acres	37.5	17.2	54.7	$2,735,000
Retrofit	drainage area acres	214.0		214.0	$4,184,000
Tree Planting	acres of planting	59.7	15.1	74.9	$2,517,000
Inlet Cleaning[1]	tons	193.0	193.0	193.0	$184,000

[1] *Inlet cleaning is an annual practice.*

Table 4-26: Patapsco-Gwynns Falls Trash & Debris Activities Implementation

BMP	Unit	20012-2025	2026	Total	Cost
Increased Inlet cleaning	lbs/yr	0	0	0	$0
New Public Education Program	lbs/yr	260.0	30.0	290.0	$1,075
New Stream Clean Up	lbs/yr	0	0	0	$0
New Structural SW Control Pickup	lbs/yr	0	0	0	$0
Increased Roadside Pickup	lbs/yr	2000.0	181.0	2181.0	$8,100

These trash reducing activities are an annual practice. Projected load reductions included here are based on a combination of historical and future projections for the purposes of this implementation plan. Actual reductions will be reported each FY in the SHA MS4 annual report.

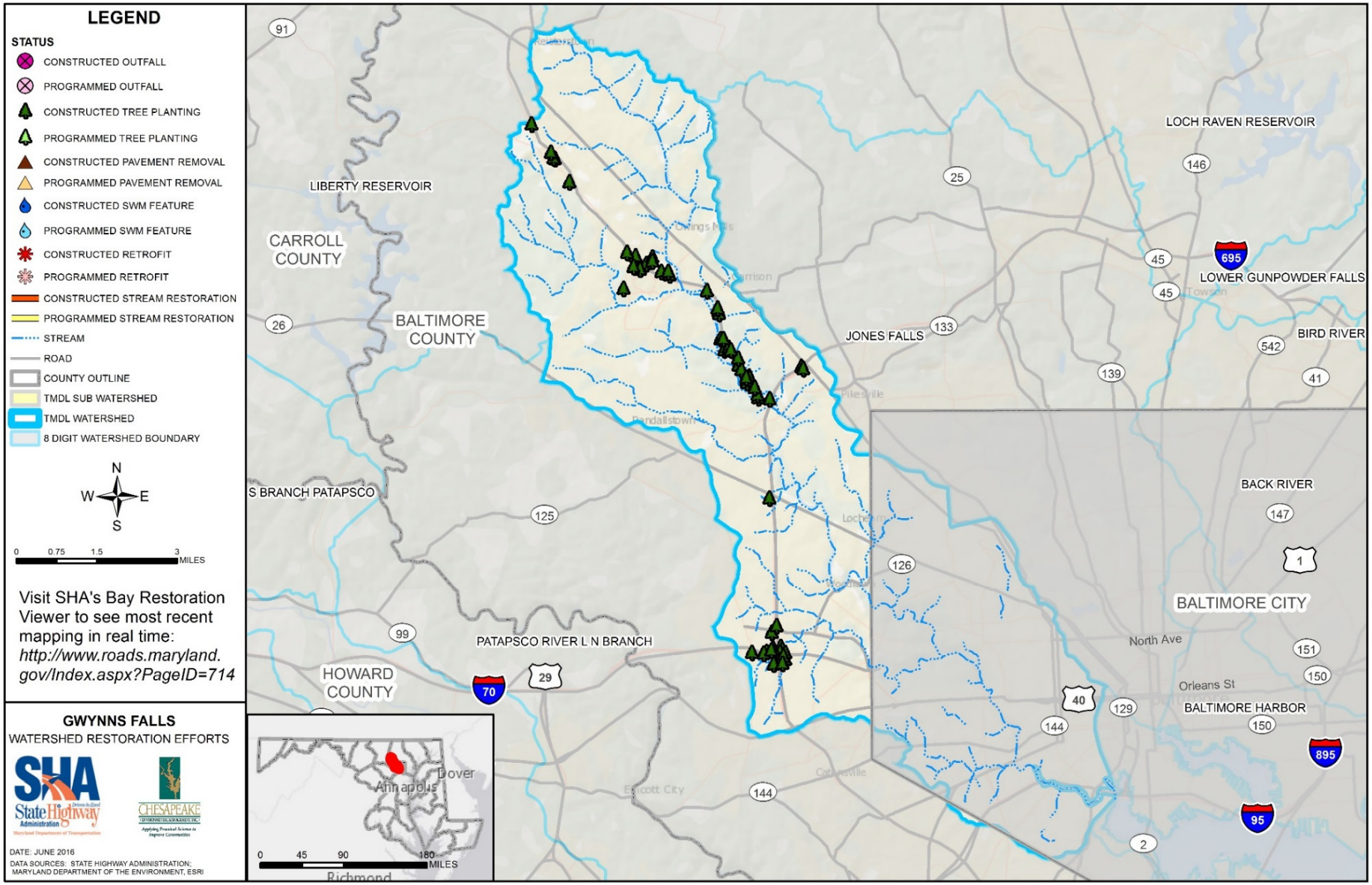


Figure 4-30: SHA Restoration Strategies within the Gwynns Falls Watershed

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K. JONES FALLS WATERSHED

K.1. Watershed Description

The Jones Falls watershed encompasses 77 square miles within Baltimore County and City of Baltimore. The headwaters of the Jones Falls are located near Garrison in Greenspring Valley, from which it flows east until it reaches Lake Roland, where it is impounded. From Lake Roland the river merges with eastern tributaries and then continues south through City of Baltimore to the Inner Harbor. The Jones Falls watershed is comprised of the Upper Jones Falls (UJF) watershed, Northeastern Jones Falls (NJF) watershed, and Lower Jones Falls (LJF) watershed. The UJF watershed makes up approximately 36 percent of the watershed, the NJF watershed makes up 19 percent of the watershed, and the LJF Watershed makes up the lower 45 percent of the watershed. Tributary creeks and streams of the Jones Falls watershed include Moores Branch, Roland Run, Towson Run, Western Run, and Stoney Run.

There are 790.9 miles of SHA roadway located within the Jones Falls watershed. The associated ROW encompasses 857.9 acres, of which 583.2 acres are impervious. SHA facilities located within the Jones Falls watershed consist of one highway office/lab facility and one salt storage facility. See **Figure 4-31** for a map of the watershed.

K.2. SHA TMDLs within Jones Falls Watershed

SHA is included in the sediment (TSS) TMDL (MDE, 2011e) and has a reduction requirement of 21.7 percent within Baltimore County as shown in **Table 3-2.**

The Jones Falls is also included in the Middle Branch and Northwest Branch Patapsco TMDL for Trash (MDE, 2015c). The allocated trash baseline for SHA is to be reduced by 100 percent (this does not mean that trash within the watershed will be reduced to zero).

The Lake Roland subwatershed within the Jones Falls watershed has a TMDL for PCBs (MDE, 2014e) with a reduction requirement of 29.3 percent as shown in **Table 3-2**.

K.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-32**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, many SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

32 Total Grids:

- Three fully reviewed;
- Eleven partially reviewed – in progress; and
- 18 awaiting review (53 percent of total grids)

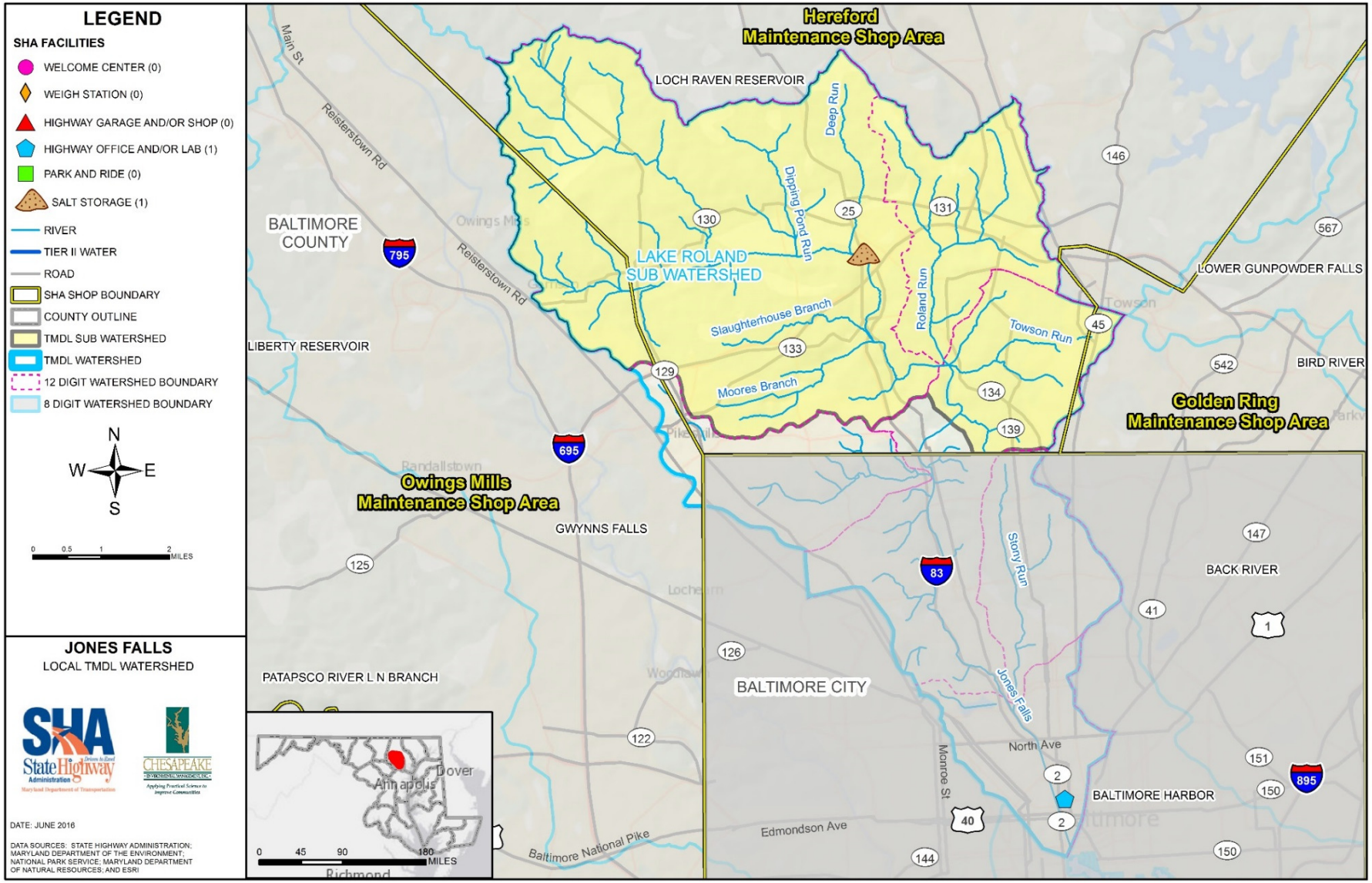


Figure 4-31: Jones Falls Watershed

The new stormwater site search has resulted in a pool of potential sites comprised of the following:

- 143 locations identified as possible candidates for new stormwater BMPs;
- Twelve facilities undergoing concept design and may be candidates for design contracts in the near future;
- One retrofit of existing stormwater facilities undergoing concept design that may be a candidate for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 404 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- Seven acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 11,514 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 783 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

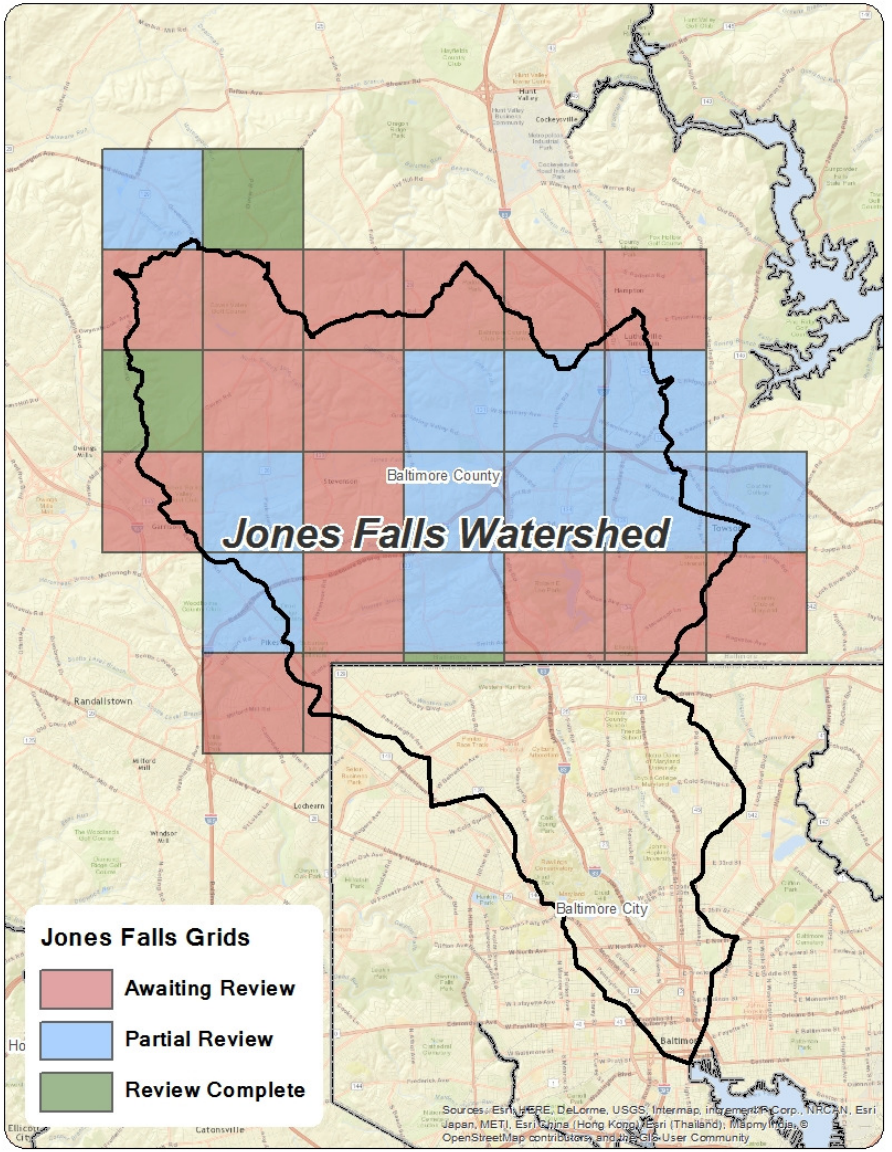


Figure 4-32: Jones Falls Site Search Grids

K.4. Summary of County Assessment Review

Waters within the Jones Falls watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Channelization;
- Chlordane;
- Chlorides;
- Copper;
- Fecal Coliform;
- Lead;
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- Phosphorus (Total);
- Sulfates;
- Temperature, water;
  TSS;
- Trash and
- Zinc;

The Baltimore County Department of Environmental Protection and Sustainability completed SWAPs for the UJF watershed (CWP, 2015), the NJF watershed (BC-DEPS, 2012), and the LJF watershed (CWP, 2008b). Impervious land cover comprises 9% of the UJF watershed, 25 percent of the NJF watershed, and 32 percent of the LJF watershed. Approximately 7 percent of the soils within the UJF watershed, 9 percent of the soils within the NJF watershed, and 60 percent of the soils within the LJF watershed are considered of high runoff potential. Urban impervious and cropland are the land uses responsible for the greatest nitrogen, phosphorus, and sediment loads within the UJF and NJF watersheds.

Jones Falls currently has completed TMDLs for sediment and fecal coliform in the mainstem and PCBs in an impoundment (Lake Roland). Jones Falls also has Category Five impairment listings (i.e., TMDL required) for chlorides and sulfates in the mainstem and temperature in the Slaughterhouse Branch and two unknown tributaries. The Jones Falls watershed also falls within the Patapsco River Mesohaline segment-shed of the Chesapeake Bay, which has TMDLs for nitrogen, phosphorus, and sediment and Category Five impairment listings for zinc and lead in the Northwest Branch and trash and Enterococcus in the Middle Branch/Northwest Harbor.

The County prioritized subwatersheds within the UJF and NJF watersheds based on ranking criteria in order to identify which subwatersheds have the greatest need and potential for restoration. For the UJF watershed, Jones Falls was the only subwatershed rated "high" in terms of restoration potential. For the NJF watershed, Roland Run was rated "very high" and Towson Run was rated "high" in terms of restoration need and potential. For the LJF watershed, the SCA identified Moore's Branch as the most impacted subwatershed based on stream erosion and inadequate buffer. In the NJF watershed, 20 of the 22 sites assessed by the County had BIBI scores in the "poor" or "very poor" categories. In the LJF watershed, 31 of the 32 sites assessed by the City and 13 of the 15 sites assessed by the County had BIBI scores in the "poor" or "very poor" categories.

For the purposes of planning, the County has selected the following generalized restoration strategies to aid in meeting restoration goals within the Jones Falls watershed:

- SWM for new development and redevelopment;
- Existing SWM facility conversions;
- SWM retrofits;
- Stream corridor restoration;
- Street sweeping and storm drain inlet cleaning;
- Illicit connection detection and disconnection program and hotspot remediation;
- Sanitary sewer consent decrees;
- Downspout disconnection;
- Citizen awareness (fertilizer application and pet waste);
- Pervious Area Restoration (reforestation and tree planting); and

- Agricultural BMPs (stream protection via fencing and conservation tillage).

The County identified numerous potential restoration sites within each subwatershed by conducting neighborhood source assessments, hotspot site investigations, institutional site investigations, and pervious area assessments. The County also identified multiple potential stormwater retrofits and conversions within each watershed: Thirteen in the UJF watershed, 16 in the NJF watershed, and 43 in the LJF watershed. Detailed information on site locations can be found in the SWAPs. The County identified five potential stormwater dry pond conversions in the NJF watershed as "high" priorities for improving water quality. The County also identified 18 potential stream restoration project sites in the NJF watershed, however, location information for these sites is not included in the SWAP.

The following potential stream restoration sites within the Jones Falls watershed are identified in the SWAPs as shown in **Table 4-27.**

Table 4-27: County-Identified Potential Stream Restoration Sites in Jones Falls Watershed

Watershed	Reach	Number of Sites	Total Linear Feet	Conditions
UJF	Deep Run	1	-	Fish Barrier
UJF	Dipping Pond Run	10	2,214	Severe erosion, fish barrier, unstable outfalls, inadequate buffers
NJF	Towson Run	1	-	Inadequate buffers, requires naturalization
LJF	Jones Falls	1	-	Inadequate buffers, requires naturalization
LJF	Western Run	1	-	Runofff of I-695
LJF	Lower Jones Falls	1	-	Runoff from upstream urbanization

K.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Jones Falls watershed are shown in **Table 4-28**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2005.

- BMPs built between 2026 through 2043, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Jones Falls watershed total $8,279,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $80,000 from the Operations Budget is estimated for annual inlet cleaning.

Proposed practices to meet PCB reduction in the Lake Roland watershed are shown in **Table 4-29**. Projected PCB reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. One timeframe is included in the table:

- BMPs built after the TMDL baseline through 2025 the projected target date. In this case the baseline is 2010. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Lake Roland watershed total $5,328,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $80,000 from the Operations Budget is estimated for annual inlet cleaning.

Proposed practices to meet trash reduction in the Middle Branch and Northwest Patapsco River-Jones Falls watershed are shown in **Table 4-30**. Projected trash reduction using these activities is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- Reduction activities implemented after the TMDL baseline year through 2025. For the Middle Branch and Northwest Patapsco River-Jones Falls TMDL, the baseline is 2011.

- Reduction activities implemented in 2026 which is the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

SHA expects to spend $5,595 annually from the Operations Budget for yearly maintenance of a new public trash education program, stream cleanup, annual trash pickup from newly constructed stormwater facilities, and increased roadside trash pickup. In the future, other trash reducing activities may be implemented to help in meeting the reduction goal.

Figure 4-33 shows a map of SHA's restoration practices throughout the Jones Falls Watershed. The practices shown include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-28: Jones Falls Restoration Sediment BMP Implementation					
BMP	**Unit**	**2006 - 2025**	**2026 - 2043**	**Total**	**Cost**
New Stormwater	drainage area acres	50.6	38.7	89.3	$5,194,000
Retrofit	drainage area acres	22.2		22.2	$879,000
Stream Restoration	linear feet	1,200.0		1,200.0	$880,000
Tree Planting	drainage area acres	39.4		39.4	$1,326,000
Inlet Cleaning[1]	tons	84.0	84.0	84.0	$80,000
[1] Inlet cleaning is an annual practice.					

Table 4-29: Lake Roland Restoration PCB BMP Implementation				
BMP	**Unit**	**2006 - 2025**	**Total**	**Cost**
New Stormwater	drainage area acres	44.0	44.0	$5,328,000
Inlet Cleaning[1]	tons	84.0	84.0	$80,000
[1] Inlet cleaning is an annual practice.				

Table 4-30: Patapsco-Jones Falls Trash & Debris Activities Implementation					
BMP	**Unit**	**2012-2025**	**2026**	**Total**	**Cost**
Increased Inlet Cleaning	lbs/yr	0	0	0	$0
New Public Education Program	lbs/yr	1,618	18	179	$670
New Stream Clean Up	lbs/yr	315	335	350	$1,300
New Structural SW Controls Pickup	lbs/yr	45	9	54	$225
Increased Roadside Pickup	lbs/yr	1,513	2,271	914	$3400
These trash reducing activities are an annual practice. Projected load reductions included here are based on a combination of historical and future projections for the purposes of this implementation plan. Actual reductions will be reported each FY in the SHA MS4 annual report.					

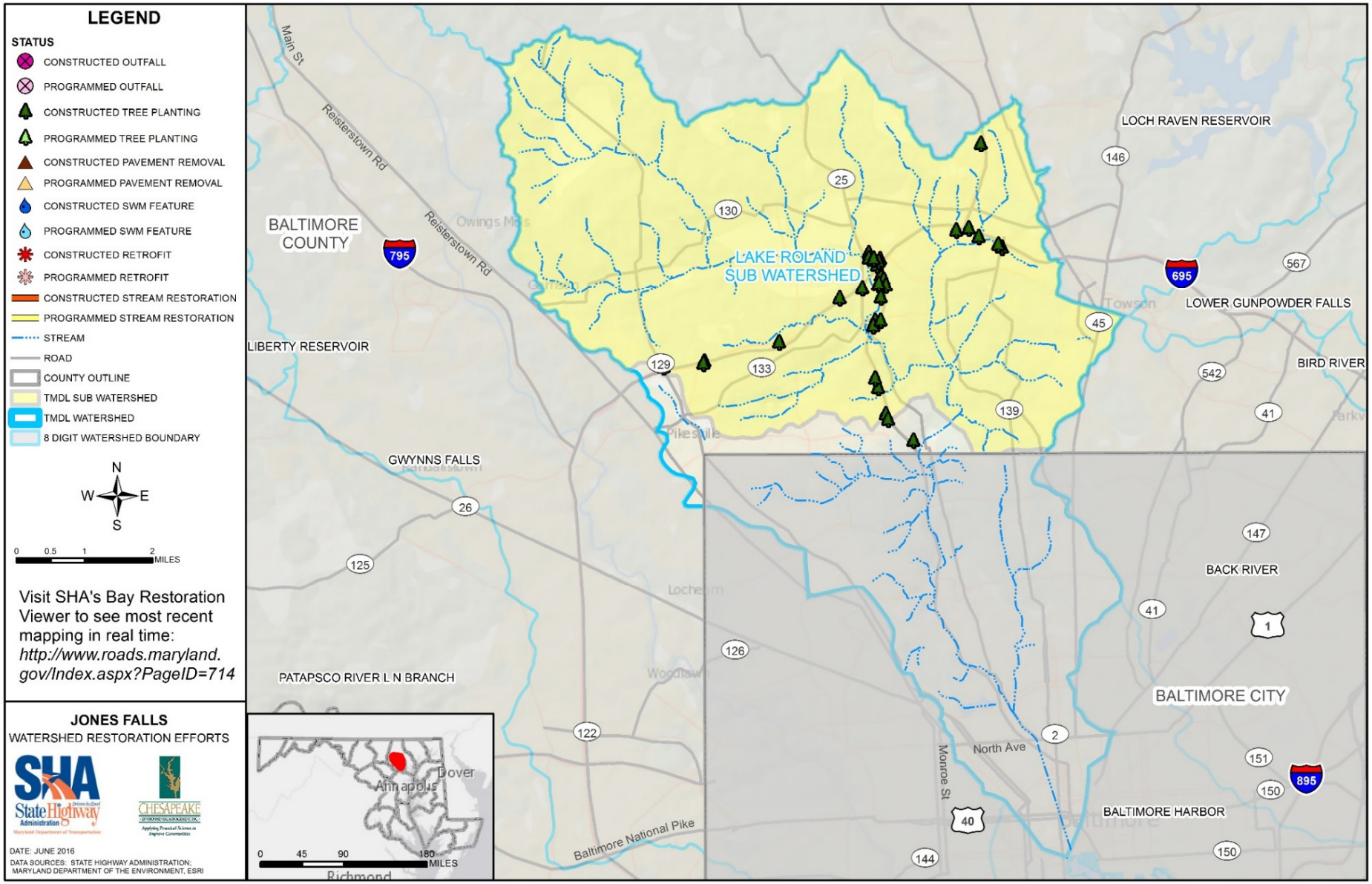


Figure 4-33: SHA Restoration Strategies within the Jones Falls Watershed

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L. LIBERTY RESERVOIR WATERSHED

L.1. Watershed Description

The Liberty Reservoir watershed encompasses 164 square miles within eastern Carroll County and western Baltimore County. The North Branch Patapsco River is the main tributary flowing into the watershed, which empties in the Lower Patapsco River watershed. Liberty Reservoir itself is located to the south of the watershed. Tributary creeks and streams of the Liberty Reservoir watershed include Aspen Run, Beaver Run, Cooks Branch, Deep Run, East Branch North Branch Patapsco, Little Morgan Run, Middle Run, Morgan Creek, Morgan Run, North Branch Patapsco, Norris Run, and Roaring Run.

There are 621.2 miles of SHA roadway located within the Liberty Reservoir watershed. The associated ROW encompasses 1,979.0 acres, of which 633.1 acres are impervious. SHA facilities located within the watershed consist of one highway garage/shop facility, two park and rides, and two salt storage facilities. See **Figure 4-34** for a map of the watershed.

L.2. SHA TMDLs within Liberty Reservoir Watershed

SHA is included in the phosphorus and sediment TMDL (MDE, 2014f) with a reduction requirement of 45.0 percent for both pollutants as shown in **Table 3-2**.

L.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-35**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, many SHA impervious areas within these grids are already treated by SHA BMPs. The current results of this ongoing grid search are as follows:

111 Total Grids:

- 38 fully reviewed;
- 42 partially reviewed – in progress; and
- 31 awaiting review (27 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 774 locations identified as possible candidates for new stormwater BMPs;
- Twelve facilities undergoing concept design and may be candidates for design contracts in the near future;
- One retrofit of existing stormwater facilities undergoing concept design that may be a candidate for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

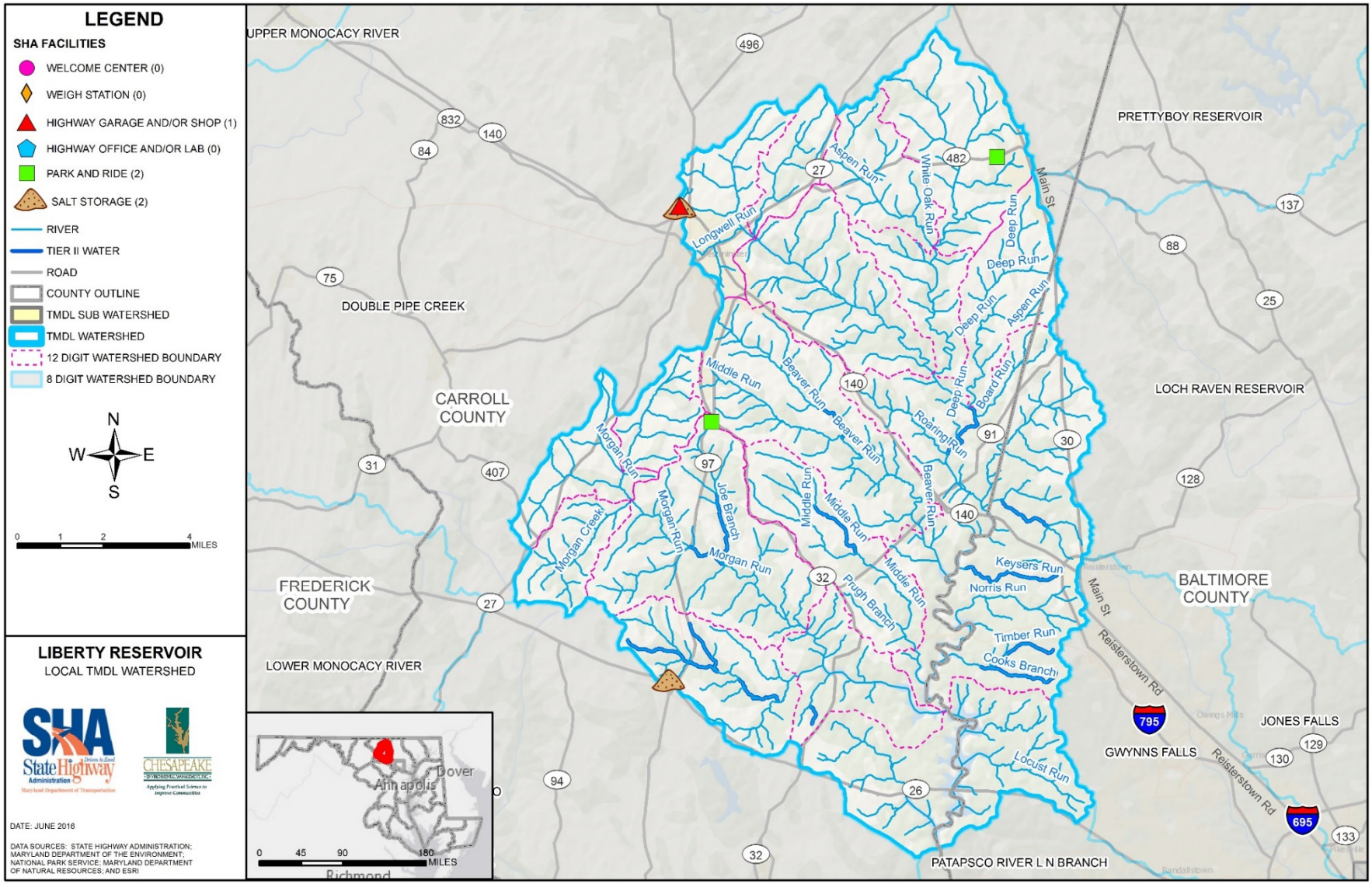


Figure 4-34: Liberty Reservoir Watershed

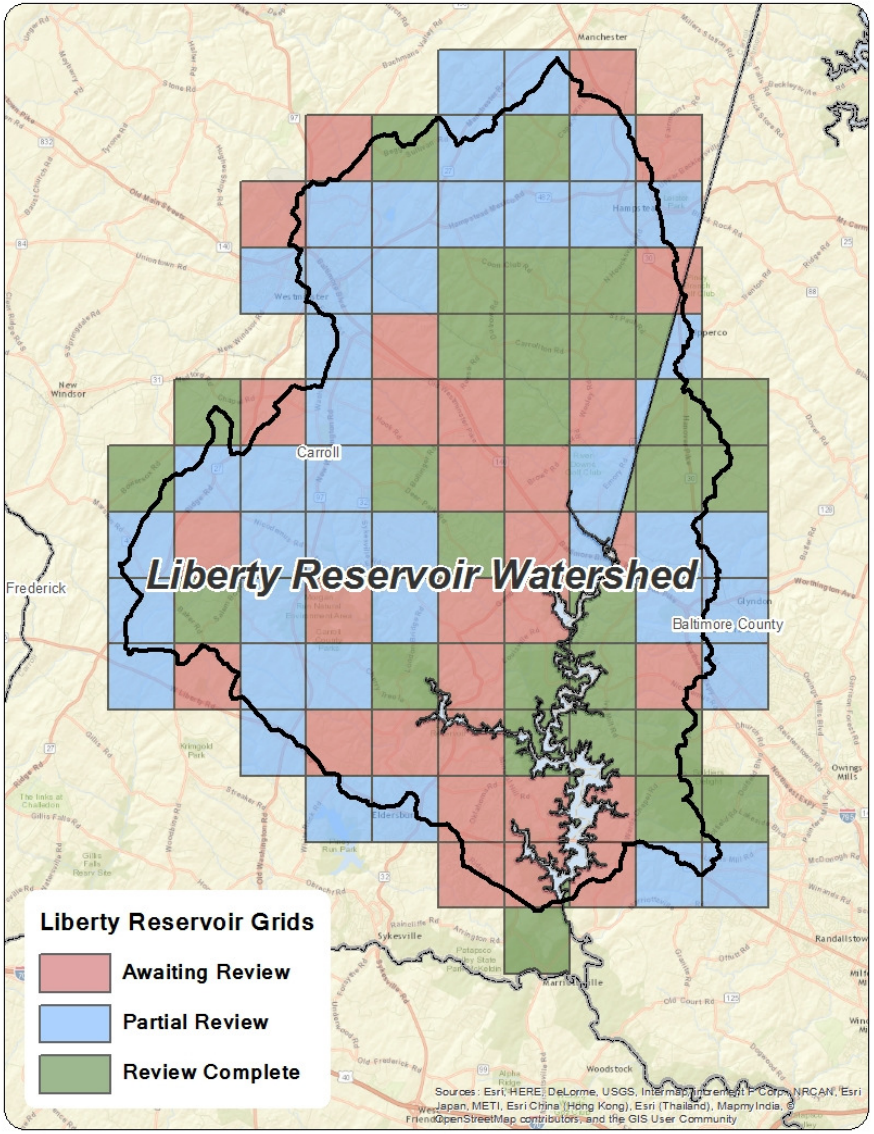


Figure 4-35: Liberty Reservoir Site Search Grids

The tree planting site search teams investigated 1,425 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 34 acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- 10 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 42,292 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 4,985 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on feasibility.

L.4. Summary of County Assessment Review

Waters within the Liberty Reservoir watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Chlorides;
- Chromium (total);
- *E. coli;*
- Lead;
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- Phosphorus (Total);
- Sedimentation/siltation; and
- Temperature, water.

The Liberty Reservoir watershed is ranked by the Clean Water Action Plan Technical Workgroup (CWAPTW) in the *Maryland Clean Water*

Action Plan as both a "Category 1 Priority" and a "Selected Category 3" (CWAPTW, 1998, p. 31). A Category 1 Priority classification indicates that a watershed needs restoration because it is not meeting clean water and other natural resource goals (CWAPTW, 1998, p. 3). A Selected Category 3 designation means that a watershed has four or more indicators related to the condition of the water (e.g., water chemistry, quality and quantity of physical habitat available for aquatic species, etc.) that meet the Category 3 classification of "pristine or sensitive" watershed needing "an extra level of protection" (CWAPTW, 1998, pp. 3-4, 22). Due to having both a Category 1 Priority and a Selected Category 3 listing, Liberty Reservoir also received the highest priority for restoration and protection under the *Maryland Clean Water Action Plan* (CWAPTW, 1998, p. 32). Six stream segments within this watershed are classified as Tier II waters, which are high quality waters with catchments under regulatory anti-degradation protection that exceed minimum WQSs (MDE, 2012d). Two Tier II segments are located in both Glenn Falls Run and Timber Run, with one in both Keyser Run and Cooks Branch. Impervious land cover comprises 6.3 percent of the watershed on average (DNR, 2002). Approximately 43 percent of streams in the Liberty Reservoir lack tree buffers (DNR, 2002).

SCAs were conducted in both counties (DNR, 2002; CC-BRM, 2012). The BC-DEPS completed a SWAP for the Liberty Reservoir watershed (BC-DEPS, 2015), and the Carroll County Bureau of Resource Management (CC-BRM) released the *Liberty Reservoir Watershed Steam Corridor Assessment* (CC-BRM, 2012). Carroll County assessments were conducted in 17 subwatersheds, and found 286 inadequate buffer sites, 447 erosion sites, and 151 fish passage barriers, for a total of 93,992 feet of erosion, and 304,986 feet of inadequate buffers (linear footage includes both banks). Site locations were not specified—only included as points on maps in the Liberty Reservoir SCA (CC-BRM, 2012). Baltimore County assessments were conducted in three subwatersheds (Cliffs Branch, Keyser Run, and Norris Run), and found 91 inadequate buffer sites, 314 erosion sites, and 78 fish passage barriers, for a total of 26,561 ft. of erosion and 39,680 ft. of inadequate buffer (BC-DEPS, 2015).

Table 4-31 lists potential stream restoration sites that were identified by the Baltimore County SWAP, limited to those rated as "Moderate," "Severe," or "Very Severe" (BC-DEPS, 2015):

Table 4-31: Potential Stream Restoration Sites in Liberty Reservoir, Baltimore County

Subwatershed	Reach ID	Length (ft.)	Impact(s)	Severity
Cliffs Branch	039A1 21-ES	26	Stage I Incision	Moderate
Cliffs Branch	039A1 40-ES	78	Stage I Incision	Moderate
Cliffs Branch	039A1 48-ES	612	Stage I Incision	Moderate
Cliffs Branch	039A1 02-ES	69	Stage II Widening	Severe
Cliffs Branch	039A1 32-ES	18	Stage II Widening	Moderate
Cliffs Branch	031A2 02-ES	44	Stage I Incision	Severe
Cliffs Branch	031A2 03-ES	29	Stage I Incision	Severe
Cliffs Branch	031A2 12-ES	166	Stage I Incision	Moderate
Cliffs Branch	031A2 13-ES	107	Stage I Incision	Moderate
Cliffs Branch	031C3 07-ES	24	Stage I Incision	Moderate
Cliffs Branch	031C2 08-ES	246	Stage I Incision	Very Severe
Cliffs Branch	031C2 09-ES	238	Stage I Incision	Very Severe
Cliffs Branch	031C2 10-ES	257	Stage I Incision	Severe
Cliffs Branch	031C2 11-ES	257	Stage I Incision	Severe
Cliffs Branch	031C2 13-ES	106	Stage I Incision	Moderate
Cliffs Branch	031C2 14-ES	59	Stage I Incision	Moderate
Cliffs Branch	031C2 14-ES	24	Stage I Incision	Moderate
Cliffs Branch	031C2 13-ES	71	Stage I Incision	Moderate

Table 4-31: Potential Stream Restoration Sites in Liberty Reservoir, Baltimore County

Subwatershed	Reach ID	Length (ft.)	Impact(s)	Severity
Cliffs Branch	031C2 14-ES	53	Stage I Incision	Moderate
Cliffs Branch	031C2 14-ES	36	Stage I Incision	Moderate
Cliffs Branch	03182 58-ES	106	Stage I Incision	Moderate
Cliffs Branch	03182 57-ES	106	Stage I Incision	Moderate
Cliffs Branch	03182 54-ES	148	Stage I Incision	Moderate
Cliffs Branch	03182 55-ES	153	Stage I Incision	Moderate
Cliffs Branch	03183 03-ES	192	Stage II Widening	Moderate
Keyser Run	047C2 12-ES	86	Stage II Widening	Moderate
Keyser Run	048a2 52-ES	58	Stage II Widening	Moderate
Keyser Run	048a2 53-ES	83	Stage II Widening	Moderate
Keyser Run	048a2 61-ES	110	Stage II Widening	Moderate
Keyser Run	048a2 03-ES	39	Stage I Incision	Moderate
Keyser Run	048a2 04-ES	28	Stage I Incision	Moderate
Keyser Run	04881 07-ES	112	Stage I Incision	Severe
Keyser Run	04881 08-ES	120	Stage I Incision	Severe
Keyser Run	04881 10-ES	121	Stage I Incision	Moderate
Keyser Run	04881 09-ES	201	Stage I Incision	Moderate
Cliffs Branch	03981 09-FB	--	Fish passage block	Moderate
Cliffs Branch	03182 01-FB	--	Fish passage block – road crossing	Moderate
Cliffs Branch	03981 39-FB	--	Fish passage block – debris dam	Moderate
Cliffs Branch	03182 19-FB	--	Fish passage block – road crossing	Severe

Table 4-31: Potential Stream Restoration Sites in Liberty Reservoir, Baltimore County

Subwatershed	Reach ID	Length (ft.)	Impact(s)	Severity
Cliffs Branch	031A3 32-FB	--	Fish passage block	Moderate
Cliffs Branch	031C3 11-FB	--	Fish passage block – road crossing	Moderate
Cliffs Branch	03182 48-FB	--	Fish passage block – channelized	Moderate
Keyser Run	047C1 06-FB	--	Fish passage block – road crossing	Moderate
Keyser Run	047C2 10-FB	--	Fish passage block – road crossing	Very Severe
Keyser Run	048A2 27-FB	--	Fish passage block – road crossing	Severe
Keyser Run	048A2 57-FB	--	Fish passage block – dam	Severe
Keyser Run	048A2 62-FB	--	Fish passage block – natural falls	Moderate
Keyser Run	048A2 34-FB	--	Fish passage block – road crossing	Moderate
Keyser Run	048A2 36-FB	--	Fish passage block – debris dam	Moderate
Keyser Run	048B1 27-FB	--	Fish passage block – natural falls	Moderate
Keyser Run	078B1 30-FB	--	Fish passage block – natural falls	Moderate
Norris Run	047C2 02-FB	--	Fish passage block – road crossing	Moderate
Norris Run	048B3 17-FB	--	Fish passage block – debris dam	Severe
Norris Run	048A3 05-FB	--	Fish passage block - channelized	Moderate
Norris Run	048B3 33-FB	--	Fish passage block – debris dam	Moderate
Norris Run	048B3 34-FB	--	Fish passage block – debris dam	Moderate

L.5. SHA Pollutant Reduction Strategies

Liberty Reservoir is listed for both phosphorus and sediment with each TMDL having a baseline year of 2009. Proposed practices to meet the phosphorus and sediment reductions in the Liberty Reservoir watershed are shown in **Table-4-32**. Projected phosphorus and sediment reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Two timeframes are included in the table below:

- BMPs built after the phosphorus and sediment TMDL baseline through 2025. In this case the baseline is 2009.

- BMPs built from 2026 through 2040, the projected target date of the sediment TMDL. 2036 is the projected target date for the phosphorus TMDL. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Liberty Reservoir watershed total $22,248,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $57,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-36 shows a map of SHA's restoration practices in the watershed, and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-32: Liberty Reservoir Restoration Nutrient and Sediment BMP Implementation					
BMP	**Unit**	**2010 - 2025**	**2026 - 2040**	**Total**	**Cost**
New Stormwater	drainage area acres	103.4	116.3	219.7	$9,931,000
Retrofit	drainage area acres	18.9		18.9	$454,000
Stream Restoration	linear feet	4,500.0	1,500.0	6,000.0	$4,398,000
Tree Planting	drainage area acres	36.5	28.4	64.9	$2,182,000
Outfall Stabilization[1]	linear feet		2,400.0	2,400.0	$5,235,000
Impervious Surface Elimination	acres removed	0.2		0.2	$48,000
Inlet Cleaning[2]	tons	59.0	59.0	59.0	$57,000
[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits					
[2] Inlet cleaning is an annual practice.					

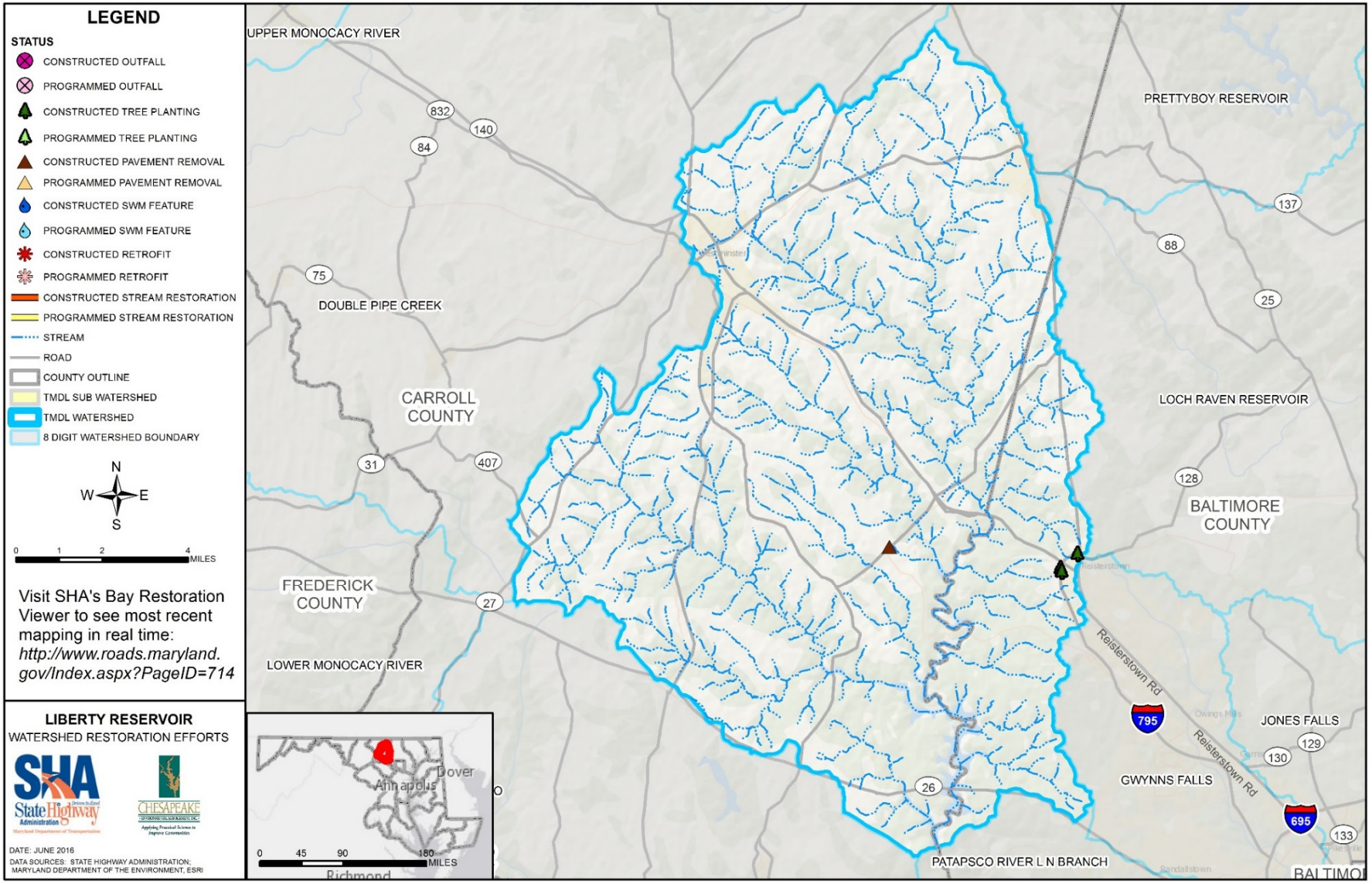


Figure 4-36: SHA Restoration Strategies within the Liberty Reservoir Watershed

M. LITTLE PATUXENT RIVER WATERSHED

M.1. Watershed Description

The Little Patuxent River watershed encompasses 103 square miles within Anne Arundel and Howard Counties. The Little Patuxent River begins near the Howard County Landfill north of Route 70. Little Patuxent River joins the Patuxent River between the towns of Bowie and Crofton, southeast of the Patuxent Research Refuge. Major tributaries of the Little Patuxent River include Hammond Branch and Midway Branch.

There are 857.9 miles of SHA roadway located within the Little Patuxent River watershed. The associated ROW encompasses 3,427.4 acres, of which 1,262.9 acres are impervious. SHA facilities located within the watershed consist of one salt storage facility, and five park and rides. See **Figure 4-37** for a map of the watershed.

M.2. SHA TMDLs within Little Patuxent River Watershed

SHA is included in the sediment TMDL (MDE, 2011f) with a reduction requirement of 36.1 percent, as shown in **Table 3-2**.

M.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-38**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, many SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

87 Total Grids:

- 21 fully reviewed;
- 35 partially reviewed – in progress; and
- 31 awaiting review (36 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 209 locations identified as possible candidates for new stormwater BMPs;
- 20 facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

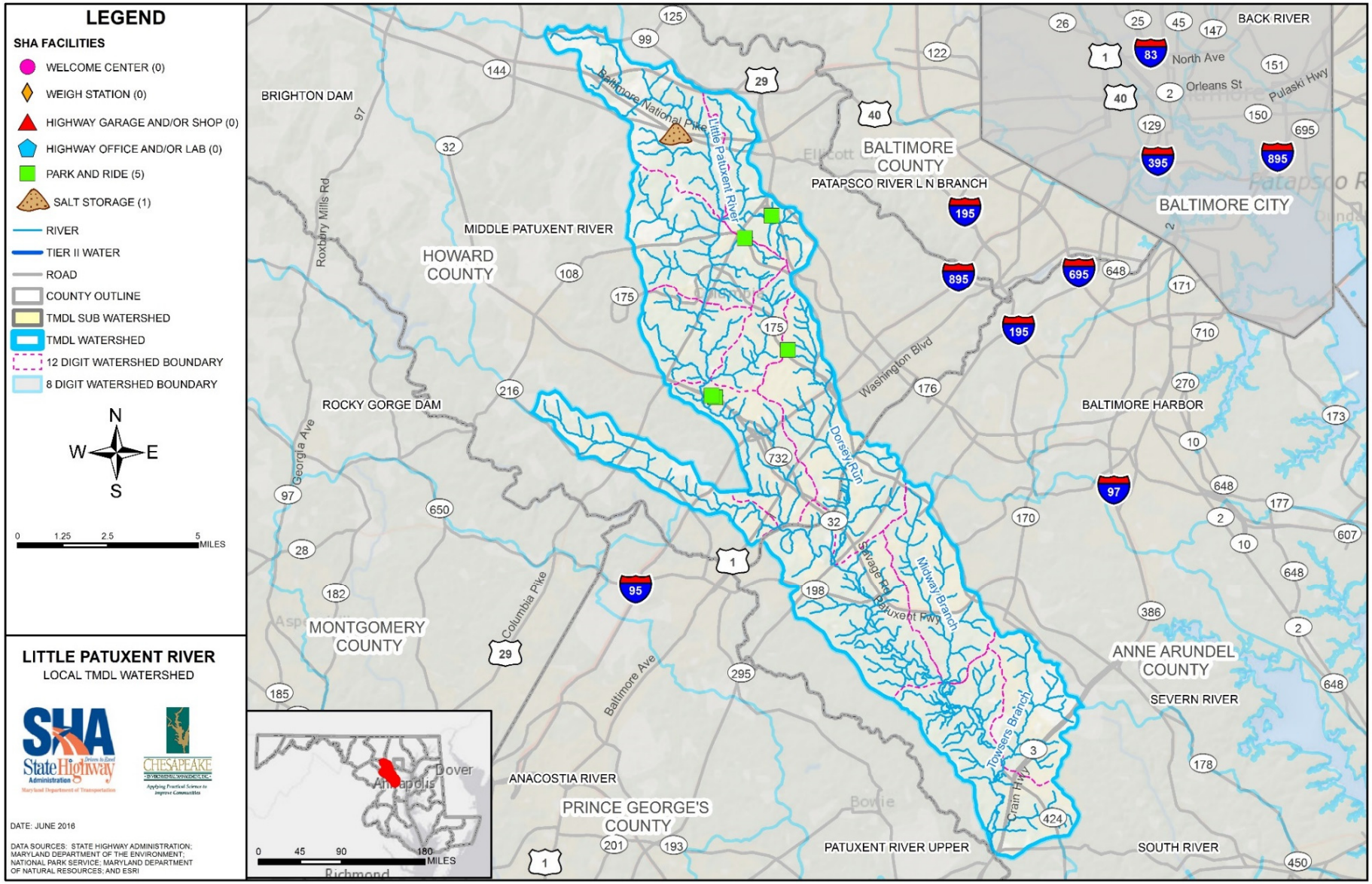


Figure 4-37: Little Patuxent River Watershed

The tree planting site search teams investigated 2,179 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 29 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 65,489 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 29,293 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

M.4. Summary of County Assessment Review

Waters within the Little Patuxent watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Cadmium;
- Chlorides;
- *Escherichia coli;*
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- Phosphorus (Total); and
- TSS.

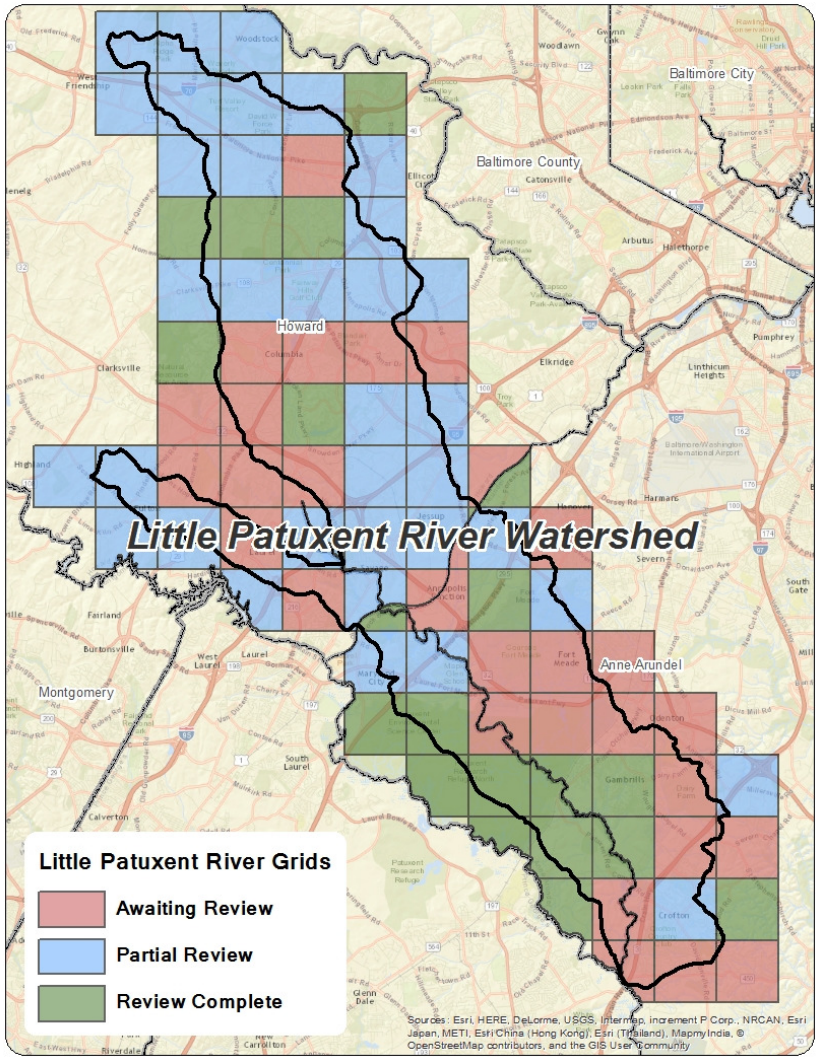


Figure 4-38: Little Patuxent River Site Search Grids

In 2015, Howard County Department of Public Works prepared the *Little Patuxent River Watershed Assessment* (Versar, 2015b). In 2016, the Anne Arundel County Department of Public Works completed the *Little Patuxent Watershed Assessment Comprehensive Summary Report* (LimnoTech & Versar, 2016) in an effort to assess the conditions in the Little Patuxent watershed and to rate and prioritize restoration and protection activities.

Howard County Assessment

Howard County conducts biological monitoring at randomly selected stations in its Countywide monitoring program, which began in 2001. The Little Patuxent watershed consists of the Lower Little Patuxent, Middle Little Patuxent, and Upper Little Patuxent subwatersheds, as well as Dorsey Run and Hammond Branch. With the exception of Hammond Branch and Dorsey Run, which were last sampled in 2009, the watershed was sampled most recently in 2013 (Versar, 2015b).

Of the 281 sites in Little Patuxent watershed identified by Howard County, only 10 (4 percent) were in "good" condition, 31 (11 percent) were rated "fair", 79 (28 percent) were rated "poor", and 160 (57 percent) rated "very poor". Some "good" sites were found in the Upper Little Patuxent subwatershed and upper reaches of Hammond Branch. However, most sites in Lower Little Patuxent subwatershed and Dorsey Run were in "poor" to "very poor" condition. Stream habitat condition was also evaluated by Howard County using EPA's Rapid Bioassessment Protocol (RBP) for habitat assessment. Of the 124 sites assessed, only one site (less than 1%) was rated as "comparable to reference" condition (the highest scoring category). Seventeen (14 percent) sites were rated as "supporting", 48 (39 percent) as "partially supporting", and 58 (47 percent) as "not supporting" (the lowest scoring category), indicating that many streams in the Little Patuxent watershed show evidence of habitat degradation (Versar, 2015b).

In 2014-2015, Howard County's Stormwater Management Division sponsored an assessment of the Little Patuxent watershed within Howard County in order to assess current conditions and recommend watershed restoration opportunities. Employing GIS and field investigations, the project team recommended a suite of opportunities including upgrades to existing stormwater BMPs, new BMPs, tree plantings, stream restoration, and stabilization of stormwater outfalls. In all, this assessment yielded 760 potential projects and produced concept plans for 109 of the top-ranked opportunities identified (Versar, 2015b).

While stream conditions vary across the County, degradation is more prevalent in the heavily developed urban areas. This reflects the history of urban and suburban development prior to effective SWM regulations. Watershed condition is generally better in the more rural parts of the county, but stream degradation still occurs in these areas as a result of large lot development and agricultural impacts. By reducing the adverse effects of stormwater runoff throughout the county, the process of watershed assessment, restoration planning, and implementation of prioritized BMPs should improve the water quality condition in Little Patuxent watershed over time (Versar, 2015b).

For the purpose of planning, the County has developed the following project concepts within the Little Patuxent watershed:

- 15 BMP Conversions;
- Ten New BMPs;
- 19 Tree Plantings;
- 20 Outfall Stabilizations; and
- 45 Stream Restorations.

Howard County listed several stream reaches recommended for restoration due to active erosion, threatened infrastructure and limited habitat. Overall, 14 stream reaches in the Northern Middle Patuxent watershed and 13 stream reaches in the Dorsey Run watershed have high stream restoration potential. Of these high priority reaches, those with the most potential are listed below:

- DOR-SR-F906 is a heavily incised and actively eroding channel which is currently threatening private property as the stream continues to erode and meander.

- DOR-SR-F909, DOR-SR-F910, and DOR-SR-F911 are experiencing moderate to severe erosion, an abundance of depositional areas, and pools filled with fine sediment (primarily silt) indicating large sediment loads upstream.

- DOR-SR-F912 has moderate to severe erosion throughout including degradation and lateral migration. Restoration could include outfall stabilization and BMPs in several locations and the length may be extended further downstream.

- NMP-SR-F133, NMP-SR-F136, and NMP-SR-F145 have severe bank erosion, numerous tree falls, lack of riparian vegetation, and moderate bar deposition.

- NMP-SR-F135 has moderate to severe erosion including headcuts and is highly sinuous.

- NMP-SR-F152 is experiencing severe active erosion along the left bank. Homeowners mow to top of bank, but expressed interest in the County planting a stream buffer.

- NMP-SR-F168 and NMP-SR-F-169 are the mainstem of the Northern Middle Patuxent and a large tributary to the mainstem, both experiencing severe erosion throughout. This is likely a more expensive restoration opportunity than lower order streams.

Anne Arundel County Assessment

The Little Patuxent subwatersheds were assessed in the spring of 2012 to determine the conditions of the watershed and prioritize watershed management activities. A small fraction of soils within the Little Patuxent subwatersheds is highly erodible (10 percent), with most being low in erodibility (37 percent). Thirty-five percent of streams assessed had more than 25 percent impervious cover, with 33 percent of streams with 0-10 percent impervious cover. Approximately 2 percent of the County's Onsite Sewage Disposal Systems are located within the watershed. As a result, five subwatersheds, Towsers Branch 3 (LPC), Little Patuxent 6 (LPF), Jessup (LPK), Towsers Branch 2 (LP6), and Little Patuxent 5 (LP7) are rated "very poor" or "poor" for total nitrogen contributions. Two subwatersheds were not assessed due to access restrictions (LimnoTech & Versar, 2016).

Based on BIBI scores, Podickery Creek (MGZ), Cornfield Creek (MR0), Gray's Creek (MRE), and Black Hole Creek (MRG) were rated as "very poor" and identified as target watersheds for restoration. Following a subwatershed restoration assessment, the County identified 13 subwatersheds as having "high" or "medium high" priority for restoration: Magothy Branch 2 (MG1), Indian Village Branch (MGW), Cypress Creek (MGC), Nannys Branch (MGY), Magothy River Tidal (MGF), Cockey Creek (MR6), Dividing Creek (MGH), Hunters Harbor (MRD), Mill Creek (MGI), Old Man's Creek (MRF), Deep Creek (MGT), Cattail Creek (MRI/MRO), and Little Magothy River (MGV). Of the 29 subwatersheds with assessed perennial streams, six had greater than one-third of their perennial streams rated as "medium high" or "high" for restoration: Cypress Creek (MGC), Magothy Narrows (MRM), Little Magothy River (MGV), Dividing Creek (MGH), Magothy Branch 1 (MR3), and Forked Creek (MGL) (LimnoTech & Versar, 2016).

For the purposes of planning, Anne Arundel County has selected the following six generalized restoration project types to focus on:

- Shallow marsh and regenerative wetland seepage system;
- Regenerative step pool outfall sand filtration device;
- Dry pond retrofit;
- Concrete ditch retrofit to water quality swale;
- Enhanced stormwater retrofit (bioretention facility); and

- Onsite sewage discharge system retrofits.

The County ranked several stream reaches based on priority for restoration, with the value one being the highest priority as shown below in **Table 4-33** (LimnoTech & Versar, 2016).

Table 4-33: Anne Arundel County Priority Stream Restoration Projects in Little Patuxent Watershed

Priority	Subwatershed	Reach
1	Cypress Creek	MGC001
2	Cypress Creek	MGC002
2	Little Magothy River	MGV009
2	Magothy Narrows	MRM001
2	Cypress Creek	MGC002
2	Bailys Branch	MR1006
8	Little Magothy River	MGV010
10	Magothy Branch 1	MR3019
10	Dividing Creek	MGH005
14	Kinder Branch	MR9008

M.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Little Patuxent River watershed are shown in **Table 4-34**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2005.

- BMPs built between 2026 through 2042, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Little Patuxent River watershed total $38,464,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $82,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-39 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-34: Little Patuxent River Restoration Sediment BMP Implementation					
BMP	**Unit**	**2006 - 2025**	**2026 - 2042**	**Total**	**Cost**
New Stormwater	drainage area acres	223.9	53.2	277.1	$18,201,000
Retrofit	drainage area acres	43.0		43.0	$1,161,000
Stream Restoration	linear feet	12,517.0	600.0	13,117.0	$9,614,000
Tree Planting	acres of tree planting	122.3		122.3	$4,112,000
Outfall Stabilization[1]	linear feet	2,400.0		2,400.0	$5,235,000
Impervious Surface Elimination	acres removed	0.5		0.5	$141,000
Inlet Cleaning[2]	tons	86.0	86.0	86.0	$82,000
[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits					
[2] Inlet cleaning is an annual practice.					

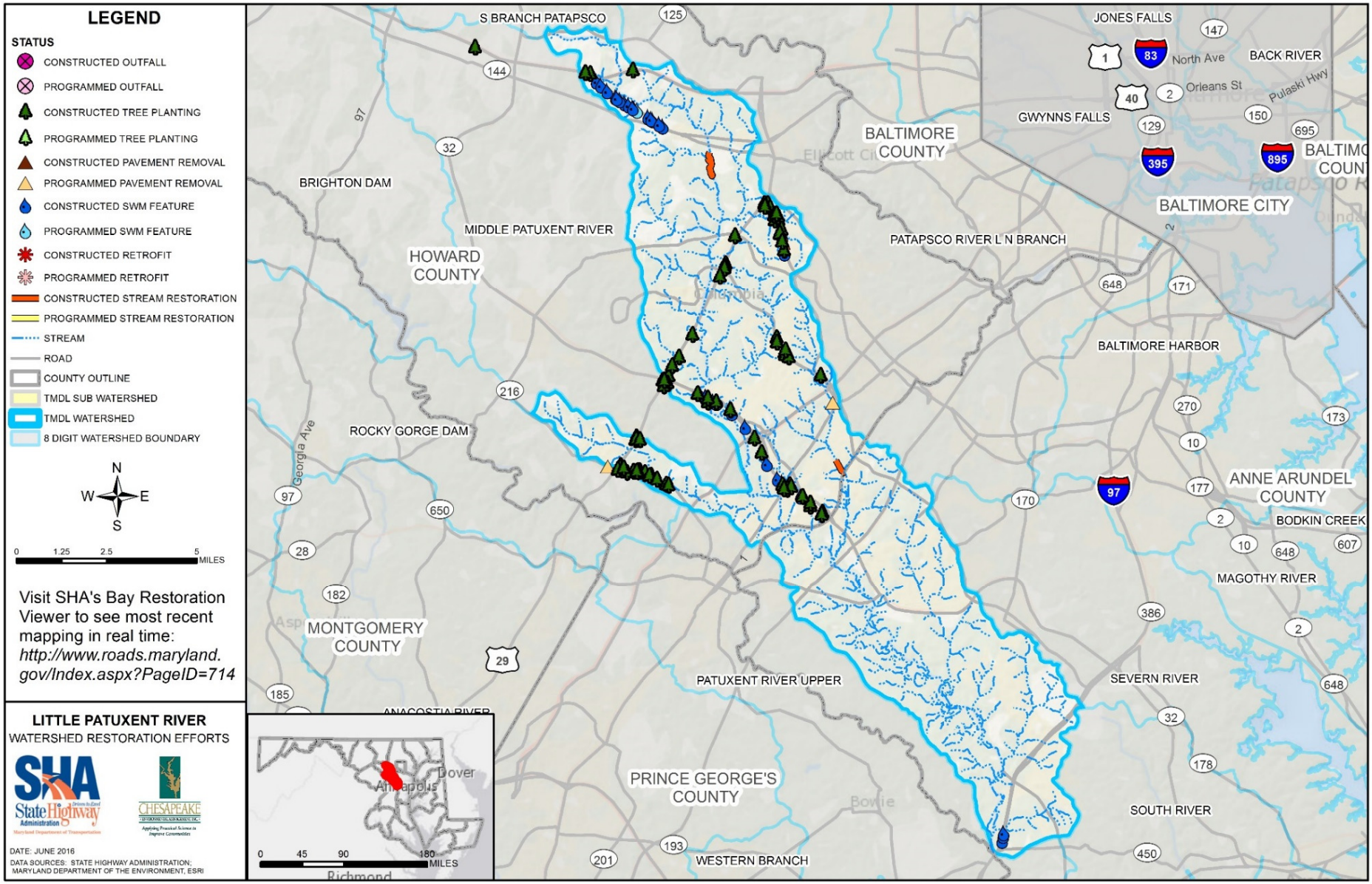


Figure 4-39: SHA Restoration Strategies within the Little Patuxent River Watershed

N. LOCH RAVEN RESERVOIR WATERSHED

N.1. Watershed Description

The Loch Raven Reservoir watershed encompasses 220 square miles within Maryland and Pennsylvania. In Maryland, the watershed is primarily located within Baltimore County, with small areas in Carroll and Harford Counties. Tributary creeks and streams of the Loch Raven Reservoir watershed include Beaverdam Run, Beetree Run, Blackrock Run, First Mine Branch, Gunpowder Falls, Little Falls, McGill Run, Piney Run, Second Mine Branch, Third Mine Branch, and Western Run.

There are 792.1 miles of SHA roadway located within the Loch Raven Reservoir watershed. The associated ROW encompasses 1,581.0 acres, of which 825.7 acres are impervious. SHA facilities located within the watershed consist of one highway garage/shop facility, one highway office/lab facility, one salt storage facility, one weigh station, and four park and rides. See **Figure 4-40** for a map of the watershed.

N.2. SHA TMDLs within Loch Raven Reservoir Watershed

SHA is included in the bacteria TMDL (MDE, 2009b) with reduction requirements of 88.0 percent in Baltimore County and 95 percent in Carroll County, as shown in **Table 3-3**.

N.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-41.** Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along heavily residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, some SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

134 Total Grids:

- 47 fully reviewed;
- 60 partially reviewed – in progress; and
- 27 awaiting review (19 percent of total grids).

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 186 locations identified as possible candidates for new stormwater BMPs;
- Twelve facilities undergoing concept design and may be candidates for design contracts in the near future;
- Two retrofit of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

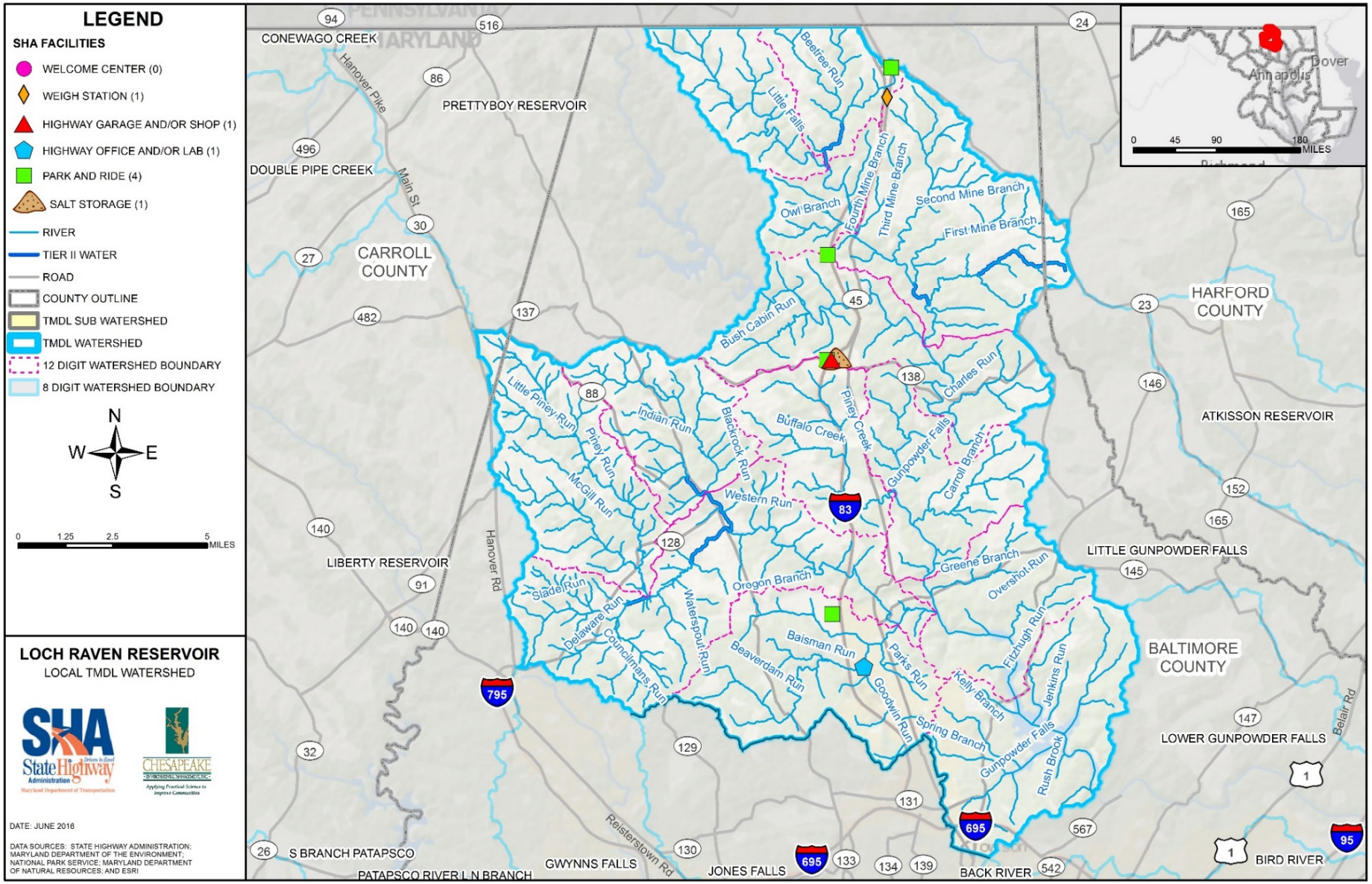


Figure 4-40: Loch Raven Reservoir Watershed

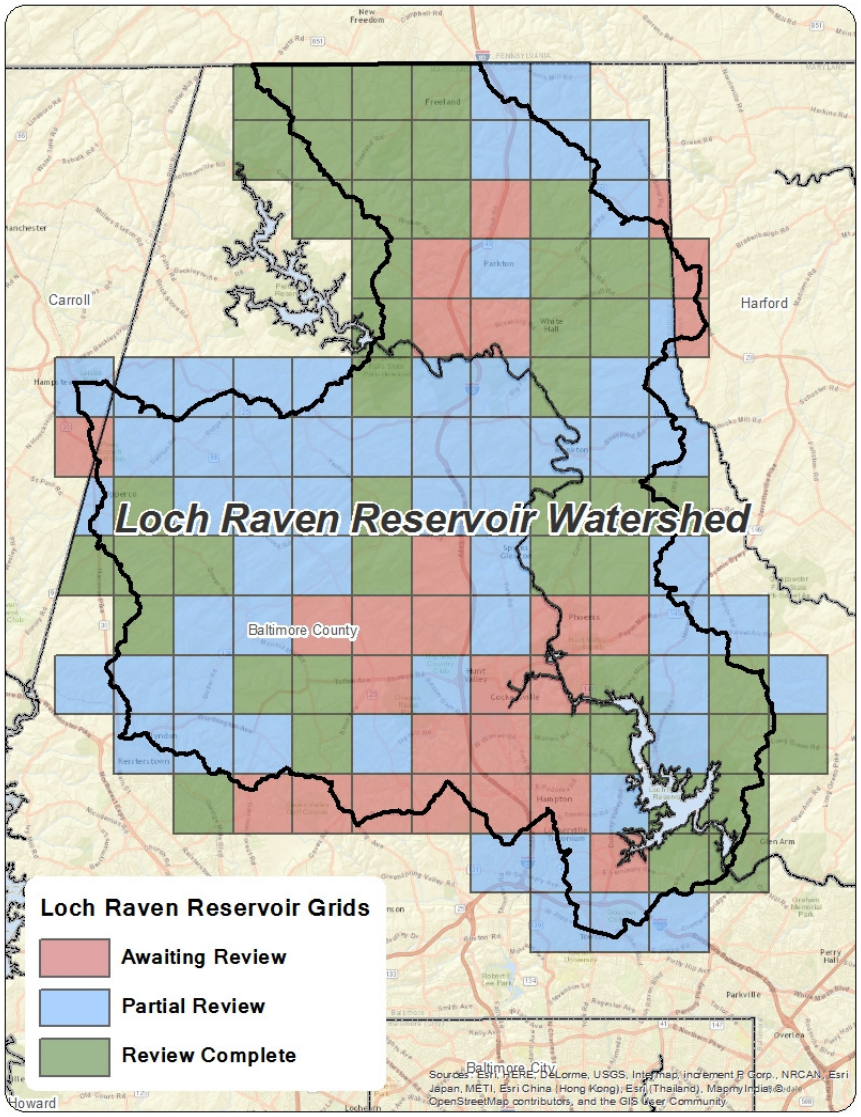


Figure 4-41: Loch Raven Reservoir Site Search Grids

The tree planting site search teams investigated 901 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 12 acres are undergoing concept design and may be candidates for planting contracts in the near future;
- Four (4) acres of tree planting potential for further investigation; and
- Some of the reasons for sites being removed from consideration include commercial locations or existing forest.

The stream restoration site search teams investigated 38,288 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 1,753 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility

N.4. Summary of County Assessment Review

Waters within the Loch Raven Reservoir watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Arsenic;
- Cadmium;
- Chlorides;
- Chromium (total);
- Copper;
- Escherichia coli;
- Lack of Riparian Buffer;
- Lead;
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- Nickel;

- Phosphorus (Total);
- Sedimentation/siltation;
- Selenium;
- Sulfates; and
- Temperature, water.

The Baltimore County Department of Environmental Protection and Sustainability completed SWAPs for the Loch Raven North in 2015 (PB, 2015), Beaverdam Run, Baisman Run, and Oregon Branch subwatersheds in 2011 (CWP, 2011), Loch Raven East subwatershed in 2014 (CWP, 2014), and the Spring Branch subwatershed (SB) in 2008 (BC-DEPRM, 2008b).

The Beaverdam Run, Baisman Run, and Oregon Branch subwatersheds (BBO) makes up approximately 6 percent of the drainage area to the Loch Raven Reservoir watershed. The Loch Raven East subwatershed (LRE) makes up approximately 8 percent of the Loch Raven Reservoir watershed drainage area. The SB makes up less than 1 percent of the Loch Raven Reservoir watershed drainage area (CWP, 2011).

Impervious land cover comprises 6.5 percent of the BBO subwatersheds, 4.8 percent of the LRE subwatershed, and 18.6 percent of the SB subwatershed. 16.6 percent of the soils within the BBO subwatershed, 14.8 percent within the LRE subwatershed, and 25.9 percent of the soils within the SB subwatershed are considered highly erodible. Impervious urban, livestock, and cropland are the land uses responsible for the greatest phosphorus loads within the BBO and SB subwatersheds, while cropland and stream channel scour are responsible for the greatest sediment loads. Impervious urban, livestock, and cropland are the land uses responsible for the greatest nitrogen, phosphorus, and sediment loads within the LRE subwatershed (CWP, 2011).

The BBO SWAP identified many moderate environmental problems, and several severe problems in Beaverdam Run, Baisman Run, and Oregon Branch based on channel alterations, erosion, and fish blockages (CWP, 2011). The LRE SWAP identified eight stream areas in Dulaney Valley Branch, totaling 5,381 feet of erosion, and 34 fish barriers, ten of which are categorized as “very severe” and “severe”. Biological assessments showed a generally unimpaired community in the BBO subwatersheds. While the majority of BIBI scores in the LRE subwatersheds were “good”, the majority of FIBI scores were “poor” (CWP, 2014).

For the purposes of planning, the County has selected the following generalized restoration strategies to aid in meeting restoration goals within the Loch Raven Reservoir watershed:

- SWM for new development and redevelopment;
- Existing SWM facility conversions;
- SWM retrofits;
- Stream corridor restoration;
- Illicit connection detection and disconnection program and hotspot remediation;
- Downspout disconnection;
- Citizen awareness (bayscaping, fertilizer application, and pet waste); and
- Pervious area restoration (reforestation and tree planting).

The County identified numerous potential restoration sites within each subwatershed, with the exception SB where assessments were not completed. The county also identified 13 stormwater retrofit or conversion projects, seven of which fell in the BBO subwatersheds, and the remaining six within the LRE subwatersheds. Detailed information on site locations can be found in the SWAPs. Loch Raven Reservoir watershed restoration recommendations are shown in **Table 4-35**:

Table 4-35: Potential Stream Restoration Sites in Loch Raven Reservoir Watershed			
Reach	**Number of Sites**	**Total Linear Feet**	**Conditions**
Dulaney Valley Branch	8	5,381	Erosion and unstable channels
Fitzhugh Run	1	2,140	
Green Branch	1	26,400	
Overshot Run	1	15,840	
Beaverdam Run	6	3,637	Erosion with headcutting, downcutting, and widening
Baisman Run	1	2,606	Erosion with downcutting

N.5. Pollutant Reduction Strategies

Proposed practices to meet the bacteria reduction in the Loch Raven Reservoir watershed are shown in **Table 4-36**. Projected bacteria reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-3**. Two timeframes are included in the table below:

- BMPs built after the bacteria TMDL baseline through 2025. In this case the baseline is 2004.
- BMPs built from 2026 through 2048, the projected target date of the bacteria TMDL. SHA will accomplish the percent reduction presented in **Table 3-3**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Loch Raven Reservoir watershed total $7,801,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category.

Figure 4-42 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction.

Table 4-36: Loch Raven Reservoir Restoration Bacteria BMP Implementation					
BMP	**Unit**	**2005 - 2025**	**2026 - 2048**	**Total**	**Cost**
New Stormwater	drainage area acres	37.6	38.3	75.9	$7,527,000
Retrofit	drainage area acres	8.9		8.9	$274,000

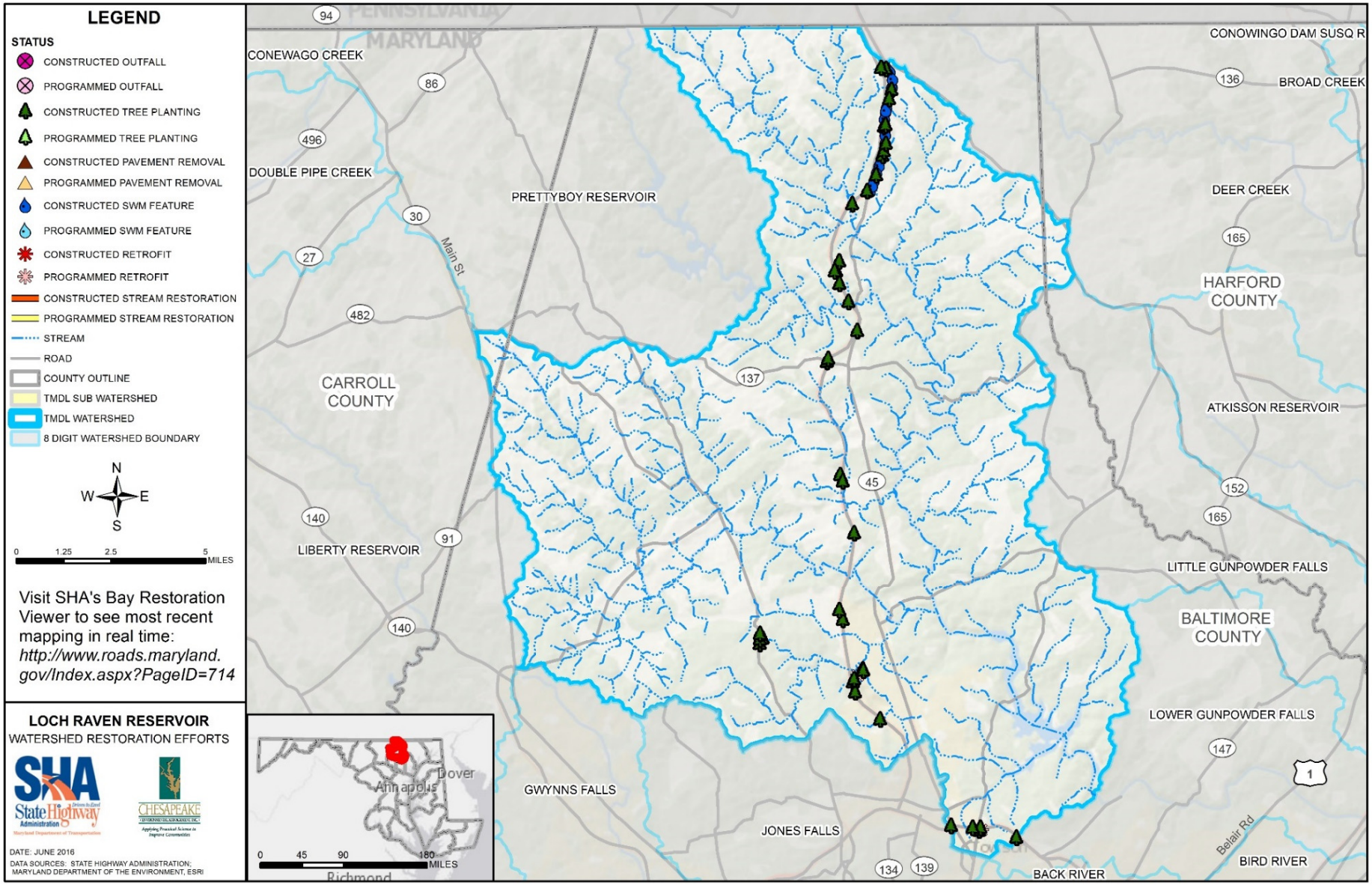


Figure 4-42: SHA Restoration Strategies within the Loch Raven Reservoir Watershed

O. LOWER MONOCACY RIVER WATERSHED

O.1. Watershed Description

The Lower Monocacy watershed encompasses 495 square miles primarily within Frederick County as well as small areas of Montgomery and Carroll Counties. The Monocacy River originates in Pennsylvania and flows through Maryland ultimately into the Potomac River. The Lower Monocacy River flows south through Frederick, and ultimately into the Middle Potomac River near the town of Dickerson. Tributary creeks and streams of the Lower Monocacy Watershed include Israel Creek, Carroll Creek, Linganore Creek, Bush Creek, Bennett Creek, and Ballenger Creek. The Lower Monocacy River watershed land use consists of crops (29.4 percent), forest (29.4 percent), residential (17.5 percent), pasture (8.8 percent), commercial (5.2 percent), and water (0.4 percent).

There are 1,224.8 miles of SHA roadway located within the Lower Monocacy watershed. The associated ROW encompasses 3,562.6 acres, of which 1,886.4 acres are impervious. SHA facilities located within the watershed consist of one highway office/lab facility, two salt storage facilities, three weigh stations, and seven park and rides. See **Figure 4-43** for a map of the watershed.

O.2. SHA TMDLs within Lower Monocacy River Watershed

SHA is included in both the phosphorus (MDE, 2013d) and sediment (MDE, 2009f) TMDLs. Phosphorus is to be reduced by 25.0 percent in Carroll, Frederick, and Montgomery Counties. Sediment is to be reduced by 60.8 percent in Frederick and Montgomery Counties, as shown in **Table 3-2**.

O.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-44**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, many SHA impervious areas within these grids are already treated by SHA BMPs. The current results of this ongoing grid search are as follows:

192 Total Grids:

- 95 fully reviewed;
- 62 partially reviewed – in progress; and
- 35 awaiting review (12 percent of total grids).

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 953 locations identified as possible candidates for new stormwater BMPs;
- 43 facilities undergoing concept design and may be candidates for design contracts in the near future;
- Four retrofit of existing facilities under current contracts; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

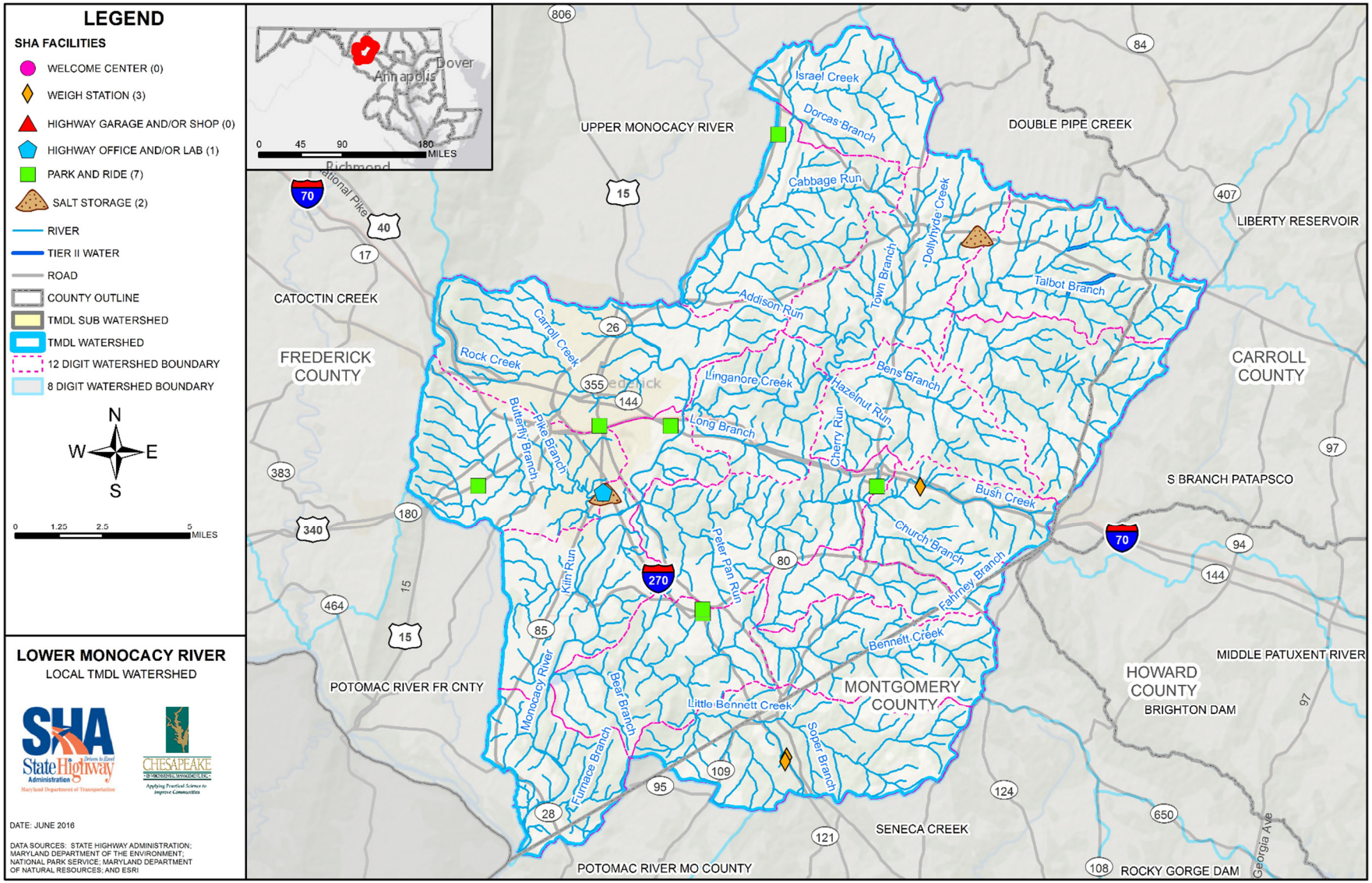


Figure 4-43: Lower Monocacy River Watershed

The tree planting site search teams investigated 2,455 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- Eight acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- Four acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 111,081 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 53,979 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

O.4. Summary of County Assessment Review

Waters within the Lower Monocacy watershed are subject to the following impairments as noted on MDE's 303(d) List:

- *Escherichia coli;*
- Lack of Riparian Buffer;
- PCB in Fish Tissue;
- Phosphorus (Total);
- Sedimentation/siltation;
- Temperature, water; and
- TSS.

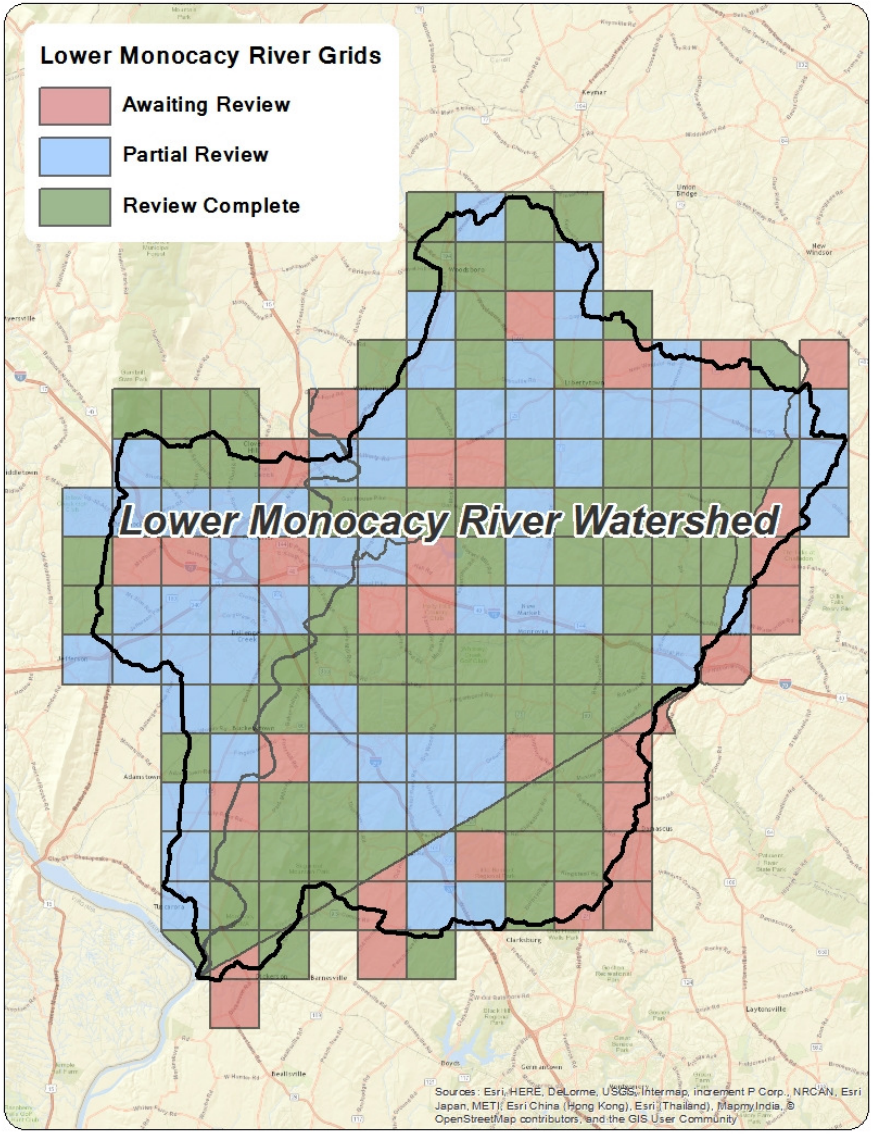


Figure 4-44: Lower Monocacy River Site Search Grids

The *Lower Monocacy River Watershed Restoration Action Strategy* (WRAS), prepared by the Frederick County Division of Public Works, was adopted in May 2004 (FC-DPW, 2004). The primary focus of the strategy is the portion of the drainage within Frederick County, which is 87 percent of the total area. The Lower Monocacy River watershed is ranked as a "Category 1 Priority" and "Selected Category 3" watershed in the *Maryland Clean Water Action Plan* (CWAPTW, 1998).

A *Stream Corridor Assessment Survey* (FC-DPW, 2004), to support the WRAS, found 247 potential environmental problem sites following a survey of 75 out of 600 miles. Issues identified included inadequate buffers, erosion, fish barriers, pipe outfalls, channel alterations, trash dumping, and exposed pipes.

The *Frederick County Stream Survey* (Versar, 2015a) found that the average BIBI score for Frederick County streams was "poor." The stream survey also indicated that 7% scored "very poor," 41% scored "poor," 37% scored "fair," and 15% scored "good."

An *Assessment of Stormwater Management Retrofit and Stream Restoration Opportunities in Bennett Creek Watershed* was published in 2009 (Tetra-Tech, 2009). The assessment identified eleven potential restoration projects. Six of the potential sites are located in Fahrney subwatershed and the others are located in the Bennett Middle, Bennett Upper, Little Bennett, Pleasant, and Urbana subwatersheds.

Restoration approaches proposed across the watershed are primarily county-owned properties and residential properties outside of SHA ROW. The Bennett Creek Assessment identified three potential stream restoration projects (Tetra-Tech, 2009):

- The channel downstream of the Englandtowne SWM pond site, is experiencing bank erosion, the upstream channel is also eroding and is contributing to silt deposition within the stormwater pond. Thus reducing the effectiveness of the stormwater pond. Stream restoration is proposed upstream and downstream.
- The stream corridor at Kemptown Park is experiencing severe erosion with widening and lateral migration also occurring. It is proposed this stream is restored.
- The stream corridor is located in close proximity to the Persimmon residential area and is experiencing severe erosion, habitat degradation, a fish barrier and man-made channel alteration. It is recommended the stream corridor is restored.

O.5. SHA Pollutant Reduction Strategies

Lower Monocacy is listed for both phosphorus and sediment with each TMDL having a different baseline year; 2000 for sediment and 2009 for phosphorus. Proposed practices to meet the phosphorus and sediment reduction in the Lower Monocacy River watershed are shown in **Table 4-37**. Projected phosphorus and sediment reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Three timeframes are included in the table below:

- BMPs built after the sediment TMDL baseline through 2009. In this case the baseline is 2000.
- BMPs built after the phosphorus TMDL baseline through 2025. In this case the baseline is 2009.
- BMPs built from 2026 through 2040, the projected target date of the phosphorus TMDL. 2036 is the projected target date for the sediment TMDL. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Lower Monocacy River watershed total $55,146,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects

for each BMP category. In addition to Capital Budget costs, $77,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-45 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-37: Lower Monocacy River Restoration Nutrient and Sediment BMP Implementation

BMP	Unit	2001 - 2009	2010 - 2025	2026 - 2040	Total	Cost
New Stormwater	drainage area acres		354.0	184.4	538.4	$27,331,000
Retrofit	drainage area acres		108.3		108.3	$1,931,000
Stream Restoration	linear feet		7,507.0	1,500.0	9,007.0	$6,602,000
Tree Planting	acres of tree planting	7.6	134.9		142.5	$4,792,000
Outfall Stabilization[1]	linear feet			6,200.0	6,200.0	$13,523,000
Impervious Surface Elimination	acres removed		3.4		3.4	$967,000
Inlet Cleaning[2]	tons		80.0	80.0	80.0	$77,000

[1] *Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits*

[2] *Inlet cleaning is an annual practice.*

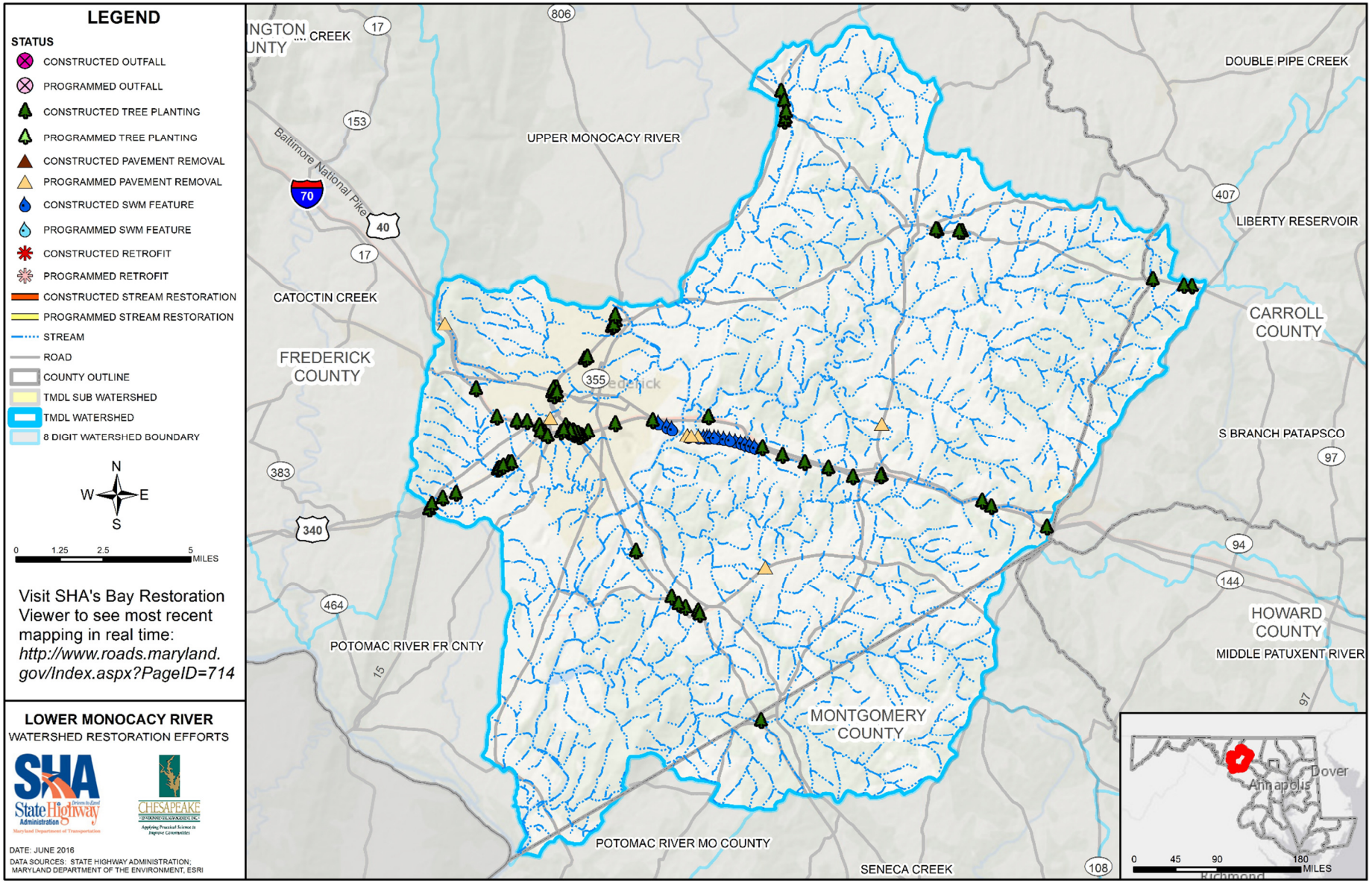


Figure 4.45: SHA Restoration Strategies within the Lower Monocacy River Watershed

P. PATAPSCO RIVER LOWER NORTH BRANCH WATERSHED

P.1. Watershed Description

The Patapsco River Lower North Branch watershed encompasses 115 square miles across Anne Arundel County, Baltimore County, City of Baltimore, Carroll County, and Howard County. The Patapsco River originates in Carroll County and flows to the Baltimore Harbor and ultimately to the Chesapeake Bay.

There are 1,019.8 miles of SHA roadway located within the Patapsco River Lower North Branch watershed. The associated ROW encompasses 3,799.2 acres, of which 1,693.7 acres are impervious. SHA facilities located within the watershed consist of one highway office/lab facility, one highway garage/shop, two salt storage facilities, and seven park and rides. See **Figure 4-46** for a map of the watershed.

P.2. SHA TMDLs within Patapsco River Lower North Branch Watershed

SHA is included in both bacteria (MDE, 2009c) and sediment (MDE, 2011g) TMDLs. Sediment is to be reduced by 18.0 percent in Anne Arundel, Baltimore and Howard Counties as shown in **Table 3-2**. Bacteria is to be reduced by 20.7 percent in Anne Arundel County, 13.0 percent in Baltimore County, and 13.4 percent in Howard County as shown in **Table 3-3.**

P.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-47**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

The grids awaiting review have little potential for additional restoration due to minimal ROW along heavily residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, some SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

104 Total Grids:

- 34 fully reviewed;
- 40 partially reviewed – in progress; and
- 30 awaiting review (21 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 258 locations identified as possible candidates for new stormwater BMPs;
- 14 facilities undergoing concept design and may be candidates for design contracts in the near future;

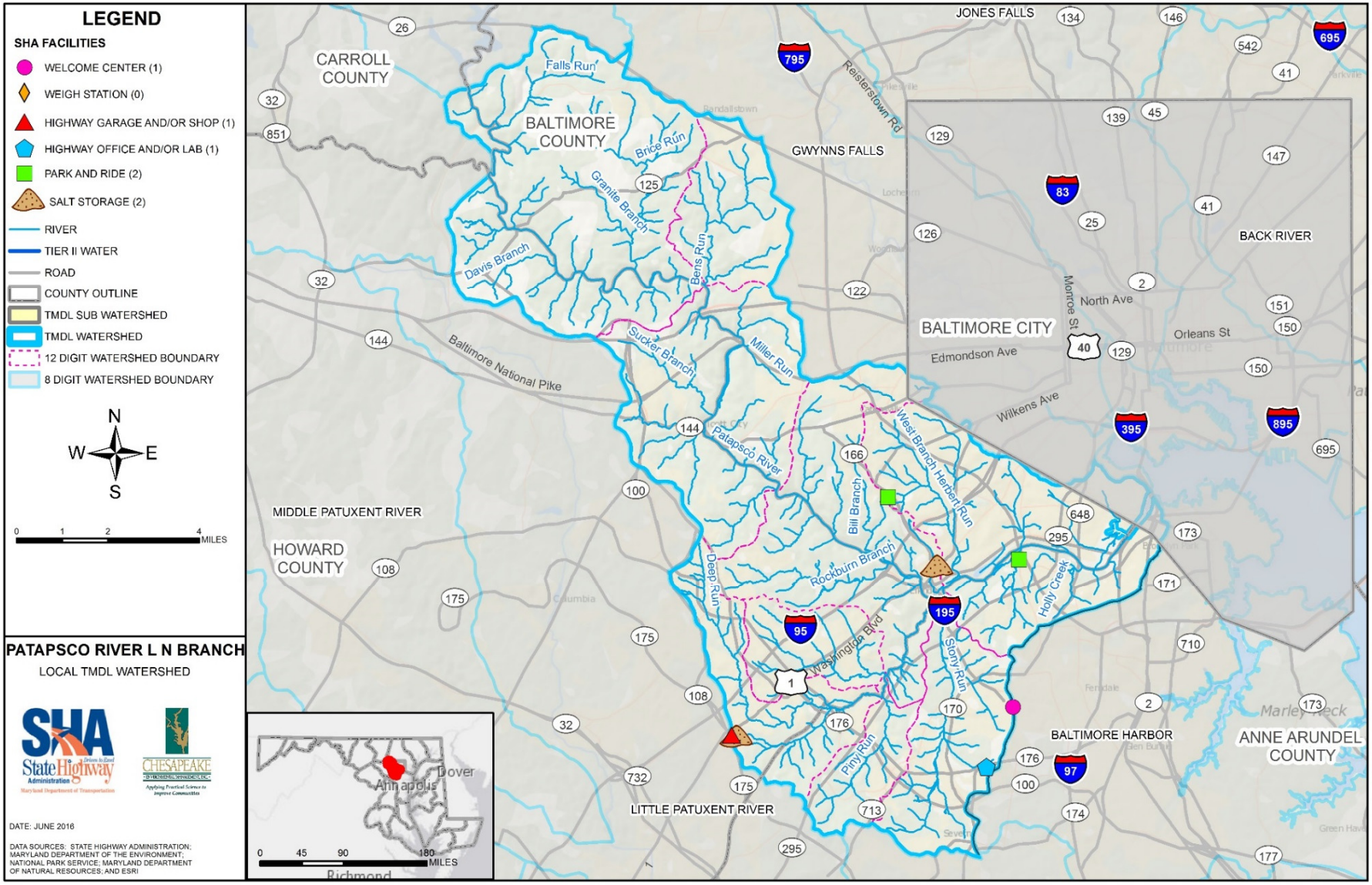


Figure 4-46: Patapsco River Lower North Branch Watershed

- Five retrofits of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 2,449 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 104 acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- 123 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 31,032 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 16,712 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

P.4. Summary of County Assessment Review

Waters within the Patapsco River Lower North Branch watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Arsenic;
- Cadmium;
- Channelization;

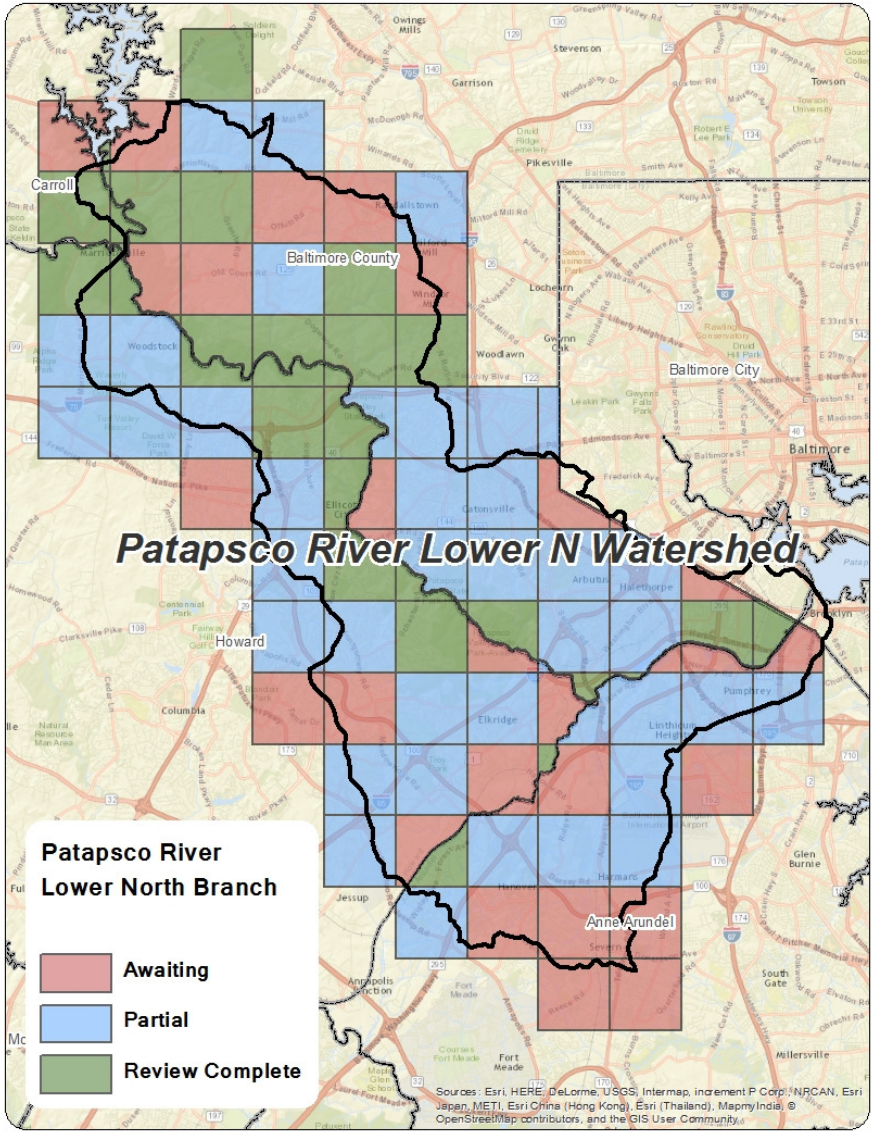


Figure 4-47: Patapsco River Lower North Branch Site Search Grids

- Chlorides;
- Chromium (total);
- Copper;
- *E. coli;*
- Lead - water column;
- Lead;
- Mercury;
- Nickel;
- PCB in Fish Tissue;
- Phosphorus (Total);
- Selenium;
- Sulfates;
- TSS; and
- Zinc.

This summary reviews findings from the *2011 Patapsco Non-Tidal Watershed Assessment* (KCI/CH2M Hill, 2011; Anne Arundel County Watershed Assessment & Planning Program), the 2012 *Lower Patapsco River Small Watershed Action Plan* (Versar, 2012b; Baltimore County Department of Environmental Protection and Sustainability), and the *2012 Tiber-Hudson & Plumtree Branch Stream Corridor Assessment* (S&S Planning and Design, 2012; Howard County Department of Public Works). These reports discuss specific issues that contribute to overall watershed impairments and identify high priority restoration projects. The Patapsco River Lower North Branch 8-digit watershed currently has completed TMDLs for *E. coli* and sediment. The Patapsco River Lower North Branch also has Category 5 impairment listings (i.e., TMDL required) for sulfates and chlorides.

The Lower Patapsco River watershed, which is the lower portion of the Patapsco Lower North Branch watershed that is located within Baltimore County, has 41.8% high/very highly erodible soils. Restoration assessments identified seven subwatersheds as "high" or "very high" priority for restoration. Patapsco River-A5, Herbert Run (E. Br.), and Herbert Run (W.Br.) received the highest scores and the prioritization category of "very high." Cooper Branch, Miller Branch, Dogwood Branch, and Cedar Branch received a priority categorization of "high." Surveys identified Soapstone Branch as a potential reference stream for future restoration projects. 25 existing detention ponds were identified for conversion potential (Versar, 2012b)

The Patapsco Non-Tidal watershed, which is the lower portion of the Patapsco Lower North Branch Watershed that is located within Anne Arundel County, has 39.7 percent of the soils classified as highly erodible and 44.5 percent classified as potentially highly erodible. There were six subwatersheds that were given Habitat Scores in the "severely degraded" category: Unnamed Tributary (PN4), Patapsco Mainstem (PN5), Stoney Run 3 (PN8), Stoney Run 4 (PN9), Deep Run (PNA), and Deep Run (PNC). The Patapsco Mainstem (PN1) was identified as the subwatershed with the highest priority for restoration based on the County's subwatershed restoration assessment. Deep Run (PNA) and the Patapsco Mainstem (PN5) were ranked as the highest priority for preservation within the watershed (KCI/CH2M Hill, 2011).

The *Tiber-Hudson & Plumtree Branch Stream Corridor Assessment* identified areas of concern in the Ellicott City watershed that were highly susceptible to erosion/flooding and recommended BMPs to improve conditions and downstream watershed health. Only the Tiber-Hudson was considered, as Plumtree Branch falls in the Little Patuxent drainage. In the Tiber-Hudson there were four severe and ten moderate erosion sites, 19 debris blockages, and seven with bank erosion from channelization (S&S Planning and Design, 2012).

Recommended BMPs for the watershed include:

- SWM;
- SWM conversions;
- SWM retrofits;
- Impervious cover removal;
- Stream corridor restoration proposed;
- Street sweeping and trash reduction;
- Illicit discharge elimination;
- Sanitary sewer consent decree;

- Pond retrofits;
- Septic system upgrades;
- ESD retrofits; and
- Inlet cleaning.

A compiled list of Lower Patapsco River priority project recommendations from the three watershed assessments are shown in **Table 4-38**:

Table 4-38: Priority Restoration Projects in the Patapsco Lower North Branch Watershed

Subwatershed	Reach	Length (ft)	Description
Dogwood Branch		6252	Two subareas with high impervious cover
Cedar Branch		13475	
Mill Branch			Trash removal/debris blockages
Patapsco River-A1		1000	
Cooper Branch	Subarea 163-03	5052	Exposed sewer line, gabions failing
Thistle Run	Subarea 149-21		
Sawmill Branch	Downstream of Frederick Rd	2800	
Sawmill Branch	Tributary south of Park Grove Ave	2100	
Santee Branch			Downcutting, sediment deposits
Bull Branch		8225	Severe channel erosion in upper 4000 ft
Patapsco River-A4	Subarea 149-36	5103	
Herbert Run	West Branch subarea 173-08; subarea 173-06	4940; 2825	Gabion failing, erosion, sewer line overflows, eroded sewer lines
Herbert Run	East Branch	850	Exposed sewer lines, significant erosion
Patapsco River-A5	Subareas 149-41, 149-48, 149-49, and 149-51		
Deep Run	PNC022	888	Potential for emergency road crossing impairment
Deep Run	PNC040	673	Poor habitat, buffer impairments

Table 4-38: Priority Restoration Projects in the Patapsco Lower North Branch Watershed			
Subwatershed	**Reach**	**Length (ft)**	**Description**
Deep Run	PNC006	1526	Incised, buffer impacts
Stoney Run 3	PNC8012	6231	Exposed sewer main, previously breached
Stoney Run 4	PN9059	2045	Incised
Deep Run	PNC003	1010	Headcuts
Deep Run	PNC025		
Deep Run	PNA001		
Deep Run	PNC065		
Stoney Run 3	PN8014	867	Headcuts, infrastructure impacts
Patapsco Mainstem	PN1012	3100	Restore piped segment to functioning habitat
Stoney Run 4	PN9037	1094	Incised

P.5. SHA Pollutant Reduction Strategies

Patapsco River Lower North Branch is listed for both bacteria and sediment with each TMDL having a different baseline year; 2003 for bacteria and 2005 for sediment. Proposed practices to meet the bacteria and sediment reductions in the Patapsco River Lower North Branch watershed are shown in **Table 4-39**. Projected bacteria and sediment reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-3** and **Table 3-2**, respectively. Three time frames are included in the table below:

- BMPs built after the bacteria TMDL baseline through 2005. In this case the baseline is 2003. Stream restoration, tree planting, outfall stabilization, inlet cleaning, and impervious surface reduction were not including in the bacteria load reduction modeling.
- BMPs built after the sediment TMDL baseline through 2025. In this, case the baseline is 2005.
- BMPs built from 2026 through 2046, the projected target date of the bacteria TMDL. 2041 is the projected target date for the sediment TMDL. SHA will accomplish the percent reduction presented in **Table 3-3** and **Table3-2**, respectively. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Patapsco Lower North Branch watershed total $33,861,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects

for each BMP category. In addition to Capital Budget costs, $156,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-48 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-39: Patapsco River Lower North Branch Restoration BMP Implementation

BMP	Unit	2004-2005	2006 - 2025	2026 - 2046	Total	Cost
New Stormwater	drainage area acres		123.4	64.3	187.7	$10,073,000
Retrofit	drainage area acres		249.4		249.4	$7,682,000
Stream Restoration	linear feet		525.0		525.0	$385,000
Tree Planting	acres planted		198.6	20.5	219.1	$7,365,000
Outfall Stabilization[1]	linear feet			3,800.0	3,800.0	$8,288,000
Impervious Surface Elimination	acres removed		0.2		0.2	$68,000
Inlet Cleaning[2]	tons		163.0	163.0	163.0	$156,000

[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits

[2] Inlet cleaning is an annual practice.

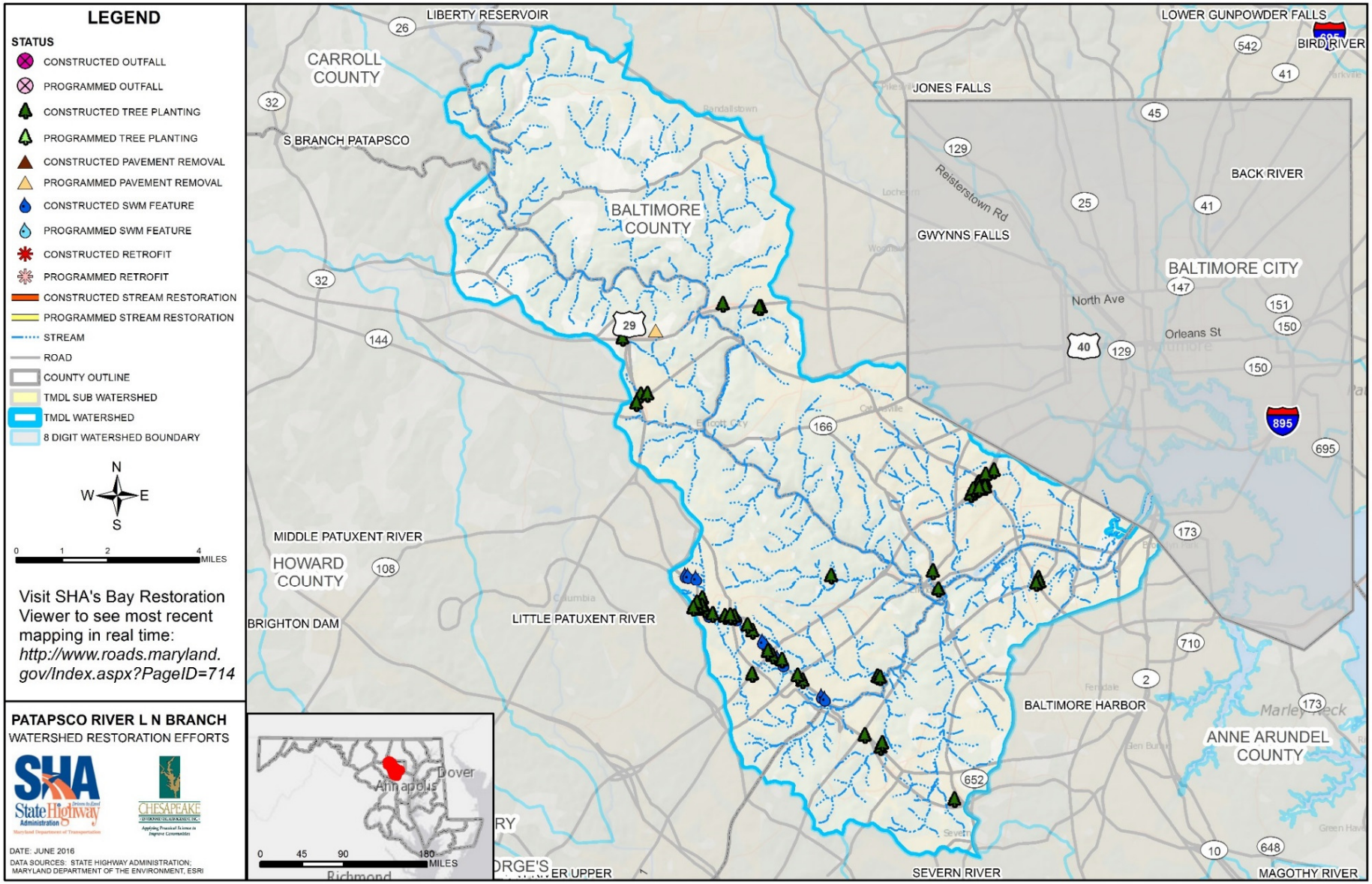


Figure 4-48: SHA Restoration Strategies within the Patapsco River Lower North Branch Watershed

Q. PATUXENT RIVER UPPER WATERSHED

Q.1. Watershed Description

The Patuxent River Upper watershed encompasses 88 square miles within west Anne Arundel and northeast Prince George's Counties, in addition to small areas in Montgomery and Howard Counties. The Patuxent River Upper begins in Howard County to the north and flows south ultimately draining to the Chesapeake Bay.

There are 556.5 miles of SHA roadway located within the Patuxent River Upper watershed. The associated ROW encompasses 1,801.9 acres, of which 784.5 acres are impervious. SHA facilities located within the watershed consist of one highway garage/shop, one salt storage facility, and one park and ride. See **Figure 4-49** for a map of the watershed.

Q.2. SHA TMDLs within Patuxent River Upper Watershed

SHA is included in both bacteria (MDE, 2011h) and sediment (MDE, 2011i) TMDLs. Sediment is to be reduced by 11.4 percent in Anne Arundel, Prince George's and Howard Counties, as shown in **Table 3-2**. Bacteria is to be reduced by 22.3 percent in Anne Arundel County, and 53.4 percent in Prince George's County, as shown in **Table 3-3**.

Q.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5 mile square system as shown in **Figure 4-50.** Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along heavily residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, some SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

89 Total Grids:

- 32 fully reviewed;
- 19 partially reviewed – in progress; and
- 38 awaiting review (28 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 153 locations identified as possible candidates for new stormwater BMPs;
- One facility undergoing concept design that may be a candidate for design contracts in the near future;

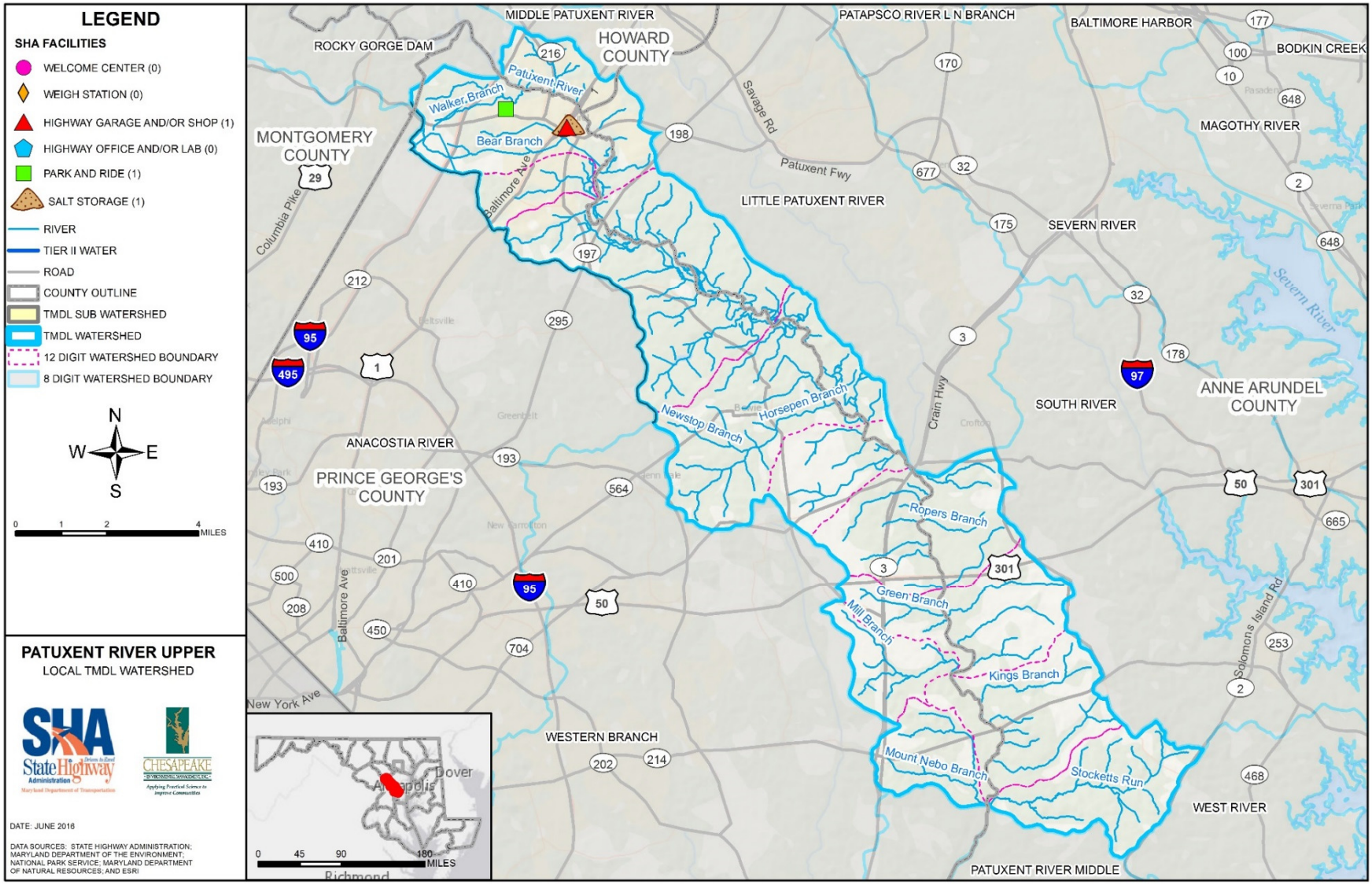


Figure 4-49: Patuxent River Upper Watershed

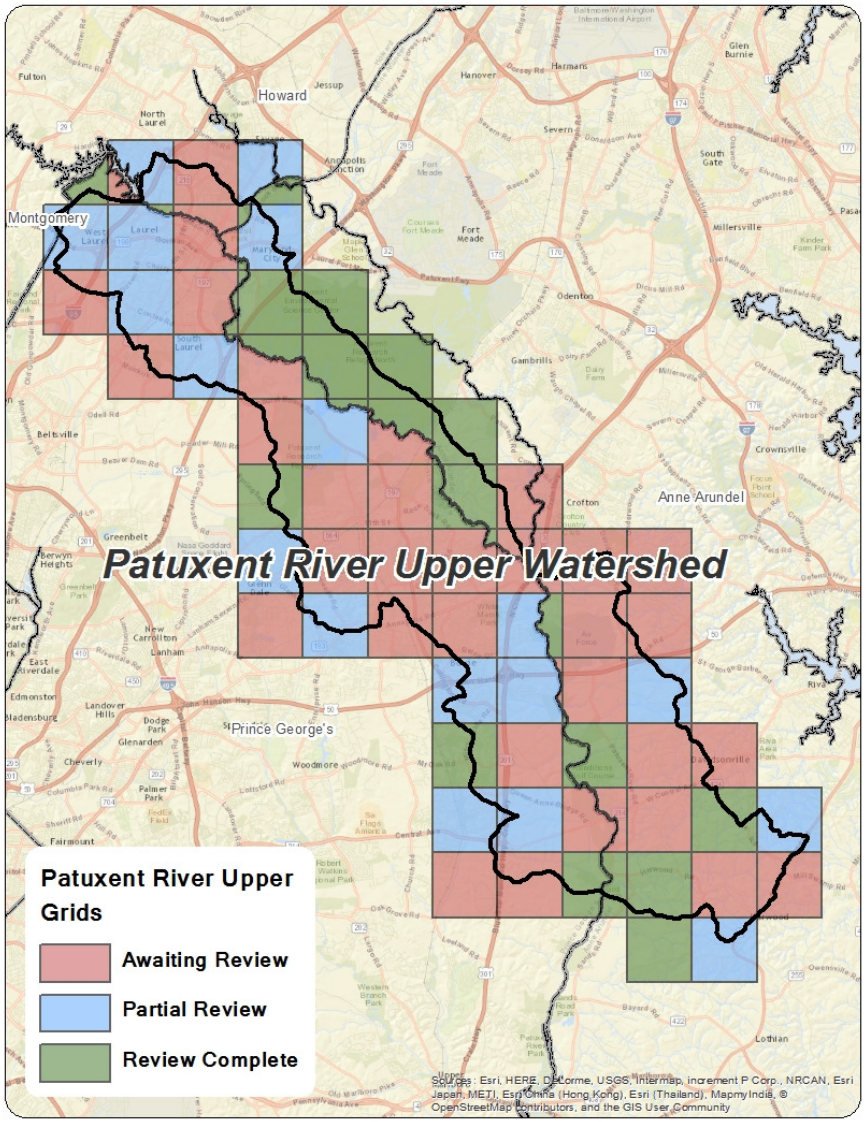


Figure 4-50: Patuxent River Upper Site Search Grids

- Two retrofit of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 1,027 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 7 acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 63,074 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 29,066 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

Q.4. Summary of County Assessment Review

Waters within the Patuxent River Upper watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Chlorides;
- *Escherichia coli;*
- Mercury in Fish Tissue;
- Nitrogen (Total);
- PCB in Fish Tissue;
- Phosphorous (Total), only for the Rocky Gorge Reservoir portion (MDE, 2008c);
- Sulfates; and
- TSS.

Prince George's County Department of the Environment prepared a *Watershed Existing Condition Report for the Upper Patuxent* (Tetra-Tech, 2014) and a *Restoration Plan for the Upper Patuxent River and Rocky Gorge Reservoir Watersheds in Prince George's County* (Tetra-Tech, 2015). The phosphorus in Rocky Gorge Reservoir, which is approximately 55 square miles in size, can be associated with non-point sources and urban runoff. In the Patuxent River Upper watershed, the problem with fecal coliform bacteria is attributed to wildlife and domestic animals, land surfaces, humans via septic and sewer systems, regulated storm water, and sanitary sewer overflow (SSO).

Total suspended solid issues in the watershed can be attributed to agricultural and urban land uses and stream bank erosion from increased storm water sources. Western Branch has a problem with BOD, which can be an indicator of organic pollution. There is also a problem with lower DO (with streams near discharges from WWTPs and stormwater runoff, agriculture feed lots, septic systems and natural debris. Within the Patuxent River Upper, Laurel and Bowie have the largest volumes of runoff, which are generated due to higher percent of impervious cover. In the lower portions of the Patuxent River Upper and Western Branch the land use is primarily forest and agriculture, which shows areas of higher nutrient loads (Tetra-Tech, 2014).

An evaluation of each subwatershed in the Patuxent River Upper watershed was performed to aid in the selection of BMPs in the areas with the highest required pollutant loading reductions. The County prioritized the subwatersheds by ranking the necessary total load reduction for each TMDL parameter and then averaging the individual ranks to obtain an overall rank for the subwatershed. The highest ranked watersheds tended to be in areas with the largest amount of impervious cover. Subwatersheds PX-28, PX30, and PX-34 are among the highly ranked watersheds. These subwatersheds encompass the cities of Laurel and South Laurel in the upper portion of the Patuxent River Upper watershed. Subwatersheds PX-12, PX-13, PX-14, and PX-17 are also highly ranked, with PX-13 emerging as the highest ranked subwatershed as a whole. These subwatersheds encompass the ity of Glenn Dale and portions of the city of Bowie. These areas are dominated by commercial and residential areas with some minor institutional areas that could be used for BMP implementation in the future (Tetra-Tech, 2015).

Storm water ponds are the most implemented BMP, which usually treat residential and non-urban areas. While this practice treats larger areas, they are less efficient than other practices at removing pollution. Infiltration practices are the second most implemented storm water control, they treat smaller areas but remove pollution with greater efficiency. The oil and grit separators are known for treating more area, but have lower removal efficiencies than infiltration practices. The Patuxent River Upper currently has no bio-retention, infiltration, oil/grit separators, and ponds in use. Western Branch has bio-retention, grass swales, infiltration, oil/grit separators and ponds (Tetra-Tech, 2014).

There were three sites mentioned in the watershed assessment report regarding benthic invertebrate and B-IBI sampling within the Patuxent River Upper and Western Branch watersheds; these sites are (Tetra-Tech, 2014):

- Horsepen Branch – in 2013, four sites were sampled, three yielding a "poor" score and one receiving a "fair" rating. The estimated number of biologically degraded stream miles increased from 33 percent to 75 percent.

- Southwest Branch – a total of 7 streams were sampled – 6 first order and one second order. One was rated "very poor", three "poor" and the remaining as "fair". The number of biologically degraded stream miles decreased from 100 percent to 57 percent.

- Collington Branch - a total of 12 streams were sampled. One was rated "very poor", three sites "poor", seven as "fair" and one as "good". The stream miles classified as biologically impaired went from 58 percent to 33 percent.

As a whole, structural and nonstructural BMPs have been implemented by the county including permit compliance, TMDL WLAs, flood mitigation and more. Prince George's County has also engaged in street sweeping, public outreach to promote environmental awareness, green initiatives and community involvement in protecting natural resources. Past public outreaches conducted include educational brochures on stormwater pollution awareness, outreach in schools, and the Can the Grease program to decrease SSOs and recycling programs (Tetra-Tech, 2014).

Q.5. SHA Pollutant Reduction Strategies

Patuxent River Upper is listed for both sediment and bacteria with each TMDL having a different baseline year; 2005 for sediment and 2009 for bacteria. Proposed practices to meet the sediment and bacteria reductions in the Patuxent River Upper watershed are shown in **Table 4-40**. Projected sediment and bacteria reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2** and **Table 3-3**, respectively. Three timeframes are included in the table below:

- BMPs built after the sediment TMDL baseline through 2009. In this case the baseline is 2005.
- BMPs built after the bacteria TMDL baseline through 2025. In this case the baseline is 2009. Stream restoration, tree planting, outfall stabilization, inlet cleaning, and impervious surface reduction were not included in bacteria load reduction modeling.
- BMPs built from 2026 through 2048, the projected target date of the bacteria TMDL. 2040 is the projected target date for the sediment TMDL. SHA will accomplish the percent reduction presented in **Table 3-3** and **Table3-2**, respectively. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Patuxent River Upper watershed total $13,294,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $74,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-51 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-40: Patuxent River Upper Restoration Sediment and Bacteria BMP Implementation						
BMP	**Unit**	**2006 - 2009**	**2010 - 2025**	**2026 - 2048**	**Total**	**Cost**
New Stormwater	drainage area acres		123.9	37.1	161.0	$7,806,000
Retrofit	drainage area acres		11.9		11.9	$365,000
Stream Restoration	linear feet			900.0	900.0	$660,000
Tree Planting	acres of planting	1.1	14.8		16.0	$537,000
Outfall Stabilization[1]	linear feet			1,800.0	1,800.0	$3,926,000
Inlet Cleaning[2]	tons		77.0	77.0	77.0	$74,000
[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits						
[2] Inlet cleaning is an annual practice.						

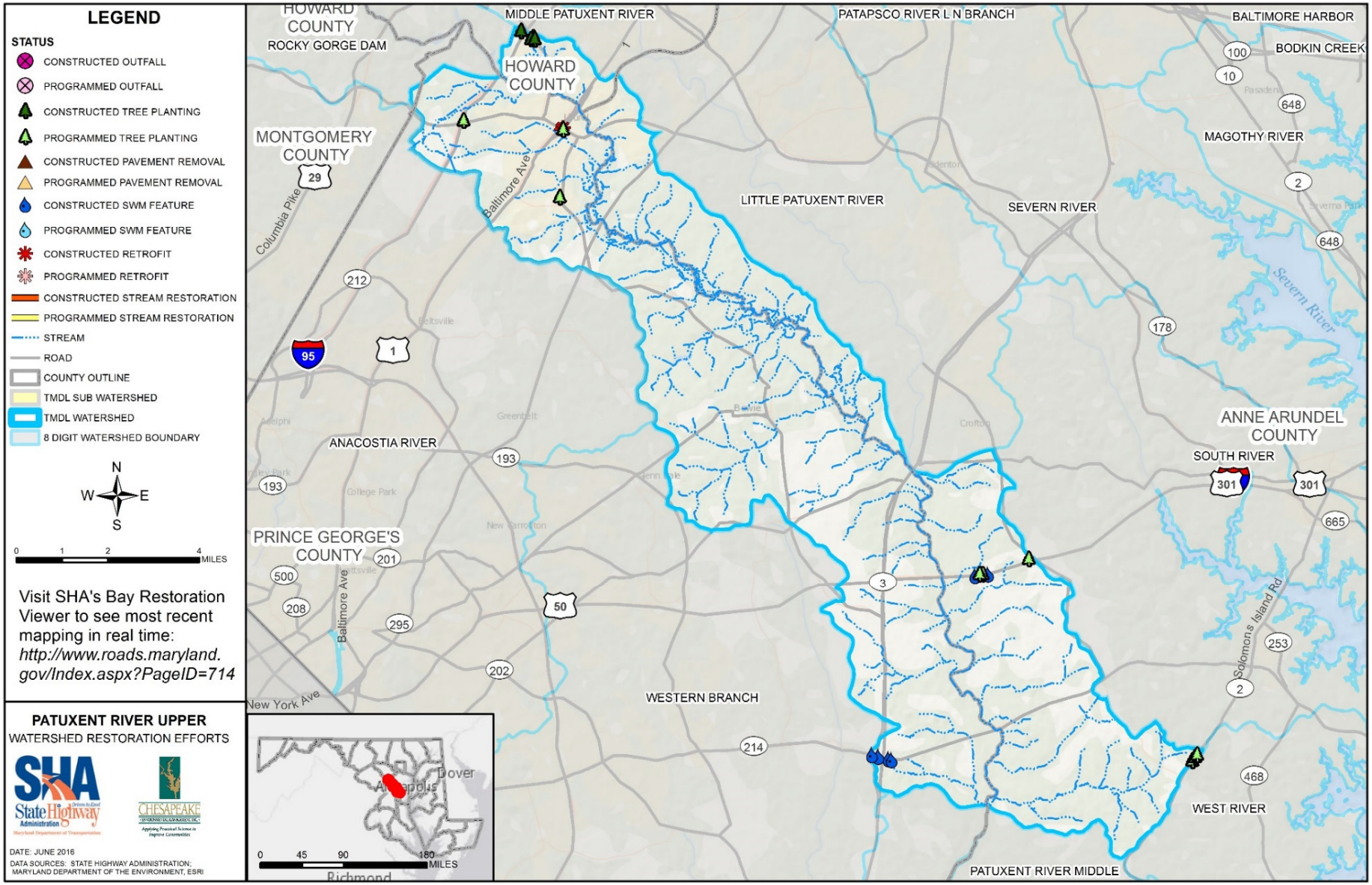


Figure 4-51: SHA Restoration Strategies within the Patuxent River Upper Watershed

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R. POTOMAC RIVER MONTGOMERY COUNTY WATERSHED

R.1. Watershed Description

The Potomac River Montgomery County watershed encompasses 137 square miles within Montgomery and Frederick Counties, Maryland and Washington, D.C. The Montgomery County section of the Potomac River flows 39 miles from the Frederick County border down to Washington, D.C. Tributary creeks and streams of the Potomac River Montgomery County watershed include Broad Run, Cabin Branch, Greenbrier Branch, Horsepen Branch, Little Falls Branch, Little Monocacy River, Muddy Branch, Piney Branch, Rocks Run, Sandy Branch, and Watts Branch.

There are 760.6 miles of SHA roadway located within the Potomac River Montgomery County watershed. The associated ROW encompasses 1,282.4 acres, of which 1,203.1 acres are impervious. There are no SHA facilities located within the Potomac River Montgomery County watershed. See **Figure 4-52** for a map of the watershed.

R.2. SHA TMDLs within Potomac River Montgomery County Watershed

SHA is included in the sediment TMDL (MDE, 2012e) and has a reduction requirement of 36.2 percent within Montgomery County, as shown in **Table 3-2**.

R.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-53**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

The grids awaiting review have little potential for additional restoration due to minimal ROW along heavily residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, some SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

98 Total Grids:

- 46 fully reviewed;
- 31 partially reviewed – in progress; and
- 21 awaiting review (21 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 78 locations identified as possible candidates for new stormwater BMPs;
- Six facilities undergoing concept design and may be candidates for design contracts in the near future;
- Three retrofit of existing stormwater facilities undergoing concept design and may be candidates for design contracts in the near future; and

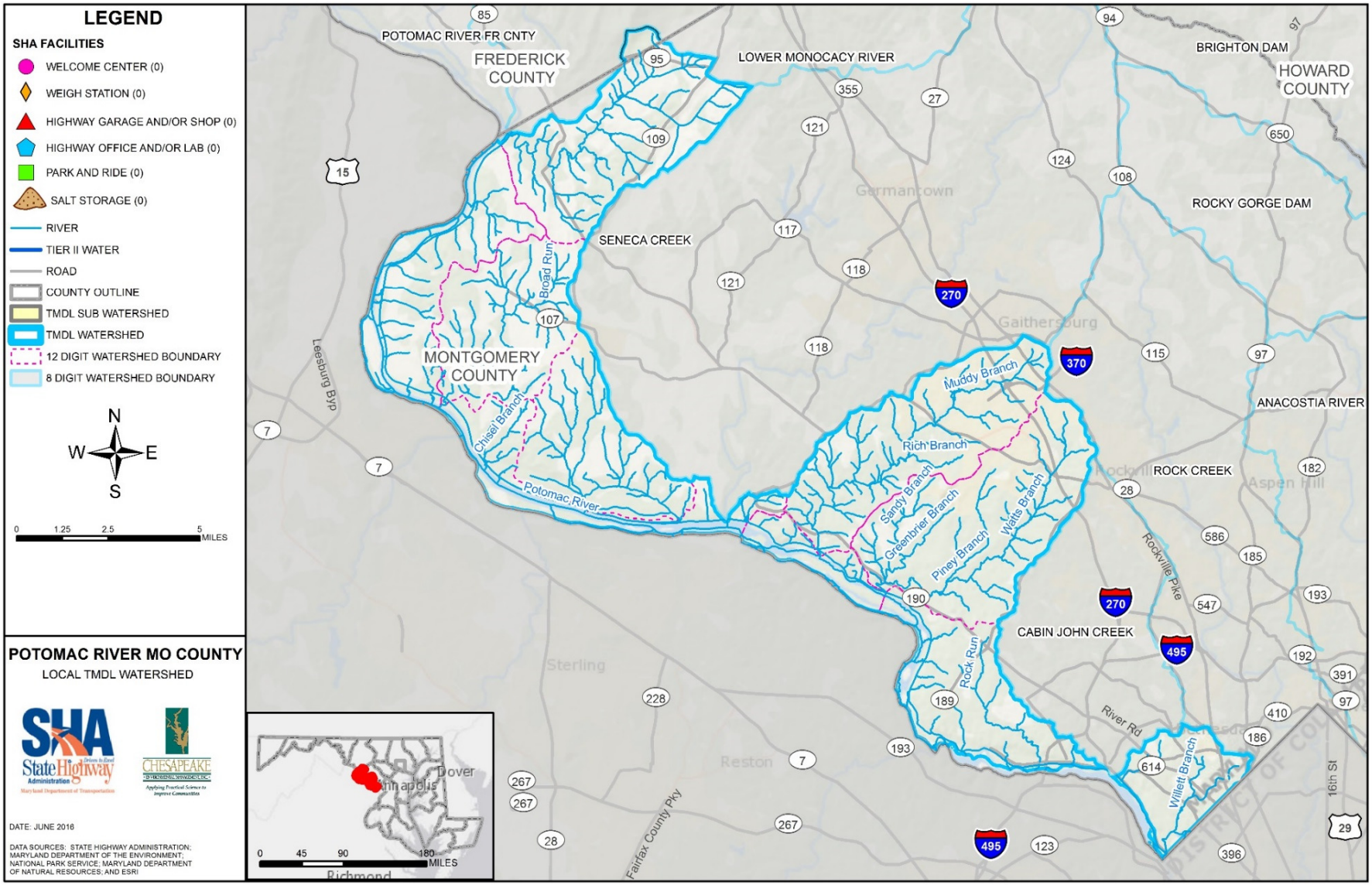


Figure 4-52: Potomac River Watershed in Montgomery County

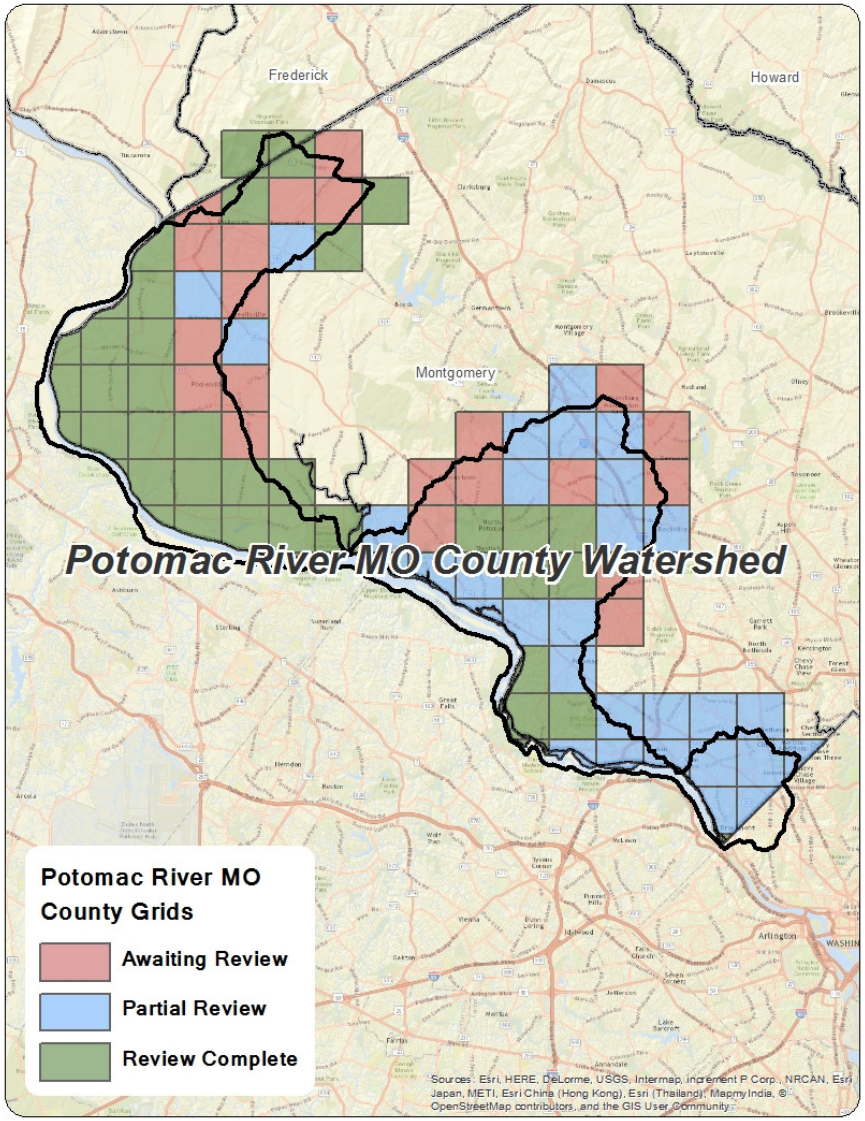


Figure 4-53: Potomac River Montgomery County Site Search Grids

- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search explored 722 acres of SHA-owned pervious area. The site search has resulted in a pool of potential sites comprised of the following:

- Four acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- Seven acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 50,452 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 22,325 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

R.4. Summary of County Assessment Review

Waters within the Potomac River Montgomery County watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Chlorides;
- Fecal Coliform;
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- pH, High;
- Phosphorus (Total);
- Sulfates; and
- TSS.

In 2011 and 2012, Montgomery County Department of Environmental Protection (MC-DEP) published the *Muddy Branch and Watts Branch Subwatersheds Implementation Plan* (HWG, 2012a), the *Upper Potomac Direct Watershed Pre-Assessment* Report (Versar, 2011a), and the *Lower Potomac Direct Watershed Pre-Assessment Report* (Versar, 2011b). MC-DEP also published the *Watts Branch Watershed Restoration Study* (AMT, Inc. and Biohabitats, 2003). The City of Gaithersburg published the *Muddy Branch Watershed Study* (URS, 2014b).

The Potomac River Montgomery County watershed comprises primarily urban land use, covering approximately 42 percent of the watershed (7 percent of which is impervious). Forested land comprises approximately 38 percent and agricultural land comprises approximately 20 percent. Within the Muddy Branch and the Watts Branch subwatersheds, the majority of the stream resource conditions were assessed as "fair" (75 percent) and 25 percent were assessed as "good" (HWG, 2014a). Within the Lower Potomac, the majority of stream resource conditions were assessed as "fair" or "poor," with only one site in the Rock Run subwatershed rated "good" (Versar, 2011b). Within the Upper Potomac, the majority of stream resource conditions were assessed as "good" or "fair" with only one site in the Broad Run watershed rated as "poor" (Versar, 2011a).

The *Upper* and *Lower Potomac Direct Pre-Assessment Reports* identified priorities for stormwater BMP retrofits. These include areas treated by pre-1986 permitted SWM facilities as high priority. Medium and lower priority sites did not include any SHA ROW, and focused on county-owned and privately-owned sites (Versar, 2011a and b).

The *Muddy Branch Watershed Study* identified four proposed stream restoration projects (URS, 2014b):

- M2 Stream Reach: Future Park City, experiencing widespread bank erosion, debris jams, sediment deposition and poor aquatic habitat. Proposed measures include grade control, rock toe protection, root wads, and a deflector.
- T3.1 Stream Reach: Quince Orchard Park, experiencing active lateral headcuts, poor aquatic habitat, and lateral channel migration. Proposed measures include grade control and rock toe protection.
- T4.1 Stream Reach: Brighton Village, experiencing widespread bank erosion, unstable banks, falling trees. Proposed measures include grade control and rock toe protection.
- T5.2a Stream Reach: I-370 Outfall, experiencing unstable banks and streambed, and poor aquatic habitat.

R.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reductions in the Potomac River Montgomery County watershed are shown in **Table 4-41**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

1. BMPs built after the TMDL baseline through 2025. In this case the baseline is 2006.
2. BMPs built between 2026 through 2040, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Potomac River Montgomery County watershed total $16,950,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $150,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-54 shows a map of SHA's restoration practices in the watershed and include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-41: Potomac River Montgomery County Restoration Sediment BMP Implementation

BMP	Unit	2006 - 2025	2026 - 2040	Total	Cost
New Stormwater	drainage area acres	72.9	15.7	88.6	$6,137,000
Retrofit	drainage area acres	50.5		50.5	$1,916,000
Stream Restoration	linear feet		1,600.0	1,600.0	$1,173,000
Tree Planting	acres of planting	59.5	11.9	71.4	$2,401,000
Outfall Stabilization[1]	linear feet	600.0	1,800.0	2,400.0	$5,235,000
Impervious Surface Elimination	acres removed	0.3		0.3	$88,000
Inlet Cleaning[2]	tons	157.0	157.0	157.0	$150,000

[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits

[2] Inlet cleaning is an annual practice.

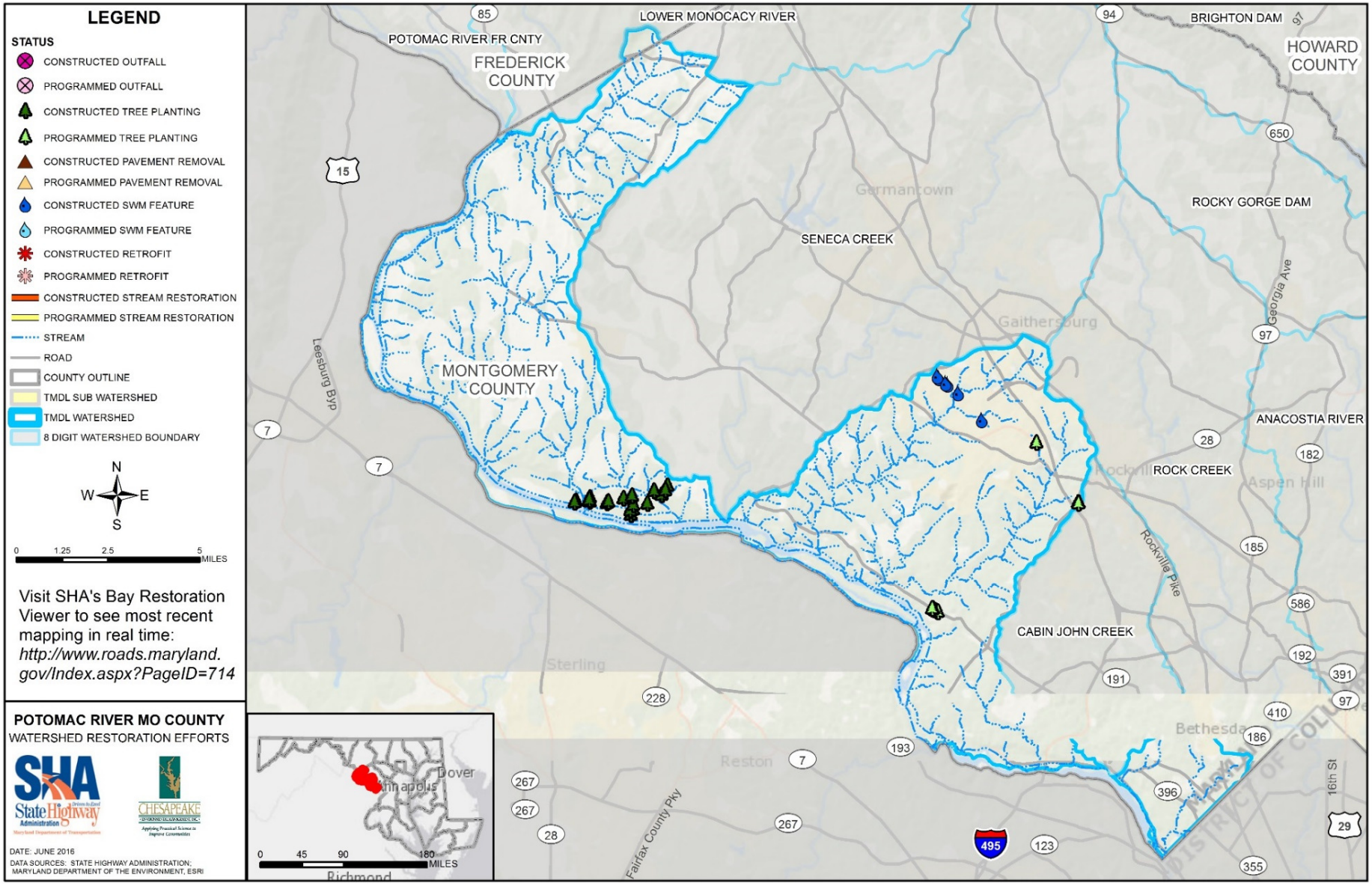


Figure 4-54: SHA Restoration Strategies within the Potomac River Watershed in Montgomery County

S. ROCK CREEK WATERSHED

S.1. Watershed Description

The Rock Creek watershed encompasses 61 square miles within Montgomery County, Maryland and Washington, D.C. Rock Creek headwaters are located in the Laytonsville area from which the river flows south to Washington, D.C, where it empties into the Potomac River. Tributary creeks and streams of the Rock Creek Watershed include Alexandra Aqueduct, Crabbs Creek, Mill Creek, and North Branch Rock Creek. The Rock Creek watershed in Maryland comprises primarily of residential land use, covering approximately 65 percent of the watershed. Municipal/institutional land comprises approximately ten percent, and roadway comprises approximately eight percent. Approximately six percent is identified as forest, open water, or bare ground.

There are 801.0 miles of SHA roadway located within the Rock Creek watershed. The associated ROW encompasses 1,358.1 acres, of which 832.8 acres are impervious. SHA facilities located within the Rock Creek watershed consist of one salt storage facility, and one highway garage/shop facility. See **Figure 4-55** for a map of the watershed.

S.2. SHA TMDLs within Rock Creek Watershed

SHA is included in both phosphorus (MDE, 2013e) and sediment (MDE, 2011j) TMDLs. Phosphorus is to be reduced by 32 percent and sediment is to be reduced by 37.9 percent, as shown in **Table 3-2**.

S.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5 mile square system as shown in **Figure 4-56**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

The grids awaiting review have little potential for additional restoration due to minimal ROW along heavily residential and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, some SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

47 Total Grids:

- Two fully reviewed;
- 25 partially reviewed – in progress; and
- 20 awaiting review (36 percent of total grids)

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 61 locations identified as possible candidates for new stormwater BMPs;
- Three facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

The tree planting site search teams investigated 570 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- Four acres of tree planting potential for further investigation.

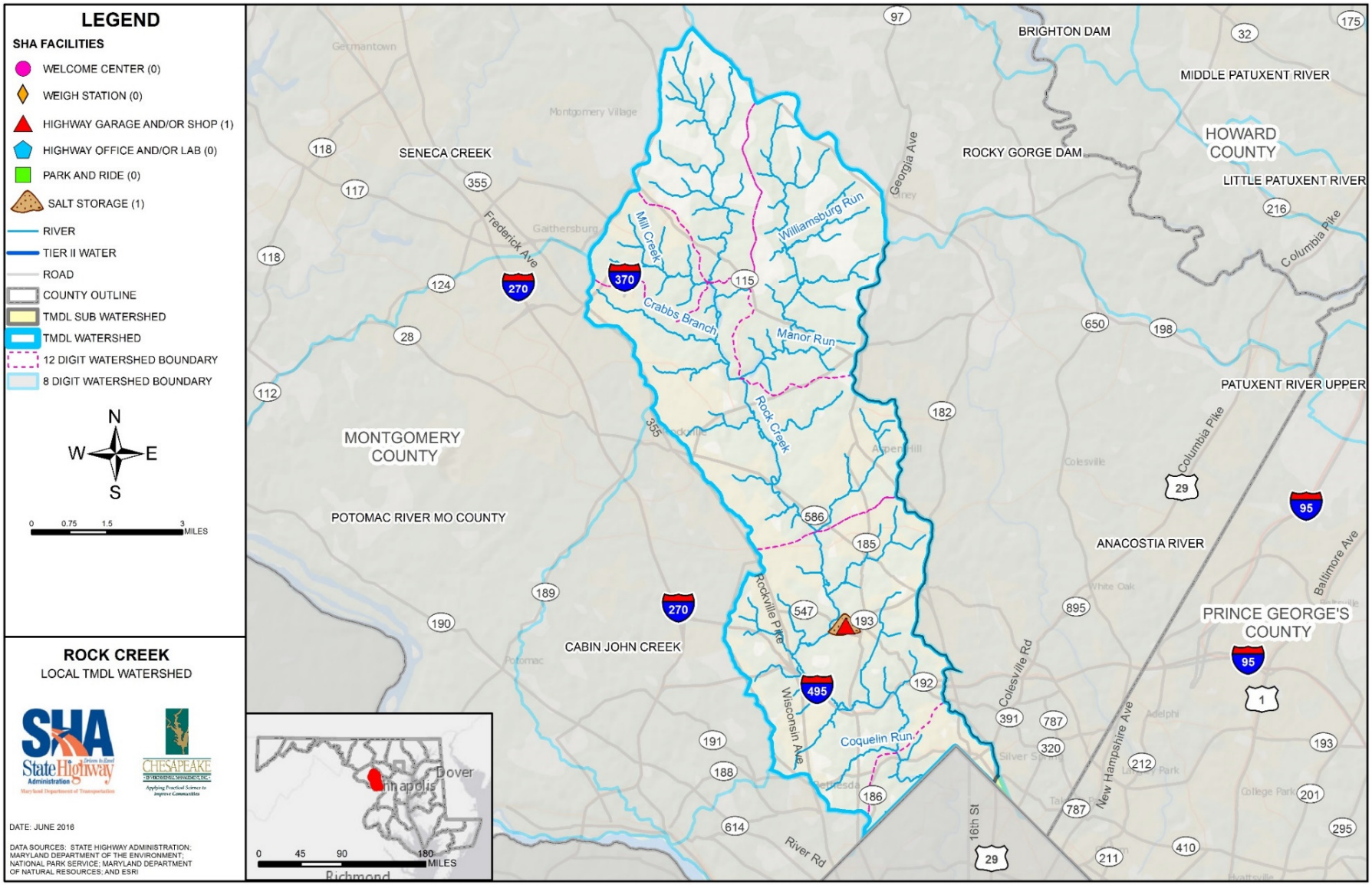


Figure 4-55: Rock Creek Watershed

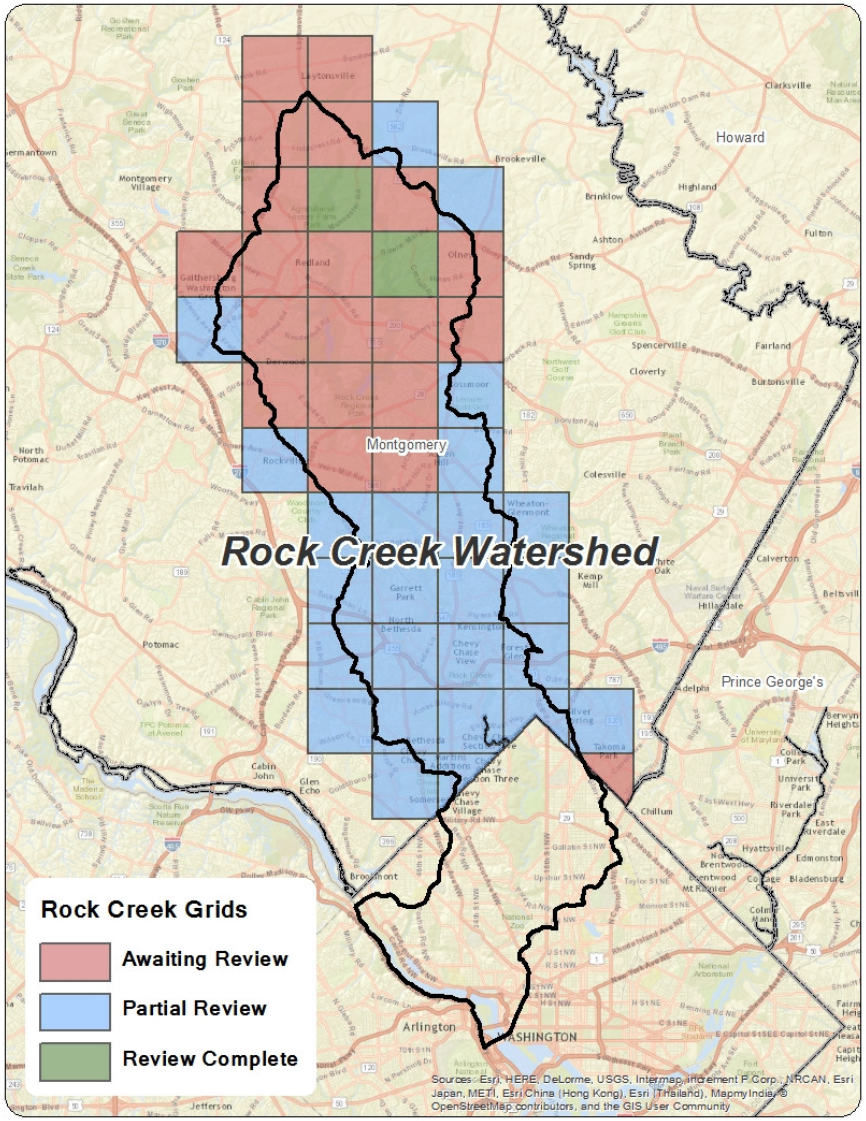


Figure 4-56: Rock Creek Site Search Grids

The stream restoration site search teams investigated 48,162 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 34,688 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

S.4. Summary of County Assessment Review

Waters within the Rock Creek watershed are subject to the following impairments as noted on MDE's 303(d) List:

- *Enterococcus*;
- Mercury in Fish Tissue;
- Phosphorus (Total);
- Temperature, water; and
- TSS.

The *Rock Creek Implementation Plan* (Biohabitats, 2012), prepared by the Montgomery County Department of Environmental Protection, was adopted in January 2012. This document provides a comprehensive plan for watershed restoration targeting bacteria reduction (with a TMDL), sediment and nutrient reduction (with a TMDL), runoff management and impervious cover treatment, and trash management. The majority of the stream resource conditions in Rock Creek were assessed as 'fair' (53 percent), 18 percent were assessed as 'good' and 22% as 'poor.' The remaining 2 percent were assessed as 'excellent' (Biohabitats, 2012).

Montgomery County's BMPs proposed within Rock Creek watershed are estimated to result in 52 percent load reductions for total nitrogen, 53 percent for total phosphorus, and 49 percent for TSS. An approximate 55 percent reduction of trash over baseline conditions is also anticipated (Biohabitats, 2012). Preferred BMPs include ESD

property retrofits, new structural SWM facilities, retrofitting underperforming SWM facilities, and stream restoration projects (Biohabitats, 2012). Projects sites for ESD, pond retrofits, and new stormwater ponds have been identified and are focused on county-owned properties and priority neighborhood areas, which do not include SHA ROW.

S.5. SHA Pollutant Reduction Strategies

Rock Creek is listed for both phosphorus and sediment with each TMDL having a different baseline year; 2009 for phosphorus and 2005 for sediment. Proposed practices to meet the phosphorus and sediment reduction in the Rock Creek watershed are shown in **Table 4-42**. Projected phosphorus and sediment reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Three timeframes are included in the table below:

- BMPs built after the phosphorus TMDL baseline through 2025. In this case the baseline is 2009.
- BMPs built after the sediment TMDL baseline through 2009. In this case the baseline is 2005.
- BMPs built from 2026 through 2035, the target date for phosphorus. 2025 is the projected target date for the phosphorus and sediment TMDL. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Rock Creek watershed total $19,770,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $153,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-57 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-42: Rock Creek Restoration Sediment and Nutrient BMP Implementation						
BMP	**Unit**	**2006 - 2009**	**2010 - 2025**	**2026 - 2035**	**Total**	**Cost**
New Stormwater	drainage area acres		67.9	21.8	89.7	$5,669,000
Retrofit	drainage area acres		32.4		32.4	$667,000
Stream Restoration	linear feet		13,764.0		13,764.0	$10,089,000
Tree Planting	acres of planting		8.6		8.6	$291,000
Outfall Stabilization[1]	linear feet		1,400.0		1,400.0	$3,054,000
Inlet Cleaning[2]	tons		160.0	160.0	160.0	$153,000
[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits						
[2] Inlet cleaning is an annual practice.						

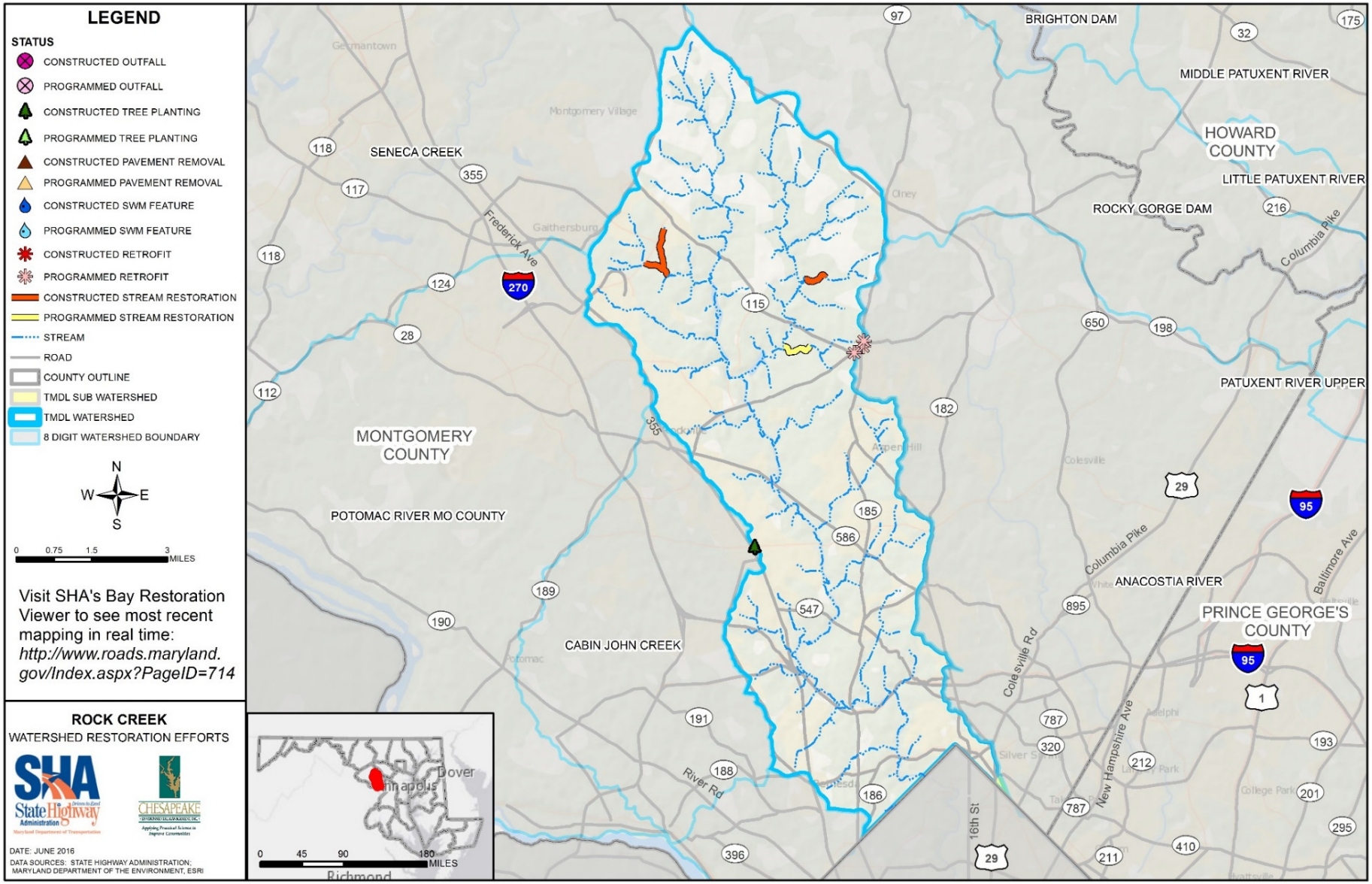


Figure 4-57: SHA Restoration Strategies within the Rock Creek Watershed

T. SENECA CREEK WATERSHED

T.1. Watershed Description

The Seneca Creek watershed encompasses 129 square miles located solely within Montgomery County. Seneca Creek begins in the northwestern portion of the County, near Damascus. Seneca Creek flows about 27 miles south, passing through the City of Gaithersburg, before joining the Potomac River. Tributary creeks and streams of the Seneca Creek watershed include Bucklodge Branch, Cabin Branch, Goshen Branch, Gunners Branch, Long Draught Branch, Magruder Branch, North Creek, Tenmile Creek, Whetstone Run, and Wildcat Branch.

There are 676.2 miles of SHA roadway located within the Seneca Creek watershed. The associated ROW encompasses approximately 1,504.9 acres, of which 1,182.9 acres are impervious. SHA facilities located within the watershed consist of two salt storage facilities, two park and rides, and one highway garage/shop facility. See **Figure 4-58** for a map of the watershed.

T.2. SHA TMDLs within Seneca Creek Watershed

SHA is included in the sediment (TSS) TMDL (MDE, 2011k) and has a reduction requirement of 44.9 percent, as shown in **Table 3-2**.

T.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-59**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

Many of the grids awaiting review have little potential for additional restoration due to minimal ROW along residential, agricultural, and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, some SHA impervious areas within these grids are already treated by SHA BMPs or are part of another SHA highway project that may ultimately provide stormwater BMPs. The current results of this ongoing grid search are as follows:

82 Total Grids:

- 17 fully reviewed;
- 25 partially reviewed – in progress; and
- 40 awaiting review (45 percent of total grids).

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 193 locations identified as possible candidates for new stormwater BMPs;
- One facility undergoing concept design that may be a candidate for design contracts in the near future;
- One retrofit of an existing facility under current contracts; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

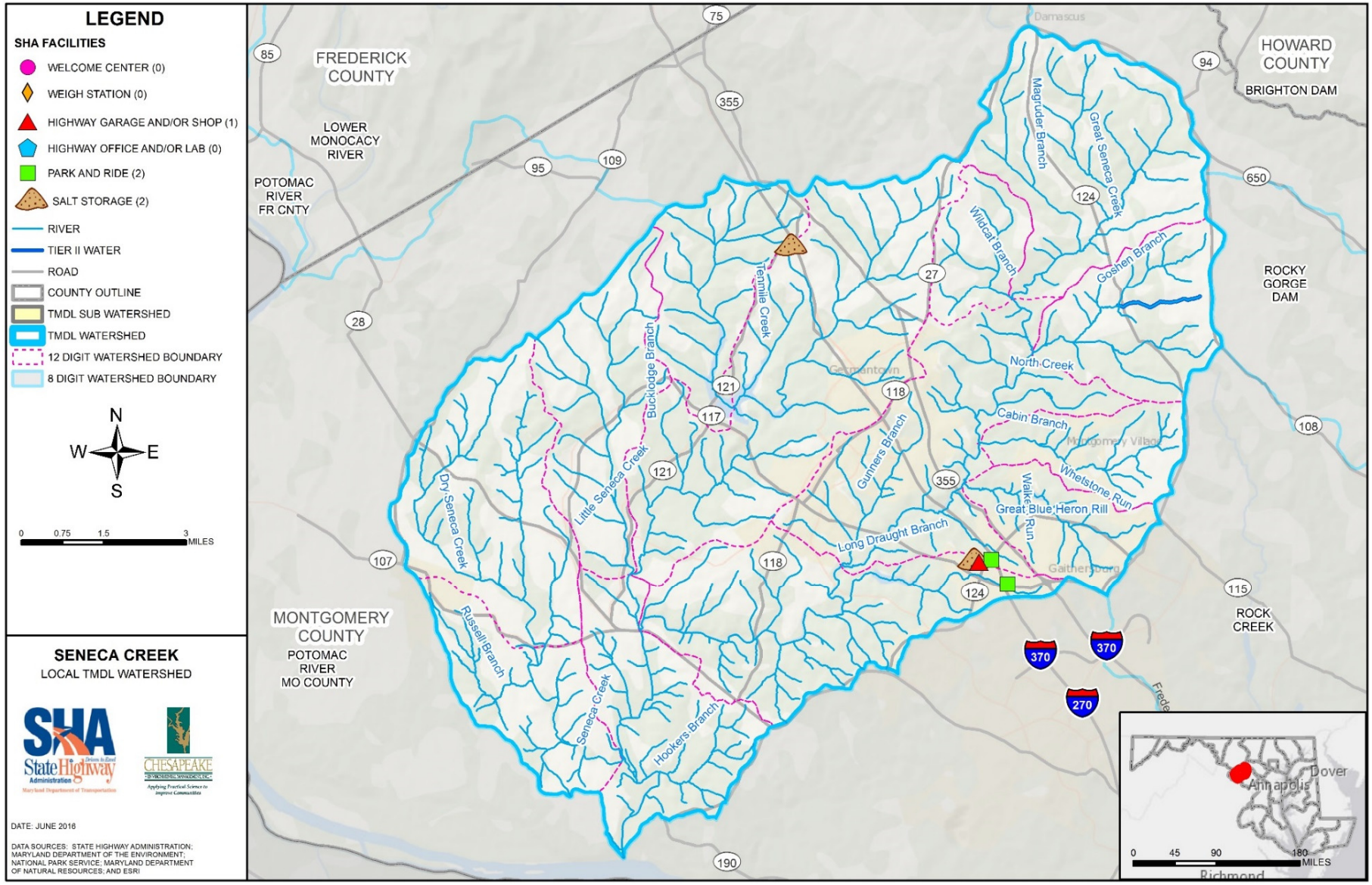


Figure 4-58: Seneca Creek Watershed

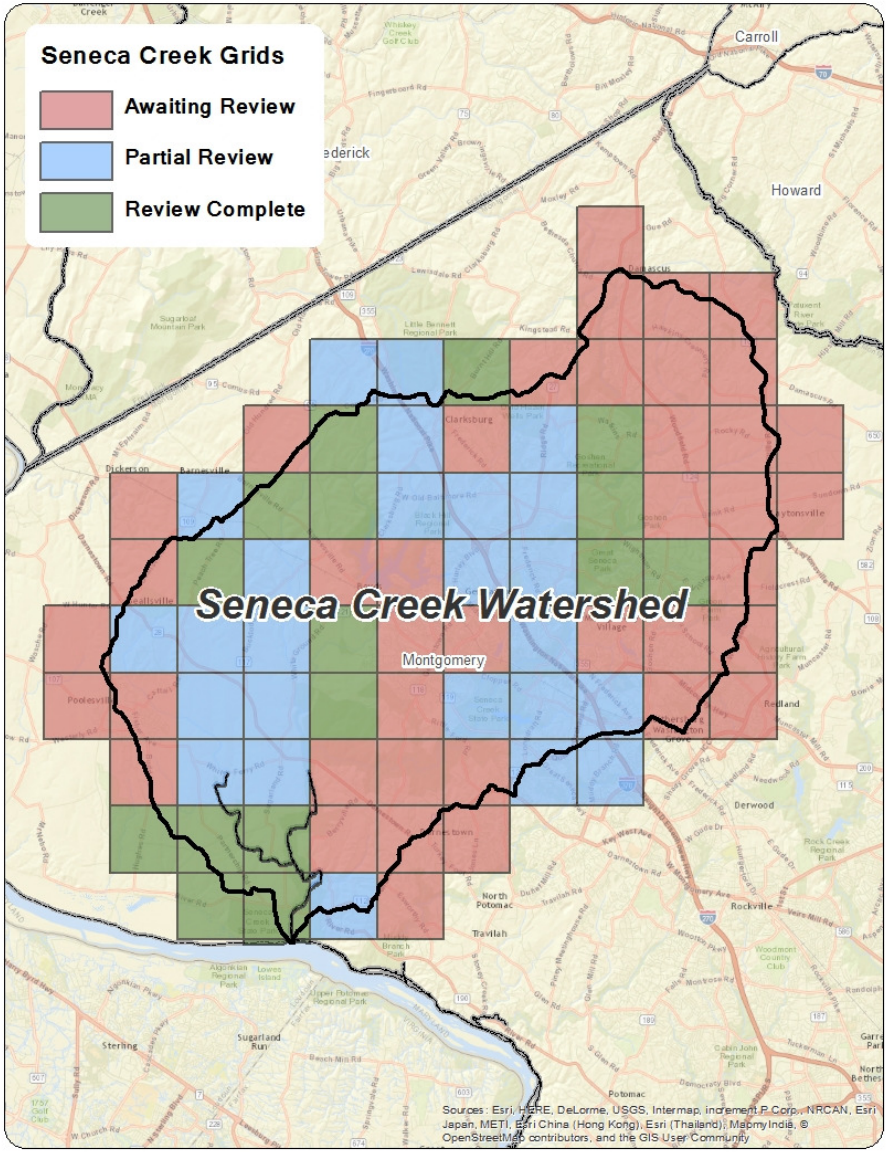


Figure 4-59: Seneca Creek Site Search Grids

The tree planting site search teams investigated 728 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- Eight acres of tree planting potential for further investigation.

The stream restoration site search teams investigated 31,587 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 15,835 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

T.4. Summary of County Assessment Review

Waters within the Seneca Creek Watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Ammonia (Total);
- Chlorides;
- Mercury in Fish Tissue;
- Phosphorus (Total);
- Sedimentation/siltation;
- Temperature, water; and
- TSS.

In 2011, Montgomery County Department of Environmental Protection (MC-DEP) published the *Dry Seneca Creek & Little Seneca Creek Pre-Assessment Report* (Versar, 2011c) and the *Great Seneca Watershed Implementation Plan* (HWG, 2012b). MC-DEP also published the *Great Seneca Creek Watershed Study* in 1999 (MC-DEP, 1999). The *Middle Great Seneca Watershed Study* was completed in 2013 (URS, 2013)

and the *Lower Great Seneca Creek Watershed Study* in 2014 (URS, 2014c).

The Seneca watershed is mostly comprised of urban, forest, agriculture, and pasture land uses. Urban land covers approximately 38.5 percent of the watershed (7.5 percent of which is impervious), forested land is approximately 37.3 percent, agricultural is approximately 20.7 percent, and pasture is 3.5 percent (Versar, 2011c).

Within the Upper Great Seneca, the majority of the streams were rated as 'good' (48 percent) or 'fair' (41 percent), with 11 percent not assessed. The highest quality streams were found in the Upper and Lower Great Seneca watersheds, with poorer streams, primarily rated as 'Fair', found in the Middle Great Seneca watershed, due to higher levels of development surrounding Gaithersburg. Stream conditions within the Dry Seneca Creek and Little Seneca Creek subwatersheds were rated as 'excellent' to 'poor', with most streams rated 'good' (HWG, 2012b).

The *Dry Seneca Creek and Little Seneca Creek Pre-Assessment Report* (Versar, 2011c) identified priorities for stormwater BMP retrofits as the areas treated by pre-1986 permitted SWM facilities. Using ESD, SWM retrofits, and new SWM ponds are the preferred BMP types for these areas. Medium and lower priority sites did not include any SHA ROW, and focused on county-owned and privately-owned sites.

The *Middle Great Seneca Creek Watershed Study* identified five proposed stream restoration projects (MC-DEP, 2013):

- Stream Reach GST-1 on Whetstone Run, experiencing meandering, downcutting, over-widening, lack of vegetation and poor aquatic habitat. Proposed measures include grade control, bank protection, and channel realignment.
- Stream Reach GST-2a on Watkins Mill Run, experiencing erosion, limited riparian zone, and lack of vegetation. Proposed measures include grade control, and bank protection.
- Stream Reach GST-2b on Watkins Mill Run, experiencing channelization, steep banks, invasive species, and incision. Proposed measures include flow diversion and bed and bank stabilization.
- Stream Reach 2012-1a on the unnamed tributary, experiencing channelization, poor aquatic habitat, and bank erosion. Proposed measures include flow diversion and bed and bank stabilization.
- Stream Reach 2012-1b on the unnamed tributary, experiencing incision, trash, lack of vegetation, downcutting, and bank erosion. Proposed measures include step pool storm conveyance, grade control, and bank regrading.

The *Lower Great Seneca Creek Watershed Study* (URS, 2014c) identified two proposed stream restoration projects:

- Rabbit East #4 Stream Reach, experiencing steep banks, bank erosion, and incised channels. Proposed measures include grade control, bank protection, and channel realignment.
- Solitaire North Stream Reach, experiencing steep banks, bank erosion, and incised channels. Proposed measures comprise bed and bank stabilization.

T.5. SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Seneca Creek watershed are shown in **Table 4-43**. Projected sediment reduction using these practices is described in **Part III, Coordinated TMDL Implementation Plan** and is shown in **Table 3-2**. Two timeframes are included in the table:

- BMPs built after the TMDL baseline through 2025. In this case the baseline is 2006.

- BMPs built between 2026 through 2042, the projected target date. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Seneca Creek watershed total $26,158,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $169,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-60 shows a map of SHA's restoration practices in the watershed and include those that are under design or constructed. Inlet cleaning is not reflected on this map.

Table 4-43: Seneca Creek Restoration Sediment BMP Implementation

BMP	Unit	2006 - 2025	2026 - 2042	Total	Cost
New Stormwater	drainage area acres	175.6	46.7	222.3	$14,253,000
Retrofit	drainage area acres	107.1		107.1	$3,297,000
Stream Restoration	linear feet	3,991.0	1,500.0	5,491.0	$4,025,000
Tree Planting	acres of planting	29.2	78.1	107.3	$3,608,000
Outfall Stabilization[1]	linear feet	400.0		400.0	$873,000
Impervious Surface Elimination	acres removed	0.4		0.4	$102,000
Inlet Cleaning[2]	tons	177.0	177.0	177.0	$169,000

[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits

[2] Inlet cleaning is an annual practice.

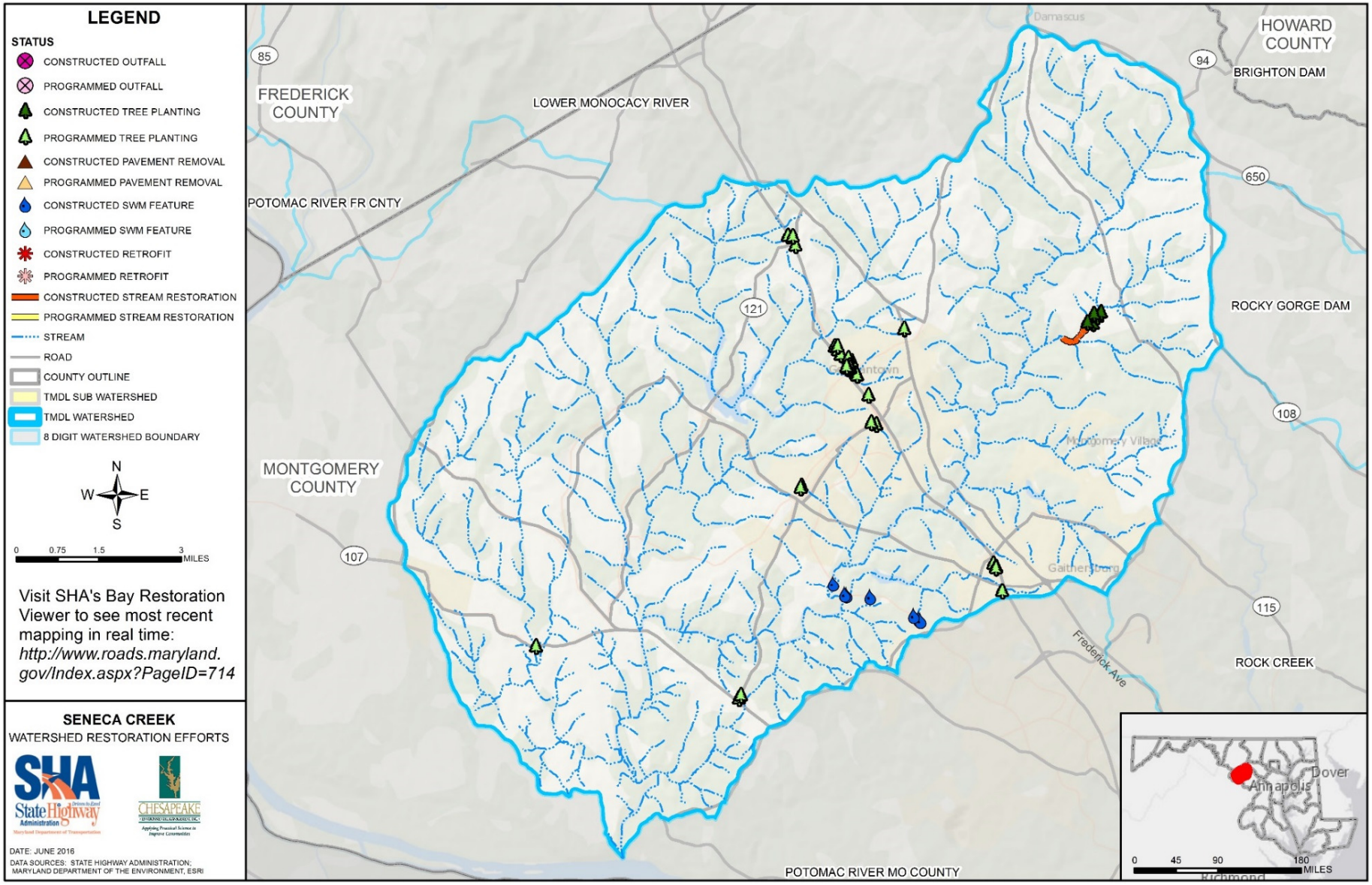


Figure 4-60: SHA Restoration Strategies within the Seneca Creek Watershed

U. UPPER MONOCACY RIVER WATERSHED

U.1. Watershed Description

The Upper Monocacy River originates in Pennsylvania and flows through Maryland ultimately into the Potomac River. The watershed encompasses approximately 274 square miles within the state of Pennsylvania and approximately 724 square miles in both Frederick and Carroll Counties, Maryland. In Frederick County it is divided into six subwatersheds: Fishing Creek, Glade Creek, Hunting Creek, Owens Creek, Toms Creek, and Tuscarora Creek.

There are 665.1 miles of SHA roadway located within the Upper Monocacy River watershed. The associated ROW encompasses 1,219.9 acres, of which 630.5 acres are impervious. SHA facilities located within the watershed consist of one highway garage/shop facility, one welcome center, and two salt storage facilities. See **Figure 4-61** for a map of the watershed.

U.2. SHA TMDLs within Upper Monocacy River Watershed

TMDLs requiring reduction by SHA include phosphorus (MDE, 2013f) and sediment (MDE, 2009g). Phosphorus is to be reduced by 3.0 percent and sediment is to be reduced by 49 percent as shown in **Table 3-2**.

U.3. SHA Visual Inventory of ROW

The MS4 permit requires SHA perform visual assessments. **Part III, Coordinated TMDL Implementation Plan** describes the SHA visual assessment process. The implementation teams are currently evaluating grids in the watershed and will continue to do so until all are completed and accepted. The grid-tracking tool was developed to assist teams to efficiently search each watershed on a 1.5 x 1.5-mile square system as shown in **Figure 4-62**. Future planning efforts will continue to be centered on areas with local TMDL needs that have been identified using the site search grid-tracking tool.

The grids awaiting review have little potential for additional restoration due to minimal ROW along residential, agricultural, and wooded areas, which limits the ability to purchase ROW for the construction of a new BMP. Additionally, some SHA impervious areas within these grids are already treated by SHA BMPs. The current results of this ongoing grid search are as follows:

157 Total Grids:

- 105 fully reviewed;
- 46 partially reviewed – in progress; and
- Six awaiting review (four percent of total grids).

The new stormwater site search resulted in a pool of potential sites comprised of the following:

- 787 locations identified as possible candidates for new stormwater BMPs;
- Seven facilities undergoing concept design and may be candidates for design contracts in the near future; and
- Potential existing grass swale locations and grass swale rehabilitation locations undergoing review.

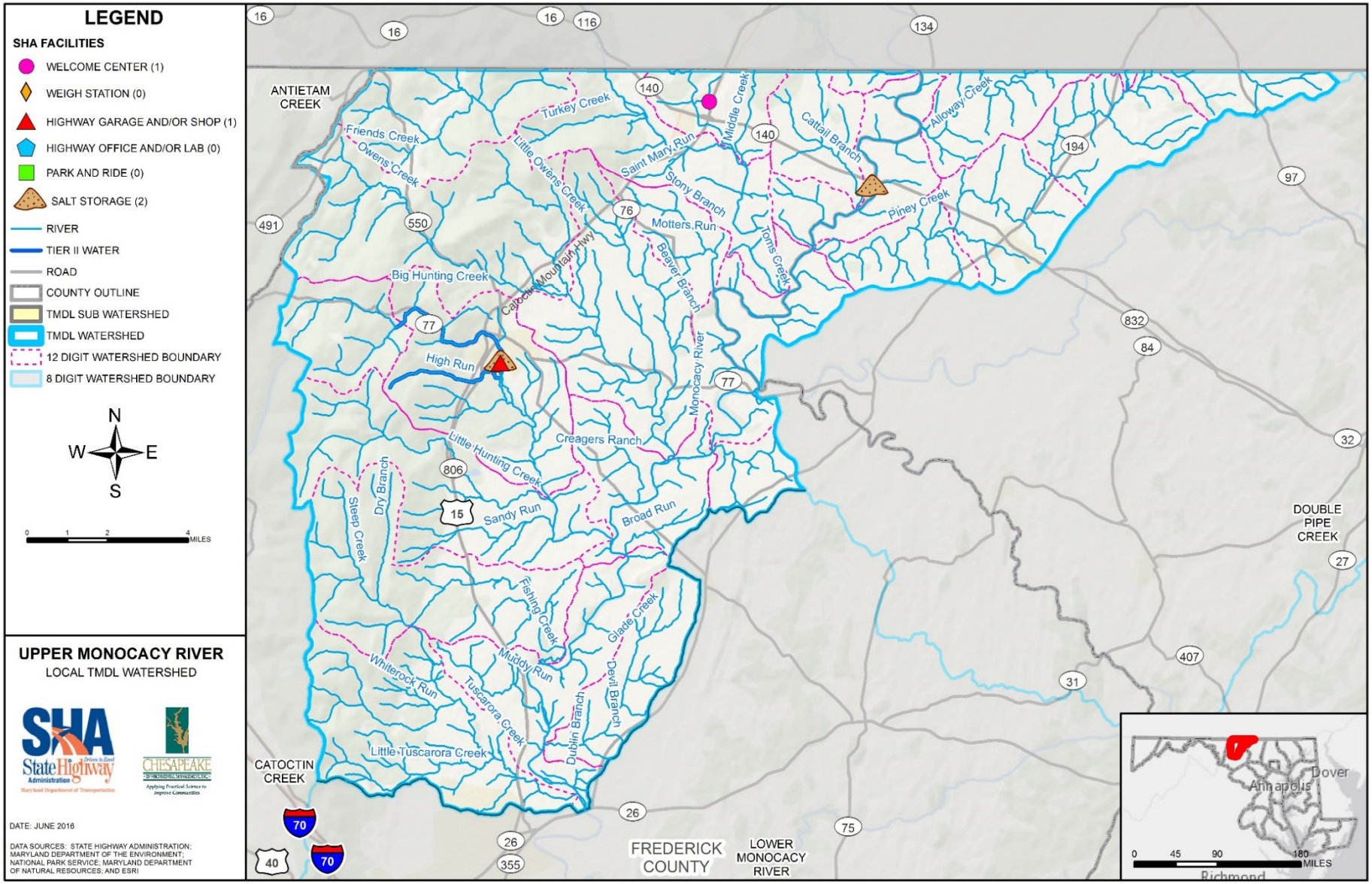


Figure 4-61: Upper Monocacy River Watershed

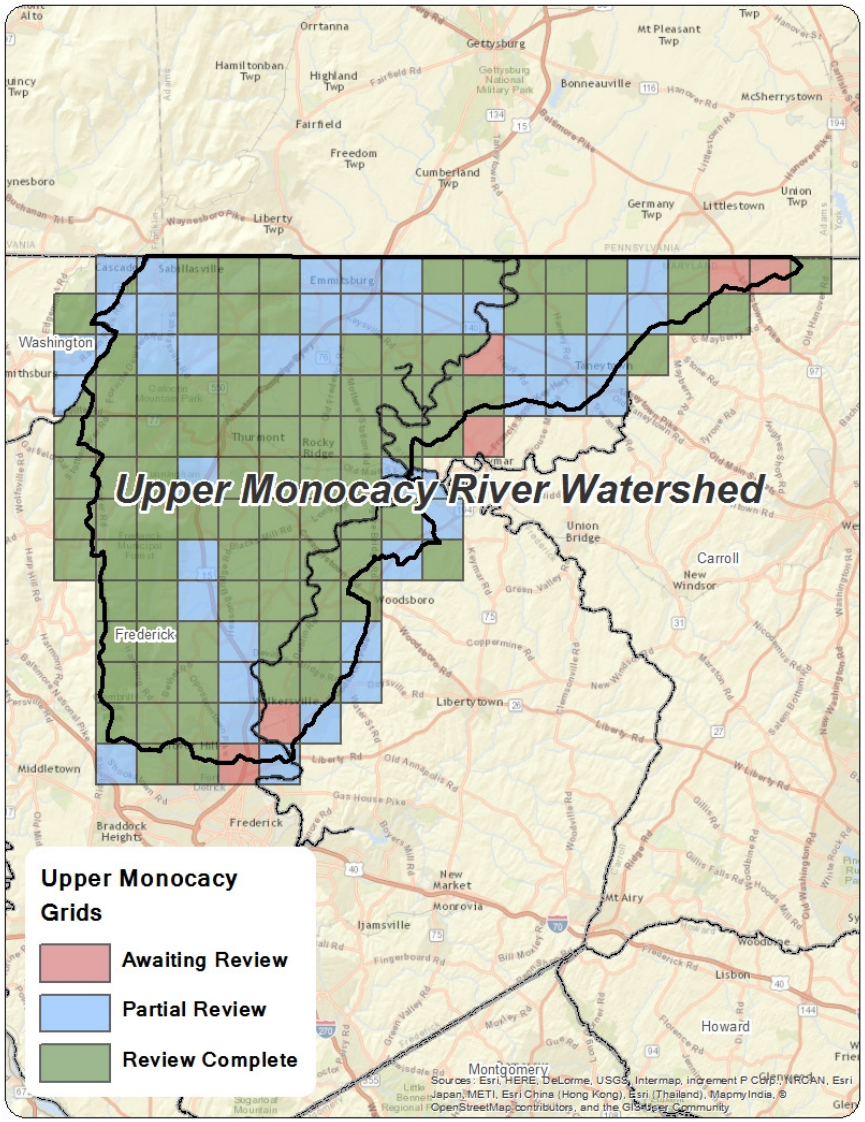


Figure 4-62: Upper Monocacy River Site Search Grids

The tree planting site search teams investigated 639 acres of SHA-owned pervious area. The ongoing site search resulted in a pool of potential sites comprised of the following:

- 24 acres are undergoing concept design and may be candidates for planting contracts in the near future; and
- Eleven acres of tree planting potential for further investigation.

The stream restoration site search teams investigated over 23,313 linear feet of stream channel for restoration opportunities. The site search resulted in the following:

- 20,846 linear feet recommended for future restoration potential.

Teams will continue to pursue the most viable and cost-effective BMPs that are currently within the existing pool of sites based on site feasibility.

U.4. Summary of County Assessment Review

Waters within the Upper Monocacy River watershed are subject to the following impairments as noted on MDE's 303(d) List:

- *E. coli;*
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- Phosphorus (Total);
- Temperature, water; and
- TSS.

The Upper Monocacy River watershed is ranked in *Maryland Clean Water Action Plan* (CWAPTW, 1998) as a "Category 1 Priority," a watershed not meeting clean water and other natural resource goals and therefore needing restoration, and a "Selected Category 3", a pristine or sensitive watershed most in need of protection. The Frederick County Division of Public Works completed a *Watershed Restoration Action*

Strategy (WRAS) for the Upper Monocacy Watershed within Frederick County in 2005 (FC-DPW, 2005). According to the WRAS, impervious land cover comprises 3.7 percent of the watershed, and 25 percent of the soils are considered highly erodible.

For the purposes of planning, Frederick County has selected the following generalized restoration strategies to aid in meeting restoration goals within the Upper Monocacy watershed:

- Restore riparian corridors;
- Improve impaired streams;
- Identify and preserve pristine areas;
- Protect and expand existing green infrastructure and riparian corridors; and
- Protect water quality and habitat through appropriate zoning.

The DNR conducted a SCA in Frederick County and identified 226 sites with varying degrees of severity in terms of channel alteration, erosion (120,153 linear feet), exposed pipes, fish passage barriers, inadequate buffers, and pipe outfalls. Sites were prioritized based on the greatest need and potential for restoration. The sites with the most severe problems are listed below in **Table 4-44.**

Detailed information on site locations and less severe sites can be found in the 2004 *Upper Monocacy River Stream Corridor Assessment Survey* (DNR, 2004). According to this survey, the following potential stream restoration sites were identified within the Upper Monocacy watershed with a severity rating of two (severe) or one (very severe).

Table 4-44: Upper Monocacy River Stream Corridor Assessment Survey Restoration Site Recommendations

Subwatershed	Reach ID	Length (ft.)	Impact(s)
Glade Creek	2719205	107	Downcutting
Glade Creek	2819202	69	Downcutting
Glade Creek	2821402	10247	Downcutting
Hunting Creek	1914103	409	Widening
Owens Creek/Beaver Branch	1621201	1980	Downcutting
Toms Creek	2208201	570	Downcutting
Tuscarora Creek	0510302	12464	Widening
Fishing Creek	1510104	--	Total fish blockage (dam)
Fishing Creek	1510106	--	Total fish blockage (dam)
Fishing Creek	1512312	--	Total fish blockage (channelized)
Hunting Creek	1813301	--	Total fish blockage (channelized)
Hunting Creek	1813302	--	Total fish blockage
Owens Creek/Beaver Branch	2419103	--	Total fish blockage (road crossing)
Toms Creek	1924301	--	Total fish blockage (channelized)
Toms Creek	2307303	--	Total fish blockage (road crossing)

The Frederick County Office of Sustainability and Environmental Resources conducted SCAs between 2008 and 2014 that include the Fishing Creek, Glade Creek, Hunting Creek, Owens Creek, Toms Creek, and Tuscarora Creek subwatershed of the Upper Monocacy River watershed (Versar, 2015a). Information on water quality, erosion, physical habitat, and BIBI scores for several sites within the Upper Monocacy River watershed can be found in the SCA reports, however detailed location information is not provided.

U.5. SHA Pollutant Reduction Strategies

Upper Monocacy is listed for both phosphorus and sediment with each TMDL having a different baseline year; 2009 for phosphorus and 2000 for sediment. Proposed practices to meet the phosphorus and sediment reduction in the Upper Monocacy River watershed are shown in **Table 4-45**. Projected phosphorus and sediment reductions using these practices are described in **Part III, Coordinated TMDL Implementation Plan** and are shown in **Table 3-2**. Three timeframes are included in the table below:

- BMPs built after the phosphorus TMDL baseline through 2025. In this case the baseline is 2009.
- BMPs built after the sediment TMDL baseline through 2009. In this case the baseline is 2000.
- BMPs built from 2026 through 2034, the projected target date of the sediment TMDL. 2025 is the projected target date for the phosphorus TMDL. SHA will accomplish the percent reduction presented in **Table 3-2**. The reduction may not equal 100 percent.

Estimated Capital Budget costs to design and construct practices within the Upper Monocacy watershed total $34,114,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP category. In addition to Capital Budget costs, $26,000 from the Operations Budget is estimated for annual inlet cleaning.

Figure 4-63 shows a map of SHA's restoration practices in the watershed and include those that are under design or construction. Inlet cleaning is not reflected on this map.

Table 4-45: Upper Monocacy River Restoration Nutrient and Sediment BMP Implementation						
BMP	**Unit**	**2001 – 2009**	**2010 – 2025**	**2026 – 2034**	**Total**	**Cost**
New Stormwater	drainage area acres		298.4	105.4	403.8	$23,042,000
Retrofit	drainage area acres		26.3		26.3	$926,000
Stream Restoration	linear feet		1,650.0	1,500.0	3,150.0	$2,309,000
Tree Planting	acres of planting	0.1	69.9		70.0	$2,354,000
Outfall Stabilization[1]	linear feet			2,400.0	2,400.0	$5,235,000
Impervious Surface Elimination	acres removed		0.9		0.9	$248,000
Inlet Cleaning[2]	tons		27.0	27.0	27.0	$26,000
[1] Outfall stabilization treatment calculated based on 200 linear foot assumption per number of outfall stabilization retrofits						
[2] Inlet cleaning is an annual practice.						

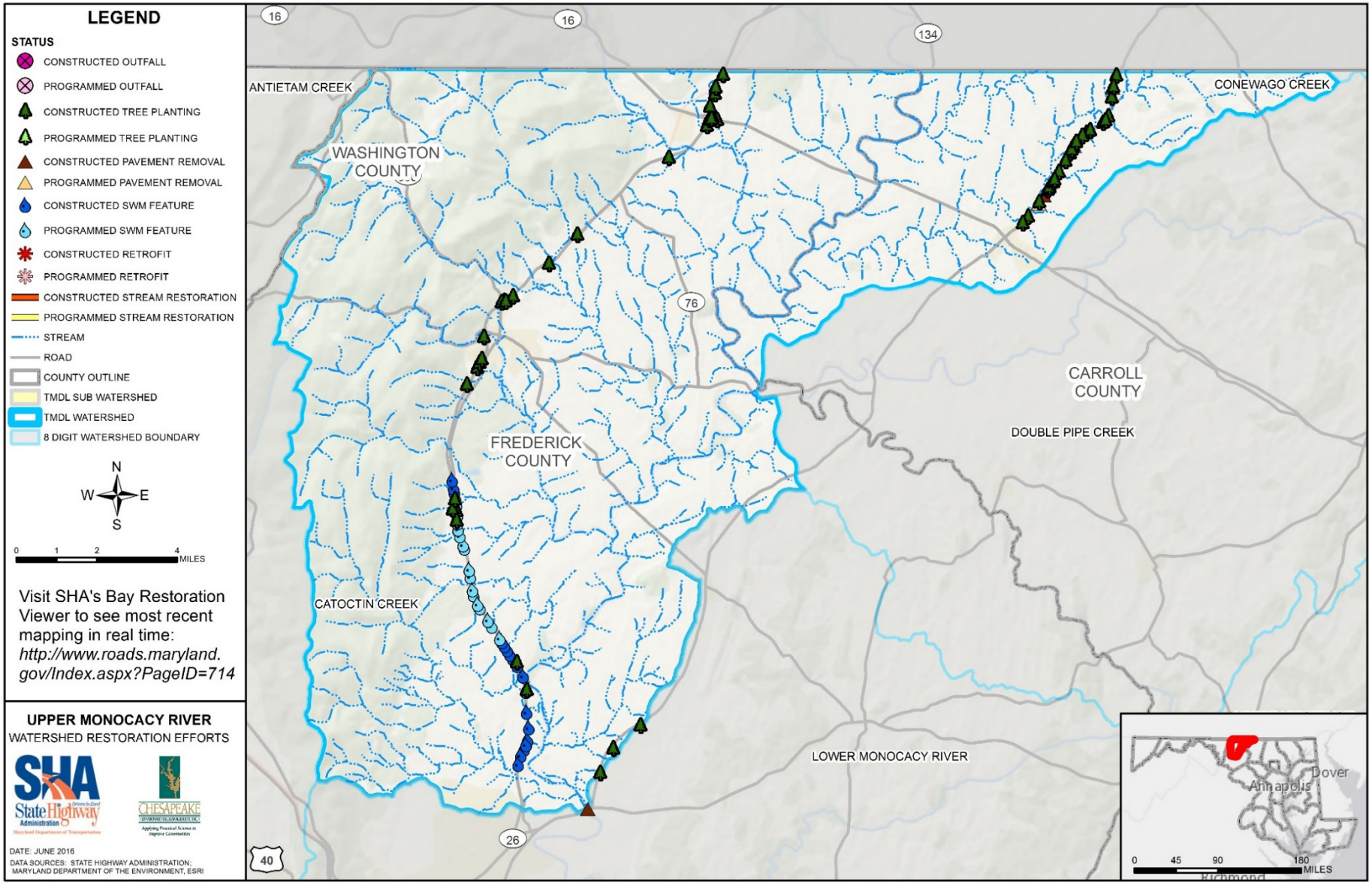


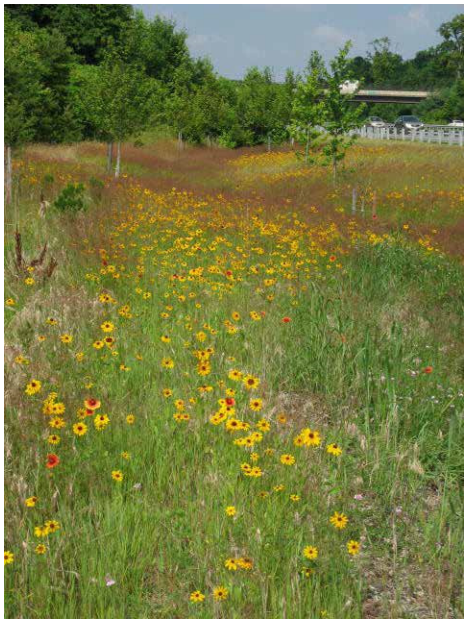
Figure 4-63: SHA Restoration Strategies within the Upper Monocacy River Watershed

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References







REFERENCES

AMT, Inc. (A. Morton Thomas and Associates, Inc.). 2011. *Upper Gwynns Falls Small Watershed Action Plan* prepared for Baltimore County, Department of Environmental Protection and Sustainability. Retrieved from http://www.baltimorecountymd.gov/Agencies/environment/watersheds/gwynnsmain.html

AMT, Inc. and Biohabitats. 2003. *Watts Branch Watershed Restoration Study*, Task 1 Report, March 2003 prepared for Montgomery County Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Lower%20Potomac%20Direct/Watts-Branch-stream-restoration-study-03.pdf

BC-DEPRM (Baltimore County, Department of Environmental Protection and Resource Management). 2008a. *Upper Back River Small Watershed Action Plan*. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/swapupperbackrivervol1.pdf

BC-DEPRM. 2008b. *Spring Branch Subwatershed - Small Watershed Action Plan* (Addendum to the Water Quality Management Plan for Loch Raven Watershed). Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/swapspringbranchvol%201.pdf

BC-DEPS (Baltimore County, Department of Environmental Protection and Sustainability). 2012. *Northeastern Jones Falls Small Watershed Action Plan* (SWAP). Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/swapnejonesfallsvol1130605.pdf

BC-DEPS. 2015. *Liberty Reservoir Small Watershed Action Plan*. Vol. 1. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/2016/libertyreservoir/libertyswapvol1complete.pdf

Biohabitats. 2012. *Rock Creek Implementation Plan p*repared for Montgomery County, Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Rock-creek-watershed-implementation-plan-11.pdf

Caraco, D. 2013. *Watershed Treatment Model (WTM) 2013 User's Guide*. Center for Watershed Protection, Ellicott City, MD.

CBP (Chesapeake Bay Program). 2015. *Toxic Contaminants Policy and Prevention Outcome: Management Strategy*. 2015-2025. Vol 1. Retrieved from http://www.chesapeakebay.net/documents/22048/3e_toxics_policyprevention_6-25-15_ff_formatted.pdf

CC-BRM (Carroll County, Bureau of Resource Management). 2012. *Liberty Reservoir Watershed Stream Corridor Assessment*. Retrieved from http://ccgovernment.carr.org/ccg/resmgmt/doc/Liberty/Liberty%20SCA.pdf?x=1466803710079

Clary, J., Jones, J., Urbonas, B., Quigley, M., Strecker, E., & Wagner, T. 2008. Can Stormwater BMPs Remove Bacteria? New Findings from the International Stormwater BMP Database. *Stormwater Magazine,* May/June 2008. Retrieved from http://www.uwtrshd.com/assets/can-stormwater-bmps-remove-bacteria.pdf

CWAPTW (Clean Water Action Plan Technical Workgroup). 1998. *Maryland Clean Water Action Plan: Final 1998 Report on Unified Watershed Assessment, Watershed Prioritization and Plans for Restoration Action Strategies*. Retrieved from http://msa.maryland.gov/megafile/msa/speccol/sc5300/sc5339/000113/000000/000385/unrestricted/20040775e.pdf

Clemson Cooperative Extension. 2015. *Managing Waterfowl in Stormwater Ponds*. Retrieved from http://www.clemson.edu/extension/natural_resources/water/stormwater_ponds/problem_solving/nuisance_wildlife/waterfowl/

CWP (Center for Watershed Protection). 2008a. *Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout*

Programs in the Chesapeake Bay Basin, CWP, Ellicott City, MD. Retrieved from https://www.epa.gov/sites/production/files/2015-11/documents/cbstreetsweeping.pdf

CWP. 2008b. *Lower Jones Falls Watershed Small Watershed Action Plan* (SWAP) prepared for Baltimore County, Department of Environment and Sustainability and the U.S. Environmental Protection Agency, Region III. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/swaplowerjonesfalls.pdf

CWP. 2011. *Beaverdam Run, Baisman Run, and Oregon Branch SWAP* prepared for Baltimore County, Department of Environmental Protection and Sustainability. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/swapareaivolume1.pdf

CWP. 2014. *Loch Raven East Small Watershed Action Plan: Final Report* prepared for Baltimore County, Department of Environmental Protection and Sustainability. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/2014/lochraveneastswapvol1.pdf

CWP. 2015. *Upper Jones Falls SWAP* prepared for Baltimore County Department of Environmental Protection and Sustainability. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/2015/AreaG/areagswapfulldoc1.pdf

DNR (Maryland Department of Natural Resources). 2002. *Liberty Reservoir Watershed Characterization*. Retrieved from http://msa.maryland.gov/megafile/msa/speccol/sc5300/sc5339/000113/002000/002374/unrestricted/20063378e.pdf

DNR. 2004. *Upper Monocacy Stream Corridor Assessment*. Baltimore, MD: DNR, Watershed Assessment and Targeting Division, Watershed Services.

EPA (United States Environmental Protection Agency). 2010a. *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns* (3rd ed.). (Publication No. EPA 841-B-10-002). Retrieved from https://cfpub.epa.gov/npstbx/files/getnstepguide.pdf

EPA. 2010b. *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment*. US EPA, Chesapeake Bay Program Office, Annapolis, MD. December 29, 2010. Retrieved from https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document

EPA. 2016. Watershed Academy Web. Watershed Change Modules: Growth and Water Resources. Retrieved from https://cfpub.epa.gov/watertrain/

FC-DPW (Frederick County, Division of Public Works). 2004. *Lower Monocacy River Watershed Restoration Action Strategy*. Final Report. Retrieved from http://www.cbtrust.org/atf/cf/%7Beb2a714e-8219-45e8-8c3d-50ebe1847cb8%7D/LOWER%20MONOCACY%20RIVER%20WRAS.PDF

FC-DPW. 2005. *Upper Monocacy River Watershed Restoration Action Strategy*. Retrieved from http://www.cbtrust.org/atf/cf/%7Beb2a714e-8219-45e8-8c3d-50ebe1847cb8%7D/UPPER%20MONOCACY%20RIVER%20WRAS.PDF

Hoos, A. B., Robinson, J. A., Aycock, R. A., Knight, R. R., & Woodside, M. D. 2000. *Sources, Instream Transport, and Trends of Nitrogen, Phosphorus, and Sediment in the Lower Tennessee River Basin, 1980-96*. U.S. Geological Survey, Water-Resources Investigations Report 99-4139. Nashville, Tennessee.

HWG (Horsley Witten Group, Inc). 2012a. *Muddy Branch and Watts Branch Subwatersheds Implementation Plan* prepared for the Montgomery County Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Muddy-Branch-Watts-Branch-Subwatersheds-Implementation-Plan-12.pdf

HWG. 2012b. *Great Seneca Subwatershed Implementation Plan* prepared for the Montgomery County Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Great-Seneca-subwatershed-implementation-plan-12.pdf

KCI/CH2M Hill. 2011. *Patapsco Non-Tidal Watershed Assessment Comprehensive Summary Report* prepared for Anne Arundel County. August 2011 Final Report. Retrieved from http://dev.aacounty.org/departments/public-works/wprp/forms-and-publications/PNT_Report.pdf

Lazarick, L. 2013. 'Scoop the Poop Day in Maryland,' O'Malley declares, *MarylandReporter.com*, 27 August 2013, Retrieved from http://marylandreporter.com/2013/08/27/scoop-the-poop-day-in-maryland-omalley-declares/#

Leisenring, M., Clary, J., & Hobson, P. 2014. *International Stormwater Best Management Practices (BMP) Database Pollutant Category Statistical Summary Report: Solids, Bacteria, Nutrients, and Metals*. Retrieved from http://www.bmpdatabase.org/Docs/2014%20Water%20Quality%20Analysis%20Addendum/BMP%20Database%20Categorical_StatisticalSummaryReport_December2014.pdf

LimnoTech & Versar. 2012. *Patapsco Tidal and Bodkin Creek Watershed Assessment Comprehensive Summary Report* prepared for Anne Arundel County, Department of Public Works. Retrieved from http://dev.aacounty.org/departments/public-works/wprp/forms-and-publications/PTB_Summary_Report_Final_Main.pdf

LimnoTech & Versar. 2016. *Little Patuxent Watershed Assessment Comprehensive Summary Report* prepared for Anne Arundel County, Department of Public Works. Retrieved from http://www.aacounty.org/AACoOIT/WPRP/DRAFT%20Little_Patuxent_Summary_Report_20160219_with_Appendices-small.pdf

MAST (Maryland Assessment Scenario Tool). 2016. MASTSource_Data_3_31_2016.xlsx. http://www.mastonline.org/Documentation.aspx. Retrieved March 31, 2016.

MC-DEP (Montgomery County, Department of Environmental Protection). 1999. *Great Seneca Watershed Study*. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Seneca%20Creek/Great-Seneca-Creek-watershed-study-99.pdf

MC-DEP. 2012. *Anacostia Watershed Implementation Plan*. Retrieved from www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Anacostia/AnacostiaRiverWIP_FINAL.pdf

MDE (Maryland Department of the Environment). 2006. *Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland*. Version: May 2006. Baltimore, MD: Maryland Department of the Environment, Wetlands and Waterways Program. Retrieved from http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/AboutWetlands/Pages/Programs/WaterPrograms/Wetlands_Waterways/about_wetlands/priordownloads.aspx

MDE. 2008a. Revised Final *Total Maximum Daily Load of Sediment in the Antietam Creek Watershed, Washington County, Maryland*. Retrieved from http://mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_antietam_creek_sediment.aspx

MDE. 2008b. Final *Total Maximum Daily Load of Sediment in the Conococheague Creek Watershed, Washington County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_conococheague_creek_sediment.aspx

MDE. 2008c. Final *Total Maximum Daily Loads of Phosphorus and Sediments for Triadelphia Reservoir (Brighton Dam) and Total Maximum Daily Loads of Phosphorus for the Rocky Gorge Reservoir, Howard, Montgomery, and Prince George's Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_pax_res_p_sed.aspx

MDE. 2009a. *2000 Maryland Stormwater Design Manual Volumes I & II* (Effective October 2000, Revised May 2009). Retrieved from http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/MarylandStormwaterDesignManual/Pages/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.aspx

MDE. 2009b. Final *Total Maximum Daily Loads of Fecal Bacteria for Loch Raven Reservoir Watershed in Baltimore, Carroll and Harford Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_loch_raven_reservoir_bacteria.aspx

MDE. 2009c. Final *Total Maximum Daily Loads of Fecal Bacteria for the Patapsco River Lower North Branch Basin in Anne Arundel, Baltimore, Carroll, and Howard Counties, and Baltimore City Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_patapsco_lnb_bacteria.aspx

MDE. 2009d. Revised Final *Total Maximum Daily Load of Sediment in the Catoctin Watershed, Frederick County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_catoctin_creek_sediment.aspx

MDE. 2009e. Final *Total Maximum Daily Load of Sediment in the Double Pipe Creek Watershed, Frederick and Carroll Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_doublepipecreek_sediment.aspx

MDE. 2009f. Final *Total Maximum Daily Load of Sediment in the Lower Monocacy River Watershed, Frederick, Carroll, and Montgomery Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_lower_monocacy_sediment.aspx

MDE. 2009g. Final *Total Maximum Daily Load of Sediment in the Upper Monocacy River Watershed, Frederick and Carroll Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_uppermonocacy_sediment.aspx

MDE. 2010a. *Total Maximum Daily Loads of Trash for the Anacostia River Watershed, Montgomery and Prince George's Counties, Maryland and the District of Columbia* Retrieved from: http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/Anacostia_Trash_TMDL_081010_final.pdf

MDE. 2010b. Final *Total Maximum Daily Load of Sediment in the Gwynns Falls Watershed, Baltimore City and Baltimore County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/tmdl_final_gwynns_falls_sediment.aspx

MDE. 2011a. Final *Total Maximum Daily Load of Polychlorinated Biphenyls in the Northeast and Northwest Branches of the Nontidal Anacostia River, Montgomery and Prince George's County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_Nontidal_Anacostia_PCBs.aspx

MDE. 2011b. Final *Total Maximum Daily Loads of Bacteria for Impaired Recreational Areas in Marley Creek and Furnace Creek of Baltimore Harbor Basin in Anne Arundel County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_final_Marley.aspx

MDE. 2011c. Final *Total Maximum Daily Load of Sediment in the Bynum Run Watershed, Harford County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_BynumRun_Sediment.aspx

MDE. 2011d. Final *Total Maximum Daily Load of Sediment in the Cabin John Creek Watershed, Montgomery County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_CabinJohnCreek_Sediment.aspx

MDE. 2011e. Final *Total Maximum Daily Load of Sediment in the Jones Falls Watershed, Baltimore City and Baltimore County, Maryland*. Retrieved from

http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_Jones_Falls_Sediment.aspx

MDE. 2011f. Final *Total Maximum Daily Load of Sediment in the Little Patuxent River Watershed, Howard and Anne Arundel Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_LittlePAX_Sediment.aspx

MDE. 2011g. Final *Total Maximum Daily Load of Sediment in the Patapsco River Lower North Branch Watershed, Baltimore City and Baltimore, Howard, Carroll and Anne Arundel Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_PatapscoLNB_Sediment.aspx

MDE. 2011h. Final *Total Maximum Daily Loads of Fecal Bacteria for the Patuxent River Upper Basin in Anne Arundel and Prince George's Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_final_Patuxent_River_Upper_bacteria.aspx

MDE. 2011i. Final *Total Maximum Daily Load of Sediment in the Patuxent River Upper Watershed, Anne Arundel, Howard and Prince George's Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_PaxUpper_Sediment.aspx

MDE. 2011j. Final *Total Maximum Daily Load of Sediment in the Rock Creek Watershed, Montgomery County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_final_Rock_Creek_sed.aspx

MDE. 2011k. Final *Total Maximum Daily Load of Sediment in the Seneca Creek Watershed, Montgomery County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_Seneca_Creek_sed.aspx

MDE. 2012a. Final *Total Maximum Daily Load of Polychlorinated Biphenyls in Back River Oligohaline Tidal Chesapeake Bay Segment, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_BackRiver_PCBs.aspx

MDE. 2012b. Final *Total Maximum Daily Load of Polychlorinated Biphenyls in Baltimore Harbor, Curtis Creek/Bay, and Bear Creek Portions of Patapsco River Mesohaline Tidal Chesapeake Bay Segment, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_BaltHarbor_PCBs.aspx

MDE. 2012c. Final *Watershed Report for Biological Impairment of the Catoctin Creek Watershed in Frederick County, Maryland Biological Stressor Identification Analysis Results and Interpretation*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/Documents/BSID_Reports/Catoctin_Creek_BSID_Report_final.pdf

MDE. 2012d. Final *Watershed Report for Biological Impairment of the Liberty Reservoir Watershed in Baltimore and Carroll Counties, Maryland, Biological Stressor Identification Analysis Results and Interpretation*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/Documents/BSID_Reports/LibertyRes_BSID_25Jan2012_final.pdf

MDE. 2012e. Final *Total Maximum Daily Load of Sediment* in the Potomac River Montgomery County Watershed, Montgomery and Frederick Counties, Maryland. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_Final_PotomacMOCnty_Sediment.aspx

MDE. 2013a. Final *Total Maximum Daily Load of Phosphorus in the Antietam Creek Watershed, Washington County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_final_Antietam_Creek_Nutrient.aspx

MDE. 2013b. Final *Total Maximum Daily Load of Phosphorus in the Catoctin Creek Watershed, Frederick County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_final_Catoctin_Creek_nutrient.aspx

MDE. 2013c. Final *Total Maximum Daily Load of Phosphorus in the Double Pipe Creek Watershed, Frederick and Carroll Counties, Maryland*. Retrieved

from
http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/tmdl_final_double_pipe_creek_phosphorus.aspx

MDE. 2013d. Final *Total Maximum Daily Load of Phosphorus in the Lower Monocacy River Watershed, Frederick, Carroll, and Montgomery Counties, Maryland*. http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/tmdl_final_lower_monocacy_river_phosphorus.aspx

MDE. 2013e. Final *Total Maximum Daily Load of Phosphorus in the Rock Creek Watershed, Montgomery County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_final_Rock_Creek_Nutrient.aspx

MDE. 2013f. Final *Total Maximum Daily Load of Phosphorus in the Upper Monocacy River Watershed, Frederick and Carroll Counties, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/tmdl_final_upper_monocacy_river_phosphorus.aspx

MDE. 2014a. *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated: Guidance for National Pollutant Discharge Elimination System Stormwater Permits*. Retrieved from http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/NPDES%20MS4%20Guidance%20August%2018%202014.pdf

MDE. 2014b. *Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Nutrient, and Sediment Total Maximum Daily Loads*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/DataCenter/Documents/Nutrient%20Sediment%20Implementation%20Plan%20Guidance_final_111814.pdf

MDE. 2014c. *Guidance for Developing a Stormwater Wasteload Allocation Implementation Plan for Bacteria Total Maximum Daily Loads*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/DataCenter/Documents/Bacteria%20Implementation%20Plan%20Guidance_051414_clean.pdf

MDE. 2014d. *General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/DataCenter/Documents/General_Implementation_Plan_Guidance_clean.pdf

MDE. 2014e. Comment Response Document regarding the Final *Total Maximum Daily Load of Polychlorinated Biphenyls in Lake Roland of Jones Falls Watershed in Baltimore County and Baltimore City, Maryland*. Retrieved from http://mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/tmdl_final_lake_roland_pcb.aspx

MDE. 2014f. *Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Trash/Debris Total Maximum Daily Loads*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/DataCenter/Documents/Trash%20Implementation%20Plan%20Guidance_052014.pdf

MDE. 2015a. *Maryland's Final 2014 Integrated Report of Surface Water Quality*. Retrieved from http://mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/2014IR.aspx

MDE. 2015b. Final *Total Maximum Daily Load of Polychlorinated Biphenyls in the Magothy River Mesohaline Chesapeake Bay Tidal Segment, Anne Arundel County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/tmdl_final_magothy_river_pcb.aspx

MDE. 2015c. Final *Total Maximum Daily Loads of Trash and Debris for Middle Branch and Northwest Branch Portions of Patapsco River Mesohaline Tidal Chesapeake Bay Segment, Baltimore City and County, Maryland*. Retrieved from http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/TMDL_final_BaltimoreHarbor_trash.aspx

MDE. 2016. Final Draft *Maryland Trading and Offset Policy and Guidance Manual Chesapeake Bay Watershed.* Retrieved from: http://www.mde.state.md.us/programs/water/pages/wqtac.aspx

MDP (Maryland Department of Planning). 2010. Land Use/Land Cover. Retrieved from http://www.mdp.state.md.us/OurWork/landuse.shtml

PACD (Pennsylvania Association of Conservation Districts). 2009. *Stream Bank Fencing and Stream Crossings: We All Live Downstream*. Retrieved from http://pacd.org/webfresh/wp-content/uploads/2009/09/StreambankFencing1.pdf

PB (Parsons Brinckerhoff). 2010. *Tidal Back River Small Watershed Action Plan (SWAP)* prepared for Baltimore County, Department of Environmental Protection and Resource Management. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/tbrswapvol1.pdf

PB. 2013. *Middle Gwynns Falls SWAP* prepared for Baltimore County, Department of Environmental Protection and Sustainability. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/2013/swapmgfareacvol131113.pdf

PB. 2015. *Loch Raven North SWAP* prepared for Baltimore County, Department of Environmental Protection and Sustainability. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/2016/lochravennorth/lrnswapvol1complete.pdf

PGC-DoE (Prince George's County, Department of the Environment). 2014. Draft *Implementation Plan for the Anacostia River Watershed Trash Total Maximum Daily Load in Prince George's County*, PGC-DoE, Largo, MD.

PGC-DoE. 2015. Restoration Plan for PCB-Impacted Water Bodies in Prince George's County. Retrieved from http://pgcdoe.net/pgcountyfactsheet/Areas/Factsheet/Documents/Plans/PCB%20Restoration%20Plan%2020151228-combined.pdf

Pitt, R., Maestre, A., & Morquecho, R. 2004. *The National Stormwater Quality Database (NSQD, version 1.1)* Retrieved from http://rpitt.eng.ua.edu/Research/ms4/Paper/Mainms4paper.html

S&S Planning and Design. 2012. *Tiber-Hudson and Plumtree Branch Stream Corridor Assessment* prepared for the Howard County Department of Public Works - Bureau of Environmental Services - Stormwater Management Division by S&S Planning and Design, LLC. Cumberland, MD. Retrieved from http://dnncquh0w.azurewebsites.net/LinkClick.aspx?fileticket=yHQ87JE3FGk%3d&portalid=0

SFEI (San Francisco Estuary Institute). 2010. *A BMP Tool Box for Reducing Polychlorinated Biphenyls (PCBs) and Mercury (Hg) in Municipal Stormwater*. Retrieved from http://www.nemallc.com/Resources/Documents/BMP%20Performance/pcb%20and%20hg%20bmp%20toolbox%202010.pdf

Schueler, T. 2000. Microbes in Urban Watersheds: Concentrations, Sources, & Pathways. *Watershed Protection Techniques, 3*(1), 554-565.

Schueler, T. 2011. *Nutrient Accounting Methods to Document Local Stormwater Reduction in the Chesapeake Bay Watershed*. CSN Technical Bulletin No. 9. Chesapeake Stormwater Network, Ellicott City, MD.

Schueler, T., & Youngk, A. 2015. *Potential Benefits of Nutrient and Sediment Practices to Reduce Toxic Contaminants in the Chesapeake Bay Watershed. Part 1: Removal of Urban Toxic Contaminants*. Final Report. Chesapeake Stormwater Network, Ellicott City, MD.

Schueler, T. R. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*. Washington, DC: Metropolitan Washington Council of Governments.

Tetra-Tech. 2009. An Assessment of Stormwater Management Retrofit and Stream Restoration Opportunities in Bennett Creek Watershed, Frederick County, Maryland

Tetra-Tech. 2014. Watershed Existing Condition Report for the Upper Patuxent River, Western Branch, and Rocky Gorge Reservoir Watershed prepared for the Prince George's County Department of the Environment. Retrieved from http://pgcdoe.net/pgcountyfactsheet/Areas/Factsheet/Documents/Reports/WECR_Patuxent_20141231.pdf

Tetra-Tech. 2015. *Restoration Plan for the Upper Patuxent River and Rocky Gorge Reservoir Watersheds in Prince George's County* prepared for the Prince George's County Department of Environment. Retrieved from

http://pgcdoe.net/pgcountyfactsheet/Areas/Factsheet/Documents/Plans/Restoration%20Plan%20Upper%20Patuxent%2020151228-combined.pdf

WC-DPW (Washington County, Division of Public Works). 2014. 2013 NPDES MS4 Annual Report. Retrieved from https://www.washco-md.net/DEM/swm/pdfs/swm_2013_NPDES_AnnualReport.pdf

WCSCD (Washington County Soil Conservation District), Board of County Commissioners of Washington County, Antietam Creek Watershed Alliance, Canaan Valley Institute, & MDE. 2012. *Antietam Creek Watershed Restoration Plan.* Retrieved from http://www.mde.state.md.us/programs/Water/319NonPointSource/Pages/AntietamCreekWRP.aspx

USGS (United States Geological Survey). 2016. The USGS Water Science School: What is a watershed? Retrieved from http://water.usgs.gov/edu/watershed.html

URS. 2013. *Middle Great Seneca Creek Watershed Study* prepared for City of Gaithersburg. Retrieved from http://www.gaithersburgmd.gov/services/environmental-services

URS. 2014a. *Small Watershed Action Plan for Declaration Run and Riverside Watersheds* prepared for Harford County Department of Public Works. Retrieved from http://www.harfordcountymd.gov/ArchiveCenter/ViewFile/Item/332

URS. 2014b. *Muddy Branch Watershed Study* prepared for the City of Gaithersburg. Retrieved from http://www.gaithersburgmd.gov/services/environmental-services

URS. 2014c. *Lower Great Seneca Watershed Study* prepared for City of Gaithersburg. Retrieved from http://www.gaithersburgmd.gov/services/environmental-services

Vaughn, C. 2012. The Scoop on Poop: Pet Waste a Major Polluter of MD Waterways, *Capital News Service*, 25 October 2012. Retrieved from http://cnsmaryland.org/2012/10/25/the-scoop-on-poop-pet-waste-a-major-polluter-of-md-waterways/

Versar. 2011a. *Upper Potomac Direct Pre-Assessment Report* prepared for Montgomery County, Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Upper-Potomac-Direct-Pre-Assessment-Report-11.pdf

Versar. 2011b. *Lower Potomac Direct Pre-Assessment Report* prepared for Montgomery County, Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Lower-Potomac-Direct-Pre-Assessment-Report-11.pdf

Versar. 2011c. *Dry Seneca & Little Seneca Creek Pre-Assessment Report* prepared for Montgomery County Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Seneca%20Creek/Dry-Seneca-Creek-and-Little-Seneca-Creek-watershed-pre-assessment-report-11.pdf

Versar. 2012a. *Cabin John Creek Implementation Plan* prepared for Montgomery County, Department of Environmental Protection. Retrieved from https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Watershed%20studies/Cabin-John-Creek-implementation-Plan-12.pdf

Versar. 2012b. *Lower Patapsco River Small Watershed Action Plan*. Final Report. Vols. 1 and 2 prepared for the Baltimore County, Department of Environmental Protection and Sustainability. Retrieved from http://resources.baltimorecountymd.gov/Documents/Environment/Watersheds/lowerpatapscoswapvol1opt.pdf

Versar. 2015a. *Frederick County Stream Survey: 2014 Countywide Results* prepared for Frederick County, Office of Sustainability and Environmental Resources.

Versar. 2015b. *Little Patuxent River Watershed Assessment* prepared for the Howard County Department of Public Works.