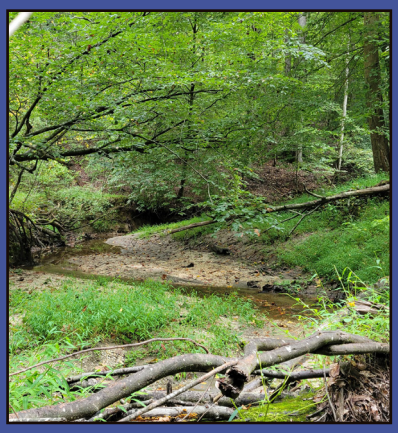
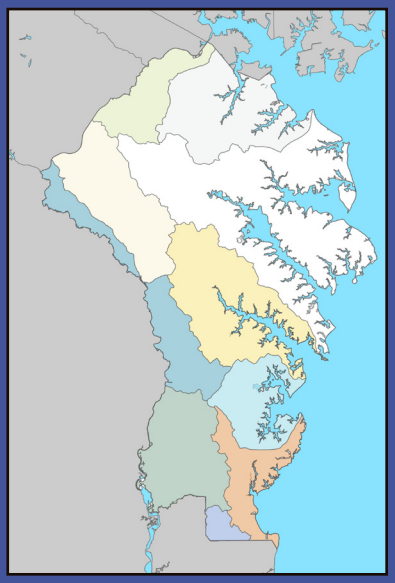
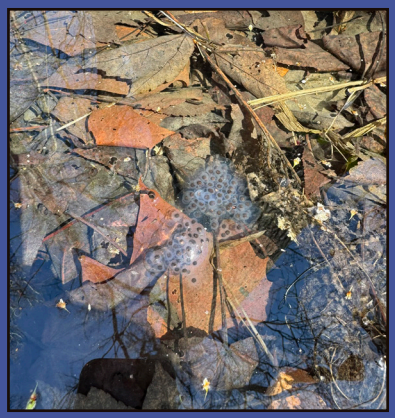
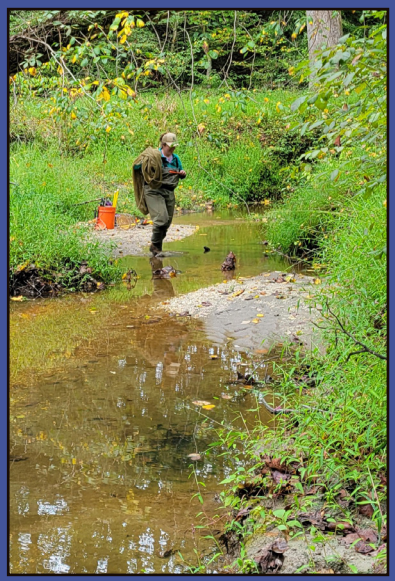








Anne Arundel County Sediment TMDL Restoration Plan Update

Anne Arundel County, Maryland
December 2025

Anne Arundel County WATERSHED Protection & Restoration PROGRAM

Anne Arundel County
Sediment TMDL Restoration Plan Update

December 2025

Prepared for:

Anne Arundel County
Department of Public Works
Bureau of Watershed Protection and Restoration
2662 Riva Road
Annapolis, Maryland 21401

Prepared by:

KCI Technologies, Inc.
936 Ridgebrook Road
Sparks, Maryland 21152

Table of Contents

List of Tables

List of Figures

Appendices

List of Acronyms

AAWSA	Anne Arundel Watershed Stewards Academy
BayFAST	Chesapeake Bay Facility Assessment Scenario Tool
BIBI	Benthic Index of Biotic Integrity
BMP	Best management practices
BSID	Biological Stressor Identification
BWPR	Bureau of Watershed Protection and Restoration
CAST	Chesapeake Assessment Scenario Tool
CBP WM P6	Chesapeake Bay Program Watershed Model Phase 6
CCLU	Chesapeake Conservancy Land Use
CIP	Capital Improvement Projects
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
DPW	Department of Public Works
EOS	Edge-of-stream
EPA	Environmental Protection Agency
ESD	Environmental site design
FAP	Financial Assurance Plan
FIBI	Fish Index of Biotic Integrity
FY	Fiscal year
GIS	Geographic Information System
IWPP	MDE's Integrated Water Planning Program
MBSS	Maryland Biological Stream Survey
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MEP	Maximum extent practicable
MS4	Municipal Separate Storm Sewer System Discharge Permit
NLCD	National Land Cover Database
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometer Turbidity Units
NWI	National Wetlands Inventory
PCBs	Polychlorinated biphenyls
PSU	Primary sampling unit
ROW	Right-of-way
RR	Runoff reduction
SHA	Maryland State Highway Administration
SWM	Stormwater management
SW-WLA	Stormwater wasteload allocation
TBD	To Be Determined
TIPP	TMDL Implementation Progress and Planning
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
WIP	Watershed implementation plans
WLA	Wasteload allocation
WQS	Water quality standards

1 Introduction

1.1 Background and Purpose

The Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration (DPW-BWPR) is updating restoration plans to address local water quality impairments for which a Total Maximum Daily Load (TMDL) has been established by the Maryland Department of the Environment (MDE) and approved by the Environmental Protection Agency (EPA). A TMDL establishes a maximum load of a specific pollutant of concern or stressor that a waterbody can assimilate and still meet water quality standards (WQS) for its designated use class.

Under the Federal Clean Water Act (CWA), the State of Maryland is required to assess and report on the quality of waters throughout the state. Where Maryland's WQS are not fully met, Section 303(d) requires the State to list these water bodies as impaired waters. The State is then required to develop a TMDL for each pollutant of concern for the listed impaired waters. Following development of the TMDL, jurisdictions with responsibility for the pollutants and the impaired waters are required to develop a plan to meet the goals of the TMDL. See Section 1.1.1 for more details.

Nine watersheds in Anne Arundel County (Figure 1-1) have sediment impairments, measured as total suspended solids (TSS), listed in *Maryland's Final Combined 2024 Integrated Report of Surface Water Quality* (303(d) list and 305(b) Report; MDE, 2024a) and have had TMDLs established as a result. Responsibility for the sediment reductions is divided among the contributing jurisdictions in each watershed, which can include Phase I and Phase II Municipal Separate Storm Sewer System Discharge Permit (MS4) permitholders, as well as other NPDES regulated stormwater permitholders (e.g., industrial facilities and construction sites). This updated plan specifically addresses the sediment TMDLs under the responsibility of Anne Arundel County, consolidates the previous individual watershed plans into one overarching plan, and was written in accordance with recommendations described in the MDE documents titled *General Guidance for Local TMDL SW-WLA Watershed Implementation Plans* (MDE, 2022a) and *Guidance for Developing Local Nutrient and Sediment TMDL (Total Maximum Daily Load) Stormwater Wasteload Allocation (SW-WLA) Watershed Implementation Plans (WIPs)* (MDE, 2022b).

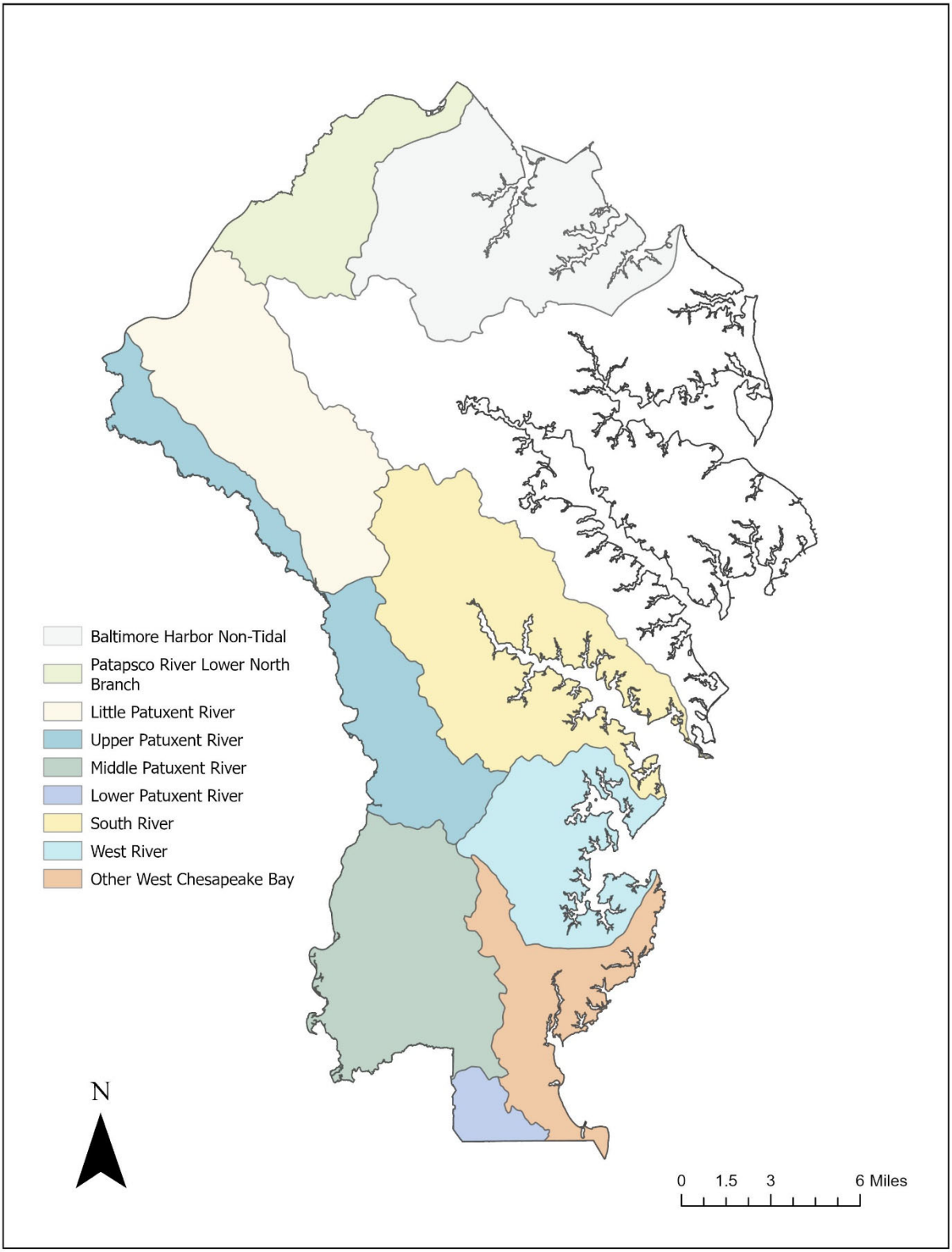


Figure 1-1. Location of Sediment TMDL Watersheds in Anne Arundel County

1.1.1 NPDES MS4 Permit Requirements

Concurrent with the issuance of the County's current MS4 permit (20-DP-3316, MD0068306; MDE, 2021a) on November 5, 2021, MDE recommended that Maryland Phase I Counties update previously approved local TMDL restoration plans by the end of the permit term, which for Anne Arundel County will be November 4, 2026. An excerpt from MDE's *General Guidance for Local TMDL (Total Maximum Daily Load) Stormwater Wasteload Allocation (SW-WLA) Watershed Implementation Plans (WIPs*; MDE, 2022a) states:

> *"All existing plans are required to be overhauled once a permit term, given: (1) the iterative and adaptive nature of the permit, and (2) the shift in planning to connect watershed modeling with the observed chemical, physical, and biological response of an applicable TMDL waterbody. The State has set the precedent for adaptive and iterative watershed management via the Chesapeake Bay TMDL accountability framework and WIP development. Local plans should follow suit."*

The County's 2021 MS4 permit also includes a new impervious restoration requirement (Part IV.E.3) which states:

> "*By November 4, 2026, Anne Arundel County shall commence and complete the restoration of 2,998 impervious acres that have not been treated to the MEP by implementing stormwater BMPs, programmatic initiatives, or alternative control practices in accordance with the 2021 Accounting Guidance*."

MDE included an annual restoration benchmark schedule to achieve the impervious restoration requirement by the end of the permit term and a requirement to submit with each annual report a list of best management practices (BMPs) to be completed in the following year to work toward meeting the impervious restoration benchmarks. Although this updated restoration plan does not directly address the County's impervious restoration requirement, restoration BMPs include those listed in Section 3 (e.g. stormwater BMPs, stream restoration, tree planting and reforestation) implemented for TMDL compliance will also provide restoration credit towards the impervious restoration goal; and, conversely, BMPs implemented for impervious restoration will also provide load reductions towards achieving the TMDL SW-WLAs.

1.1.2 Sediment TMDLs and Restoration Plans

This updated restoration plan addresses sediment loads allocated to Anne Arundel County NPDES regulated stormwater point source. The TMDL documents developed by MDE, which identify the SW-WLAs and associated pollutant reductions assigned to Anne Arundel County's MS4, as well as the County's original restoration plans to achieve sediment reductions are listed in Table 1-1.

Table 1-1. Anne Arundel County Sediment Watershed Code, TMDL Document Names, EPA Approval Date, Restoration Plan Names, and Publication Dates

Watershed Code	TMDL Document	EPA Approval Date	TMDL Restoration Plan	Plan Publication Date
02130903	Total Maximum Daily Load of Sediment in the Non-Tidal Baltimore Harbor Watershed, Baltimore City, Baltimore County, and Anne Arundel County, Maryland (MDE, 2022c)	January 2022	Non-Tidal Baltimore Harbor Watershed Sediment TMDL Restoration Plan	December 2022
02131003	Total Maximum Daily Load of Sediment in the Non-tidal South River Watershed, Anne Arundel County, Maryland (MDE, 2017)	September 2017	Non-Tidal South River Watershed Sediment TMDL Stormwater Wasteload Allocation Attainment Report	December 2022
02131004	Total Maximum Daily Load of Sediment in the Non-Tidal West River Watershed, Anne Arundel County, Maryland (MDE, 2019)	April 2019	Non-Tidal West River Sediment TMDL Restoration Plan	December 2021
02131101	Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Lower Watershed, Anne Arundel, Calvert, Charles, Prince George's and Saint Mary's Counties, Maryland (MDE, 2018a)	July 2018	Nontidal Patuxent River Lower and Middle Watersheds Sediment TMDL Restoration Plan	January 2020
02131102	Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Middle Watershed, Anne Arundel, Calvert, and Prince George's Counties, Maryland (MDE, 2018b)			
02131105	Total Maximum Daily Load of Sediment in the Other West Chesapeake Watershed, Anne Arundel and Calvert Counties, Maryland (MDE, 2018c)	February 2018	Other West Chesapeake Watershed Sediment TMDL Restoration Plan	January 2020
02131105	Total Maximum Daily Load of Sediment in the Little Patuxent River Watershed, Howard and Anne Arundel Counties, Maryland (MDE, 2011a)	September 2011	Little Patuxent River Sediment TMDL Restoration Plan	November 2016
02131104	Total Maximum Daily Load of Sediment in the Patuxent River Upper Watershed, Anne Arundel, Howard and Prince George's Counties, Maryland (MDE, 2011b)	September 2011	Upper Patuxent River Sediment TMDL Restoration Plan	November 2016
02130906	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 (MDE, 2011c)	September 2011	Patapsco River Lower North Branch Sediment TMDL Restoration Plan	November 2016

1.2 Allocated and Future Loads Summary

The TMDL loading targets, or allocations, are divided among the pollution source categories, which in this case includes non-point sources (termed load allocation or LA) and point sources (termed waste load allocation or WLA). The WLA consists of loads attributable to regulated process water or wastewater treatment, and regulated stormwater, which is the SW-WLA. For the purposes of the TMDL and consistent with implementation of the National Pollutant Discharge Elimination System (NPDES) MS4, stormwater runoff from MS4 areas is considered a point source contribution.

The required watershed sediment TMDL target load, as defined by the TMDL, is shown in Table 1-2 below, along with target years determined by the County through the planning process. Based on MDE guidance, potential increases in the stormwater load since the TMDL baseline years that are attributed to growth in the stormwater sector (i.e., growth in developed land uses) are not accounted for in the development of this plan. Local TMDLs are considered met, from a planning and pollutant loading accounting perspective, when the load reductions associated with restoration progress coupled with the future restoration load reductions exceed the load reduction required. Methods to address additional nutrient and sediment loads since the baseline year and potential future loads that may result from anticipated growth within County are discussed in Section 2.3.

This section of the plan provides a concise summary of the loads at important timeline intervals including the Baseline, Current Progress, Interim Programmed, and Target Year Planned intervals. These terms and dates are used throughout the plan and are presented and defined here to assist the reader in understanding the definitions of each, how they were derived, and to provide an overall summary demonstrating the percent reduction required and percent reduction achieved through full implementation of this plan. Sediment loads and SW-WLAs are presented as either tons/year or lbs/year in each watersheds' sediment TMDL document (see Section 1.1.2) but will be discussed as lbs/year in this restoration plan. Current Progress, Interim Programmed, and Planned BMP implementation and their associated load reductions are discussed in detail by watershed in Section 6.

- **EOS lbs/yr**: An edge of stream (EOS) load is the amount of pollutant that is transported from a source to the nearest stream. Local TMDLs for impairments at the freshwater tributary scale are developed and modeled at the EOS scale.
- **Baseline Load:** Sediment loads (i.e., land use loads with treatment from baseline development and restoration BMPs included) reflecting TMDL baseline year conditions (see Table 1-2) in the Anne Arundel MS4 source sector using MDE's TMDL Implementation Progress and Planning (TIPP) spreadsheet tool, which is described further in Section 4. Baseline loads were used to calculate the target load or SW-WLA.
- **Target Load (SW-WLA):** SW-WLAs are allocated loads derived using the following calculation: Target Load = Baseline Load – (Baseline Load x Target % Reduction). The SW-WLA is the portion of the overall TMDL that is assigned to or 'allocated' to the responsibility of the stormwater sector.
- **Target % Reduction:** Percent reductions required in the TMDL and assigned to Anne Arundel County Phase I MS4 stormwater sector (MS4 Permit Appendix A and WLA Search tool available in MDE's TMDL Data Center; https://wlat.mde.state.md.us/WLASearch.aspx).
- **FY24 Progress Load:** Progress loads achieved from restoration BMP implementation after the baseline year through Fiscal Year 2024 (FY24, i.e., June 30, 2024).
- **FY24 Progress % Reduction:** Percent reduction achieved from restoration BMP implementation after the baseline year through FY24 (i.e., June 30, 2024).

- **Interim Programmed and Planned % Reduction:** Percent reduction associated with the BMP implementation in only the planning tiers (Interim Programmed and Planned; see Section 3.3).
- **Target Year**: FY that full restoration BMP implementation meets the target load (SW-WLA).
- **Full Implementation Load:** Future load resulting from full implementation of this restoration plan.
- **Full Implementation % Reduction:** Percent reduction that will result from full implementation of completed and planned BMPs. This % reduction is assessment against the Target % Reduction. The Full Implementation % Reduction should match or exceed the Target % Reduction.

In several watersheds, there are more projects identified for implementation than are needed, resulting in a full implementation percent reduction that is greater than the target percent reduction. This is most noticeable for the Little Patuxent River and Upper Patuxent River watersheds. Little Patuxent River reaches its target reduction in FY26, but full BMP implementation is not projected to be completed until FY30. Upper Patuxent River has one Planned BMP projected to be completed in 2029 that will singularly achieve the remaining reduction required for the watershed. Future potential projects are regularly re-evaluated prior to implementation and in some cases are not ultimately pursued due to a variety of factors. As implementation progresses in the Little Patuxent River, there is the possibility that projects identified now for implementation will not be implemented and the total eventual reduction achieved will meet the TMDL goals, but not reach the levels currently identified in Table 1-2. If the project identified for the Upper Patuxent is deemed not implementable it will be replaced by a project or combination of projects to meet the reduction goals.

Additionally, BMP implementation is not required for South River, but there are still Interim Programmed BMPs identified because the projects are already included in the County's plans and failed restoration BMPs need to be remediated. More details on specific watershed load reductions are provided in Section 6.

Table 1-2. Local TMDL Baseline, Progress, Interim Programmed and Planned, and Full Implementation Loads and Reductions; TSS EOS lbs/yr

	Baltimore Harbor Non-Tidal	Little Patuxent River	Upper Patuxent River	Middle Patuxent River	Lower Patuxent River	Patapsco River Lower North Branch	South River[1]	Other West Chesapeake Bay	West River
Baseline Year	*2009*	*2005*	*2005*	*2009*	*2009*	*2005*	*2009*	*2009*	*2009*
Baseline Load	21,775,064	18,927,369	12,770,101	15,868,830	1,967,006	16,658,125	18,936,404	10,990,993	9,166,941
Target % Reduction	58.0%	20.5%	11.4%	56.0%	61.0%	22.2%	28.0%	33.0%	22.0%
Target Reduction Required	12,629,537	3,880,111	1,455,792	8,886,545	1,199,873	3,698,104	5,302,193	3,627,028	2,016,727
Target Load (SW-WLA)	9,145,527	15,047,258	11,314,310	6,982,285	767,132	12,960,021	13,634,211	7,363,965	7,150,214
FY24 Progress Load	19,283,393	17,127,496	12,529,504	15,792,672	1,967,006	15,385,647	11,212,345	10,848,572	9,106,155
FY24 Progress % Reduction	11.4%	9.5%	1.9%	0.5%	0.0%	7.6%	40.8%	1.3%	0.7%
Interim Programmed and Planned % Reduction	46.7%	25.8%	21.4%	55.8%	63.5%	17.3%	14.5%	31.7%	21.4%
Full Implementation Load	9,115,214	12,243,070	9,799,032	6,932,564	718,631	12,510,397	8,468,601	7,362,957	7,146,928
Full Implementation % Reduction	58.1%	35.3%	23.3%	56.3%	63.5%	24.9%	55.3%	33.0%	22.0%
Target Year	*2037*	*2026[2]*	*2029*	*2039*	*2026*	*2034*	*N/A*	*2037*	*2034*

[1] Per Progress modeling, SW-WLA achieved in the South River watershed

[2] SW-WLA will be achieved in 2026; however full BMP implementation will be completed in 2030 (35.3% reduction)

1.3 Plan Elements and Structure

This Plan is developed within the context of on-going watershed management planning, restoration, and resource protection being conducted by Anne Arundel County. The primary audience of this plan is the County as it provides an overview of the strategy to achieve the SW-WLAs assigned to the watersheds with sediment impairments, which fulfills MS4 permit requirements related to TMDL implementation plans. Additionally, because SW-WLAs for these sediment TMDLs are assigned to other Phase I MS4s, as well as several smaller Phase II MS4 entities, the plan can serve as a tool to coordinate and collaborate with other MS4 jurisdictions within the watersheds on water quality improvements across the impaired watersheds. MDE has prepared several guidance documents to assist municipalities with preparation of TMDL implementation plans. This plan is developed following the guidance detailed in the following documents:

- *General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan (MDE, 2014a)*
- *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. Guidance for National Pollutant Discharge Elimination System Stormwater Permits (MDE, 2021b)*
- *General Guidance for Local TMDL Maximum Daily Load Stormwater Wasteload Allocation Watershed Implementation Plans (MDE, 2022a)*
- *Guidance for Developing Local Nutrient and Sediment TMDL (Total Maximum Daily Load) Stormwater Wasteload Allocation (SW-WLA) Watershed Implementation Plans (WIPs) (MDE, 2022b)*

MDE's *General Guidance for Local TMDL (Total Maximum Daily Load) Stormwater Wasteload Allocation (SW-WLA) Watershed Implementation Plans (WIPs;* MDE, 2022a) calls for an iterative and adaptive approach for implementation. If new methods of stormwater treatment are developed, or better approaches to source control are found subsequent to the development of the plan, the County's strategy can be revised to incorporate the changes. Similarly, if some elements of the plan do not achieve the expected reductions in loads, adaptations and improvements can be implemented and reported in annual progress updates. The County's adaptive management process is further described in Section 8.4 of this plan.

This updated Restoration Plan is organized as follows:

Section 1 Introduction

Section 2 Describes pollutant impacts within the watershed, water quality, and current programs that mitigate the pollutant loading impacts from new development in the watersheds.

Section 3 Presents an overview of the types of BMPs being implemented or that may be planned in the watershed. The County's geodatabase is also described including definitions of project development statuses and planning tiers used in the database and in this plan.

Section 4 Describes the modeling used to calculate baseline loads, FY24 progress reductions, and planned reductions presented in this plan.

Section 5 Describes the project prioritization approach used to select planned BMP implementation. Presents project ranking results by watershed.

Section 6 Presents the current and planned BMP implementation and associated load reductions organized by watershed.

Section 7 Presents the restoration plan costs and schedule with target loads and activities required to achieve those targets based on milestone implementation targets.

Section 8 Discusses the County's system for tracking implementation of management measures, reporting requirements to MDE, estimating load reductions through modeling, and tracking overall program success through long term monitoring. The County's adaptive management process is also described in this section.

Section 9 Presents the County's policies and procedures in place for stormwater management facility inspection, maintenance, and enforcement.

Section 10 Describes the County's various monitoring programs including Countywide biological monitoring, restoration monitoring, water quality monitoring, and watershed assessments.

Section 11 Describes the County's public outreach and education programs, the key steps in the County's restoration plan submittal process, and MDE comment and response process.

The outcome of the planning effort is to provide guidance for the strategic implementation of watershed protection and restoration efforts that will meet Anne Arundel County's local TMDL SW-WLAs and contribute to meeting water quality standards. Successful implementation of the plan will lead to improvements in local watershed conditions and aquatic health.

2 Causes of Impairments

This section describes the designated uses and water quality conditions of the watersheds, as well as current programs that mitigate the pollutant loading impacts from new development within the County.

2.1 Sediment Impairments

Elevated levels of sediment currently impair several of Anne Arundel County's watersheds as evident through the 303(d) listings and local TMDL requirement. Sediment, both from upland and in-stream sources, can impact in-stream habitat by covering and filling gravelly and rocky substrate, which is a preferred substrate habitat for some aquatic organisms (fish and benthic communities) and necessary for some fish species for spawning. Additional details on impairment causes and sources, as well as water quality information can be found in each watershed's original sediment restoration plan (see Section 1.1.2).

2.2 Water Quality

The watersheds discussed in this restoration plan function as a source of the County's aquatic recreational opportunities and habitat for aquatic and terrestrial organisms. The watersheds also consist of residential

neighborhoods, dining, parks, and beaches. The following section outlines the designated use classifications for surface waters within these watersheds, highlight Tier II high quality waters, and identify additional TMDLs and 303(d) impairments based on regulatory criteria established by MDE.

2.2.1 Use Designations

According to WQS established by MDE in the Code of Maryland Regulations (COMAR), Surface Water Use Designations, the streams within all nine watersheds are classified as Use I - Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life (COMAR 26.08.02.08), except for specific unnamed tributaries to the Little Patuxent River; these tributaries are Use I-P – Water Contact Recreation, and Protection of Aquatic Life and Public Drinking Supply (COMAR 26.08.02.08). A map of designated use class location by County and 8-digit watershed is available on MDE's website: Designated Use Classes for Maryland's Surface Waters. Sediment TMDLs of non-tidal tributary streams address the narrative water quality criteria specific to designated uses for the support of aquatic health (COMAR 26.08.02.03-3b/3e/3g). A review of the most recent Triennial Review of Water Quality Standards (MDE, 2025) was conducted to identify changes in designated uses since the original version of the sediment watershed restoration plans were completed. None of the sediment impaired waterbodies were noted with changes in designated use categorization. Use designations of the Use Class I and I-P watersheds are presented in Table 2-1 (COMAR 26.08.02.02).

Table 2-1. Designated Uses for Use Class I Watersheds

Designated Uses	Use I	Use I-P
Growth and propagation of fish (not trout), other aquatic life and wildlife	X	X
Water contact sports	X	X
Leisure activities involving direct contact with surface water	X	X
Fishing	X	X
Agricultural water supply	X	X
Industrial water supply	X	X
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	-	X

Source: https://mde.maryland.gov/programs/water/tmdl/waterqualitystandards/pages/wqs_designated_uses.aspx

2.2.2 Tier II High Quality Waters

Tier II waters are those that have an existing water quality that is significantly better than WQS minimum requirements (MDE, 2021d). Maryland's antidegradation policy has been promulgated to provide implementation of more restrictive planning efforts in areas where Tier II waters have been designated to maintain the condition of high-quality waters. This implementation has the greatest immediate effect on local government planning due to higher standards for discharge into Tier II waters. Currently, Tier II

streams are identified according to fish and benthic indices of biotic integrity (FIBI and BIBI). Streams listed as Tier II waters will always remain Tier II waters and require antidegradation review if permitted activities occur in the watershed.

Based on analysis of MDE Tier II spatial data (as of December 2024), Maryland has 263 designated Tier II streams segments. Of the nine watersheds in Anne Arundel County with sediment impairments, there is one Tier II stream segment (0.6 miles of Wilson Owens Branch) in the Middle Patuxent River watershed. The 2025 Triennial Review also identified 1.25 miles of Midway Branch in the Little Patuxent River watershed as high quality and will be proposed in Maryland regulations as Tier II High Quality waters (MDE, 2025).

2.2.3 Additional TMDLs and 303(d) Impairments

TMDLs are established for waterbodies on Maryland's 303(d) integrated list of impaired waterbodies to set pollutant limits to achieve attainment of the designated use. In addition to the nine sediment TMDLs discussed in this report, the County also has TMDLs for nutrients (Baltimore Harbor Tidal; including Baltimore Harbor Non-Tidal and Patapsco River Lower North Branch); bacteria (Magothy River, Patapsco River, Upper Patuxent River, Rhode River, Severn River, South River, Other West Chesapeake Bay, and West River); and polychlorinated biphenyls (PCBs; Baltimore Harbor Tidal and Patuxent River), which are not addressed in this plan. The Chesapeake Bay TMDL, established by the EPA (EPA, 2010), sets pollution limits for nutrients and sediment in the Bay Watershed. Although the County has responsibility for this TMDL, it is not addressed in this plan.

For each combination of waterbody and pollutant, the State must estimate the maximum allowable pollutant load, or TMDL, that the waterbody can receive and still meet water quality standards. TMDLs are required by the CWA. Category 4a of the 303(d) list describes impaired waters with a TMDL or other reduction measure already in place. Category 5 lists impaired waters in need of a TMDL. Maryland's Final Combined 2024 Integrated Report (MDE, 2024a) included a new subcategory to Category 5 called Category 5s and includes waterbody impairments caused by chloride from road salt. Six watersheds within the County are listed with chloride impairments, and five of these watersheds also have sediment impairments – Baltimore Harbor Non-Tidal, Patapsco River Lower North Branch, South River, Upper Patuxent River, and Little Patuxent River.

2.3 Anticipated Growth

Future urban sector growth and the anticipated increase in urban loads that may result are expected to be controlled by two elements: stormwater management to the maximum extent practicable (MEP) that is required with new development and anticipated "Accounting for Growth" policies. Based on coordination with MDE, TMDL restoration planning should focus on the untreated and undertreated areas associated with the urban footprint at the time of the TMDL baseline. Future load and loads potentially added to the urban sector from the baseline year to present, are not accounted for here as they are addressed under other programs described below.

2.3.1 Plans for Future Growth

Plan2040 (Anne Arundel County, 2021b), the General Development Plan for Anne Arundel County, was adopted in May 2021 and includes policy framework to protect the natural environment and shape development of the built environment. With an expected population increase of 0.4 to 1% per year from

2020 to 2040, the plan outlines how the County will balance future growth while creating resilient, environmentally sound, and sustainable communities. The County has six goals related to the natural environment:

- Preserve, enhance, and restore sensitive areas, including habitats of rare, threatened, and endangered species, streams, floodplains, tidal and non-tidal wetlands, bogs, shorelines, steep slopes, and all applicable buffers.
- Retain existing forest cover, increase forest replanting efforts, and increase urban tree canopy.
- Expand, enhance and continue to protect the County's greenways, open space, rural areas, including the Priority Preservation Area.
- Improve and protect water quality by reducing impacts from stormwater runoff, wastewater discharge, and septic systems.
- Ensure the safe and adequate supply of groundwater resources and wastewater treatment services for current and future generations.
- Create resilient, environmentally sound and sustainable communities.

The County created a Development Policy Areas Map which identifies areas in the County where development and redevelopment are encouraged, as well as areas where preservation of rural or suburban character and natural features are prioritized. Several goals related to the built environment will decrease stormwater runoff and improve water quality:

- Align development regulations and review practices with Plan2040, that recognizes the importance of the County's environmental features; limitations on infrastructure; and the desire to focus development, redevelopment and revitalization in the Targeted Development,
- Redevelopment and Revitalization Policy Areas; enhance quality of life; and protect and enhance neighborhoods.
- Preserve the agricultural and rural character of the County's Rural and Agricultural Policy Area.
- Support quality of life and economic vitality in County Peninsula Policy Areas, while preserving environmentally sensitive areas.
- Focus and encourage carefully planned and high-quality development, redevelopment, and revitalization in the Targeted Development, Redevelopment and Revitalization Policy Areas while meeting environmental requirements.
- Promote vibrant, high-quality development in Town Centers that provides opportunities to live, work, learn, and play without daily use of a car.
- Revitalize and stabilize existing communities in order to preserve physical character, capitalize on investments and infrastructure, strengthen and beautify neighborhoods, and create economically, socially, and environmentally sustainable communities.
- Provide a well-maintained multimodal transportation network that is safe, efficient, environmentally sensitive, and provides practical and reliable transportation choices and connections for all users.
- Increase the County's resilience to future changes in climate and reduce emissions of greenhouse gases.

The plan has an emphasis on protection of the natural environment, as well as plans to redevelop in targeted areas, which will result in redevelopment of areas developed prior to new stormwater requirements, resulting in overall reduced stormwater runoff. Redevelopment in areas of high impervious

surface cover will slow the increase of impervious surface coverage across the County. Compact growth will also reduce development pressure on rural and natural areas (Anne Arundel County, 2021b). The County's careful planning for future growth and development will reduce the potential detrimental impact that future development in the County could have on the ability for non-tidal streams in the watershed to meet the State's thresholds for assessing sediment impacts.

2.3.2 Offsetting Sediment Loads from Future Growth

Despite intentional and compact growth and development in the County, pollutant loading from urban stormwater sources is expected as new development occurs. Several policies and practices are in place to mitigate and offset sediment loads and the associated impacts, namely current State and County stormwater management regulations, state conservation programs, and forthcoming Maryland Accounting for Growth policies.

New development and redevelopment in the County follow current MDE Stormwater Regulations and the Anne Arundel County Stormwater Management Regulations adopted in 2010. Maryland's 2007 Stormwater Management Act went into effect in October of 2007, with resulting changes to COMAR and the 2000 Maryland Stormwater Design Manual in May of 2009. The most significant changes related to watershed planning are in regard to implementation of Environmental Site Design (ESD). The 2007 Act defines ESD as "using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources," and requires that ESD be implemented to the maximum extent practicable. Additionally, MDE's Water and Science Administration requires the use of various erosion and sediment control practices during construction projects.

The County's Stormwater Management Practices and Procedures Manual (Anne Arundel County, 2017) includes practices to reduce pollutant loads from developed areas through use of best stormwater management practices. Additionally, County regulations include establishing an 'adequate outfall' for installation of stormwater outfalls to ensure downstream conveyance capacity and stability in the receiving stream reach. This practice is particularly impactful to reduce potential future bed and bank erosion and the associated impacts from excessive downstream sediment loads.

In addition to State and County stormwater management regulations, the following State programs effectively mitigate most of the pollutant loading impacts from new development: 1991 Forest Conservation Act, 1997 Priority Funding Areas Act, 2009 Smart, Green & Growing Planning Legislation, 2010 Sustainable Communities Act, 2011 Best Available Technology Regulation, and the 2012 Sustainable Growth & Agricultural Preservation. It states in Part VI Special Programmatic Conditions of Anne Arundel County's current NPDES MS4 permit that "any additional loads will be offset through Maryland's Aligning for Growth policies and procedures as articulated through Chesapeake Bay milestone achievement" (MDE, 2021a).

Anticipated "Accounting for Growth" policies will address the residual load (TN: 50%, TP: 40%, TSS: 10%, and bacteria: 30%) that is potentially uncontrolled by development-based stormwater controls. As required by the State's Watershed Implementation Plan (Bay Restoration Plan) Maryland is developing an Accounting for Growth policy that will address the expected increase in the State's pollution load from increases in population growth and new development. While not currently a fully formed policy, the State's plan, as of the Final Report of the Workgroup on Accounting for Growth in Maryland (August 2013)

focuses on two elements: 1) the strategic allotment of nutrients loads to large wastewater treatment plants, upgraded to the best available technology; and 2) the requirement that all other new loads must be offset by securing pollution credits.

3 Management Measures

Best management practices (BMPs) include both structural practices and programmatic practices that provide management and, in some cases, restoration of water quality and natural resources. The BMPs in this plan are either already implemented or are planned for implementation to achieve the required reduction stated in each watershed's sediment TMDL. BMP definitions are provided in the section below and load reductions that result from these measures are discussed in Section 6. The recommended BMP practices to achieve the required sediment reductions are approved by MDE and described further in the 2021 MS4 Accounting Guidance (MDE, 2021b). This section also reviews the geospatial database tracking BMP information throughout the County, as well as the implementation tiers for these BMPs.

3.1 BMP Definitions

This section briefly describes each practice and includes a summary of the nutrient and sediment reductions achieved with each type. Associated BMP names used in the TIPP are included in *italics*. The recommended BMP practices are approved by MDE, described in the 2021 MS4 Accounting Guidance (MDE, 2021b). The practices include:

Stormwater BMPs

- **New Stormwater BMP**: Upland BMPs related to run-off reduction (RR; e.g., permeable pavement) and stormwater treatment (ST; e.g., wet pond). *BMP Short Name used in TIPP = RR / ST*
- **BMP Conversion**: A BMP conversion, or stormwater retrofit, involves improving stormwater management at an existing stormwater site; may include converting dry ponds, dry extended detention ponds, or wet extended detention ponds into wet pond structures, wetlands, or infiltration basins. *BMP Short Name used in TIPP = RR / ST*

Land Use Conversion BMPs

- **Impervious Surface Reduction**: Reducing impervious surfaces by direct removal to promote infiltration and percolation of runoff storm water. *Land Use Conversion(s) in TIPP = Converting from Aggregate Impervious to Turf / Converting from Aggregate Impervious to Forest*
- **Riparian Forest Planting**: Riparian forest buffers are planted adjacent to a stream, with a recommended buffer of 100 feet and a 35-foot minimum width required. *Land Use Conversion in TIPP = Converting from Turf to Forest with Buffer*
- **Urban Tree Planting**: Urban tree canopy planting is the conversion of pervious turf to tree canopy over turf. The understory remains managed (regularly mowed and/or fertilized). Survival rate is assumed to be 100% and trees are not required to be planted in a contiguous area. *Land Use Conversion in TIPP = Converting from Turf to Tree Canopy over Turf*

Alternative BMPs

- **Stream Restoration**: Stream restoration in urban areas is used to restore the urban stream ecosystem by restoring the natural hydrology and function of a stream, helping to improve habitat and water quality conditions in degraded streams. Load reductions calculated in the TIPP using the default rate will be replaced with individual site-specific values once protocol information is

available. Details on the protocols can be found in the *Consensus Recommendations for Improving the Application of the Prevented Sediment Protocol for Urban Stream Restoration Projects Built for Pollutant Removal Credit* (Wood, 2020) and *Consensus Recommendations to Improve Protocols 2 and 3 for Defining Stream Restoration Pollutant Removal Credits* (Wood and Schueler, 2020).

- **Outfall Stabilization**: Per the report *Recommendations for Crediting Outfall and Gully Stabilization Projects in the Chesapeake Bay Watershed* (Hanson et. al, 2019), outfall stabilization projects are an engineering approach to design a stable channel to dissipate energy that extends from the upland source to the stream channel. Load reductions from outfall stabilization projects are creditable only if Protocol 5 is applied.
- **Street Sweeping**: Street sweeping is an annual practice that must be tracked and reported each year to receive load reduction credit. Per the MDE 2021 MS4 Accounting Guidance (MDE, 2021b), MS4 jurisdictions may generate varying load reduction credit based on a range of sweeping schedules and type of sweeper used.
- **Inlet Cleaning:** Inlet cleaning includes direct removal of sediments from the catch basin of the storm drain system. Inlet cleaning is an annual practice that must be tracked and reported each year to receive load reduction credit. Per the MDE 2021 MS4 Accounting Guidance (MDE, 2021b), load reduction credit is available when the mass of nutrient-rich catch basin sediments is measured and physically removed from the storm drain system. Load reductions vary based on the material removed: organic or inorganic. At this time, the County is not weighing organic and inorganic material separately; so, an assumption of the percentage of organic and inorganic material is being used to support the modeling calculations. Predominant material type will be visually determined in the future.

3.2 BMP Database

The County relies on geographic information system (GIS) databases and other data sources to spatially locate both previously implemented and future planned BMP projects and manage tables of data related to those projects. Features are tracked spatially with records of the necessary treatment values, statuses, built dates, BMP information, and planning information needed for reporting and modeling. These datasets generate the input data that are used to measure progress towards TMDL reduction targets. Regular review and upkeep of the data is imperative to this process. The growth and development of this spatial database is a critical component of the reporting and tracking capability of the County.

The County's MS4 geodatabase, geographic data, and related datasets are compliant with MDE's NPDES geodatabase schema for annual MS4 reporting purposes. The County will continue to manage the geodatabase and make updates when necessary.

3.3 Planning Tiers and Implementation Status

BMPs implemented for restoration purposes, particularly those planned as part of the County's Capital Improvement Program (CIP) or by the County's non-governmental organization (NGO) partners, are entered into the County's BMP geodatabase at the schematic design phase by DPW-BWPR.

To estimate pollutant loads at different stages of implementation, treatments (e.g., impervious and turf acres, acres converted, linear feet) of each BMP type are grouped by project phase and incorporated into the model according to planning tiers. This allows the County to assess pollutant reduction progress in near real time and plan BMPs needed to meet the remaining reduction goal. BMP implementation status

is based on progress in planning, design, and construction of structural, ESD, and alternative BMPs, and are identified as Complete, Under Construction, In Design, or Planned for each BMP.

Definitions of the planning tiers are provided below:

- **Baseline:** Projects in the ground at the time the TMDL goal was established. These projects are part of the baseline load.
- **Current Progress**: Restoration projects that have completed construction and include a built or install date that occurs after the sediment TMDL baseline year through FY24 (i.e., June 30, 2024). This planning tier includes BMPs with a Complete implementation status.
- **Interim Programmed**: Proposed restoration BMPs that have the highest confidence that they will be implemented and where funding is allocated towards them in the inventory. This planning tier includes BMPs with Under Construction or In Design (30% or greater) implementation status.
- **Planned**: Primarily placeholder restoration projects included in the County's CIP tracking that are not at a concept design phase and with no open task order at this time. Some projects are derived from watershed assessment fieldwork, where contiguous blocks of the worse eroded stream segments were identified. This planning tier includes BMPs with Planned implementation status.

4 Modeling Approach

The TMDL Implementation Progress and Planning (TIPP) spreadsheet tool (version 2.6: 01/25/2024; MDE, 2024b) was used to model baseline, progress, and future loads for the nine watersheds with sediment local TMDLs. The TIPP tool was developed by MDE to simplify the load estimating and planning process for development and tracking of local TMDL implementation plans. The spreadsheet tool estimates load reductions at various points in the watershed planning process, allowing users to assess current progress and planned BMP implementation. The TIPP uses methods associated with Phase 6 of the Chesapeake Bay Watershed Model (CBWM P6), which is consistent with the MDE 2021 Accounting Guidance (MDE, 2021). Additional information on the TIPP, including frequently asked questions and live walkthrough and demo, can be found on MDE's website at https://mde.maryland.gov/programs/water/TMDL/DataCenter/Pages/TMDLStormwaterToolkit.aspx.

The TIPP spreadsheet was first published by MDE in 2021, and the original Restoration Plans developed for Non-tidal West River (Anne Arundel County, 2021a), Non-tidal Baltimore Harbor (Anne Arundel County, 2022a), and Non-tidal South River (Anne Arundel County, 2022b) utilized this first version of the TIPP tool (version 1.0: 06/04/2021) to estimate pollutant reductions. Prior to the TIPP, the Chesapeake Assessment Scenario Tool (CAST) was used to estimate pollutant reductions. CAST is a web-based pollutant load estimating tool that calculates pollutant loads and reductions calibrated to the Chesapeake Bay Program's Watershed Model (CBP, 2017). CAST was used for modeling sediment loads and reductions in the original Restoration Plans developed for Non-tidal Lower Patuxent and Middle Patuxent River (Anne Arundel County, 2020) and Other West Chesapeake Bay (Anne Arundel County, 2020). The original Restoration Plans for Little Patuxent River (Anne Arundel County, 2016a), Patapsco River Lower North Branch (Anne Arundel County, 2016b), and Upper Patuxent River (Anne Arundel County, 2016c) used the Chesapeake Bay Facility Assessment Scenario Tool (BayFAST) to estimate sediment loads and treatment options for the watershed. BayFAST functioned similarly to CAST but allowed users to specify, delineate facility boundaries (e.g., watershed, parcel, drainage area), and alter land use information within the

delineated boundary depending on the model year. The Bay Program removed BayFAST from their suite of models in 2018.

Modeling methodologies may change in the future because of updated versions of the Bay Model, which could change loading rates, or because of crediting changes directed by MDE or Chesapeake Bay Program Sponsored Expert Panels, which could affect load reduction calculations or BMP pollutant removal efficiencies. If modeling methodologies or information are updated or revised, MDE will determine whether an updated version of the TIPP tool is warranted. Revised components of any updated version would then need to be incorporated into the County's TIPP workbooks. Restoration plans may need to be revised if modeling changes occur in the future.

Anne Arundel County's modeling approach does not seek to determine the current level of loading compared to the originally published SW-WLA. Instead, it is recommended that local jurisdictions demonstrate their progress towards achieving SW-WLAs by comparing reduction percentages rather than absolute loads (MDE, 2014a).

It is understood that load reductions developed by the County will not match the absolute loads listed in the TMDL because the model used to develop the TMDL is different from what is currently available and may not be available to the County or other permittees. The SW-WLAs are translated into a compatible target load using the TIPP spreadsheet tool described above. Demonstrating progress using percent load reduced will allow the County to meet the TMDL using the best and most accurate data available on land use, sources, loading rates, and removal efficiencies.

To translate SW-WLAs that were developed under older versions of the CBP watershed model or using different models, the published baseline loads were re-calculated in the TIPP spreadsheet by modeling baseline BMPs within the TMDL watershed on top of baseline land use.

TIPP Baseline Land Use Data Inputs

Land use within the County's jurisdiction is a critical input for any model used to assess TMDL compliance. Impervious and pervious acres within the County's MS4 boundary were translated to baseline conditions following a backcasting land cover methodology developed by Baltimore County and reviewed and approved by MDE (MDE, 2021e). This methodology uses National Land Cover Database (NLCD) layers, which are available in a range of years and allows a more accurate representation of land cover conditions during a particular TMDL baseline year, along with Chesapeake Conservancy Land Use (CCLU) 2013/2014 dataset, which uses land use categories that generally match the land use categories used by MDE in the TIPP. Land cover data from the National Land Cover Database (NLCD) was used to quantify land cover acreage for each TMDL baseline year (either 2005 or 2009). The County calculated County MS4 impervious acres as aggregate impervious. The TIPP model uses the turf land use type that includes MS4 turf grass land use. The resulting baseline MS4 land use acres are shown in Table 4-1 below and were used as data input into the TIPP spreadsheets.

Table 4-1. TIPP Model Baseline Land Use Data Inputs for each watershed

Watershed (Baseline Year)	Land Use Type (acres)		Total (acres)
	Aggregate Impervious	Turf	
Baltimore Harbor (2009)	6,041.0	8,510.4	14,551.3
Little Patuxent River (2005)	2,523.6	3,422.4	5,946.0
Lower Patuxent River (2009)	108.0	511.8	619.8
Middle Patuxent River (2009)	902.0	4,035.2	4,937.2
Upper Patuxent River (2005)	925.8	2,963.5	3,889.3
Patapsco River Lower North Branch (2005)	2,441.1	2,820.7	5,261.9
South River (2009)	3,357.1	6,506.5	9,863.6
Other West Chesapeake Bay (2009)	649.6	2,046.8	2,696.4
West River (2009)	774.3	2,312.7	3,086.9

5 Plan Optimization

In support of updates to the County's sediment TMDL implementation plans, the County completed an assessment and determination of restoration strategies that optimize costs and sediment reductions towards achieving the County's target SW-WLAs. Plan optimization is defined as the achievement of the target reduction with projects that maximize biological benefits, minimize costs, and have limited conflicts after assessing overall project feasibility. The goal was to determine which projects to prioritize implementing to achieve target SW-WLA in each watershed.

The initial modeling of all Current Progress, Interim Programmed, and Planned BMPs completed for each sediment TMDL watershed met or surpassed the target loads in all watersheds. In four watersheds (i.e., Little Patuxent River, South River, Upper Patuxent River, and Patapsco River Lower North Branch), the Interim Programmed BMPs sufficiently met or surpassed the target reduction. In the other five watersheds (i.e., Baltimore Harbor Non-Tidal, Lower Patuxent River, Middle Patuxent River, Other West Chesapeake Bay, and West River), the combination of Interim Programmed and Planned BMPs met or surpassed the target reduction.

The County retained all Interim Programmed projects in the modeling because these projects are already in development, regardless of whether the reductions associated with these projects exceed the sediment reduction targets. After a closer review of the reductions achieved by the Interim Programmed and Planned projects, the County further grouped these watersheds into three categories based on actions required to further optimize project selection within the watershed:

> The first category includes watersheds where implementation of the Interim Programmed BMPs met or surpassed the target reduction. The watersheds in this category include Little Patuxent River, South River, Upper Patuxent River, and Patapsco River Lower North Branch. There were no Planned BMPs in the County's lists of proposed projects for the first three watersheds; thus, no change is warranted for these watersheds. However, there were several Planned BMPs identified for Patapsco River Lower North Branch that were not needed to achieve the target reduction.

Therefore, all Planned BMPs identified for the Patapsco River Lower North Branch were excluded from the plan.

The second category includes watersheds where implementation of the combination of Interim Programmed and Planned BMPs met or surpassed the target reduction. After iterative modeling of different scenarios, it was determined that all Planned BMPs were required in the plan to achieve target reductions. Plan optimization is not necessary, and no change is warranted for these watersheds. The watersheds in this category include Lower Patuxent River, Middle Patuxent River, Other West Chesapeake Bay.

The third category includes watersheds where implementation of the combination of Interim Programmed and Planned BMPs met or surpassed the target reduction and after iterative modeling of different scenarios, it was determined that not all Planned BMPs were required to achieve the target reductions. Therefore, a prioritized selection of Planned BMPs was needed to reduce the number of projects implemented and optimize the plan. These projects are presented in Section 5.3. The watersheds in this category include Baltimore Harbor Non-Tidal and West River. The project prioritization methods used to determine which specific projects to include in the plan are described in Section 5.1 below.

5.1 Project Prioritization Methods

Although project prioritization was only warranted to determine the specific projects for the Baltimore Harbor Non-Tidal and West River watersheds, the County saw value in assessing every Planned project with the aforementioned metrics. The resulting “feasibility analysis” provides important considerations for all projects planned for implementation within the sediment TMDL watersheds.
The prioritization result would indicate which projects might be the most beneficial and cost effective relative to the set of Planned projects proposed. The prioritization methods involved a matrix made up of a series of metrics which evaluated each Planned project and allowed for discrimination between the projects. Each metric was scored for each project, either qualitatively or quantitatively, as appropriate, and the sum of the scores determined the highest priority projects to implement.

The prioritization methods used a series of metrics that describe attributes of a Planned project. The metrics were scored and ranked within three categories: Benefits, Constraints, and Cost. Metrics evaluated by the project team are listed in Table 5-1 with a brief description of each. Including factors of feasibility and cost is necessary because the potential exists for the most beneficial project to also be relatively less feasible. For example, it might be the most expensive project, have limited access, utility conflicts, or require disturbance to natural resources.

Table 5-1. Project Prioritization Metrics and Descriptions

Metric	Description
Project Benefits	
Pollutant Removal	How much TSS is removed (lbs) based on modeling?
Combined Benefit	Are there multiple projects in close proximity (i.e., within same tributary) that together provide a larger cumulative benefit?
Biotic Integrity	Could project improve the biological conditions, reflected by BIBI and FIBI scores, of connected stream reaches?
Project Constraints	
Design/Construction	Do the site layout, topography, elevations allow for a design that maximizes benefit and is constructible?
Existing Utility Conflicts	Are there existing known or mapped underground or overhead utilities conflicting with the design?
Access	Are there constraints to access – infrastructure, steep slopes, distance?
Natural Resource Conflicts	Are there significant conflicts with natural resource features – wetland/forest disturbance?
Ownership	Is ownership of the parcels involved held publicly or privately?
Project Cost	
Total Implementation Cost	What is the total cost to implement the project?
Cost per Pollutant Removed	What is the total cost efficiency of the TSS reduction?

5.2 Project Prioritization Scoring

Quantitative metrics were scored based on results of the preliminary design and cost estimates (e.g. pollutant removal, implementation cost). Other metrics were scored more qualitatively based on professional judgment and assessment of each project site (e.g., access constraints, site ownership) relative to each other. Project assessment was performed via desktop analysis using geospatial data layers from the County's Open Data repository (e.g., utility lines, parcels, steep slopes). Because scoring is based on the review of specific projects, evaluating any additional projects will require a modified approach. Narrative descriptions of the scoring values for project metrics are provided in Appendix A.

Each Planned project was assigned a score between 1 and 5 for each metric. Projects evaluated to have the most benefit received a score of 5, and those with the least benefit were given a score of 1. Constraints and costs were evaluated in a similar fashion such that projects with the least constraints or costs were scored a 5, and those with the most were given a score of 1. Scores for each metric within the Project Benefits category – Combined Benefit, Pollutant Removal, and Biotic Integrity – were then averaged for the final Project Benefits rank. The same is true for the Project Constraints and Project Costs metric scores.

5.2.1 Project Benefits Metrics

Pollutant Removal scores were calculated using the modeled total sediment load reduction (lbs/year) to rank each project from 1 to 56 (i.e., total number of projects), where the greatest reduction warrants the top ranking (56). For consistency with other metrics, the ranking was then used to calculate a scaled score between 1 and 5 for each project, with the highest-ranking project receiving the highest score.

Combined Benefit scores were calculated based on the number of Current Progress, Interim Programmed, and other Planned projects within 0.25mi and within the same tributary. The total number of additional projects within the same tributary were used to calculate a scaled score between 1 and 5. Projects contributing to the combined sediment load reduction efforts of other projects along the stream system received higher scores than isolated projects.

Biotic Integrity scores for benthic macroinvertebrates and fish were calculated based on the assigned BIBI/FIBI rating from field observations of sampling sites assessed since 2014 and in same tributary, upstream or downstream, of the Planned project. Data from the Maryland Biological Stream Survey (MBSS), as well as the Countywide Biological Stream Survey annual biomonitoring efforts were used for this assessment. A BIBI or FIBI rating of 3 and up (i.e., Fair and Good categories) are considered in good condition and therefore not a great candidate for restoration. Projects near these sites were given lower scores (1 or 2). Ratings below 3 (i.e., Poor and Very Poor) have more potential for biological improvement and are better candidates for restoration. Projects near these sites were given higher prioritization scores (4 or 5). If no sampling was conducted within the same tributary as a project, then the project was given a score of 3. Very few proposed projects are located within the same tributary as a MBSS or County biomonitoring sampling site, so the majority of the projects received a score of 3. Because the majority of the sites are data deficient and do not have information on biotic integrity (e.g., Prioritization Scores of 3), in-situ baseline monitoring should be used to confirm the biological condition of streams prior to final project selection and design, and streams with "fair" and "good" FIBI/BIBI scores should be re-prioritized to reflect the updated information.

5.2.2 Project Constraints Metrics

Design/Construction constraints, such as site layout (e.g., stream restoration length, pond size and orientation), topography (e.g., slopes, depressions), and surrounding environment (e.g., existing infrastructure, waterbodies), were analyzed for each project. This metric is intended to represent the functional space constraints related to space limitations. For example, a pond retrofit that seeks to add depth for a wet pond conversion or looks to widen to add volume could be limited if there are roads and buildings adjacent to the existing pond and needs to stay within a max allowable side slope; versus a site surrounded by flat open space is much easier to work with. A stream restoration site could be limited by a narrow cross-section and steep valley slopes which increase grading costs and can limit functional workspace for heavy equipment. Projects that were identified as having a large footprint relative to the available space, being adjacent to steep slopes or constrained by the surrounding environment received lower scores. Projects that had a small footprint or relatively larger available space, smooth terrain, and are not constrained by its surroundings received higher scores.

Utility constraints were assessed and scored. A project adjacent to and/or overlapping known/mapped utility infrastructure (e.g., sewer line, powerlines) was considered in conflict. The majority of the projects did not have utility conflicts; however, some sites intersected sewer or water pipes or had overhead powerlines, which subsequently lowered their scores in this metric.

Access constraints were analyzed for each site. The presence of paved access roads or trails, or proximity to existing roads or parking lots was considered. Projects adjacent to a parking lot or access road received higher scores. Projects far from an access road received lower scores. Topography (i.e., easy, flat terrain or difficult, steep terrain) along the potential access routes, particularly for projects far from an access road, was also considered and factored into the assigned score. Lastly, stream restorations with large

footprints were given lower scores due to the potential need for multiple points of access to complete implementation. Projects far from an access road with steep slopes en route to the project and needing multiple access points received the lowest scores.

Natural Resource Conflicts to features such as wetlands, open water, or forests, were evaluated for each project. The following spatial layers were used for this assessment: Forest Conservation Easement (Source: Open Data repository), Maryland Wetlands (Source: Maryland iMap Portal) National Wetlands Inventory (NWI) lines and polygons (e.g., streams and wetlands; Source: USGS), and EagleView aerial imagery. A project in close proximity to and/or overlapping a natural resource was considered in conflict. Projects adjacent to the County's forest conservation easements were also noted. The majority of the projects overlap with NWI streams or wetlands, and several conflicts for stream restoration projects are from potential forest impact to access the site.

Maryland's "Guidance for Stream Restoration Based on Key Wildlife Habitats" (MDE, 2023) states that stream restoration should focus on degraded habitats, and that impacts to areas that support sensitive species or rare habitats should be minimized. MDE recommends that planners utilize the Watershed Resources Registry (WRR) to identify high quality resources and other features which may be potential constraints on design or require specialized construction practices, as well as avoiding habitat conversion in areas that have been identified as priorities for protection. MDE recommends robust baseline monitoring to establish resource tradeoffs and net anticipated benefits for aquatic resources prior to proceeding with stream restoration and habitat conversions, including reviewing projects using the WRR for overlap with Sensitive Species Project Review Areas (SSPRAs), Forest Interior Dwelling Species Habitat (FIDS), Targeted Ecological Areas (TEAs), and non-tidal wetlands of concern.

While an effort has been made to incorporate natural resource constraints into project prioritization, we recognize that many of the proposed locations are data deficient. For example, many of the projects received a moderate Biotic Integrity Score because there were no biological data near a project within the past 10 years. Further, many of the NWI layers are at a coarser resolution and cannot be used to accurately resolve reach-level features. While some natural resource conflict information has been incorporated into the project rankings, these rankings should be considered preliminary and additional desktop and field assessments should be completed prior to finalizing site plans.

Site Ownership was identified using the County's Parcels spatial layer (Source: Open Data repository). Projects on private property (e.g., private residence, private business, homeowners association [HOA]) received lower scores than those on public property (e.g., Maryland State Highway Administration) or utility property (e.g., Baltimore Gas & Electric). Projects intersecting multiple private properties received the lowest score (1) due to the need for more permissions. Projects on Anne Arundel County property are preferrable for implementation and received the highest score (5).

5.2.3 Project Costs Metrics

Total Implementation Costs were estimated by the County and used to rank each project from 1 to 56, where the greatest cost warrants the lowest ranking (1). For consistency with other metrics, the ranking was then used to calculate a scaled score between 1 and 5 for each project, with the highest-ranking project (56) receiving the highest score (5).

Cost per Pollutant Removed was calculated by dividing the total implementation cost by the modeled total sediment load reduction (lbs). The cost per lbs reduced was used to rank each project from 1 to 56, where the greatest cost per lbs reduced warrants lowest ranking (1). For consistency with other metrics, the ranking was then used to calculate a scaled score between 1 and 5 for each project, with the highest-ranking project (56) receiving the highest score (5).

5.3 Project Prioritization Results

Total scores for each metric were summed for each project within three categories – Project Benefits, Project Constraints, and Project Costs – and ranked within each category, where the highest total score was given the top rank in the category. Each project's respective Project Benefits rank, Project Constraints, and Project Costs were summed (i.e., rank sum), where the lowest Rank Sum was given the top final overall rank. The final list of projects in order of priority is presented in Table 5-2.

Table 5-2. Planned Project Prioritization Ranking of Baltimore Harbor Non-Tidal and West River BMPs, Grouped by Watershed and Sorted by Watershed Rank

8 Digit Watershed Name	BMP ID	Project Type	Benefits Rank[1]	Constraints Rank	Cost Rank	Rank Sum	Final Overall Rank	Watershed Rank
Baltimore Harbor Non-Tidal	STRE_PTB_039	Stream Restoration	3	50.5	8	61.5	2	1
Baltimore Harbor Non-Tidal	AA06POI202196	Stormwater Retrofit	10	21	39	70	10	2
Baltimore Harbor Non-Tidal	STRE_PTG_131	Stream Restoration	1	46.5	26	73.5	14	3
Baltimore Harbor Non-Tidal	AA91POI202283	Stormwater Retrofit	16	4.5	55	75.5	18.5	4
Baltimore Harbor Non-Tidal	AA97POI204298	Stormwater Retrofit	26	1	52	79	22	5
Baltimore Harbor Non-Tidal	STRE_PT8_032	Stream Restoration	6	46.5	27	79.5	23.5	6
Baltimore Harbor Non-Tidal	AA93POI204199	Stormwater Retrofit	40	11	30	81	29	7
Baltimore Harbor Non-Tidal	AA97POI207627	Stormwater Retrofit	34	2.5	53	89.5	41.5	8
Baltimore Harbor Non-Tidal	AA06POI207565	Stormwater Retrofit	36	11	49	96	48	9
Baltimore Harbor Non-Tidal	AA93POI204655	Stormwater Retrofit	49	11	40	100	50	10
Baltimore Harbor Non-Tidal	AA98POI203421	Stormwater Retrofit	51	21	32	104	51	11
Baltimore Harbor Non-Tidal	STRE_PT0_063	Stream Restoration	14	40.5	51	105.5	52	12
Baltimore Harbor Non-Tidal	AA88POI201944	Stormwater Retrofit	50	11	46	107	53	13
Baltimore Harbor Non-Tidal	AA10POI202701	Stormwater Retrofit	45	21	54	120	55	14

8 Digit Watershed Name	BMP ID	Project Type	Benefits Rank[1]	Constraints Rank	Cost Rank	Rank Sum	Final Overall Rank	Watershed Rank
Baltimore Harbor Non-Tidal	AA91POI201827	Stormwater Retrofit	47	26	56	129	56	15
West River	AA00POI209660	Stormwater Retrofit	52	11	11	74	15.5	1
West River	AA06POI205805	Stormwater Retrofit	46	21	12.5	79.5	23.5	2
West River	AA01POI209478	Stormwater Retrofit	55	11	14	80	25	3
West River	AA05POI209098	Stormwater Retrofit	54	11	15.5	80.5	26.5	4
West River	RR9068	Stream Restoration	41	35	5	81	29	5
West River	AA00POI206813	Stormwater Retrofit	53	21	12.5	86.5	36	6
West River	AA00POI208478	Stormwater Retrofit	56	26	5	87	37.5	7
West River	AA06POI205807	Stormwater Retrofit	44	27.5	15.5	87	37.5	7
West River	RR9036	Stream Restoration	27	50.5	31	108.5	54	8

[1]Note: Lowest numerical value for each rank category is the highest ranked project.

Table 5-3. Planned Project Prioritization Ranking of Lower Patuxent River, Middle Patuxent River, Patapsco Lower North Branch, and Other West Chesapeake Bay BMPs, Grouped by Watershed and Sorted by Watershed Rank

8 Digit Watershed Name	BMP ID	Project Type	Benefits Rank[1]	Constraints Rank	Cost Rank	Rank Sum	Final Overall Rank	Watershed Rank
Lower Patuxent River	STRE_MPX_006	Stream Restoration	15	40.5	28	83.5	33	1
Middle Patuxent River	MP3027	Stream Restoration	30	11	23	64	3	1
Middle Patuxent River	MP7062	Stream Restoration	25	11	34	70	10	2
Middle Patuxent River	MPO017	Stream Restoration	31	21	22	74	15.5	3
Middle Patuxent River	MPQ010	Stream Restoration	7	27.5	44	78.5	20.5	4
Middle Patuxent River	MPN050	Stream Restoration	13	46.5	21	80.5	26.5	5
Middle Patuxent River	MPU004	Stream Restoration	20	21	42	83	31.5	6
Middle Patuxent River	MPV001	Stream Restoration	21	21	41	83	31.5	6
Middle Patuxent River	MPQ015	Stream Restoration	11	40.5	33	84.5	34.5	7
Middle Patuxent River	MPH025	Stream Restoration	33	35	20	88	39.5	8
Middle Patuxent River	MPM007	Stream Restoration	23	30.5	38	91.5	44	9
Middle Patuxent River	MP0023	Stream Restoration	37	30.5	25	92.5	45	10
Middle Patuxent River	MP6009	Stream Restoration	28	40.5	29	97.5	49	11
Patapsco River Lower North Branch	AA09POI202048	Stormwater Retrofit	19	4.5	36.5	60	1	1

8 Digit Watershed Name	BMP ID	Project Type	Benefits Rank[1]	Constraints Rank	Cost Rank	Rank Sum	Final Overall Rank	Watershed Rank
Patapsco River Lower North Branch	AA09POI202049	Stormwater Retrofit	22	11	35	68	7	2
Patapsco River Lower North Branch	AA00POI101578	Stormwater Retrofit	2	21	47.5	70.5	12.5	3
Patapsco River Lower North Branch	AA91POI202055	Stormwater Retrofit	17	11	47.5	75.5	18.5	4
Patapsco River Lower North Branch	AA60POI201974	Stormwater Retrofit	32	2.5	50	84.5	34.5	5
Patapsco River Lower North Branch	AA09POI202050	Stormwater Retrofit	24	21	43	88	39.5	6
Patapsco River Lower North Branch	STRE_PNB_030	Stream Restoration	4	40.5	45	89.5	41.5	7
Patapsco River Lower North Branch	AA84POI204242	Stormwater Retrofit	48	11	36.5	95.5	47	8
Other West Chesapeake Bay	HB2040	Stream Restoration	9	46.5	9	64.5	4	1
Other West Chesapeake Bay	HB2032	Stream Restoration	12	50.5	3	65.5	5	2
Other West Chesapeake Bay	HB0010	Stream Restoration	8	35	24	67	6	3
Other West Chesapeake Bay	HBQ001	Stream Restoration	29	35	5	69	8	4
Other West Chesapeake Bay	HB2035	Stream Restoration	18	35	17	70	10	5
Other West Chesapeake Bay	HB2039	Stream Restoration	5	46.5	19	70.5	12.5	6
Other West Chesapeake Bay	HBF005	Stream Restoration	43	30.5	1	74.5	17	7
Other West Chesapeake Bay	HB2102	Stream Restoration	38	30.5	10	78.5	20.5	8

8 Digit Watershed Name	BMP ID	Project Type	Benefits Rank[1]	Constraints Rank	Cost Rank	Rank Sum	Final Overall Rank	Watershed Rank
Other West Chesapeake Bay	HB2001	Stream Restoration	39	35	7	81	29	9
Other West Chesapeake Bay	HB2026	Stream Restoration	42	46.5	2	90.5	43	10
Other West Chesapeake Bay	HB2021	Stream Restoration	35	40.5	18	93.5	46	11

[1]Note: Lowest numerical value for each rank category is the highest ranked project.

After project prioritization was complete, modeling was completed for all watersheds. The prioritization ranking heavily influenced the process used to determine which specific Planned BMPs to include and exclude optimizing achievement of the SW-WLA for the Baltimore Harbor Non-Tidal and West River watersheds. However, being ranked higher did not automatically lead to the inclusion of those projects; strategic selection of projects that achieved the SW-WLA without overtreatment was still necessary. The BMPs included in and excluded from Baltimore Harbor Non-Tidal and are listed in Table 5-4 and Table 5-5, and the BMPs included in and excluded from West River implementation are listed in Table 5-6 and Table 5-7.

Table 5-4. Baltimore Harbor Non-Tidal BMPs Included in Optimized Model

Planning Tier	BMP ID	BMP Type	Watershed Prioritization Ranking[1]
Interim Programmed	BMP0079	Filtering Practice	--
	BMP0196	Filtering Practice	--
	BMP0789	Filtering Practice	--
	BMP0183	Infiltration Practices	--
	BMP0204	Stream Restoration	--
	BMP0281	Stream Restoration	--
	BMP0298	Stream Restoration	--
	BMP0299	Stream Restoration	--
	BMP0304	Stream Restoration	--
	BMP0308	Stream Restoration	--
	BMP0309	Stream Restoration	--
	BMP0310	Stream Restoration	--
	BMP0311	Stream Restoration	--
	BMP0312	Stream Restoration	--
	BMP0314	Stream Restoration	--
	BMP0468	Stream Restoration	--
	BMP0475	Stream Restoration	--
	BMP0714	Stream Restoration	--
	BMP0777	Stream Restoration	--
	BMP0838	Stream Restoration	--
	BMP0839	Stream Restoration	--
	BMP0136	Wet Ponds and Wetlands	--
	BMP0246	Wet Ponds and Wetlands	--
	BMP0421	Wet Ponds and Wetlands	--
Planned	STRE_PTB_039	Stream Restoration	1
	AA06POI202196	Stormwater Retrofit	2
	STRE_PTG_131	Stream Restoration	3
	AA91POI202283	Stormwater Retrofit	4
	AA97POI204298	Stormwater Retrofit	5
	AA97POI207627	Stormwater Retrofit	8

[1]Only applicable for Planned BMPs

Table 5-5. Baltimore Harbor Non-Tidal BMPs Excluded from Optimized Model

Planning Tier	BMP ID	BMP Type	Watershed Prioritization Ranking
Planned	STRE_PT8_032	Stream Restoration	6
	AA93POI204199	Stormwater Retrofit	7
	AA06POI207565	Stormwater Retrofit	9
	AA93POI204655	Stormwater Retrofit	10
	AA98POI203421	Stormwater Retrofit	11
	STRE_PT0_063	Stream Restoration	12
	AA88POI201944	Stormwater Retrofit	13
	AA10POI202701	Stormwater Retrofit	14
	AA91POI201827	Stormwater Retrofit	15

Table 5-6. West River BMPs Included in Optimized Model

Planning Tier	BMP ID	BMP Type	Watershed Prioritization Ranking[1]
Interim Programmed	BMP0856	Stream Restoration	--
	BMP0864	Urban Tree Planting	--
Planned	AA00POI209660	Stormwater Retrofit	1
	AA06POI205805	Stormwater Retrofit	2
	AA01POI209478	Stormwater Retrofit	3
	AA05POI209098	Stormwater Retrofit	4
	RR9036	Stream Restoration	5
	RR9068	Stream Restoration	8

[1]Only applicable for Planned BMPs

Table 5-7. West River BMPs Excluded from Optimized Model

Planning Tier	BMP ID	BMP Type	Watershed Prioritization Ranking
Planned	AA00POI206813	Stormwater Retrofit	6
	AA00POI208478	Stormwater Retrofit	7
	AA06POI205807	Stormwater Retrofit	7

6 Proposed Implementation and Expected Load Reductions

Current Progress, Interim Programmed, and Planned BMP implementation and associated load reductions are presented below in Sections 6.1 through 6.9. Information is presented for each Maryland 8-digit watershed within Anne Arundel County with a sediment TMDL. Section 1.2 provided a list of defined terms and dates used throughout this plan. Additional terms and definitions that will be referenced in this section are provided below. Refer to Section 4 for a detailed description of the modeling approach used and how the County's analyses and methods are comparable with MDE's TMDL analyses.

BMP Implementation

- **Unit:** BMP treatment unit (e.g., impervious and turf acres, acres converted, linear feet)
- **Current Progress:** All restoration BMPs currently implemented in the Current Progress planning tier. Includes BMPs with built dates between the TMDL baseline date and the end of FY24 (June 30, 2024).
- **Interim Programmed:** Proposed BMP implementation in the Interim Programmed planning tier. Refer to the definition provided in Section 3.3.
- **Planned:** Proposed BMP implementation in the Planned planning tier. Refer to the definition provided in Section 3.3.
- **Full Implementation:** The cumulative restoration BMP implementation occurring after the baseline year through planned restoration outlined in this plan.

Load Reduction

- **Total Reduction Required:** Reduction calculation from subtracting the baseline load by the target load.
- **FY24 Progress Reduction:** Reduction amount (lbs/yr) achieved from restoration BMP implementation after the baseline year through FY24.
- **Interim Programmed and Planned Reduction:** Reduction amount (lbs/yr) associated with the BMP implementation in only the planning tiers (Interim Programmed and Planned).
- **Full Implementation Reduction:** The combined reduction amount (lbs/yr) achieved from restoration BMP implementation after the baseline year through the target year.

The locations of completed and planned BMPs are shown in Figure 6-1 through Figure 6-9 and presented as circles representing BMPs at varying stages of completion (i.e., Current Progress, Interim Programmed, and Planned). The BMP points outside the TMDL watershed boundary have drainage that overlap partially with the watershed, despite falling outside the boundary used for mapping. These BMP drainage areas are determined from high-resolution QL1 LiDAR and the County's stormwater infrastructure network and are more accurate than the Maryland 8-digit watershed boundaries. This is the case for all maps containing BMP points outside the watershed boundary.

6.1 Baltimore Harbor Non-Tidal

The Baltimore Harbor Non-Tidal watershed (Maryland 8-digit watershed: 02130903) is located within the northeastern portion of the County. The Anne Arundel County portion of the Baltimore Harbor Non-Tidal watershed is approximately 30,357 acres (47.4 square miles) in area and contains approximately 160.4 total miles of stream reaches, including 50 miles of perennial streams.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include Baltimore City, Baltimore County, and the SHA, which hold Phase I MS4 permits, in addition to Phase II stormwater permittees. The County received MDE approval of the draft Baltimore Harbor Non-Tidal Watershed Sediment TMDL Restoration Plan on January 26, 2024, with recommendations for revision. MDE's comments and recommendations are addressed in this Plan update.

6.1.1 BMP Implementation

Table 6-1 presents a BMP implementation summary for the sediment TMDL in the Baltimore Harbor Non-Tidal watershed. Current Progress sediment reduction through the end of FY24 was achieved via 44 stormwater management practices, three land cover conversion BMPs (2.8 acres), two outfall stabilizations (350 linear feet) five stream restorations (7,383 linear feet), street sweeping (60 miles/year), and inlet cleaning (126,043 lbs/year). A list of Interim Programmed and Planned projects, determined after project prioritization (see Section 5.3), is included in Appendix B. The locations of Current Progress, Interim Programmed, and Planned BMPs included in implementation, are shown in Figure 6-1 and presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the Baltimore Harbor Non-Tidal watershed is expected to be met.

Table 6-1. BMP Implementation for the Sediment Local TMDL in the Baltimore Harbor Non-Tidal Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned[2]	Full Implementation
Stormwater					
New Stormwater BMP	# of BMPs	44	7	0	51
	drainage acres	566	146	0	712
BMP Conversion	# of BMPs	0	0	4	4
	drainage acres	0	0	422	422
Alternative Practices					
Stream Restoration	# of BMPs	5	14	2	21
	linear feet	7,383	24,577	7,330	39,290
Outfall Stabilization	# of BMPs	2	3	0	5
	linear feet	350	976	0	1,326
Street Sweeping[1]	miles/year	60	0	0	60
Inlet Cleaning[1]	lbs/year	126,043	0	0	126,043
Land Cover Conversion					
Impervious Surface Reduction to Forest	# of BMPs	1	0	0	1
	acres converted	0.04	0	0	0.04
Impervious Surface Reduction to Turf	# of BMPs	1	0	0	1
	acres converted	0.1	0	0	0.1
Urban Tree Planting	# of BMPs	1	0	0	1
	acres converted	3	0	0	3

[1]Annual Practice

[2]Planned projects determined after project prioritization

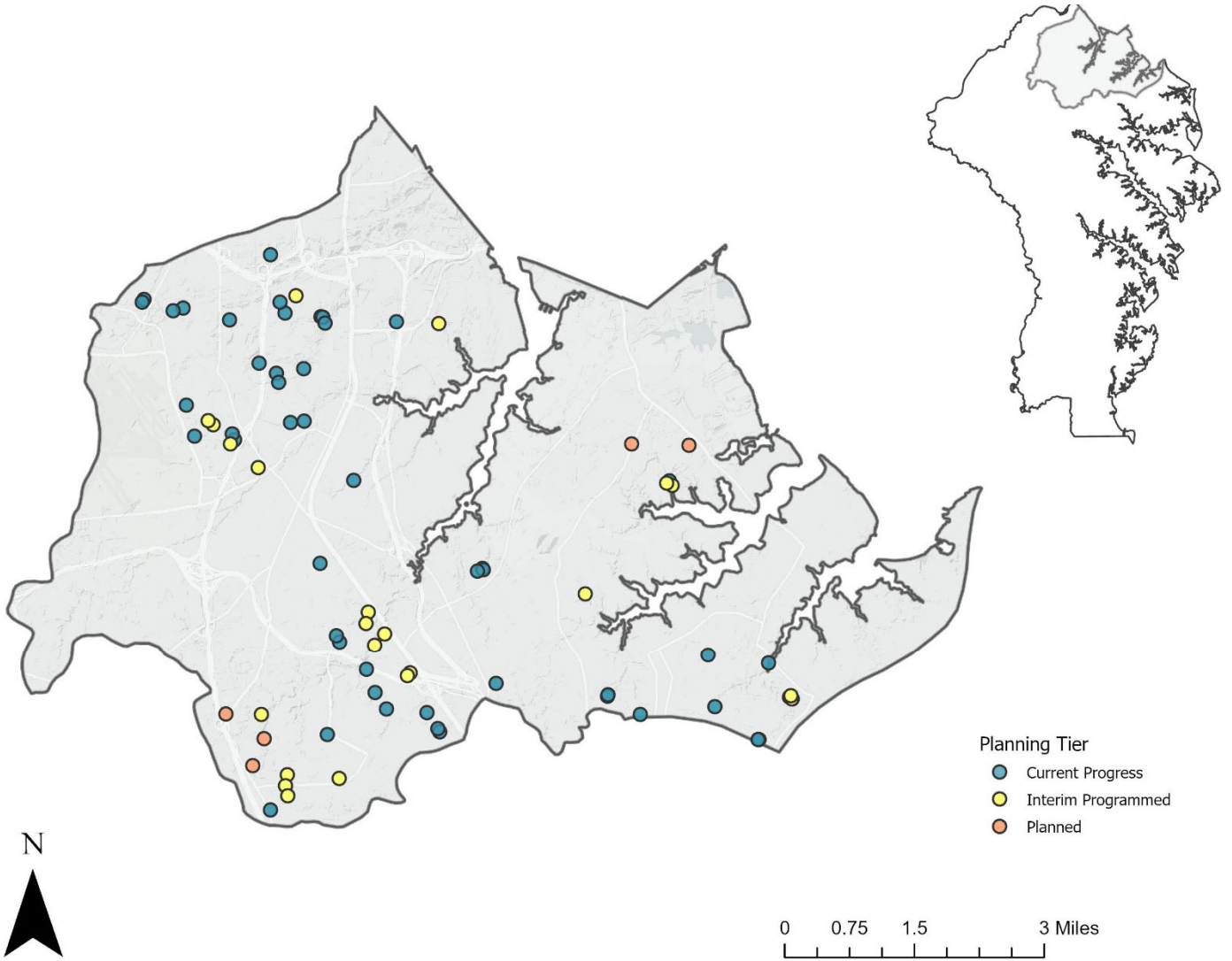


Figure 6-1. Baltimore Harbor Non-Tidal Watershed Restoration Project Locations

6.1.2 Load Reduction

Table 6-2 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed and Planned, and Full BMP implementation. The SW-WLA in the sediment TMDL for the Baltimore Harbor Non-Tidal watershed was determined to be 9,145,527 lbs/year. This is a 58% reduction from the baseline load of 21,775,064 lbs/year. Current Progress as of FY24 shows a reduction of 2,491,671 lbs/year (11.4% reduction). Implementation of the Interim Programmed and Planned BMPs will result in an additional 10,168,179 lbs/year reduction (46.7% reduction). Full implementation will result in 58.1 % total reduction from the baseline and achievement of the sediment SW-WLA for Baltimore Harbor Non-Tidal watershed by approximately FY37.

Table 6-2. Baltimore Harbor Non-Tidal Watershed Load Reduction Summary

	Baltimore Harbor Non-Tidal
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2009
Baseline Load	21,775,064
Target Reduction (%)	58.0
Total Reduction Required	12,629,537
Target Load (SW-WLA)	9,145,527
FY24 Current Progress	
Progress Reduction	2,491,671
Progress Reduction (%)	11.4
Interim Programmed and Planned Restoration	
Programmed and Planned Reduction	10,168,179
Programmed and Planned Reduction (%)	46.7
Full Implementation	
Full Implementation Reduction	12,659,850
Full Implementation Reduction (%)	58.1
Full Implementation Load	9,115,214

6.2 Little Patuxent River

The Little Patuxent River watershed (Maryland 8-digit watershed: 02131105) is situated in the northwestern portion of the County and shares political boundaries with Howard County. The Little Patuxent River watershed is a part of the Chesapeake Bay watershed with the Little Patuxent River mainstem joining the Patuxent River just southeast of the Patuxent Research Refuge before discharging to the tidal portions of the Patuxent River in Calvert County before entering the Chesapeake Bay. The Anne Arundel County portion of the Little Patuxent River watershed is approximately 27,752 acres (43.4 square miles) in area and contains approximately 1,200 total miles of stream reaches.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include Howard County and the SHA, which hold Phase I MS4 permits. The County received MDE approval of the

Little Patuxent River Watershed Sediment TMDL Restoration Plan in 2016, and there were no outstanding comments or recommendations to be addressed in this restoration plan update.

6.2.1 BMP Implementation

Table 6-3 presents a BMP implementation summary for the sediment TMDL in the Little Patuxent River watershed. Current Progress sediment reduction through the end of FY24 has been achieved via 11 stormwater management practices, one outfall stabilization (1,627 linear feet), three stream restorations (2,594 linear feet), street sweeping (45 miles/year), and inlet cleaning (16,690 lbs/year). A list of Interim Programmed projects is included in Appendix B. The locations of Current Progress and Interim Programmed BMPs are shown in Figure 6-2 and are presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the Little Patuxent River watershed is expected to be met.

Table 6-3. BMP Implementation for the Sediment Local TMDL SW-WLA in the Little Patuxent River Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned	Full Implementation
Stormwater					
New Stormwater BMP	# of BMPs	11	1	0	12
	drainage acres	169	0.8	0	170
Alternative Practices					
Stream Restoration	# of BMPs	3	5	0	8
	linear feet	2,594	11,542	0	14,136
Outfall Stabilization	# of BMPs	1	2	0	3
	linear feet	1,627	1,089	0	2,716
Street Sweeping[1]	miles/year	45	0	0	45
Inlet Cleaning[1]	lbs/year	16,690	0	0	16,690

[1]Annual Practice

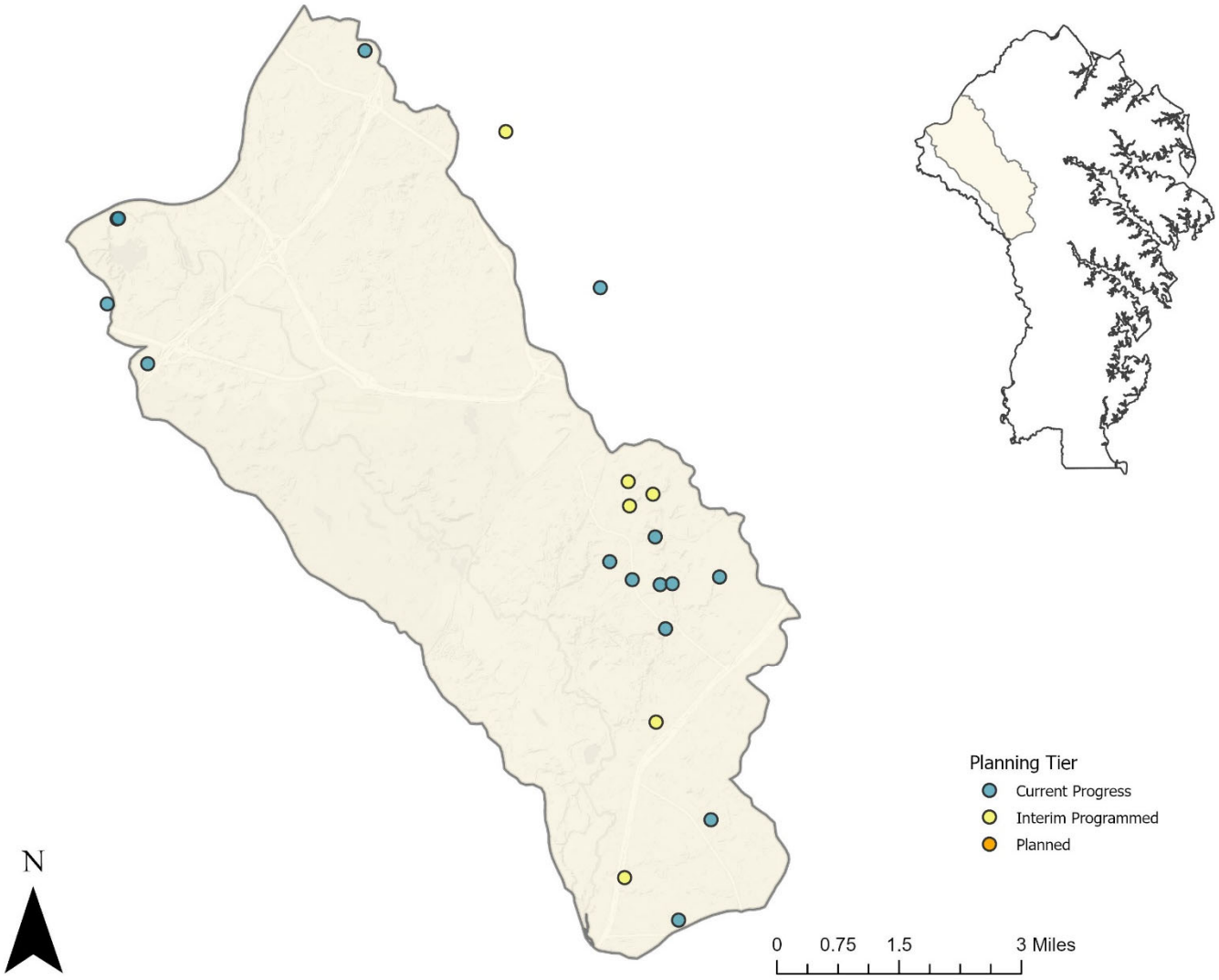


Figure 6-2. Little Patuxent River Watershed Restoration Project Locations

6.2.2 Load Reduction

Table 6-4 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed, and Full BMP implementation The SW-WLA in the sediment TMDL for the Little Patuxent River watershed was determined to be 15,047,258 lbs/year. This is a 20.5% reduction from the baseline load of 18,927,369 lbs/year. Current Progress as of FY24 shows a reduction of 1,799,872 lbs/year (9.5% reduction). Implementation of the Interim Programmed BMPs will result in an additional 4,884,426 lbs/year reduction (25.8% reduction). No Planned BMPs are needed for achieving target reduction, as shown in Table 6-3. Full implementation will result in 35.3% total reduction from the baseline and achievement of the sediment SW-WLA for the Little Patuxent River watershed by approximately FY30. Full implementation reduction exceeds target % reduction because the County plans to implement additional Interim Programmed BMPs to address other TMDL requirements within the watershed.

Table 6-4. Little Patuxent River Watershed Load Reduction Summary

	Little Patuxent River
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2005
Baseline Load	18,927,369
Target Reduction (%)	20.5
Total Reduction Required	3,880,111
Target Load (SW-WLA)	15,047,258
FY24 Current Progress	
Progress Reduction	1,799,872
Progress % Reduction (%)	9.5
Interim Programmed Restoration	
Programmed Reduction	4,884,426
Programmed % Reduction (%)	25.8
Full Implementation	
Full Implementation Reduction	6,684,298
Full Implementation % Reduction (%)	35.3
Full Implementation Load	12,243,070

6.3 Lower Patuxent River

The Lower Patuxent River watershed (Maryland 8-digit watershed: 02131101) is located within the southernmost portion of the County. Only a small portion of the entire Lower Patuxent River watershed is located within Anne Arundel County; the rest of the Lower Patuxent watershed extends through Prince George's, Calvert, Charles, and St. Mary's counties until the point of discharge from the Patuxent River into the Chesapeake Bay. The Anne Arundel County portion of the Lower Patuxent River watershed is approximately 3,217 acres (5 square miles) and contains approximately 24.7 miles of streams.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include Prince George's County, Charles County, and the SHA, which hold Phase I MS4 permits. The County received MDE

approval of the Lower Patuxent River Watershed Sediment TMDL Restoration Plan in 2020, and there were no outstanding comments or recommendations to be addressed in this restoration plan update.

6.3.1 BMP Implementation

Table 6-5 presents a BMP implementation summary for the sediment TMDL in the Lower Patuxent River watershed. There has been no BMP implementation in this watershed through FY24. A list of Interim Programmed and Planned projects is included in Appendix B. The locations of Interim Programmed and Planned BMPs are shown in Figure 6-3 and are presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the Lower Patuxent River watershed is expected to be met.

Table 6-5. BMP Implementation for the Sediment Local TMDL SW-WLA in the Lower Patuxent River Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned	Full Implementation
Alternative Practices					
Stream Restoration	# of BMPs	0	1	1	2
	linear feet	0	2,906	1,598	4,504

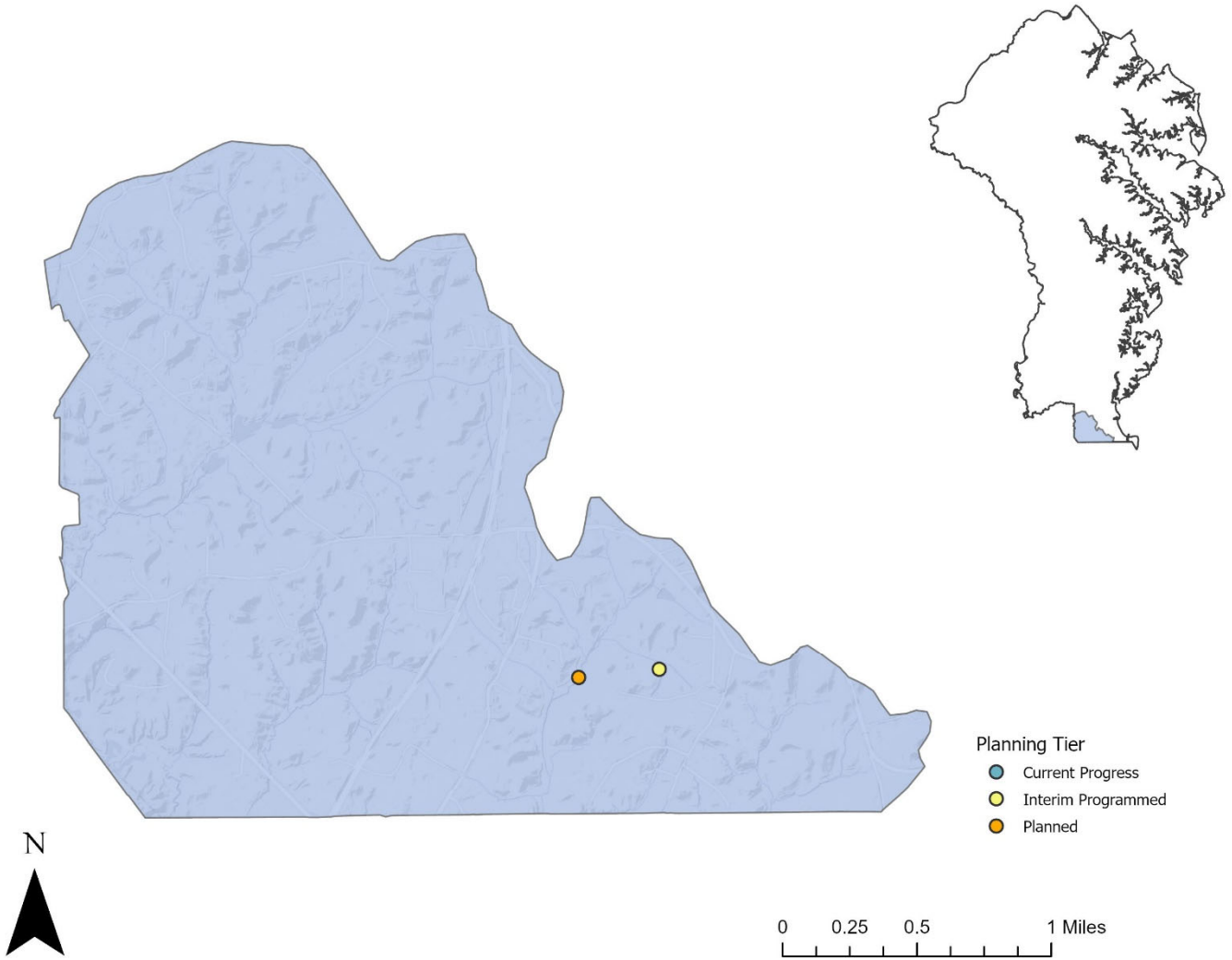


Figure 6-3. Lower Patuxent River Watershed Restoration Project Locations

6.3.2 Load Reduction

Table 6-6 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed and Planned, and Full BMP implementation. The SW-WLA in the sediment TMDL for the Lower Patuxent River watershed was determined to be 767,132 lbs/year. This is a 61% reduction from the baseline load of 1,967,006 lbs/year. There has been no progress in reductions through FY24 (0%). Implementation of the Interim Programmed and Planned BMPs will result in 1,248,374 lbs/year reduction (63.5% reduction). Full implementation will result in 63.5% total reduction from the baseline, and achievement of the sediment SW-WLA for the Lower Patuxent River watershed by approximately FY26.

Table 6-6. Lower Patuxent River Watershed Load Reduction Summary

	Lower Patuxent River
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2009
Baseline Load	1,967,006
Target Reduction (%)	61.0
Total Reduction Required	1,199,873
Target Load (SW-WLA)	767,132
FY24 Current Progress	
Progress Reduction	0
Progress Reduction (%)	0
Interim Programmed and Planned Restoration	
Programmed and Planned Reduction	1,248,374
Programmed and Planned Reduction (%)	63.5
Full Implementation	
Full Implementation Reduction	1,248,374
Full Implementation Reduction (%)	63.5
Full Implementation Load	718,631

6.4 Middle Patuxent River

The Middle Patuxent watershed (Maryland 8-digit watershed: 02131102) is located in the southwestern portion of the County and shares political boundaries with Prince George's County along the Patuxent River to the west, and with Calvert County along Lyons Creek to the south. The Anne Arundel County portion of the Middle Patuxent watershed is approximately 26,490 acres (41.4 square miles) and contains approximately 228 miles of streams.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include Prince George's County and the SHA, which hold Phase I MS4 permits. The County received MDE approval of the Middle Patuxent River Watershed Sediment TMDL Restoration Plan in 2020, and there were no outstanding comments or recommendations to be addressed in this restoration plan update.

6.4.1 BMP Implementation

Table 6-7 presents a BMP implementation summary for the sediment TMDL in the Middle Patuxent River watershed. Current Progress sediment reduction through the end of FY24 was achieved via one outfall stabilization (244 linear feet), street sweeping (1 miles/year), inlet cleaning (441 lbs/year), and three land cover conversion BMPs (37 acres). A list of Interim Programmed and Planned projects is included in Appendix B. The locations of Current Progress, Interim Programmed, and Planned BMPs are shown in Figure 6-4 and presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the Middle Patuxent River watershed is expected to be met.

Table 6-7. BMP Implementation for the Sediment Local TMDL SW-WLA in the Middle Patuxent River Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned	Full Implementation
Alternative Practices					
Stream Restoration	# of BMPs	0	1	12	13
	linear feet	0	3,800	31,926	35,726
Outfall Stabilization	# of BMPs	1	0	0	1
	linear feet	244	0	0	244
Street Sweeping[1]	miles/year	1	0	0	1
Inlet Cleaning[1]	lbs/year	441	0	0	441
Land Cover Conversion					
Impervious Surface Reduction to Forest	# of BMPs	1	0	0	1
	acres converted	0.1	0	0	0.1
Urban Tree Planting	# of BMPs	2	0	0	2
	acres converted	37	0	0	37

[1]Annual Practice

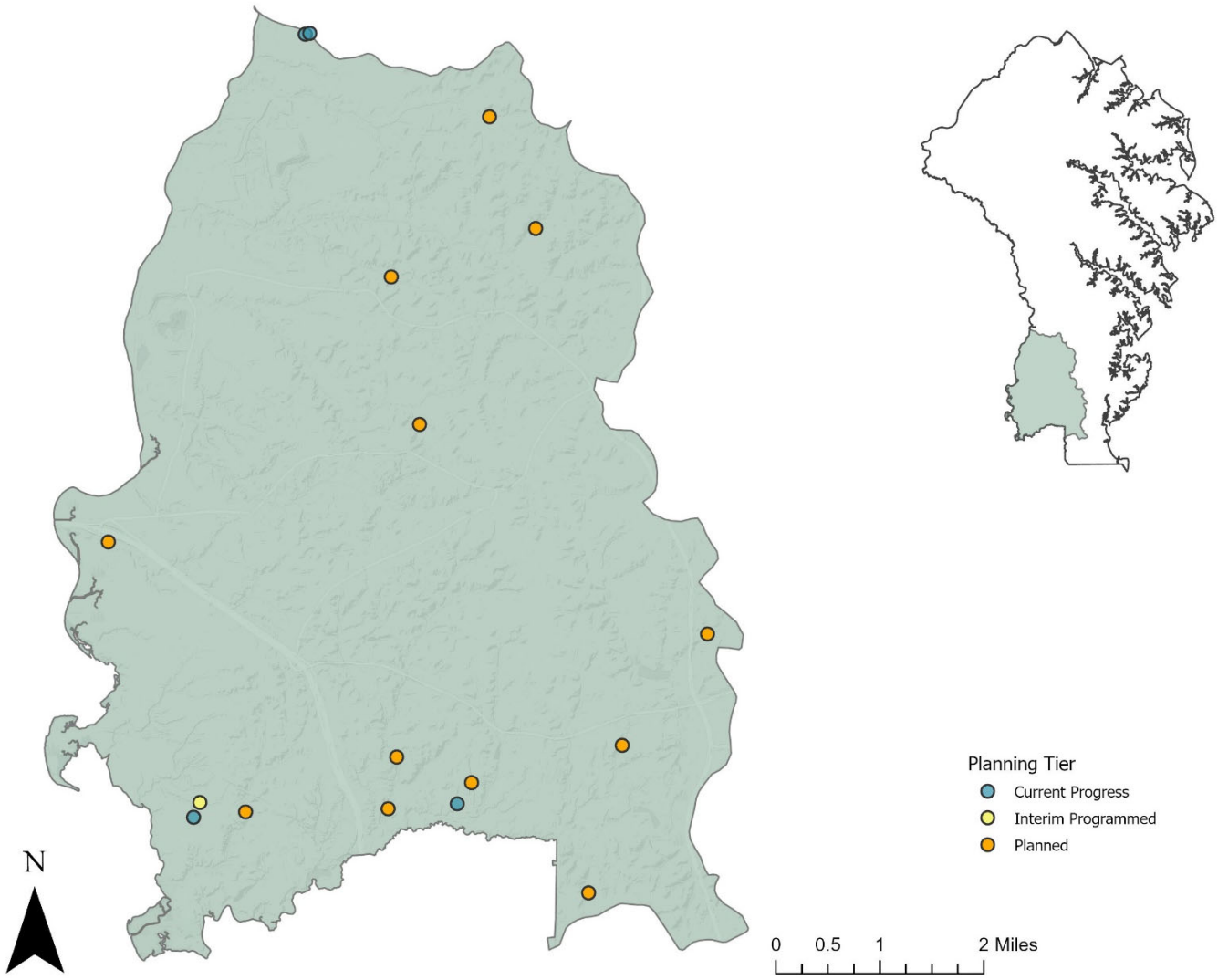


Figure 6-4. Middle Patuxent River Watershed Restoration Project Locations

6.4.2 Load Reduction

Table 6-8 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed and Planned, and Full BMP implementation. The SW-WLA in the sediment TMDL for the Middle Patuxent River watershed was determined to be 6,982,285 lbs/year. This is a 56% reduction from the baseline load of 15,868,830 lbs/year. Current Progress as of FY24 shows a reduction of 76,158 lbs/year (0.5%). Implementation of the Interim Programmed and Planned BMPs will result in an additional 8,860,108 lbs/year reduction (55.8% reduction). Full implementation will result in 56.3% total reduction from the baseline and achievement of the sediment SW-WLA for Middle Patuxent River watershed by approximately FY39.

Table 6-8. Middle Patuxent River Watershed Load Reduction Summary

	Middle Patuxent River
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2009
Baseline Load	15,868,830
Target % Reduction (%)	56.0
Total Reduction Required	8,886,545
Target Load (SW-WLA)	6,982,285
FY24 Current Progress	
Progress Reduction	76,158
Progress % Reduction (%)	0.5
Interim Programmed and Planned Restoration	
Programmed and Planned Reduction	8,860,108
Programmed and Planned % Reduction (%)	55.8
Full Implementation	
Full Implementation Reduction	8,936,266
Full Implementation Reduction (%)	56.3
Full Implementation Load	6,932,564

6.5 Upper Patuxent River

The Upper Patuxent River watershed (Maryland 8-digit watershed: 02131104) is situated in the western portion of the County and shares political boundaries with Prince George's County along the Patuxent River and a small portion of Howard County. Anne Arundel County's portion of the Upper Patuxent watershed is approximately 22,420 acres (35.0 square miles) in area and contains approximately 90 total perennial miles of stream reaches.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include Prince George's County, Howard County, and the SHA, which hold Phase I MS4 permits, in addition to Phase II stormwater entities. The County received MDE approval of the Upper Patuxent River Watershed Sediment TMDL Restoration Plan in 2016, and there were no outstanding comments or recommendations to be addressed in this restoration plan update.

6.5.1 BMP Implementation

Table 6-9 presents a BMP implementation summary for the sediment TMDL in the Upper Patuxent River watershed. Current Progress sediment reduction through the end of FY24 was achieved via two stormwater management practices, one stream restoration (236 linear feet), street sweeping (5 miles/year), and inlet cleaning (1,416 lbs/year). A list of Interim Programmed projects is included in Appendix B. The locations of Current Progress and Interim Programmed BMPs are shown in Figure 6-5 and presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the Upper Patuxent River watershed is expected to be met.

Table 6-9. BMP Implementation for the Sediment Local TMDL SW-WLA in the Upper Patuxent River Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned	Full Implementation
Stormwater					
New Stormwater BMP	# of BMPs	2	0	0	2
	drainage acres	18	0	0	18
Alternative Practices					
Stream Restoration	# of BMPs	1	0	0	1
	linear feet	236	0	0	236
Outfall Stabilization	# of BMPs	0	1	0	1
	linear feet	0	2,030	0	2,030
Street Sweeping[1]	miles/year	5	0	0	5
Inlet Cleaning[1]	lbs/year	1,416	0	0	1,416

[1]Annual Practice

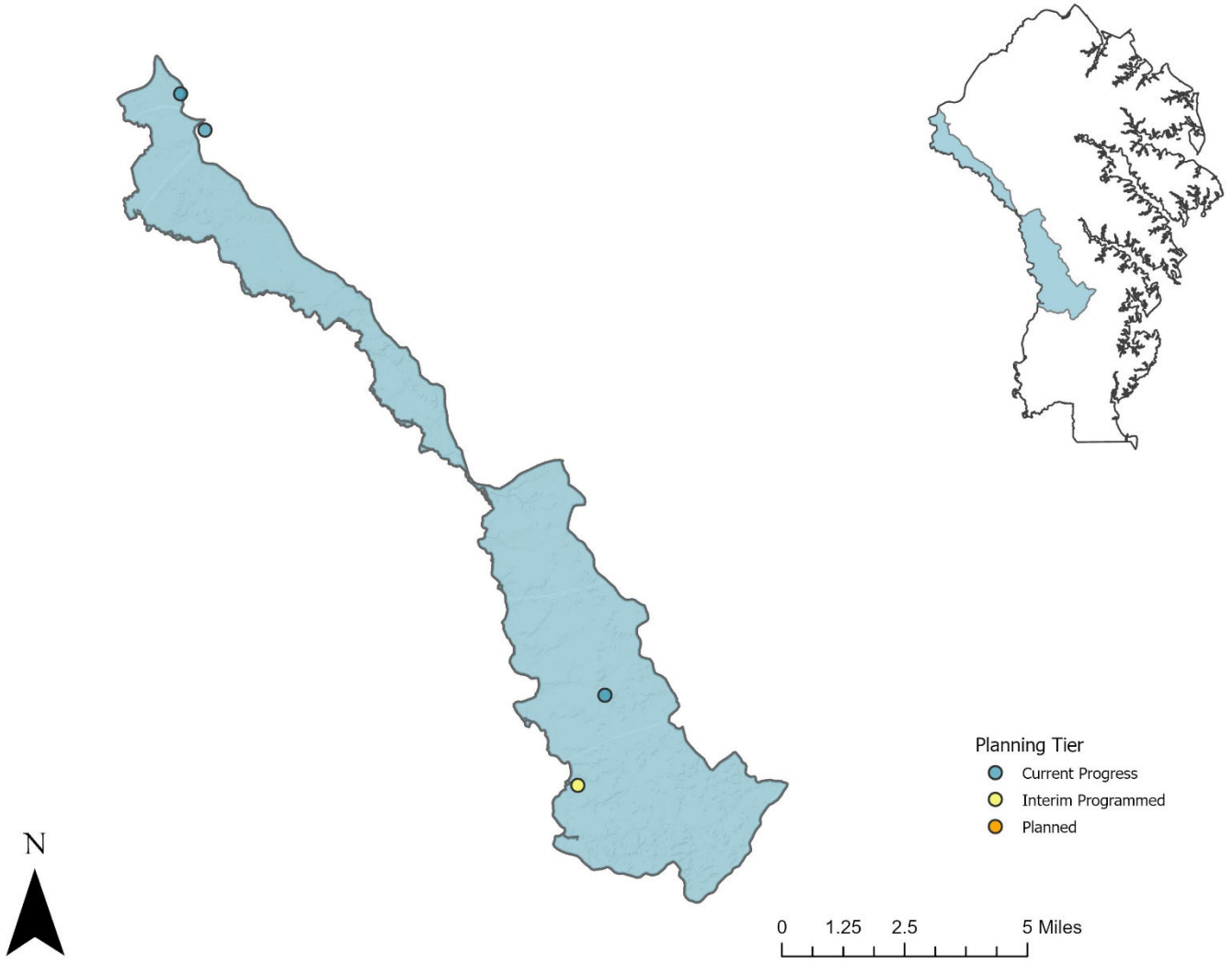


Figure 6-5. Upper Patuxent River Watershed Restoration Project Locations

6.5.2 Load Reduction

Table 6-10 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed, and Full BMP implementation. The SW-WLA in the sediment TMDL for the Upper Patuxent River watershed was determined to be 11,314,310 lbs/year. This is an 11.4% reduction from the baseline load of 12,770,101 lbs/year. Current Progress as of FY24 shows a reduction of 240,597 lbs/year (1.9% reduction). Implementation of the Interim Programmed BMPs will result in an additional 2,730,472 lbs/year reduction (21.4% reduction). No Planned BMPs are needed for achieving target reduction, as shown in Table 6-9. Full implementation will result in 23.3% total reduction from the baseline, and achievement of the sediment SW-WLA for Upper Patuxent River watershed by approximately FY29. Full implementation reduction exceeds target % reduction because the County plans to implement additional interim programmed BMPs to address other TMDL requirements within the watershed.

Table 6-10. Upper Patuxent River Watershed Load Reduction Summary

	Upper Patuxent River
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2005
Baseline Load	12,770,101
Target Reduction (%)	11.4
Total Reduction Required	1,455,792
Target Load (SW-WLA)	11,314,310
FY24 Current Progress	
Progress Reduction	240,597
Progress Reduction (%)	1.9
Interim Programmed Restoration	
Programmed Reduction	2,730,472
Programmed Reduction (%)	21.4
Full Implementation	
Full Implementation Reduction	2,971,069
Full Implementation Reduction (%)	23.3
Full Implementation Load	9,799,032

6.6 Patapsco River Lower North Branch

The Patapsco River Lower North Branch watershed (Maryland 8-digit watershed: 02130906) is situated in the northwestern portion of the County and shares political boundaries with Howard County along Deep Run and Baltimore County along the mainstem of the Patapsco River. The downstream extent of the watershed borders Baltimore City. Anne Arundel County's portion of the Patapsco River Lower North Branch watershed is approximately 15,270 acres (23.9 square miles) in area and contains approximately 96 miles of streams.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include Baltimore County, Baltimore City, Carroll County, Howard County, and the SHA, which hold Phase I MS4

permits. The County received MDE approval of the Patapsco River Lower North Branch Watershed Sediment TMDL Restoration Plan in 2016, and there were no outstanding comments or recommendations to be addressed in this restoration plan update.

6.6.1 BMP Implementation

Table 6-11 presents a BMP implementation summary for the sediment TMDL in the Patapsco River Lower North Branch watershed. Current Progress sediment reduction through the end of FY24 was achieved via five stormwater management practices, two stream restorations (515 linear feet), street sweeping (34 miles/year), and inlet cleaning (1,221 lbs/year), and one land cover conversion BMPs (0.03 acres). A list of Interim Programmed projects is included in Appendix B. The locations of Current Progress and Interim Programmed BMPs are shown in Figure 6-6 and presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the Patapsco River Lower North Branch watershed is expected to be met.

Table 6-11. BMP Implementation for the Sediment Local TMDL SW-WLA in the Patapsco River Lower North Branch Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned	Full Implementation
Stormwater					
New Stormwater BMP	# of BMPs	25	5	0	30
	drainage acres	400	151	0	551
BMP Conversion	# of BMPs	0	0	0	0
	drainage acres	0	0	0	0
Alternative Practices					
Stream Restoration	# of BMPs	2	2	0	4
	linear feet	515	13,935	0	14,450
Street Sweeping[1]	miles/year	34	0	0	34
Inlet Cleaning[1]	lbs/year	1,221	0	0	12,221
Land Cover Conversion					
Impervious Surface Reduction to Turf	# of BMPs	1	0	0	1
	acres converted	0.03	0	0	0.03

[1]Annual Practice

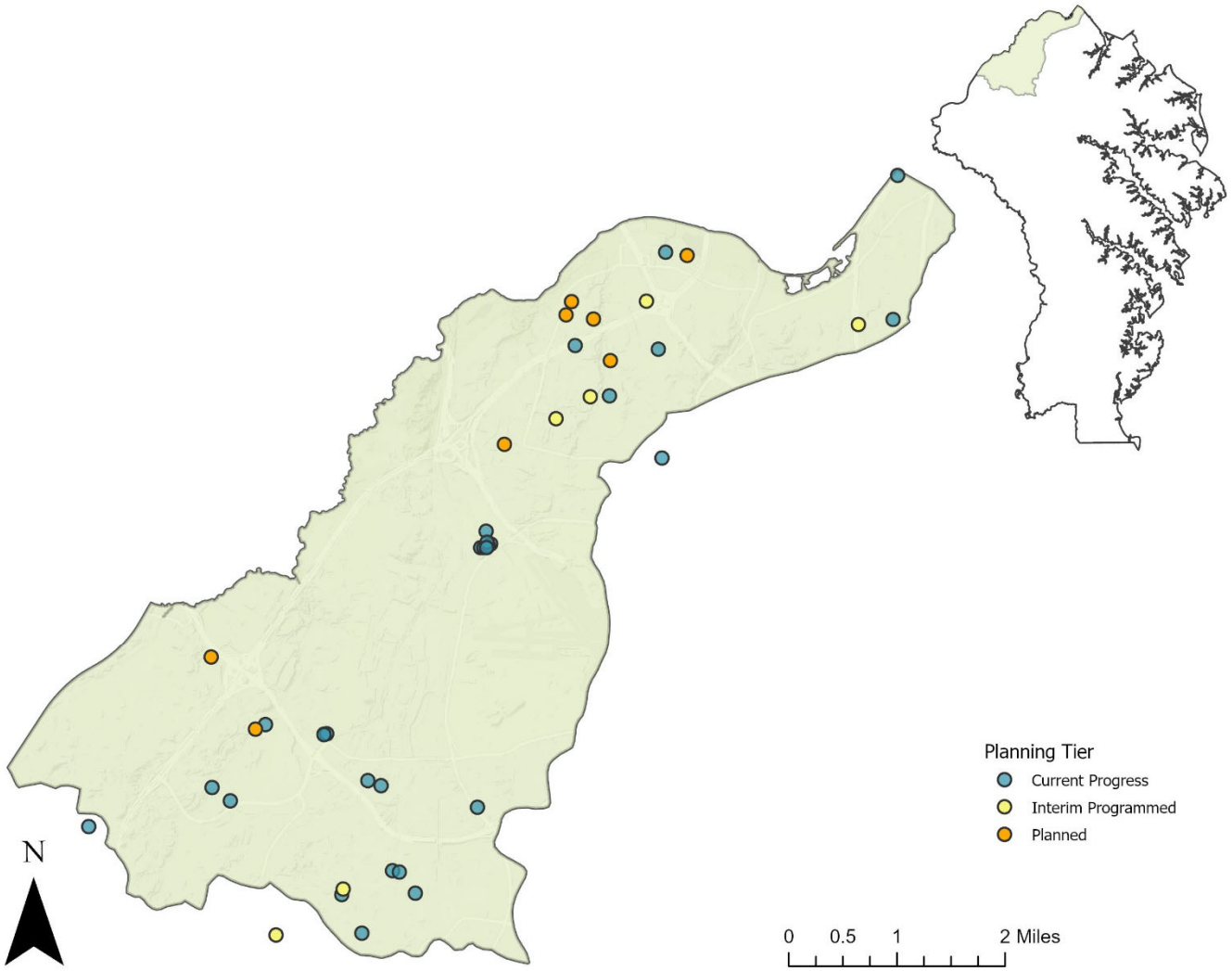


Figure 6-6. Patapsco River Lower North Branch Watershed Restoration Project Locations

6.6.2 Load Reduction

Table 6-12 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed and Planned, and Full BMP implementation. The SW-WLA in the sediment TMDL for the Patapsco River Lower North Branch watershed was determined to be 12,960,021 lbs/year. This is a 22.2% reduction from the baseline load of 16,658,125 lbs/year. Current Progress as of FY24 shows a reduction of 1,272,479 lbs/year (7.6% reduction). Implementation of the Interim Programmed and Planned BMPs will result in an additional 2,875,250 lbs/year reduction (17.3% reduction). Full implementation will result in 24.9 % total reduction from the baseline, and achievement of the sediment SW-WLA for the Patapsco River Lower North Branch watershed by approximately FY34.

Table 6-12. Patapsco River Lower North Branch Watershed Load Reduction Summary

	Patapsco River Lower North Branch
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2005
Baseline Load	16,658,125
Target Reduction (%)	22.2
Total Reduction Required	3,698,104
Target Load (SW-WLA)	12,960,021
FY24 Current Progress	
Progress Reduction	1,272,479
Progress Reduction (%)	7.6
Interim Programmed and Planned Restoration	
Programmed and Planned Reduction	2,875,250
Programmed and Planned Reduction (%)	17.3
Full Implementation	
Full Implementation Reduction	4,147,728
Full Implementation Reduction (%)	24.9
Full Implementation Load	12,510,397

6.7 South River

The South River watershed (Maryland 8-digit watershed: 02131003) is situated in the central portion of the County and drains directly to the Chesapeake Bay. The watershed comprises approximately 36,514 acres and lies entirely within the County.

Other major jurisdictions with sediment SW-WLA responsibility include the SHA, which holds a Phase I MS4 permit. The County received MDE approval of the South River Watershed Sediment TMDL Restoration Plan on April 29, 2019, with recommendations for revision. MDE's comments and recommendations were addressed in the restoration plan update published in 2022, and there were no additional outstanding comments or recommendations to be addressed in this restoration plan update.

6.7.1 BMP Implementation

South River achieved sediment load reduction in excess of the target load reduction, resulting in attainment of the TMDL SW-WLA in FY22. Despite successful attainment, the County has additional planned BMPs. These additional BMPs will result in even greater overachievement of SW-WLA goal reductions Table 6-13 presents a BMP implementation summary for the sediment TMDL in the South River watershed. Current Progress reduction has been achieved via one stormwater management practice, twenty-one stream restorations (34,342 linear feet), two outfall stabilizations (713 linear feet), street sweeping (20 miles/year), inlet cleaning (25,296 lbs/year), and three land cover conversion BMPs (9.9 acres). Additional BMPs are not required for the sediment reduction goal of this watershed, but there are still Interim Programmed BMPs set for South River because the projects are already included in the County's plans and failed restoration BMPs need to be remediated. These Interim Programmed are included in Table 6-13. A list of Interim Programmed projects is included in Appendix B. The locations of Current Progress and Interim Programmed BMPs are shown in Figure 6-7 and presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the South River watershed is expected to be met.

Table 6-13. BMP Implementation for the Sediment Local TMDL SW-WLA in the South River Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned	Full Implementation
Stormwater					
New Stormwater BMP	# of BMPs	43	4	0	47
	drainage acres	430	39	0	469
Alternative Practices					
Stream Restoration	# of BMPs	21	3	0	24
	linear feet	34,342	12,091	0	46,433
Outfall Stabilization	# of BMPs	2	3	0	5
	linear feet	713	1,563	0	22,760
Street Sweeping[1]	miles/year	20	0	0	20
Inlet Cleaning[1]	lbs/year	25,296	0	0	25,296
Land Cover Conversion					
Impervious Surface Reduction to Forest	# of BMPs	0	1	0	1
	acres converted	0	0.3	0	0.3
Impervious Surface Reduction to Turf	# of BMPs	1	1	0	2
	acres converted	0.3	0.04	0	0.3
Riparian Forest Planting	# of BMPs	1	0	0	1
	acres converted	0.5	0	0	0.5
Urban Tree Planting	# of BMPs	1	0	0	1
	acres converted	9	0	0	9

[1]Annual Practice

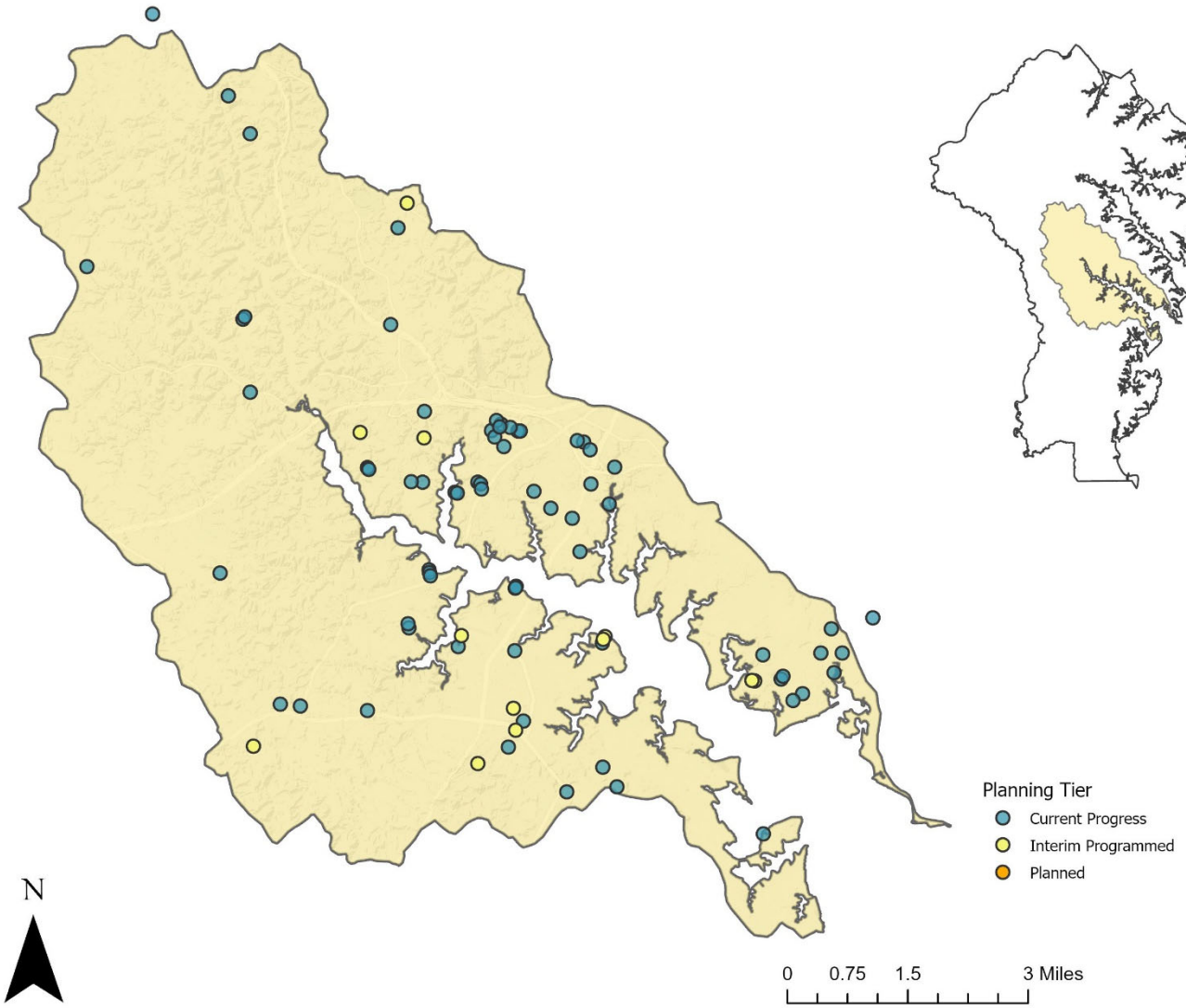


Figure 6-7. South River Watershed Restoration Project Locations

6.7.2 Load Reduction

Table 6-14 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed, and Full BMP implementation. The SW-WLA in the sediment TMDL for the South River watershed was determined to be 13,634,211 lbs/year. This is a 28% reduction from the baseline load of 18,936,404 lbs/year. Achievement of the sediment SW-WLA for the South River watershed occurred in FY23. Current Progress as of FY24 shows a reduction of 7,724,059 lbs/year (40.8% reduction). Implementation of the Interim Programmed BMPs will result in an additional 2,743,745 lbs/year reduction (14.5% reduction). No Planned BMPs are needed for achieving target reduction, as shown in Table 6-13. Full implementation will result in 55.3% total reduction from the baseline. Full implementation reduction exceeds target % reduction because the County plans to implement additional interim programmed BMPs to address other TMDL requirements within the watershed.

Table 6-14. South River Watershed Load Reduction Summary

	South River
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2009
Baseline Load	18,936,404
Target Reduction (%)	28.0
Total Reduction Required	5,302,193
Target Load (SW-WLA)	13,634,211
FY24 Current Progress	
Progress Reduction	7,724,059
Progress Reduction (%)	40.8
Interim Programmed Restoration	
Programmed Reduction	2,743,745
Programmed Reduction (%)	14.5%
Full Implementation	
Full Implementation Reduction	10,467,804
Full Implementation Reduction (%)	55.3
Full Implementation Load	8,468,601

6.8 Other West Chesapeake Bay

The Other West Chesapeake Bay watershed (Maryland 8-digit watershed: 02131005) is situated in the southeastern portion of the County and shares political boundaries with Calvert County. The Anne Arundel County portion of the Other West Chesapeake watershed is approximately 14,662 acres (22.9 square miles) in area and contains approximately 100 total miles of streams.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include the SHA, which holds a Phase I MS4 permit. The County received MDE approval of the Little Patuxent River Watershed Sediment TMDL Restoration Plan in 2020, and there were no outstanding comments or recommendations to be addressed in this restoration plan update.

6.8.1 BMP Implementation

Table 6-15 presents a BMP implementation summary for the sediment TMDL in the Other West Chesapeake Bay watershed. Current Progress sediment reduction through the end of Fy24 was achieved via two stormwater management practices, one stream restoration (240 linear feet), one outfall stabilization (323 linear feet), street sweeping (0.1 miles/year), and inlet cleaning (1,057 lbs/year). A list of Planned projects is included in Appendix B. The locations of Current Progress and Planned BMPs are shown in Figure 6-8 and presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the Other West Chesapeake Bay watershed is expected to be met.

Table 6-15. BMP Implementation for the Sediment Local TMDL SW-WLA in the Other West Chesapeake Bay Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned	Full Implementation
Stormwater					
New Stormwater BMP	# of BMPs	2	0	0	2
	drainage acres	16	0	0	16
Alternative Practices					
Stream Restoration	# of BMPs	1	0	11	12
	linear feet	240	0	14,055	14,295
Outfall Stabilization	# of BMPs	1	0	0	1
	linear feet	323	0	0	323
Street Sweeping[1]	miles/year	0.1	0	0	0.1
Inlet Cleaning[1]	lbs/year	1,057	0	0	1,057

[1]Annual Practice

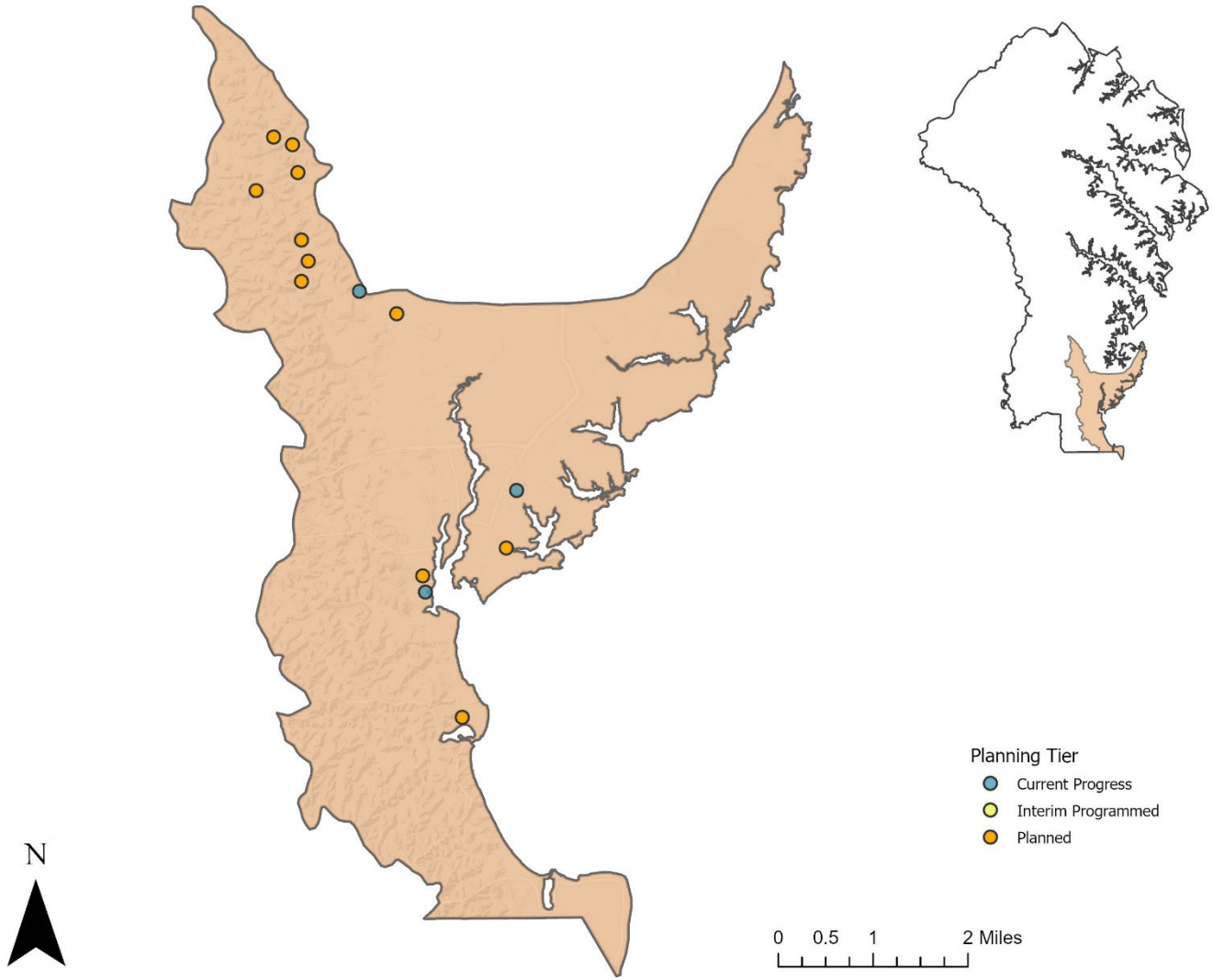


Figure 6-8. Other West Chesapeake Bay Watershed Restoration Project Locations

6.8.2 Load Reduction

Table 6-16 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Planned, and Full BMP implementation. The SW-WLA in the sediment TMDL for the Other West Chesapeake Bay watershed was determined to be 7,363,965 lbs/year. This is a 33.0% reduction from the baseline load of 10,990,993 lbs/year. Current Progress as of FY24 shows a reduction of 142,421 lbs/year (1.3% reduction). No Interim Programmed BMPs are needed for achieving target reduction, as shown in Table 6-15. Implementation of the Planned BMPs will result in an additional 3,485,615 lbs/year reduction (31.7% reduction). Full implementation will result in 33.0% total reduction from the baseline, and achievement of the sediment SW-WLA for the Other West Chesapeake Bay watershed by approximately FY37.

Table 6-16. Other West Chesapeake Bay Watershed Load Reduction Summary

	Other West Chesapeake Bay
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2009
Baseline Load	10,990,993
Target Reduction (%)	33.0
Total Reduction Required	3,627,028
Target Load (SW-WLA)	7,363,965
FY24 Current Progress	
Progress Reduction	142,421
Progress Reduction (%)	1.3
Planned Restoration	
Planned Reduction	3,485,615
Planned Reduction (%)	31.7
Full Implementation	
Full Implementation Reduction	3,628,036
Full Implementation Reduction (%)	33.0
Full Implementation Load	7,362,957

6.9 West River

The Non-Tidal West River watershed (Maryland 8-digit watershed: 02131004) is located in the southeastern part of Anne Arundel County and consists of two major segments - the West River and the Rhode River. The Non-Tidal West River watershed is approximately 15,623 acres (24.4 square miles) and contains approximately 62 miles of streams, 33 miles of which are perennial streams.

Other major jurisdictions with sediment SW-WLA responsibility that overlap the watershed include the SHA, which holds a Phase I MS4 permit. The County received MDE approval of the West River Watershed Sediment TMDL Restoration Plan on August 14, 2023, with recommendations for revision. MDE's comments and recommendations are addressed in this Plan update.

6.9.1 BMP Implementation

Table 6-17 presents a BMP implementation summary for the sediment TMDL in the West River watershed. Current Progress sediment reduction through the end of FY24 has been achieved via four stormwater management practices, one stream restoration (1,400 linear feet), street sweeping (0.1 miles/year), inlet cleaning (758 lbs/year), and one land cover conversion BMPs (0.1 acres). A list of Interim Programmed and Planned projects, determined after project prioritization (see Section 5.3), is included in Appendix B. The locations of Current Progress, Interim Programmed, and Planned BMPs included in implementation, are shown in Figure 6-9 and presented as circles representing BMPs at varying stages of completion. Based on the sediment reduction anticipated from full BMP implementation, the SW-WLA for the West River watershed is expected to be met.

Table 6-17. BMP Implementation for the Sediment Local TMDL SW-WLA in the West River Watershed

BMP Category	Unit	Current Progress	Interim Programmed	Planned[2]	Full Implementation
Stormwater					
New Stormwater BMP	# of BMPs	4	0	0	4
	drainage acres	6	0	0	6
BMP Conversion	# of BMPs	0	0	4	4
	drainage acres	0	0	13	13
Alternative Practices					
Stream Restoration	# of BMPs	1	1	2	4
	linear feet	1,400	1,580	3,800	6,780
Street Sweeping[1]	miles/year	0.1	0	0	0.1
Inlet Cleaning[1]	lbs/year	758	0	0	758
Land Cover Conversion					
Impervious Surface Reduction to Turf	# of BMPs	1	0	0	1
	acres converted	0.1	0	0	0.1
Urban Tree Planting	# of BMPs	0	1	0	1
	acres converted	0	2	0	2

[1]Annual Practice
[2] Planned projects determined after project prioritization

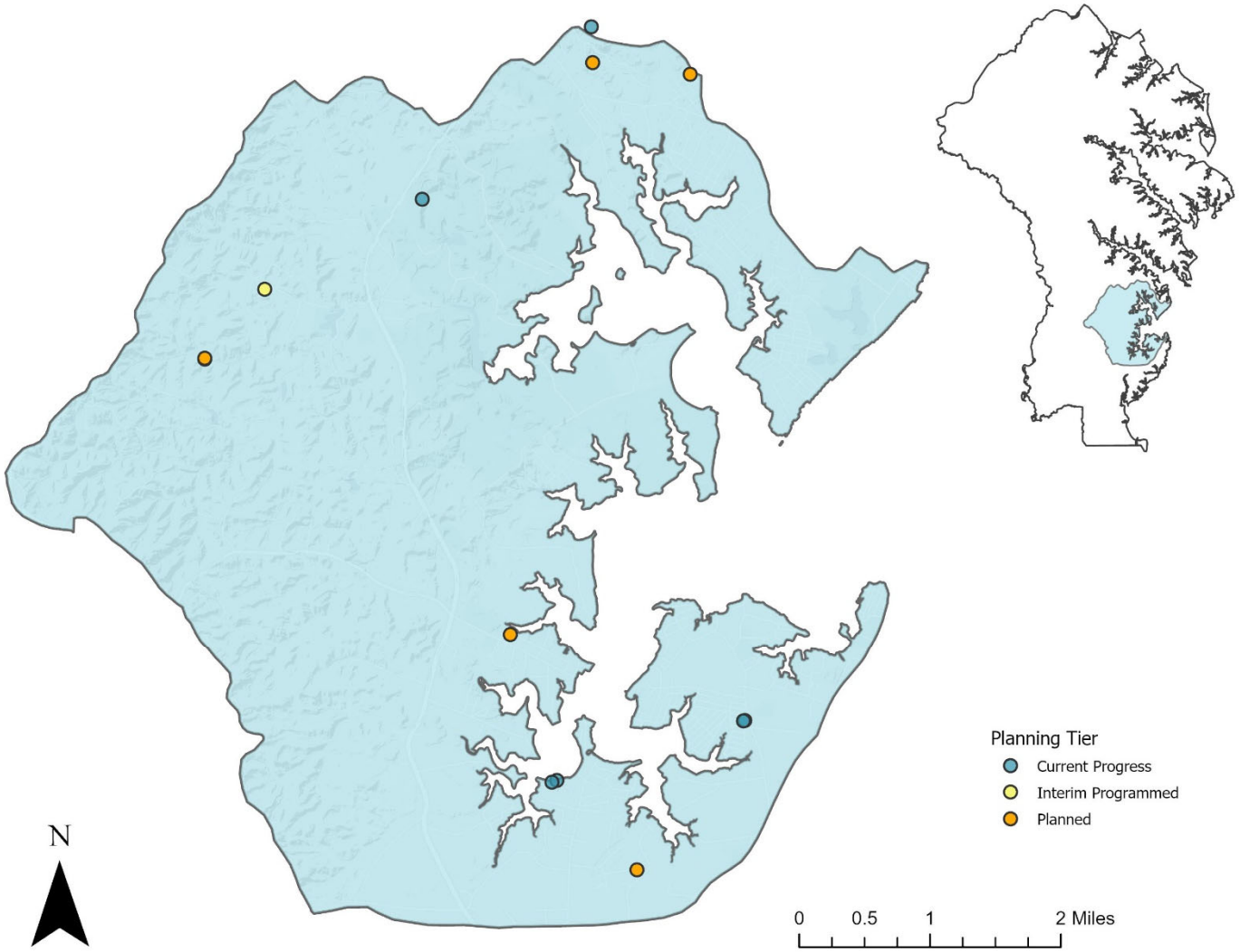


Figure 6-9. West River Watershed Restoration Project Locations

6.9.2 Load Reduction

Table 6-18 presents the TIPP modeling results for pollutant reduction achieved for FY24 Current Progress, Interim Programmed and Planned, and Full BMP implementation. The SW-WLA in the sediment TMDL for the West River watershed was determined to be 7,150,214 lbs/year. This is a 22% reduction from the baseline load of 9,166,941 lbs/year. Current Progress as of FY24 shows a reduction of 60,786 lbs/year (0.7% reduction). Implementation of the Interim Programmed and Planned BMPs will result in an additional 1,959,227 lbs/year reduction (21.4% reduction). Full implementation will result in 22.0% total reduction from the baseline, and achievement of the sediment SW-WLA for the West River watershed by approximately FY34.

Table 6-18. West River Watershed Load Reduction Summary

	West River
Impairment (Unit)	**TSS (EOS lbs/yr)**
Baseline Load and TMDL SW-WLA	
Baseline Year	2009
Baseline Load	9,166,941
Target Reduction (%)	22.0
Total Reduction Required	2,016,727
Target Load (SW-WLA)	7,150,214
FY24 Current Progress	
Progress Reduction	60,786
Progress Reduction (%)	0.7
Interim Programmed and Planned Restoration	
Programmed and Planned Reduction	1,959,227
Programmed and Planned Reduction (%)	21.4
Full Implementation	
Full Implementation Reduction	2,020,013
Full Implementation Reduction (%)	22.0
Full Implementation Load	7,146,928

7 Implementation Cost and Schedule

This section presents the restoration plan costs and schedule with target loads based on milestone implementation targets. The actual project implementation timelines have deviated from original expectations due to various challenges. These include limited staff capacity, discrepancies between desktop assessments and field conditions, rising project costs and funding constraints, extended contracting processes, and the need for contractors to adapt to County requirements and evolving scientific approaches.

7.1 Implementation Cost

A major source of funding for the implementation of restoration projects is the County's Watershed Protection and Restoration Fee (WPRF). Funding for the Interim Programmed and Planned restoration

projects is through the CIP, through NGO and private funding, and through the County's DPW-BWPR Grant Program. In addition to funding provided through the WPRF, Anne Arundel County actively pursues grant funding from federal, state, and NGOs to leverage funding for its restoration projects.

The estimated total projected cost to implement the Interim Programmed and Planned projects described in this plan for the County's portion of the sediment TMDL watersheds is approximately $200,242,000. Table 7-1 through Table 7-9 includes a summary of funding needs per BMP type and planning tiers for each watershed. Project costs are inclusive of all project elements and include design, permitting, obtaining land right-of-way (ROW), and construction. This estimate does not account for inflation, interest, monitoring, or operation and maintenance costs. When projected implementation costs were unavailable, project costs were estimated using unit costs from the County's active projects implemented between FY21 and FY24 For stream restoration a unit cost of $1,080 per linear foot of project length was used. Stormwater BMPs were estimated using the cost per impervious acre credit (IA) at $54,000 per acre treated. When IA was greater than 50 acres the cost was capped at $2,500,000, and when IA was greater than 100 acres the cost was capped at $3,000,000.

The costs are presented based on restoration planning periods out to FY39. The total costs of the suite of BMPs determined after project prioritization (see Section 5.3), and necessary to meet the TMDL SW-WLAs assigned to Anne Arundel County's Phase I MS4 was calculated and are presented in Table 7-1 through 7-9.

Table 7-1. Restoration Cost for Interim Programmed and Planned Implementation in the Baltimore Harbor Non-Tidal Watershed

Project Type	Interim Programmed	Planned	Total Cost
New Stormwater BMP	$4,561,623	$0	$4,561,623
BMP Conversion	$0	$9,050,570	$9,050,570
Stream Restoration	$40,704,267	$7,916,718	$48,620,985
Outfall Stabilization	$507,761	$0	$507,761
		Grand Total	**$62,740,939**

Table 7-2. Restoration Cost for Interim Programmed and Planned Implementation in the Little Patuxent Watershed

Project Type	Interim Programmed	Planned	Total Cost
New Stormwater BMP	$1,571,713	$0	$1,571,713
Stream Restoration	$15,757,816	$0	$15,757,816
Outfall Stabilization	$2,386,607	$0	$2,386,607
		Grand Total	**$19,716,136**

Table 7-3. Restoration Cost for Interim Programmed and Planned Implementation in the Lower Patuxent Watershed

Project Type	Interim Programmed	Planned	Total Cost
Stream Restoration	$1,642,000	$1,725,840	$3,367,840
		Grand Total	**$3,367,840**

Table 7-4. Restoration Cost for Interim Programmed and Planned Implementation in the Middle Patuxent Watershed

Project Type	Interim Programmed	Planned	Total Cost
Stream Restoration	$4,104,000	$34,480,339	$38,584,339
		Grand Total	**$38,584,339**

Table 7-5. Restoration Cost for Interim Programmed and Planned Implementation in the Upper Patuxent Watershed

Project Type	Interim Programmed	Planned	Total Cost
Outfall Stabilization	$2,001,430	$0	$2,001,430
		Grand Total	**2,001,430**

Table 7-6. Restoration Cost for Interim Programmed and Planned Implementation in the Patapsco River Lower North Branch Watershed

Project Type	Interim Programmed	Planned	Total Cost
New Stormwater BMP	$7,848,070	$0	$7,848,070
BMP Conversion	$0	$0	$0
Stream Restoration	$21,032,659	$0	$21,032,659
Impervious Surface Reduction to Turf	$0	$0	$0
		Grand Total	**$28,880,729**

Table 7-7. Restoration Cost for Interim Programmed and Planned Implementation in the South River Watershed

Project Type	Interim Programmed	Planned	Total Cost
New Stormwater BMP	$483,160	$0	$483,160
Stream Restoration	$19,904,344	$0	$19,904,344
Outfall Stabilization	$2,925,105	$0	$2,925,105
Impervious Surface Reduction to Forest	$30,614	$0	$30,614
Impervious Surface Reduction to Turf	$63,676	$0	$63,676
		Grand Total	**$23,406,899**

Table 7-8. Restoration Cost for Interim Programmed and Planned Implementation in the Other West Chesapeake Bay Watershed

Project Type	Interim Programmed	Planned	Total Cost
Stream Restoration	$0	$15,179,292	$15,179,292
		Grand Total	**$15,179,292**

Table 7-9. Restoration Cost for Interim Programmed and Planned Implementation in the West River Watershed

Project Type	Interim Programmed	Planned	Total Cost
BMP Conversion	$0	$275,548	$275,548
Stream Restoration	$1,947,220	$4,104,000	$6,051,220
Urban Tree Planting	$36,885	$0	$36,885
		Grand Total	**$6,363,653**

7.2 Implementation Schedule and Milestones

This section presents the target loads and activities required to achieve those targets based on milestone implementation targets. For the purposes of identifying the updated Target Year and Milestone 1 Year, the cost of each project was assumed to be recognized in the year of project completion. In reality, project funding will be encumbered in the years prior to project implementation and potentially split across design and construction phases depending on the project contracting type used. County annual budgets and CIP plans will include greater annual budget detail breaking down project implementation costs.

For this Plan, the FY associated with Milestone 1 is based on the latest implementation year for Interim Programmed projects in each watershed. The Milestone 1 load is the total load after Interim Programmed project implementation.

7.2.1 Implementation Milestones

To meet the loading allocations outlined in Section 1.2 and throughout Section 6, implementation of programs and BMPs must keep pace and meet future implementation targets. The Target Year may be revisited to account for budgetary or implementation schedule changes within each watershed. The most recent updates presented in this Plan include significant changes in implementation schedule, including the Target Year, due to the transition of modeling to Phase 6 of the Chesapeake Bay Watershed Model (CBWM). The previous Target Year for each watershed as stated in the *FY24 Countywide TMDL Stormwater Plan* (Anne Arundel County, 2024) is provided in Table 7-10. Updated Milestone 1 and Target Years that reflect the optimized future implementation are also presented in Table 7-10.

Table 7-10. Previous and Updated Milestone and Target Year Schedules for the TSS TMDLs

TMDL Watershed	Previous Target Year	Updated Milestone 1	Updated Target Year	Current Progress % Reduction	Target % Reduction
Baltimore Harbor Non-Tidal	2035	2029	2037	11.1%	58.0%
Little Patuxent River	2025	2027	2026[1]	9.5%	20.5%
Lower Patuxent River	2030	2025	2026	0.0%	61.0%
Middle Patuxent River	2030	2025	2039	0.5%	56.0%
Upper Patuxent River[2]	2025	2029	2029	1.9%	11.4%
Patapsco River Lower North Branch	2025	2028	2034	7.6%	22.2%
South River	2025	N/A[3]	N/A	40.8%	28.0%
Other West Chesapeake Bay	2030	N/A[4]	2037	1.3%	33.0%
West River	2030	2027	2034	0.7%	22.0%

[1]SW-WLA will be achieved in 2026; however full BMP implementation will be completed in 2030
[2]Based on Milestone 1 definition, this year aligns with the updated Target Year
[3]Per Progress modeling, SW-WLA achieved in the South River watershed
[4]Other West Chesapeake Bay did not have any Interim Programmed BMPs identified, so no Milestone 1 Year listed

7.2.2 Loading Allocations and Milestone Targets

Load allocations for Milestone 1 and Target Year for the nine watersheds with sediment TMDLs are presented in Table 7-11 below. Sediment reduction progress is already underway with the implementation of strategies throughout the watershed. Based on future modeling in the TIPP tool, after implementing the Interim Programmed and Planned BMPs described in Section 6, Anne Arundel County will meet its sediment SW-WLA for each watershed by the Target Years listed in Table 7-11.

Table 7-11. Local TMDL Milestone and Target Loads and Reductions, TSS (EOS lbs/yr)

	Baltimore Harbor Non-Tidal	Little Patuxent River	Upper Patuxent River	Middle Patuxent River	Lower Patuxent River	Patapsco River Lower North Branch	South River[1]	Other West Chesapeake Bay[2]	West River
Target Load (SW-WLA)	9,145,527	15,047,258	11,314,310	6,982,285	767,132	12,960,021	13,634,211	7,363,965	7,150,214
Target Reduction Required	12,629,537	3,880,111	1,455,792	8,886,545	1,199,873	3,698,104	5,302,193	3,627,028	2,016,727
Target % Reduction	58.0%	20.5%	11.4%	56.0%	61.0%	22.2%	28.0%	33.0%	22.0%
Milestone 1 Load	13,126,285	12,243,070	9,799,032	14,850,272	971,188	12,510,397	8,468,600	10,848,572	8,127,097
Milestone 1 Reduction	8,648,779	6,684,298	2,971,069	1,018,558	995,817	4,147,728	10,467,804	142,421	1,039,844
Target Year Full Implementation Load	9,115,214	12,243,070	9,799,032	6,932,564	718,631	12,510,397	8,468,601	7,362,957	7,146,928
Target Year Full Implementation Reduction	12,659,850	6,684,298	2,971,069	8,936,266	1,248,374	4,147,728	10,467,804	3,628,036	2,020,013
Target Year Full Implementation Reduction %	58.1%	35.3%	23.3%	56.3%	63.5%	24.9%	55.3%	33.0%	22.0%
Target Year	*2037*	*2026*[2]	*2029*	*2039*	*2026*	*2034*	*N/A*	*2037*	*2034*

[1] Per Progress modeling, SW-WLA achieved in the South River watershed

[2] SW-WLA will be achieved in 2026; however full BMP implementation will be completed in 2030 (35.3% reduction)

8 Load Reduction Evaluation Criteria

Adaptive management is a critical component of achieving the SW-WLAs required in the sediment TMDL watersheds. As presented in Section 7 of this plan, the County has established implementation and load reduction targets, and milestone dates as interim planning targets to facilitate assessment of progress toward the final load reduction targets.

Progress will be measured through three approaches: tracking implementation of management measures, estimating load reductions through modeling, and tracking overall program success through long term monitoring. Planning targets will be re-evaluated against progress and revised to ensure that Anne Arundel County is on track to meet established goals. Progress assessments are completed annually and reported to MDE with the County's annual report.

8.1 Tracking and Reporting Implementation of Management Measures

Anne Arundel County manages a comprehensive system for adding and tracking projects and accounting for new programs. New BMPs constructed through new development and redevelopment projects are entered into the County's BMP database and NPDES MS4 geodatabase as they come on-line. DPW-BWPR is responsible for implementing and tracking Water Quality Improvement Projects (WQIP; i.e., restoration and retrofit projects and programs). The County's Bureau of Highway Road Operation Division, which is responsible for maintenance efforts (i.e., street sweeping and inlet cleaning), reports details of their progress to DPW-BWPR for full tabulation of BMPs and their load reductions. The County captures and tracks projects implemented by the Anne Arundel Watershed Stewards Academy (AAWSA) and the DPW-BWPR Chesapeake Bay Trust Restoration Grant Program.

Countywide Stormwater TMDL Implementation Plan

Anne Arundel County produces a Countywide TMDL Stormwater Implementation Plan annually to assess and report progress for each County TMDL that has a complete and final implementation plan in place. The report includes implementation and load reduction summaries for the projects and programs completed in the current reporting year, and also for the full restoration period from the baseline through the current reporting year. Comparisons are made against the planned implementation targets to determine if the County is on track. Costs of program implementation are reported. For sediment TMDLs, a section is dedicated to reporting County water quality and biomonitoring results from the Countywide Biological Stream Survey and from any relevant targeted restoration monitoring sites. See Section 10 for more details on the County's monitoring programs. The Countywide TMDL Stormwater Implementation Plan is submitted to MDE with the County's MS4 Annual Report.

Annual NPDES Reporting

As a requirement of the NPDES permit described in Part V.A, on or before December 31 of each year, the County must submit a progress report demonstrating implementation of the NPDES stormwater program based on activities of the previous fiscal year. If the County's MS4 Annual Report does not demonstrate compliance with their permit and show progress toward meeting SW-WLAs, the County must implement BMP and program modifications within 12 months. The MS4 Annual Report includes the following (items in bold font directly relate to elements of the load reduction evaluation criteria):

a. The status of implementing the components of the stormwater management program that are established as permit conditions including:
    i. Permit Administration,
    ii. Legal Authority,

iii. Source Identification
iv. **Stormwater Management**
v. Erosion and Sediment Control
vi. Illicit Discharge Detection and Elimination
vii. Property Management and Maintenance
viii. Public Education
ix. **Stormwater Restoration**
x. **Countywide Stormwater TMDL Implementation Plan**
xi. Assessment of Controls, and
xii. **Program Funding**.

b. A narrative summary describing the results and analyses of data, including monitoring data that is accumulated throughout the reporting year
c. Expenditures for the reporting period and the proposed budget for the upcoming year
d. A summary describing the number and nature of enforcement actions, inspections and public education programs.
e. The identification of water quality improvements and documentation of attainment and/or progress toward attainment of benchmarks and applicable WLAs developed under EPA approved TMDLs; and,
f. The identification of any proposed changes to the County's program when WLAs are not being met.

All annual reporting is required to be made using MDE's MS4 Geodatabase format. Elements of the database, following MDE's current schema (Version 2.1, July 2024), include feature classes and associated tables that store and report the County's restoration projects to MDE. MDE and the CBP use the data for larger scale Chesapeake Bay modeling and TMDL compliance tracking. The most relevant database features include:

- AltBMPLine - stream restoration, shoreline restoration, outfalls
- StreamRestorationProtocols – details of stream restoration projects
- AltBMPPoint – septic system practices (pump-out, upgrades, connections)
- AltBMPPoly – tree planting, street sweeping, storm drain cleaning, impervious removal
- BMP – stormwater BMPs (bioretention, filtering practices, wet ponds etc.)

Financial Assurance Plan and Watershed Protection and Restoration Program Reporting

The County's Financial Assurance Plan (FAP) and the Watershed Protection and Restoration Program (WPRP) report outline the County's financial ability to meet its impervious surface and local and Chesapeake Bay TMDL obligations and is another mechanism of reporting progress with a focus on funding. The reports demonstrate the County's ability to fund projects that will reduce pollutants of concern and make measurable progress towards improving water quality. Anne Arundel County's first FAP was submitted to MDE in July of 2016, and submitted an updated version was adopted by the County Council on October 3, 2022 (Resolution #37-22) and submitted as an appendix to the County's FY22 Annual NPDES MS4 Report. A copy of the 2022 Financial Assurance Plan can be found at:
https://www.aacounty.org/public-works/bwpr/npdes-ms4-permit/financial-assurance-plan

8.2 Tracking Load Reductions through Modeling

The County performs modeling annually to evaluate load reductions and progress towards meeting SW-WLA goals. The load reductions are reported in the County's NPDES annual report and the Countywide

Stormwater TMDL Implementation Plan progress report, as described above. These progress assessments allow the reevaluation of management plans, and adjustments are made as technologies and efficiencies change, programs mature, and regulations are put in place. The County is currently modeling load reductions for sediment TMDLs using the TIPP spreadsheet tool, as described in Section 6 of this plan. Modeled load reductions of current progress and future implementation are compared annually against benchmarks and implementation plans are adjusted accordingly.

8.3 Tracking Overall Program Success through Monitoring

The ultimate test of program success is monitoring to assess any changes in water quality. This assessment is done using trends identified through the monitoring programs described below in Section 10. Sediment TMDLs in particular are based on impairments identified through biological stream monitoring results, therefore continued monitoring of those resources is crucial to determine if restoration and sediment reduction efforts have the desired effect. Ultimately, biological monitoring data will be used by the County and MDE to determine subwatersheds and reaches that are meeting water quality standards and are candidates for removal from the State's impaired waters list.

8.4 Adaptive Management Process

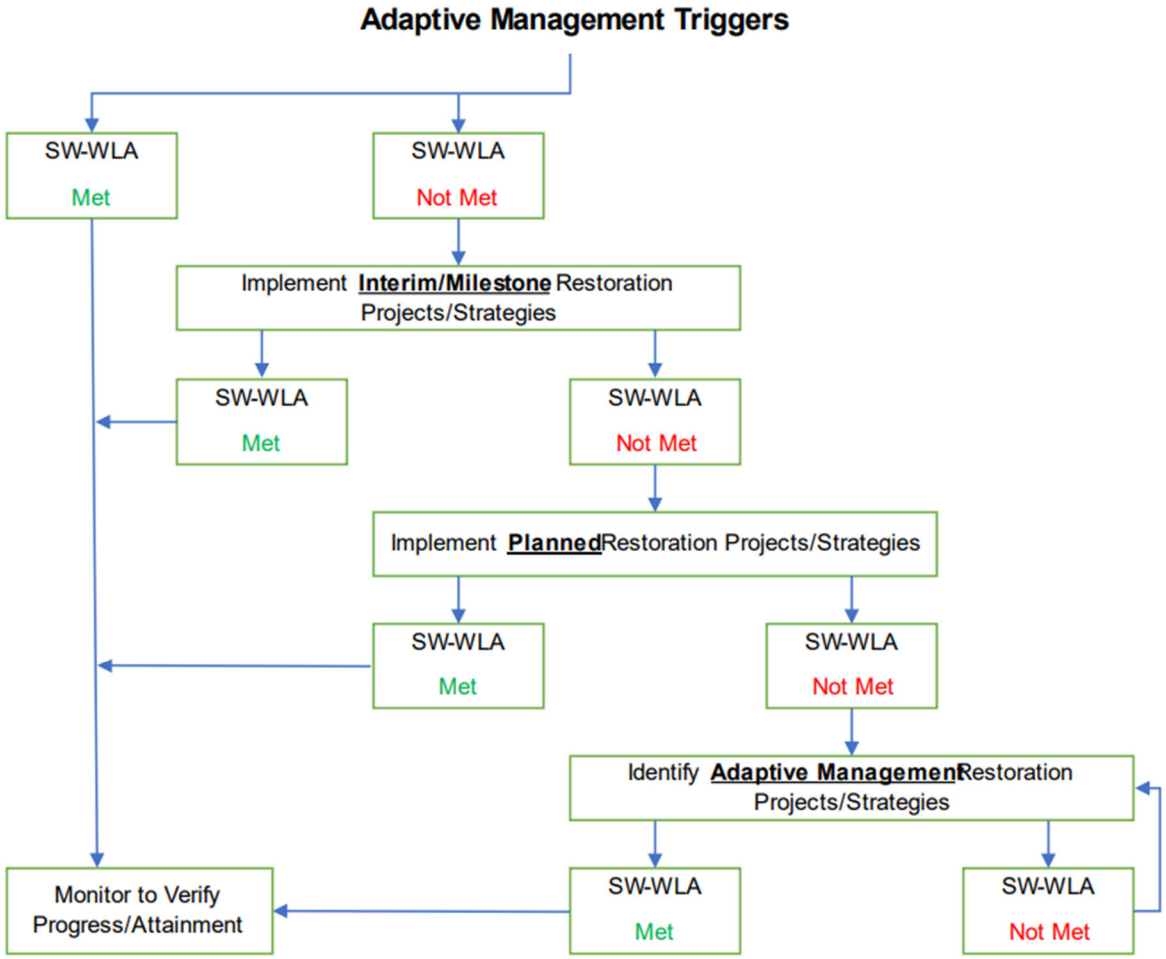
Feasibility studies of the future strategies may reveal that some existing structures or sites identified for retrofitting or enhancement may not be feasible candidates for future projects and may be eliminated from consideration. Since many restoration projects will need to be done on private property, lack of approval by private property owners may also impact the number and types of projects that can be accomplished. The County will take an adaptive management approach and will re-evaluate treatment needs as feasibility studies progress. The County will take an adaptive management approach and will re-evaluate treatment needs as feasibility studies progress. The County will continue to track the overall effectiveness of the various BMP strategies and will adapt the suite of solutions based on the results. New technologies are continuously developed and evaluated to determine their pollutant control efficiencies, and the County regularly explores avenues to incorporate innovative programs, emerging technologies, and new partnerships into its restoration program. The County will also continue to monitor changes in regulations and policy that could impact the program.

The County will follow an adaptive management process guided by the information feedback loops shown in Figure 8-1 to evaluate implementation of this plan. Once the plan is reviewed and approved by MDE, the County will immediately begin implementing the outlined strategies. The County will monitor implementation progress on a regular basis and report progress and load reductions achieved to MDE with the NPDES annual report and at milestone intervals, which is defined the latest implementation year assigned to Interim Programmed BMPs in each watershed (see Section 7.2 for more details). The County and IWPP will also hold semi-annual meetings. Monitoring methods are described in detail in Section 10.

If new methods of stormwater treatment are identified, or better approaches to source control are found, the plans can be extended and updated to take these changes into account. Similarly, if some elements of the plans are not as successful as expected, adaptations and improvements will be incorporated in future updates. Plans may also change if pollutant removal crediting methods are modified in the future.

When progress modeling shows achievement of the allocated SW-WLAs (e.g., South River attainment in FY22), the County will develop an attainment plan that incorporates a monitoring component that is consistent with the water quality criteria specific to designated uses discussed in Section 2.2.1. This

attainment plan reduces the likelihood of backsliding and ensures BMPs are regularly inspected and maintained. Water quality monitoring and biological monitoring consistent with MDE's designated use and water quality criteria assessment methodologies will be implemented at that time.



Source: Anne Arundel County, 2024a

Figure 8-1. Anne Arundel County's Adaptive Implementation Cycle

9 BMP Inspection and Maintenance

With BMPs installed throughout the watershed and successful attainment of sediment WLA goals, it is important that the BMPs remain functional and maintained. Anne Arundel County has established policies and procedures in place for stormwater management facility inspection, maintenance, and enforcement.

Both the State and County stormwater management (SWM) Codes require maintenance inspections to be performed on all SWM practices during the first year of operation and every three years thereafter. The first year of operation inspections are performed by the Environmental Control Inspectors before Certificates of Completion are issued for the grading permits under which the practices were constructed. The three-year maintenance inspections include assessment of debris and trash accumulation, plant composition and health, vegetative cover, dewatering, erosion, sediment and/or leaves and debris accumulation, blockages, structure components, maintenance access, and overall function of facility. The

responsibility for triennial maintenance inspections of BMPs is divided between two groups of inspectors within the County. All BMPs owned or maintained by DPW are inspected by the DPW-BWPR's Stormwater Infrastructure Program (SIP) inspectors. In addition to performing triennial maintenance inspections and identifying all maintenance and repairs required, these inspectors utilize established contracts to promptly address any issues noted during the inspection. For certain significant repairs or upgrades, where the necessary work exceeds existing contracts, CIP may be planned to address compliance issues for those BMPs. SIP inspectors then perform follow-up inspections to verify that all work was completed properly and that the BMP functions as designed and is in compliance with all State and County SWM Codes.

BMPs not owned or maintained by DPW-BWPR are inspected by the Department of Inspection and Permits Environmental Control Inspectors on a triennial basis. The inspection and enforcement processes utilized by these inspectors are detailed below.

9.1 Phase 1 Inspection and Enforcement

Phase 1 reflects the first time a SWM practice receives a three-year maintenance inspection and maintenance is required. Using the proper Maintenance Inspection Checklists, the Inspector performs the required three-year maintenance inspection, indicating on the Checklist boxes if maintenance is required, not required or the item is non-applicable. The information on the completed Checklist will serve to comply with the inspection requirements of COMAR 26.17.02.11 and is used to complete a Phase 1 Correction Notice issued in the field or mailed to the property owner. The Phase 1 Correction Notices are prepared using the I&P standard computerized inspection report software. They include a detailed description of the maintenance required and the compliance date by which the required maintenance is to be completed. If necessary, Phase 1 Correction Notices can be completed by hand using the standard Environmental Programs Inspection Report Form. Phase 1 Correction Notices contain the proper contact information. The BMP geodatabase is updated to document when a three-year Maintenance Inspection is performed. For monthly reporting purposes, all re-inspections are recorded as inspections and not as facilities inspected or as new correction notices issued. Depending on the degree of maintenance required, a Compliance Schedule may be appropriate. All proposed Compliance Schedules must be authorized by the I&P Environmental Control Inspection Supervisor.

9.2 Phase 2 Inspection and Enforcement

Phase 2 reflects situations where Phase 1 Enforcement was not successful in obtaining compliance. Phase 2 Enforcement consists of a formal Phase 2 Violation Notice in the form of a certified letter to the property owner or responsible party. The Phase 2 Violation Notice is prepared by the Environmental Control Inspector using the appropriate form letter, reviewed by the Environmental Control Inspection Supervisor/Environmental Code Administrator as appropriate, and signed by the Environmental Control Inspection Supervisor. The Phase 2 Notice establishes final compliance dates for the completion of the required maintenance. The final compliance dates may reflect agreed upon Compliance Schedules as authorized by the Environmental Control Inspection Supervisor.

9.3 Phase 3 Inspection and Enforcement

Phase 3 reflects situations where Phase 2 Enforcement was not successful in obtaining compliance. Phase 3 enforcement consists of a legal referral to the Office of Law for the enforcement of the Private Inspection and Maintenance Agreement recorded against the deed for the property in question. The referral is prepared by the Environmental Code Administrator using the records associated with the violation.

10 Monitoring

To determine the specific parameters to be monitored for tracking progress, one must understand the approach used for the initial listing. In 2002, the State began listing biological impairments on the Integrated Report, at the 8-digit scale, based on a percentage of stream miles degraded and whether they differ significantly from a reference condition watershed (i.e., <10% stream miles degraded). The biological listing is based on Benthic and Fish Indices of Biotic Integrity (BIBI/FIBI) results from wadeable streams from assessments conducted by the Maryland Department of Natural Resources (MDNR) Maryland Biological Stream Survey (MBSS) and supplemented with data from MDE where available.

MDE then utilized its Biological Stressor Identification (BSID) process to identify the probable or most likely causes of poor biological conditions. The range of potential causes can vary across watersheds, but the County's sediment TMDL watersheds all have impairments related to sediment noted and references to elements such as "altered flow / sediment and instream habitat related stressors". The result was sediment TMDLs published for the County's nine watersheds with TSS as the listed stressor. While sediment is the listed stressor, the ultimate endpoint, and therefore the focus of monitoring attainment, is whether biological conditions are meeting water quality standards, which includes BIBI and FIBI scores at 3.0 or greater.

While historically the official monitoring for Integrated Report assessments and impairment status has been the responsibility of the State, MDE does solicit and include data from other sources, including Anne Arundel County, in the Integrated Report. Additionally, the County's current MS4 permit includes a Watershed Assessment element (permit section IV.G.2) requiring biological monitoring and habitat assessment. The goal of the permit element is to provide data to supplement State programs and support listing and attainment assessments. The permit requirement is met by Anne Arundel County's Countywide Biological Stream Survey. Data from the stream survey, as described in Section 10.1 below, is considered by MDE to be a Tier III data source indicating it has been vetted and meets quality objectives. County data in the 2024 Integrated Report was used for informational purposes and will be integrated into biological assessments in future Integrated Reports (MDE, 2024a).

Ultimately, MDE and Anne Arundel County seek to attain the TMDL, demonstrate that biological conditions are meeting water quality standards, and ultimately remove the watersheds from the Integrated Report's list of impaired waters. MDE's de-listing methodology (MDE, 2023) details the monitoring approach using vetted biological monitoring data collected and analyzed with MBSS methods to demonstrate that biological conditions meet standards and be considered for de-listing.

In addition to the Countywide Stream Survey, DPW-BWPR has several on-going monitoring programs that target measures of water quality. Those monitoring elements are described below.

10.1 Countywide Biological Monitoring

In 2004, a Countywide Biological Stream Survey was developed to assess the biological condition of the County's streams at multiple scales (i.e., site-specific, primary sampling unit (PSU), and countywide). Under the program, biology (i.e., benthic macroinvertebrates and fish), stream habitat, as well as geomorphological and water quality parameters, are assessed at 8 sites in each of the 24 PSUs sites throughout the entire County over a 5-year period using a probabilistic, rotating-basin design. Round One of the County's Biological Monitoring and Assessment Program occurred between 2004 and 2008, Round Two occurred between 2009 and 2013, Round Three occurred between 2017 and 2021, and Round 4

began in 2023 and is on-going. As described above, the program meets the goals and requirements of the Watershed Assessment element of the County's MS4 permit.

The comprehensive monitoring and assessment program allows County watershed managers to:

- Document the ecological status of Anne Arundel County watersheds,
- Contribute to understanding dominant stressors and stressor sources affecting stream and watershed ecology,
- Track ecological health trends in the County's watersheds over time, and
- Have monitoring data as an integral part of resource management in the County.

10.2 Watershed Assessment

Between 2001 and 2018, Anne Arundel County initiated and completed a series of systematic and comprehensive watershed assessments and management plans for restoration and protection across the County covering each major County watershed. The plans are developed within a regulatory context that includes NPDES MS4 requirements, local TMDLs and Watershed Implementation Plans for the Chesapeake Bay TMDL, Maryland Stormwater Regulations and the Water Resources Element of the County's General Development Plan. The completed assessments involved intensive field investigations. Going forward, the County is using desktop watershed assessments techniques to evaluate watershed conditions and identify potential restoration areas. The County is investigating use of desktop methods compared against previously measured field conditions to document changes over time.

10.3 Supplemental Monitoring

Monitoring related to sediment TMDL compliance and attainment can take on many forms. In addition to the Countywide program described above, several County monitoring and inspection programs are in place to ensure that the goals of specific restoration projects are being met and to identify opportunities to correct potential issues related to stability, hydrology, and/or biology.

Stream Restoration Monitoring - Monitoring the stability and success of restoration activities, including stream restoration, is often a requirement of the MDE and USACE joint permit for the Alteration of Floodplain, Waterway, Tidal or Nontidal Wetlands in Maryland. Pre- and post- restoration monitoring is conducted on a project specific basis. The monitoring required is based on the type of project, specific project elements, and the associated success criteria, but generally include measures of channel geometry, stream stability, wetland establishment, vegetation success, and photo-documentation. The County completes the required monitoring per the permit and identifies corrective action where needed. The County generally evaluates biological integrity at all proposed stream restoration sites prior to the permitting stage, including evaluating BIBI and FIBI scores. Not only does this help with project planning, but this information can also help re-prioritize sites that were determined to be data deficient during the project prioritization.

Stream Restoration Inspection/Verification – Stream restoration project credits for TMDL reductions and impervious surface restoration credit are maintained through inspection of project sites at least once every five years to ensure the project is stable and functioning as intended. The County conducts the inspections on a routine basis to maintain the credits and follows up with corrections to project issues when needed.

General Monitoring – The County regularly identifies sites for additional monitoring outside of that required by permit conditions. Project types monitored include stream restoration and sand seepage wetlands and include biological monitoring of benthic macroinvertebrates and fish, habitat assessment, and water quality analysis.

BMP Inspection – As described in Section 8, the County conducts triennial inspection of stormwater BMPs to ensure BMPs are in place, stable, and functional. Passing inspections maintain TMDL and impervious surface restoration credits while failing BMPs are noted for corrective actions to return the facility to its fully functional state.

Pooled Monitoring Program – The County participates in a Chesapeake Bay Trust (CBT)–coordinated pooled monitoring program to meet BMP Effectiveness and Watershed Assessment requirements. Funds support the CBT Restoration Research Program to advance watershed restoration science. Participation streamlines permit compliance and reduces local monitoring costs, though permittees may opt for independent monitoring based on local needs.

Biological Trend Network – Biological Trend Network (BTN) – A network of long-term sites selected from other existing County monitoring programs with one site located in each of the County's twelve 8-digit watersheds. Sites were selected based on drainage area characteristics, land use and land cover similarity to watershed averages, and with biological index scores greater than the watershed average. Selecting sites with higher biological index scores may help identify the full range of interannual variability in ecological data which can aid in analysis of biological monitoring data collected within the County. Sites are sampled annually for benthic macroinvertebrates as well as stream physical habitat and fish data are collected biennially. Data from this program are used to measure variability attributable to climactic extremes (e.g. wet years, dry years) which is difficult to detect with the rotating watershed design of the Countywide Biological Stream Survey. A subset of restoration sites are adopted into the Long-Term Trend (LTT) monitoring network.

Long-Term Trend (LTT) – Sites sampled in and around restoration projects on a longer-term basis then is typically required to meet permit conditions. Restoration sites in this program may have up to 10 years of data. Each grouping of sites may have different monitoring goals based on the restoration project goals. Sites are generally sampled for benthic macroinvertebrates and physical habitat annually with some sites sampled for fish on a less frequent basis. Data from these site groupings are used to evaluate long-term restoration performance and ecological response.

11 Public Participation and Education

Public outreach and stewardship play an important role in improving water quality conditions. The County is committed to continuing and expanding programs and activities to educate and involve the community, with focused efforts to provide outreach to culturally diverse communities.

The County's public outreach and education program achievements are annually documented in the County's NPDES MS4 Annual Report (Anne Arundel County, 2024b). In summary, the County consistently surpasses the annual requirement of 75 outreach efforts through a combination of in-person events, virtual meetings, website engagement, and media outreach. A key component of this strategy is the DPW-BWPR's comprehensive education and outreach program. The DPW-BWPR's website, www.aarivers.org, serves as a central hub for residents seeking information on stormwater pollution, watershed restoration,

and related topics, linking to other County resources. Additionally, the DPW-BWPR regularly shares updates and communicates with residents/partners through our Facebook, Instagram, and LinkedIn accounts.

The County has a variety of organizations interested in water quality, including South River Federation; Anne Arundel County Commercial Owners; Anne Arundel County Chamber of Commerce, Environmental Committee; Leadership Anne Arundel; Chesapeake Environmental Protection Association and Anne Arundel Watershed Stewards Academy (AASWA; Anne Arundel County, 2012). The AAWSA, a pre-eminent non-profit (501(c)3) environmental organization, was formed through Anne Arundel County Department of Public Works and the County Board of Education's Arlington Echo Outdoor Education Center (Anne Arundel County, 2012). AAWSA's mission is to identify, train, and support citizens to become Master Watershed Stewards who take action with their neighbors to restore local waterways in Anne Arundel County. This program is a unique way to integrate education as a vital element in its role in preservation, conservation and advocacy. There are currently more than 100 certified Master Watershed Stewards throughout Anne Arundel County and adjacent areas.

In order to implement an effective strategy to meet water quality standards and achieve pollutant load reduction, an effort to engage a very broad audience of landowners is a necessity. The County has given numerous public presentations throughout the development of the County's TMDL Restoration Plans to disseminate information on the planning process and strategies for meeting the County's assigned pollutant load reductions. In addition to providing a level of understanding to the public, the County uses the presentations as an opportunity to receive input and comment on restoration efforts. For new restoration projects, DPW-BWPR holds public meetings (in-person and virtually) to inform residents and businesses about the project, potential impacts to community during construction, and long-term maintenance of the project.

12 References

Anne Arundel County. 2024a. Anne Arundel Countywide TMDL Stormwater Implementation Plan. FY24 Annual Progress Report. – December 2024. Annapolis, MD. Accessed from: https://aacoprod.aacounty.org/AACOServicePublic/rest/SharedDrive/BWPR-MS4/file/14tBb3fJiR4ht93gI5EV3WdA-PJz16njC

Anne Arundel County. 2024b. Fiscal Year 2024 NPDES MS4 Annual Report – December 2024. Annapolis, MD. Accessed from: https://aacoprod.aacounty.org/AACOServicePublic/rest/SharedDrive/BWPR-MS4/file/16gFwIrAMCdlSWYpyL

Anne Arundel County. 2022a. Non-Tidal Baltimore Harbor Watershed Sediment TMDL Restoration Plan. Prepared by LimnoTech, Washington, D.C. for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated December 2022. Accessed from: https://www.aacounty.org/sites/default/files/2023-04/balt-harbor-sediment-tmdl-plan.pdf

Anne Arundel County. 2022b. Non-Tidal South River Watershed Sediment TMDL Stormwater Wasteload Allocation Attainment Report. Prepared by KCI Technologies, Inc., Sparks, Maryland for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated December 2022. Accessed from: https://www.aacounty.org/sites/default/files/2023-04/2022-south-river-sediment-tmdl-plan.pdf

Anne Arundel County 2021a. Non-Tidal West River Watershed Sediment TMDL Restoration Plan. Prepared by LimnoTech, Washington, D.C. for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated December 2021. Accessed from: https://www.aacounty.org/sites/default/files/2023-04/non-tidal-west-river-watershed-plan.pdf

Anne Arundel County, 2021b. Plan2040: Anne Arundel County General Development Plan. Adopted May 3, 2021.

Anne Arundel County. 2020. Non-Tidal Patuxent River Lower and Middle Watersheds Sediment TMDL Restoration Plan. Prepared by LimnoTech, Washington, D.C. for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated January 2020. Accessed from: https://www.aacounty.org/sites/default/files/2023-04/Non%2520Tidal%2520Lower%2520and%2520Middle%2520Patuxent%2520River%2520Sediment%2520Restoration%2520Plan%2520Final%2520January%25202020%2520with%2520Appendices.pdf

Anne Arundel County. 2020. Other West Chesapeake Watershed Sediment TMDL Restoration Plan. Prepared by KCI Technologies, Inc., Sparks, Maryland for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated January 2020.

Anne Arundel County. 2017. Anne Arundel County Government Stormwater Management Practices and Procedures Manual – October 1, 2017. Accessed from: https://www.aacounty.org/sites/default/files/2023-03/Practices_Procedures_Manual.pdf

Anne Arundel County. 2016a. Little Patuxent River Sediment TMDL Restoration Plan. Prepared by KCI Technologies, Inc., Sparks Maryland for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated November 2016. Accessed from: https://www.aacounty.org/sites/default/files/2024-10/little_patuxent_restoration_plan_2016.11.17.pdf

Anne Arundel County. 2016b. Patapsco River Lower North Branch Sediment TMDL Restoration Plan. Prepared by KCI Technologies, Inc., Sparks, Maryland for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated November 2016. Accessed from: https://www.aacounty.org/sites/default/files/2023-04/Patapsco_LNB_Restoration_Plan_2016.11.17_1.pdf

Anne Arundel County. 2016c. Upper Patuxent River Sediment TMDL Restoration Plan. Prepared by KCI Technologies, Inc., Sparks, Maryland for Anne Arundel County Department of Public Works, Bureau of Watershed Protection and Restoration, Annapolis, Maryland. Dated November 2016. Accessed from: https://www.aacounty.org/sites/default/files/2025-06/31-upper_patuxent_restoration_plan_2016.11.16.pdf

Anne Arundel County. 2012. Anne Arundel County Government Chesapeake Bay TMDL Phase II Watershed Implementation Plan – July 2, 2012. Annapolis, Maryland.

CBP, 2017. Chesapeake Assessment and Scenario Tool (CAST) Version 2017d. Chesapeake Bay Program Office, Accessed from: https://cast.chesapeakebay.net

MDE. 2025. Maryland's 2025 Triennial Review of Water Quality Standards. Accessed from: https://mde.maryland.gov/programs/water/TMDL/WaterQualityStandards/Documents/WQSwebpageDocs/ANPRM_2025TriennialReview.pdf

Maryland Department of the Environment (MDE). 2024a. Maryland's Final Combined 2024 Integrated Report of Surface Water Quality. EPA Approval Date: September 4, 2024. Accessed from: https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Documents/Integrated_Report_Section_PDFs/IR_2024/MD%202024%20Final%20IR%209_4_24.pdf

MDE. 2024b. TMDL Implementation Progress and Planning Tool (TIPP). Version: 01/25/2024. Accessed from: https://mde.maryland.gov/programs/Water/TMDL/DataCenter/Pages/TMDLStormwaterImplementation.aspx

MDE. 2023. Delisting Methodology for Biological Assessments in Maryland's Integrated Report. October 2023. Accessed from: https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Documents/Assessment_Methodologies/Final_Draft_Delisting_Methodology_10_2_23.pdf

MDE. 2022a. General Guidance for Local TMDL Maximum Daily Load Stormwater Wasteload Allocation Watershed Implementation Plans. August 2022. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DataCenter/Documents/General_Guidance_for_Local_TMDL_WIPs_2022.pdf

MDE. 2022b. Guidance for Developing Local Nutrient and Sediment TMDL (Total Maximum Daily Load) Stormwater Wasteload Allocation (SW-WLA) Watershed Implementation Plans (WIPs). March 2022. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DataCenter/Documents/MDE_Nutrient_Sediment_Guidance_2022.pdf

MDE. 2022c. Total Maximum Daily Load of Sediment in the Non-Tidal Baltimore Harbor Watershed, Baltimore City, Baltimore County, and Anne Arundel County, Maryland. EPA Approval Date January 27, 2022. Accessed from: https://mde.maryland.gov/programs/water/TMDL/Baltimore_Harbor_02130903/Balt_Harbor_SedTMDL_final.pdf

MDE. 2021a. Maryland Department of the Environment National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit. 20-DP-3316, MD0068308. Effective Date: November 5, 2021. Accessed from: https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Documents/Final%20Determination%20Dox%20N5%202021/Anne%20Arundel%20County%20MS4%20Permit%20Final.pdf

MDE. 2021b. Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. Guidance for National Pollutant Discharge Elimination System Stormwater Permits. November 2021.

MDE. 2021d. Maryland's High Quality Waters (Tier II). Accessed from: https://mde.maryland.gov/programs/Water/TMDL/WaterQualityStandards/Pages/Antidegradation_Policy.aspx.

MDE. 2021e. Backcasting Land Cover Approved Methodology. Accessed from: https://mde.maryland.gov/programs/Water/TMDL/DataCenter/Documents/Backcasting_LC_Approved_Methodology_060421.pdf

MDE. 2019. Total Maximum Daily Load of Sediment in the Non-Tidal West River Watershed, Anne Arundel County, Maryland. EPA Approval Date: April 24, 2019. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DocLib_WestRiver_02131004/WestRiverSedTMDL_010719_final.pdf

MDE. 2018a. Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Lower Watershed, Anne Arundel, Calvert, Charles, Prince George's and Saint Mary's Counties, Maryland. EPA Approval Date: July 2, 2018. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DocLib_PaxLower_02131101/PATXL_SedTMDL_060418_final.pdf

MDE. 2018b. Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Middle Watershed, Anne Arundel, Calvert, and Prince George's Counties, Maryland. EPA Approval Date: July 2, 2018. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DocLib_PaxMiddle_02131102/PATXM_SedTMDL_060418_final.pdf

MDE. 2018c. Total Maximum Daily Load of Sediment in the Other West Chesapeake Watershed, Anne Arundel and Calvert Counties, Maryland. EPA Approval Date: February 9, 2018. Accessed from:

https://mde.maryland.gov/programs/water/TMDL/DocLib_WestChesapeake_02131005/OWC_SedTMDL_121117_final.pdf

MDE. 2017. Total Maximum Daily Load of Sediment in the Non-tidal South River Watershed, Anne Arundel County, Maryland. EPA Approval Date: September 28, 2017. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DocLib_South_02131003/South_River_SedTMDL_091117_final.pdf

MDE. 2014a. General Guidance for Developing a Stormwater Wasteload Allocation (SW-WLA) Implementation Plan. October 2014. Accessed from: https://mde.maryland.gov/programs/Water/TMDL/DataCenter/Documents/General_Implementation_Plan_Guidance_clean.pdf

MDE. 2014b. Watershed Report for Biological Impairment of the South River in Anne Arundel County, Maryland – Biological Stressor Identification Analysis Results and Interpretation. Maryland Department of the Environment, Baltimore, MD. Prepared for Water Protection Division, U.S. Environmental Protection Agency, Region III. Philadelphia, PA.

MDE. 2011a. Total Maximum Daily Load of Sediment in the Little Patuxent River Watershed, Howard and Anne Arundel Counties, Maryland. EPA Approval Date: September 30, 2011. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DocLib_LittlePax_02131105/LittlePatx_Sed_TMDL_093011_Final.pdf

MDE. 2011b. Total Maximum Daily Load of Sediment in the Patuxent River Upper Watershed, Anne Arundel, Howard and Prince George's Counties, Maryland. EPA Approval Date September 30, 2011. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DocLib_PaxUpper_02131104/UpperPatx_Sed_TMDL_093011_Final.pdf

MDE. 2011c. 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 – EPA Approval Date: September 30, 2011. Accessed from: https://mde.maryland.gov/programs/water/TMDL/DocLib_PatapscoLNB_02130906/PatapLNB_Sed_TMDL_093011_Final.pdf

U.S. Environmental Protection Agency (EPA). 2010. *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment*. Annapolis, MD: US Environmental Protection Agency, Chesapeake Bay Program Office.

Appendix A

Narrative descriptions of the scoring values for project metrics are provided below:

Metric	Scoring Description
Project Benefits	
Pollutant Removal	Raw values scaled to 1 to 5 scoring range
Combined Benefit	Raw values scaled to 1 to 5 scoring range
Biotic Integrity	1 – BIBI/FIBI Score of 4.0 - 5.0 (Good) 2 – BIBI/FIBI Score of 3.0 - 3.9 (Fair) 3 – [NO RATING] 4 – BIBI/FIBI Score of 2.0 - 2.9 (Poor) 5 – BIBI/FIBI Score of 1.0 - 1.9 (Very Poor)
Project Constraints	
Design/Construction	1 – Four or more design/construction constraints 2 – Three construction constraints 3 – Two construction constraints 4 – One construction constraint 5 – No construction constraints
Existing Utility Conflicts	1 – Complete overlap of utility 2 – Multiple instances of utility intersecting 3 – One instance of utility intersecting 4 – Utility adjacent 5 – No utility conflicts
Access	1 – Far from access road and difficult topography 2 – Far from access road, and easy topography 3 – Near access road and difficult topography 4 – Near access road and easy topography 5 – Near parking lot or bordering roadway
Natural Resource Conflicts	1 – Entirely overlapping wetland/open waterbody 2 – Multiple natural resource conflicts, adjacent to open waterbody 3 – Multiple natural resource conflicts, not near open waterbody 4 – One natural resources conflict 5 – No natural resources conflicts
Ownership	1 – Multiple private properties 2 – Private residence 3 – Business, Utility, or Homeowners Association 4 – State 5 – County
Project Costs	
Total Implementation Cost	Raw values scaled to 1 to 5 scoring range
Cost per Pollutant Removed	Raw values scaled to 1 to 5 scoring range

Project Prioritization Summary – Project Benefits

8 Digit Watershed Name	BMP ID	Project Type	Pollutant Removal			Combined Benefit		Biotic Integrity (BIBI)		Biotic Integrity (FIBI)	
			TSS Reduction (lbs/yr)	RANK (1-56)[1]	SCORE (1-5)	# of Sites	SCORE (1-5)	Rating	SCORE (1-5)	Rating	SCORE (1-5)
Baltimore Harbor Non-Tidal	AA06POI202196	Stormwater Retrofit	60,318.7	12	1.8	3	5.0	--	3	--	3
Baltimore Harbor Non-Tidal	AA06POI207565	Stormwater Retrofit	430,586.0	37	3.6	0	1.0	--	3	--	3
Baltimore Harbor Non-Tidal	AA10POI202701	Stormwater Retrofit	150,269.4	20	2.4	0	1.0	--	3	--	3
Baltimore Harbor Non-Tidal	AA88POI201944	Stormwater Retrofit	43,295.8	9	1.6	0	1.0	--	3	--	3
Baltimore Harbor Non-Tidal	AA91POI201827	Stormwater Retrofit	105,424.9	16	2.1	0	1.0	--	3	--	3
Baltimore Harbor Non-Tidal	AA91POI202283	Stormwater Retrofit	142,345.2	19	2.3	2	3.7	--	3	--	3
Baltimore Harbor Non-Tidal	AA93POI204199	Stormwater Retrofit	45,332.7	10	1.7	1	2.3	--	3	--	3
Baltimore Harbor Non-Tidal	AA93POI204655	Stormwater Retrofit	50,379.0	11	1.7	0	1.0	--	3	--	3
Baltimore Harbor Non-Tidal	AA97POI204298	Stormwater Retrofit	265,375.6	30	3.1	1	2.3	--	3	--	3
Baltimore Harbor Non-Tidal	AA97POI207627	Stormwater Retrofit	163,702.3	21	2.5	1	2.3	--	3	--	3

8 Digit Watershed Name	BMP ID	Project Type	Pollutant Removal			Combined Benefit		Biotic Integrity (BIBI)		Biotic Integrity (FIBI)	
			TSS Reduction (lbs/yr)	RANK (1-56)[1]	SCORE (1-5)	# of Sites	SCORE (1-5)	Rating	SCORE (1-5)	Rating	SCORE (1-5)
Baltimore Harbor Non-Tidal	AA98POI203421	Stormwater Retrofit	17,166.4	8	1.5	0	1.0	--	3	--	3
Baltimore Harbor Non-Tidal	STRE_PT0_063	Stream Restoration	504,255.1	43	4.1	1	2.3	--	3	--	3
Baltimore Harbor Non-Tidal	STRE_PT8_032	Stream Restoration	1,279,149.1	55	4.9	1	2.3	--	3	--	3
Baltimore Harbor Non-Tidal	STRE_PTB_039	Stream Restoration	625,890.3	45	4.2	3	5.0	--	3	--	3
Baltimore Harbor Non-Tidal	STRE_PTG_131	Stream Restoration	2,753,439.0	56	5.0	3	5.0	1.00	5	2.00	4
Lower Patuxent River	STRE_MPX_006	Stream Restoration	252,556.9	28	3.0	1	2.3	2.14	4	2.33	4
Middle Patuxent River	MP0023	Stream Restoration	408,406.4	35	3.5	0	1.0	--	3	--	3
Middle Patuxent River	MP3027	Stream Restoration	536,399.2	44	4.1	0	1.0	--	3	--	3
Middle Patuxent River	MP6009	Stream Restoration	655,960.0	46	4.3	0	1.0	--	3	--	3
Middle Patuxent River	MP7062	Stream Restoration	736,396.3	49	4.5	0	1.0	--	3	--	3
Middle Patuxent River	MPH025	Stream Restoration	460,188.8	40	3.8	0	1.0	--	3	--	3
Middle Patuxent River	MPM007	Stream Restoration	758,855.2	50	4.6	0	1.0	--	3	--	3
Middle Patuxent River	MPN050	Stream Restoration	483,079.2	41	3.9	0	1.0	1.58	5	2.00	4

8 Digit Watershed Name	BMP ID	Project Type	Pollutant Removal			Combined Benefit		Biotic Integrity (BIBI)		Biotic Integrity (FIBI)	
			TSS Reduction (lbs/yr)	RANK (1-56)[1]	SCORE (1-5)	# of Sites	SCORE (1-5)	Rating	SCORE (1-5)	Rating	SCORE (1-5)
Middle Patuxent River	MPO017	Stream Restoration	490,568.8	42	4.0	0	1.0	--	3	--	3
Middle Patuxent River	MPQ010	Stream Restoration	904,158.4	53	4.8	1	2.3	--	3	--	3
Middle Patuxent River	MPQ015	Stream Restoration	701,220.0	48	4.4	1	2.3	--	3	--	3
Middle Patuxent River	MPU004	Stream Restoration	896,024.0	52	4.7	0	1.0	--	3	--	3
Middle Patuxent River	MPV001	Stream Restoration	886,451.2	51	4.6	0	1.0	--	3	--	3
Patapsco River Lower North Branch	AA00POI101578	Stormwater Retrofit	340,884.7	32	3.3	3	5.0	1.57	5	2.00	4
Patapsco River Lower North Branch	AA09POI202048	Stormwater Retrofit	120,816.3	17	2.2	2	3.7	--	3	--	3
Patapsco River Lower North Branch	AA09POI202049	Stormwater Retrofit	93,781.2	14	1.9	2	3.7	--	3	--	3
Patapsco River Lower North Branch	AA09POI202050	Stormwater Retrofit	91,003.9	13	1.9	2	3.7	--	3	--	3
Patapsco River Lower North Branch	AA60POI201974	Stormwater Retrofit	177,027.8	23	2.6	1	2.3	--	3	--	3
Patapsco River Lower North Branch	AA84POI204242	Stormwater Retrofit	96,307.6	15	2.0	0	1.0	--	3	--	3
Patapsco River Lower North Branch	AA91POI202055	Stormwater Retrofit	140,577.4	18	2.2	2	3.7	--	3	--	3

8 Digit Watershed Name	BMP ID	Project Type	Pollutant Removal			Combined Benefit		Biotic Integrity (BIBI)		Biotic Integrity (FIBI)	
			TSS Reduction (lbs/yr)	RANK (1-56)[1]	SCORE (1-5)	# of Sites	SCORE (1-5)	Rating	SCORE (1-5)	Rating	SCORE (1-5)
Patapsco River Lower North Branch	STRE_PNB_030	Stream Restoration	1,066,400.0	54	4.9	2	3.7	--	3	--	3
Other West Chesapeake Bay	HB0010	Stream Restoration	386,532.8	34	3.4	2	3.7	--	3	--	3
Other West Chesapeake Bay	HB2001	Stream Restoration	257,771.2	29	3.0	0	1.0	--	3	--	3
Other West Chesapeake Bay	HB2021	Stream Restoration	440,596.8	38	3.7	0	1.0	--	3	--	3
Other West Chesapeake Bay	HB2026	Stream Restoration	206,088.0	24	2.7	0	1.0	--	3	--	3
Other West Chesapeake Bay	HB2032	Stream Restoration	223,448.0	25	2.7	2	3.7	--	3	--	3
Other West Chesapeake Bay	HB2035	Stream Restoration	419,864.0	36	3.5	1	2.3	--	3	--	3
Other West Chesapeake Bay	HB2039	Stream Restoration	448,111.2	39	3.8	2	3.7	--	3	--	3
Other West Chesapeake Bay	HB2040	Stream Restoration	332,320.0	31	3.2	2	3.7	--	3	--	3
Other West Chesapeake Bay	HB2102	Stream Restoration	349,655.2	33	3.3	0	1.0	--	3	--	3
Other West Chesapeake Bay	HBF005	Stream Restoration	173,228.0	22	2.5	0	1.0	--	3	--	3

8 Digit Watershed Name	BMP ID	Project Type	Pollutant Removal			Combined Benefit		Biotic Integrity (BIBI)		Biotic Integrity (FIBI)	
			TSS Reduction (lbs/yr)	RANK (1-56)[1]	SCORE (1-5)	# of Sites	SCORE (1-5)	Rating	SCORE (1-5)	Rating	SCORE (1-5)
Other West Chesapeake Bay	HBQ001	Stream Restoration	248,000.0	26.5	2.9	1	2.3	--	3	--	3
West River	AA00POI206813	Stormwater Retrofit	12,452.6	6	1.4	0	1.0	--	3	--	3
West River	AA00POI208478	Stormwater Retrofit	2,389.3	2	1.1	0	1.0	--	3	--	3
West River	AA00POI209660	Stormwater Retrofit	14,797.7	7	1.4	0	1.0	--	3	--	3
West River	AA01POI209478	Stormwater Retrofit	10,398.4	4	1.2	0	1.0	--	3	--	3
West River	AA05POI209098	Stormwater Retrofit	10,985.6	5	1.3	0	1.0	--	3	--	3
West River	AA06POI205805	Stormwater Retrofit	1,587.3	1	1.0	1	2.3	--	3	--	3
West River	AA06POI205807	Stormwater Retrofit	2,931.1	3	1.1	1	2.3	--	3	--	3
West River	RR9036	Stream Restoration	694,400.0	47	4.3	0	1.0	--	3	--	3
West River	RR9068	Stream Restoration	248,000.0	26.5	2.9	0	1.0	--	3	--	3

[1]Note: Highest numerical value for metric is the highest ranked project (i.e., 56). Highest rank is also the highest score (i.e., 5).

Project Prioritization Summary – Project Constraints

8 Digit Watershed Name	BMP ID	Project Type	Design/Construction		Utility		Access		Nature Resources		Ownership	
			Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)
Baltimore Harbor Non-Tidal	AA06POI202196	Stormwater Retrofit	Constrained surroundings	3	None noted	5	Near parking lot	5	Forest	4	Business	3
Baltimore Harbor Non-Tidal	AA06POI207565	Stormwater Retrofit	Constrained surroundings	4	Sewer main adjacent	4	Near road; Easy topo	4	Stream	4	County	5
Baltimore Harbor Non-Tidal	AA10POI202701	Stormwater Retrofit	Constrained surroundings	4	Powerlines	4	Near parking lot	5	Wetland	4	Business	3
Baltimore Harbor Non-Tidal	AA88POI201944	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near parking lot	5	Stream	4	Business	3
Baltimore Harbor Non-Tidal	AA91POI201827	Stormwater Retrofit	Constrained surroundings	3	Powerlines; Sewer main adjacent	3	Near parking lot	5	None noted	5	Business	3
Baltimore Harbor Non-Tidal	AA91POI202283	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near parking lot	5	None noted	5	Business	3
Baltimore Harbor Non-Tidal	AA93POI204199	Stormwater Retrofit	None noted	5	None noted	5	Near road; Easy topography	4	Forest	4	HOA	3
Baltimore Harbor Non-Tidal	AA93POI204655	Stormwater Retrofit	Constrained surroundings ; Topography	3	None noted	5	Near road; Easy topography	4	Wetland; Forest	4	County	5
Baltimore Harbor Non-Tidal	AA97POI204298	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near parking lot	5	None noted	5	County	5
Baltimore Harbor Non-Tidal	AA97POI207627	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near parking lot	5	None noted	5	SHA	4
Baltimore Harbor Non-Tidal	AA98POI203421	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near road; Easy topography	4	Wetland	4	HOA	3

8 Digit Watershed Name	BMP ID	Project Type	Design/Construction		Utility		Access		Nature Resources		Ownership	
			Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)
Baltimore Harbor Non-Tidal	STRE_PT0_063	Stream Restoration	Large footprint	3	Stormwater pipes intersect	3	Near road; Difficult topography; Multiple access points	2	Stream	4	HOA; County	3
Baltimore Harbor Non-Tidal	STRE_PT8_032	Stream Restoration	Large footprint; Constrained Surroundings	3	Powerlines	4	Near road; Difficult topography; Multiple access points	2	Stream	4	Multiple	1
Baltimore Harbor Non-Tidal	STRE_PTB_039	Stream Restoration	Topography; Large footprint	3	Sewer mains intersect	3	Near road; Difficult topography; Multiple access points	2	Stream; Forest	4	Multiple	1
Baltimore Harbor Non-Tidal	STRE_PTG_131	Stream Restoration	Large footprint; Constrained Surroundings ; Topography	3	Sewer mains intersect; Water main line intersect	3	Near road; Easy topography; Multiple access points	3	Stream; Wetland; Forest	2	County; Business	3
Lower Patuxent River	STRE_MPX_006	Stream Restoration	Large footprint	3	None noted	5	Far from road; Easy topography	2	Stream; Forest	4	Multiple	1
Middle Patuxent River	MP0023	Stream Restoration	Large footprint; Topography	3	None noted	5	Near road; Easy topography; Multiple access points	3	Wetland; Forest	4	Private	2

8 Digit Watershed Name	BMP ID	Project Type	Design/Construction		Utility		Access		Nature Resources		Ownership	
			Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)
Middle Patuxent River	MP3027	Stream Restoration	Large footprint	5	None noted	5	Near road	5	Stream; Forest	4	Private	2
Middle Patuxent River	MP6009	Stream Restoration	Large footprint; Constrained Surroundings ; Topography	3	None noted	5	Near road; Difficult topography; Multiple access points	3	Wetland; Forest	3	Multiple	1
Middle Patuxent River	MP7062	Stream Restoration	Large footprint; Topography	3	None noted	5	Near road	5	Wetland; Forest	4	State	4
Middle Patuxent River	MPH025	Stream Restoration	Constrained surroundings ; Large footprint	3	Stormwater infrastructure	4	Near road; Easy topography; Multiple access points	4	Wetland; Forest	3	Private	2
Middle Patuxent River	MPM007	Stream Restoration	Constrained surroundings ; Large footprint	3	Stormwater infrastructure	4	Near road; Difficult topography; Multiple access points	3	Forest	4	HOA	3
Middle Patuxent River	MPN050	Stream Restoration	Large footprint; Topography	3	None noted	5	Far from road; Difficult topography; Multiple access points	1	Stream; Forest	3	Private	2
Middle Patuxent River	MPO017	Stream Restoration	Large footprint; Topography	3	None noted	5	Near road; Difficult topography	3	Wetland; Forest	4	County	5

8 Digit Watershed Name	BMP ID	Project Type	Design/Construction		Utility		Access		Nature Resources		Ownership	
			Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)
Middle Patuxent River	MPQ010	Stream Restoration	Large footprint; Constrained Surroundings ; Topography	3	None noted	5	Near road	5	Wetland; Forest	4	Multiple	1
Middle Patuxent River	MPQ015	Stream Restoration	Large footprint; Topography	3	None noted	5	Far from road; Easy topography	2	Wetland; Forest	4	Multiple	1
Middle Patuxent River	MPU004	Stream Restoration	Large footprint	3	None noted	5	Near road; Easy topography; Multiple access points	4	Wetland; Forest	3	County	5
Middle Patuxent River	MPV001	Stream Restoration	Large footprint; Constrained Surroundings ; Topography	3	None noted	5	Near road; Easy topography; Multiple access points	4	Stream; Wetland; Forest	3	County	5
Patapsco River Lower North Branch	AA00POI101578	Stormwater Retrofit	Topography	4	Sewer main adjacent	4	Near parking lot	5	Stream	4	Business; County	3
Patapsco River Lower North Branch	AA09POI202048	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near parking lot	5	None noted	5	Business	3
Patapsco River Lower North Branch	AA09POI202049	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near parking lot	5	Forest	4	Business	3

8 Digit Watershed Name	BMP ID	Project Type	Design/Construction		Utility		Access		Nature Resources		Ownership	
			Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)
Patapsco River Lower North Branch	AA09POI202050	Stormwater Retrofit	Constrained surroundings ; Topography	3	None noted	5	Near parking lot	5	Wetland	4	Business	3
Patapsco River Lower North Branch	AA60POI201974	Stormwater Retrofit	None noted	5	None noted	5	Near parking lot	5	Stream	4	State	4
Patapsco River Lower North Branch	AA84POI204242	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near road; Easy topography	4	None noted	5	Business	3
Patapsco River Lower North Branch	AA91POI202055	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near parking lot	5	Wetland	3	State	4
Patapsco River Lower North Branch	STRE_PNB_030	Stream Restoration	Constrained surroundings ; Large footprint	3	Sewer main intersect	2	Near road; Difficult topography; Multiple access points	3	Stream; Forest	4	HOA; County	3
Other West Chesapeake Bay	HB0010	Stream Restoration	Large footprint	3	Powerlines	4	Far from road; Difficult topography	1	Wetland; Forest	4	Utility	4
Other West Chesapeake Bay	HB2001	Stream Restoration	Mid-size footprint	4	None noted	5	Far from road; Easy topography	2	Stream; Forest	3	Private	2
Other West Chesapeake Bay	HB2021	Stream Restoration	Large footprint	3	None noted	5	Near road; Easy topography	4	Wetland; Open Water	2	Multiple	1

8 Digit Watershed Name	BMP ID	Project Type	Design/Construction		Utility		Access		Nature Resources		Ownership	
			Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)
Other West Chesapeake Bay	HB2026	Stream Restoration	Mid-size footprint; Constrained Surroundings	3	Sewer main intersect; Powerlines	3	Near road; Easy topography	4	Wetland; Forest	3	Multiple	1
Other West Chesapeake Bay	HB2032	Stream Restoration	Mid-size footprint	4	Powerlines	4	Far from road; Difficult topography	1	Stream; Wetland; Forest	3	Multiple	1
Other West Chesapeake Bay	HB2035	Stream Restoration	Large footprint	3	Powerlines	4	Far from road; Difficult topography	1	Wetland; Forest	4	Utility	4
Other West Chesapeake Bay	HB2039	Stream Restoration	Large footprint; Topography	3	None noted	5	Far from road; Difficult topography	1	Wetland; Forest	4	Multiple	1
Other West Chesapeake Bay	HB2040	Stream Restoration	Large footprint; Topography	3	None noted	5	Far from road; Difficult topo	1	Wetland; Forest	4	Multiple	1
Other West Chesapeake Bay	HB2102	Stream Restoration	Large footprint	3	Powerlines	4	Far from road; Easy topography	2	Wetland; Forest	4	Utility	4
Other West Chesapeake Bay	HBF005	Stream Restoration	Mid-size footprint; Constrained Surroundings	3	None noted	5	Near parking lot	5	Wetland; Open Water	2	Private	2
Other West Chesapeake Bay	HBQ001	Stream Restoration	Mid-size footprint	4	Powerlines	4	Far from road; Difficult topography	1	Stream; Wetland; Forest	3	Utility	4
West River	AA00POI206813	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near road; Easy topography	4	Forest	4	HOA	3

8 Digit Watershed Name	BMP ID	Project Type	Design/Construction		Utility		Access		Nature Resources		Ownership	
			Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)	Comments	SCORE (1-5)
West River	AA00POI208478	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near road; Easy topography	4	Forest	4	Private	2
West River	AA00POI209660	Stormwater Retrofit	None noted	5	None noted	5	Near road; Easy topography	4	Stream	4	HOA	3
West River	AA01POI209478	Stormwater Retrofit	None noted	5	None noted	5	Near road; Easy topography	4	Wetland	4	HOA	3
West River	AA05POI209098	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near road; Easy topography	4	None noted	5	HOA	3
West River	AA06POI205805	Stormwater Retrofit	Constrained surroundings	4	None noted	5	Near road; Easy topography	4	None noted	5	Private	2
West River	AA06POI205807	Stormwater Retrofit	Constrained surroundings	4	Sewer main intersect	3	Near road; Easy topography	4	Forest	4	HOA	3
West River	RR9036	Stream Restoration	Large footprint	3	None noted	5	Far from road; Difficult topography	1	Stream; Forest	3	Multiple	1
West River	RR9068	Stream Restoration	Mid-size footprint	4	None noted	5	Far from road; Easy topography	2	Stream; Forest	3	Private	2

Project Prioritization Summary – Project Costs

8 Digit Watershed Name	BMP ID	Project Type	Implementation Cost			Cost Per TSS Reduced		
			Cost	RANK (1-56)[1]	SCORE (1-5)	Cost/lbs TSS reduced	RANK (1-56)	SCORE (1-5)
Baltimore Harbor Non-Tidal	AA06POI202196	Stormwater Retrofit	$1,050,570	43	4.1	$17.42	6	1.4
Baltimore Harbor Non-Tidal	AA06POI207565	Stormwater Retrofit	$3,000,000	12.5	1.8	$6.97	23	2.6
Baltimore Harbor Non-Tidal	AA10POI202701	Stormwater Retrofit	$2,500,000	17	2.2	$16.64	8	1.5
Baltimore Harbor Non-Tidal	AA88POI201944	Stormwater Retrofit	$1,150,200	39	3.8	$26.57	1	1.0
Baltimore Harbor Non-Tidal	AA91POI201827	Stormwater Retrofit	$2,500,000	17	2.2	$23.71	2	1.1
Baltimore Harbor Non-Tidal	AA91POI202283	Stormwater Retrofit	$2,500,000	17	2.2	$17.56	5	1.3
Baltimore Harbor Non-Tidal	AA93POI204199	Stormwater Retrofit	$769,500	47	4.3	$16.97	7	1.4
Baltimore Harbor Non-Tidal	AA93POI204655	Stormwater Retrofit	$1,023,030	44	4.1	$20.31	4	1.2
Baltimore Harbor Non-Tidal	AA97POI204298	Stormwater Retrofit	$3,000,000	12.5	1.8	$11.30	16	2.1
Baltimore Harbor Non-Tidal	AA97POI207627	Stormwater Retrofit	$2,500,000	17	2.2	$15.27	9	1.6

8 Digit Watershed Name	BMP ID	Project Type	Implementation Cost			Cost Per TSS Reduced		
			Cost	RANK (1-56)[1]	SCORE (1-5)	Cost/lbs TSS reduced	RANK (1-56)	SCORE (1-5)
Baltimore Harbor Non-Tidal	AA98POI203421	Stormwater Retrofit	$391,230	49	4.5	$22.79	3	1.1
Baltimore Harbor Non-Tidal	STRE_PT0_063	Stream Restoration	$3,348,868	7	1.4	$6.64	26	2.8
Baltimore Harbor Non-Tidal	STRE_PT8_032	Stream Restoration	$5,382,616	2	1.1	$4.21	54	4.9
Baltimore Harbor Non-Tidal	STRE_PTB_039	Stream Restoration	$2,212,158	22	2.5	$3.53	55	4.9
Baltimore Harbor Non-Tidal	STRE_PTG_131	Stream Restoration	$5,704,560	1	1.0	$2.07	56	5.0
Lower Patuxent River	STRE_MPX_006	Stream Restoration	$1,725,840	31	3.2	$6.83	25	2.7
Middle Patuxent River	MP0023	Stream Restoration	$1,778,544	30	3.1	$4.35	28.5	3.0
Middle Patuxent River	MP3027	Stream Restoration	$2,335,932	20	2.4	$4.35	41.5	3.9
Middle Patuxent River	MP6009	Stream Restoration	$2,856,600	14	1.9	$4.35	41.5	3.9
Middle Patuxent River	MP7062	Stream Restoration	$3,206,887	9	1.6	$4.35	41.5	3.9
Middle Patuxent River	MPH025	Stream Restoration	$2,004,048	25	2.7	$4.35	41.5	3.9
Middle Patuxent River	MPM007	Stream Restoration	$3,304,692	8	1.5	$4.35	41.5	3.9
Middle Patuxent River	MPN050	Stream Restoration	$2,103,732	24	2.7	$4.35	41.5	3.9

8 Digit Watershed Name	BMP ID	Project Type	Implementation Cost			Cost Per TSS Reduced		
			Cost	RANK (1-56)[1]	SCORE (1-5)	Cost/lbs TSS reduced	RANK (1-56)	SCORE (1-5)
Middle Patuxent River	MPO017	Stream Restoration	$2,136,348	23	2.6	$4.35	41.5	3.9
Middle Patuxent River	MPQ010	Stream Restoration	$3,937,464	4	1.2	$4.35	41.5	3.9
Middle Patuxent River	MPQ015	Stream Restoration	$3,053,700	10	1.7	$4.35	41.5	3.9
Middle Patuxent River	MPU004	Stream Restoration	$3,902,040	5	1.3	$4.35	41.5	3.9
Middle Patuxent River	MPV001	Stream Restoration	$3,860,352	6	1.4	$4.35	41.5	3.9
Patapsco River Lower North Branch	AA00POI101578	Stormwater Retrofit	$2,500,000	17	2.2	$7.33	21	2.5
Patapsco River Lower North Branch	AA09POI202048	Stormwater Retrofit	$1,396,440	35	3.5	$11.56	15	2.0
Patapsco River Lower North Branch	AA09POI202049	Stormwater Retrofit	$1,253,880	38	3.7	$13.37	12	1.8
Patapsco River Lower North Branch	AA09POI202050	Stormwater Retrofit	$1,270,890	36	3.5	$13.97	10	1.7
Patapsco River Lower North Branch	AA60POI201974	Stormwater Retrofit	$2,266,380	21	2.5	$12.80	14	1.9
Patapsco River Lower North Branch	AA84POI204242	Stormwater Retrofit	$1,260,360	37	3.6	$13.09	13	1.9
Patapsco River Lower North Branch	AA91POI202055	Stormwater Retrofit	$1,937,520	27	2.9	$13.78	11	1.7

8 Digit Watershed Name	BMP ID	Project Type	Implementation Cost			Cost Per TSS Reduced		
			Cost	RANK (1-56)[1]	SCORE (1-5)	Cost/lbs TSS reduced	RANK (1-56)	SCORE (1-5)
Patapsco River Lower North Branch	STRE_PNB_030	Stream Restoration	$4,644,000	3	1.1	$4.35	41.5	3.9
Other West Chesapeake Bay	HB0010	Stream Restoration	$1,683,288	32	3.3	$4.35	28.5	3.0
Other West Chesapeake Bay	HB2001	Stream Restoration	$1,122,552	40	3.8	$4.35	41.5	3.9
Other West Chesapeake Bay	HB2021	Stream Restoration	$1,918,728	28	3.0	$4.35	41.5	3.9
Other West Chesapeake Bay	HB2026	Stream Restoration	$897,480	46	4.3	$4.35	41.5	3.9
Other West Chesapeake Bay	HB2032	Stream Restoration	$973,080	45	4.2	$4.35	41.5	3.9
Other West Chesapeake Bay	HB2035	Stream Restoration	$1,828,440	29	3.0	$4.35	41.5	3.9
Other West Chesapeake Bay	HB2039	Stream Restoration	$1,951,452	26	2.8	$4.35	41.5	3.9
Other West Chesapeake Bay	HB2040	Stream Restoration	$1,447,200	34	3.4	$4.35	41.5	3.9
Other West Chesapeake Bay	HB2102	Stream Restoration	$1,522,692	33	3.3	$4.35	41.5	3.9
Other West Chesapeake Bay	HBF005	Stream Restoration	$754,380	48	4.4	$4.35	41.5	3.9
Other West Chesapeake Bay	HBQ001	Stream Restoration	$1,080,000	41.5	3.9	$4.35	41.5	3.9
West River	AA00POI206813	Stormwater Retrofit	$90,651	51	4.6	$7.28	22	2.5
West River	AA00POI208478	Stormwater Retrofit	$12,177	56	5.0	$5.10	27	2.9
West River	AA00POI209660	Stormwater Retrofit	$102,576	50	4.6	$6.93	24	2.7

8 Digit Watershed Name	BMP ID	Project Type	Implementation Cost			Cost Per TSS Reduced		
			Cost	RANK (1-56)[1]	SCORE (1-5)	Cost/lbs TSS reduced	RANK (1-56)	SCORE (1-5)
West River	AA01POI209478	Stormwater Retrofit	$76,421	53	4.8	$7.35	20	2.4
West River	AA05POI209098	Stormwater Retrofit	$83,938	52	4.7	$7.64	19	2.3
West River	AA06POI205805	Stormwater Retrofit	$12,613	55	4.9	$7.95	18	2.2
West River	AA06POI205807	Stormwater Retrofit	$25,224	54	4.9	$8.61	17	2.2
West River	RR9036	Stream Restoration	$3,024,000	11	1.7	$4.35	41.5	3.9
West River	RR9068	Stream Restoration	$1,080,000	41.5	3.9	$4.35	41.5	3.9

[1]Note: Lowest numerical value for metric is the highest ranked project (i.e., 56). Highest rank is also the highest score (i.e., 5).

Appendix B

Interim Programmed and Planned Implementation Project List, After Project Prioritization

8 Digit Watershed Name	BMP ID	Project Name	MDE BMP Description	Unit	Treatment	Status	Projected Implementation Year
Baltimore Habor Non-Tidal	BMP0079	Elizabeth Place - SHA Outfall Retrofit - SPSC	Filtering Practice	DA Acres	9.1	Interim Programmed	2029
Baltimore Habor Non-Tidal	BMP0196	Sawmill Creek Phase I Muddy Bridge Branch SPSC	Filtering Practice	DA Acres	79.3	Interim Programmed	2026
Baltimore Habor Non-Tidal	BMP0789	(SR-06) Patapsco-Untd Trib Ntd OT Ph3	Filtering Practice	DA Acres	1.5	Interim Programmed	2026
Baltimore Habor Non-Tidal	BMP0421	R.P. Eason School Extended Detention Wetland	Wet Ponds and Wetlands	DA Acres	17.3	Interim Programmed	2025
Baltimore Habor Non-Tidal	BMP0136	Mill Pond Stormwater Management Retrofit	Wet Ponds and Wetlands	DA Acres	19.3	Interim Programmed	2025
Baltimore Habor Non-Tidal	BMP0183	Elizabeth Station SWM Pond Retrofit	Infiltration Practices	DA Acres	5.5	Interim Programmed	2025
Baltimore Habor Non-Tidal	BMP0204	Elizabeth Station Outfall Stabilization	Outfall Stabilization	Linear Feet	95.0	Interim Programmed	2025
Baltimore Habor Non-Tidal	BMP0839	Chestnut Hill Cove BGE Gully SPSC	Outfall Stabilization	Linear Feet	430.0	Interim Programmed	2028
Baltimore Habor Non-Tidal	BMP0714	Sawmill Creek Phase I Muddy Bridge Branch-P5 Line	Outfall Stabilization	Linear Feet	451.0	Interim Programmed	2026
Baltimore Habor Non-Tidal	BMP0468	Marley Creek Old Mill Branch	Stream Restoration	Linear Feet	579.0	Interim Programmed	2028
Baltimore Habor Non-Tidal	BMP0314	Marley Creek Ruth Park Eason School Stream Rest	Stream Restoration	Linear Feet	1,300.0	Interim Programmed	2028

8 Digit Watershed Name	BMP ID	Project Name	MDE BMP Description	Unit	Treatment	Status	Projected Implementation Year
Baltimore Habor Non-Tidal	BMP0777	Marley Creek - Green Branch Stream Restoration	Stream Restoration	Linear Feet	1,525.0	Interim Programmed	2027
Baltimore Habor Non-Tidal	BMP0312	Marley Creek Stream Restoration - Trib 8	Stream Restoration	Linear Feet	499.0	Interim Programmed	2027
Baltimore Habor Non-Tidal	BMP0311	Marley Creek Stream Restoration - Trib 7	Stream Restoration	Linear Feet	633.0	Interim Programmed	2027
Baltimore Habor Non-Tidal	BMP0304	Marley Creek Stream Restoration - Mainstem	Stream Restoration	Linear Feet	3,124.0	Interim Programmed	2028
Baltimore Habor Non-Tidal	BMP0310	Marley Creek Stream Restoration - Trib 6	Stream Restoration	Linear Feet	516.0	Interim Programmed	2028
Baltimore Habor Non-Tidal	BMP0309	Marley Creek Stream Restoration - Trib 5	Stream Restoration	Linear Feet	1,735.0	Interim Programmed	2027
Baltimore Habor Non-Tidal	BMP0308	Marley Creek Stream Restoration - Trib 4	Stream Restoration	Linear Feet	2,173.0	Interim Programmed	2027
Baltimore Habor Non-Tidal	BMP0281	Sloop Cove Stream Restoration	Stream Restoration	Linear Feet	1,893.0	Interim Programmed	2025
Baltimore Habor Non-Tidal	BMP0838	Chestnut Hill Cove Nabb's Creek RSC	Stream Restoration	Linear Feet	558.0	Interim Programmed	2025
Baltimore Habor Non-Tidal	BMP0298	Sawmill Creek - Irving Branch	Stream Restoration	Linear Feet	1,024.0	Interim Programmed	2025
Baltimore Habor Non-Tidal	BMP0299	Sawmill Creek - Muddy Bridge Branch	Stream Restoration	Linear Feet	6,608.0	Interim Programmed	2028
Baltimore Habor Non-Tidal	BMP0475	PT-Back Creek MS Stream Rest	Stream Restoration	Linear Feet	2,410.0	Interim Programmed	2028
Baltimore Habor Non-Tidal	BMP0246	Patapsco Tidal Private Pond BMP 136 Retrofit	Wet Ponds and Wetlands	Linear Feet	14.2	Interim Programmed	2025
Little Patuxent River	BMP0855	Chapelgate Towsers Outfall 7	Outfall Stabilization	Linear Feet	779.0	Interim Programmed	2026

8 Digit Watershed Name	BMP ID	Project Name	MDE BMP Description	Unit	Treatment	Status	Projected Implementation Year
Little Patuxent River	BMP0854	Chapelgate Towsers Outfall 1 P5 Line	Outfall Stabilization	Linear Feet	310.0	Interim Programmed	2026
Little Patuxent River	BMP0784	Crofton Golf Course Stream Restoration (Segment 3)	Stream Restoration	Linear Feet	1,955.0	Interim Programmed	2027
Little Patuxent River	BMP0783	Crofton Golf Course Stream Restoration (Segment 1)	Stream Restoration	Linear Feet	1,410.0	Interim Programmed	TBD
Little Patuxent River	BMP0447	Russett Feasibility Stream Restoration	Stream Restoration	Linear Feet	3,850.0	Interim Programmed	TBD
Little Patuxent River	BMP0301	Evergreen Stream Restoration	Stream Restoration	Linear Feet	1,665.0	Interim Programmed	2026
Little Patuxent River	BMP0853	Chapelgate Towsers Stream Restoration	Stream Restoration	Linear Feet	2,662.0	Interim Programmed	2026
Little Patuxent River	BMP0848	Lake Marion SWM Pond Retrofit	Wet Ponds and Wetlands	Linear Feet	0.8	Interim Programmed	2025
Patapsco River Lower North Branch	BMP0170	Concorde Circle Dry Pond Retrofit	Filtering Practice	DA Acres	32.2	Interim Programmed	2026
Patapsco River Lower North Branch	BMP0789	(SR-06) Patapsco-Untd Trib Ntd OT Ph3	Filtering Practice	DA Acres	12.1	Interim Programmed	2026
Patapsco River Lower North Branch	BMP0472	Patapsco NTDL Unnamed Trib/Maritime Institute	Stream Restoration	Linear Feet	10,285.0	Interim Programmed	2028
Patapsco River Lower North Branch	BMP0815	Piney Run Stream Restoration	Stream Restoration	Linear Feet	3,650.0	Interim Programmed	TBD
Patapsco River Lower North Branch	BMP0098	601-611 Hammonds Ferry Road North Pond Retrofit	Filtering Practice	DA Acres	29.8	Interim Programmed	2026
Patapsco River Lower North Branch	BMP0848	Lake Marion SWM Pond Retrofit	Wet Ponds and Wetlands	DA Acres	5.7	Interim Programmed	2025
Lower Patuxent River	BMP0782	Wildlands Full Delivery Hall Creek	Stream Restoration	Linear Feet	2906.0	Interim Programmed	2025

8 Digit Watershed Name	BMP ID	Project Name	MDE BMP Description	Unit	Treatment	Status	Projected Implementation Year
Middle Patuxent River	BMP0692	Jug Bay Wetlands Sanctuary Stream Restoration	Stream Restoration	Linear Feet	3,800.0	Interim Programmed	2025
Upper Patuxent River	BMP0694	Darcey Lane RSC - P5 Line	Outfall Stabilization	Linear Feet	2,029.5	Interim Programmed	2029
South River	BMP0800	Harness Creek SPSC	Filtering Practice	DA acres	3.9	Interim Programmed	2025
South River	BMP0845	Historic London Town and Garden SPSC	Filtering Practice	DA acres	0.6	Interim Programmed	2026
South River	BMP0861	Southdown Shores RSC	Filtering Practice	DA acres	33.8	Interim Programmed	2025
South River	BMP0858	Southern District Police Station IA Removal	Impervious Surface Reduction to Turf	Acres Converted	0.0	Interim Programmed	2025
South River	BMP0863	Village of Middle Cove IA Removal	Impervious Surface Reduction to Forest	Acres Converted	0.3	Interim Programmed	2025
South River	BMP0846	Historic London Town and Garden Microbioretention	Bioretention	DA acres	0.8	Interim Programmed	2026
South River	BMP0464	Homestead Gardens Outfall and Stream Restoration	Outfall Stabilization	Linear Feet	785.0	Interim Programmed	2025
South River	BMP0772	Harness Creek SPSC - P5 Line	Outfall Stabilization	Linear Feet	413.0	Interim Programmed	2026
South River	BMP0826	Broad Creek Gully Stream Restoration	Outfall Stabilization	Linear Feet	365.0	Interim Programmed	2027
South River	BMP0480	So-Glebe Branch Strm Rstn Reaches A-B	Stream Restoration	Linear Feet	4,491.0	Interim Programmed	2027
South River	BMP0479	So-Glebe Branch Strm Rstn Reaches C-D	Stream Restoration	Linear Feet	2,600.0	Interim Programmed	2027

8 Digit Watershed Name	BMP ID	Project Name	MDE BMP Description	Unit	Treatment	Status	Projected Implementation Year
South River	BMP0482	Susans Branch West Stream Restoration	Stream Restoration	Linear Feet	5,000.0	Interim Programmed	2028
West River	BMP0856	Dove Hill Farm Stream Restoration RFP 24000051	Stream Restoration	Linear Feet	1,580.0	Interim Programmed	2027
West River	BMP0864	Tulip Hill Reforestation (2.1 acres FPU)	Urban Tree Planting	Acres Converted	2.1	Interim Programmed	TBD
Baltimore Harbor Non-Tidal	AA91POI202283	TBD	Stormwater Retrofit	DA Acres	105.2	Planned	TBD
Baltimore Harbor Non-Tidal	AA97POI207627	TBD	Stormwater Retrofit	DA Acres	99.0	Planned	TBD
Baltimore Harbor Non-Tidal	AA97POI204298	TBD	Stormwater Retrofit	DA Acres	168.7	Planned	TBD
Baltimore Harbor Non-Tidal	AA06POI202196	TBD	Stormwater Retrofit	DA Acres	48.7	Planned	TBD
Baltimore Harbor Non-Tidal	STRE_PTG_131	TBD	Stream Restoration	Linear Feet	5,282.0	Planned	TBD
Baltimore Harbor Non-Tidal	STRE_PTB_039	TBD	Stream Restoration	Linear Feet	2,048.3	Planned	TBD
Lower Patuxent River	STRE_MPX_006	TBD	Stream Restoration	Linear Feet	1,598.0	Planned	TBD
Middle Patuxent River	MPM007	TBD	Stream Restoration	Linear Feet	3,059.9	Planned	TBD
Middle Patuxent River	MP0023	TBD	Stream Restoration	Linear Feet	1,646.8	Planned	TBD
Middle Patuxent River	MPQ010	TBD	Stream Restoration	Linear Feet	3,645.8	Planned	TBD
Middle Patuxent River	MP6009	TBD	Stream Restoration	Linear Feet	2,645.0	Planned	TBD
Middle Patuxent River	MPQ015	TBD	Stream Restoration	Linear Feet	2,827.5	Planned	TBD

8 Digit Watershed Name	BMP ID	Project Name	MDE BMP Description	Unit	Treatment	Status	Projected Implementation Year
Middle Patuxent River	MPN050	TBD	Stream Restoration	Linear Feet	1,947.9	Planned	TBD
Middle Patuxent River	MPH025	TBD	Stream Restoration	Linear Feet	1,855.6	Planned	TBD
Middle Patuxent River	MP7062	TBD	Stream Restoration	Linear Feet	2,969.3	Planned	TBD
Middle Patuxent River	MPO017	TBD	Stream Restoration	Linear Feet	1,978.1	Planned	TBD
Middle Patuxent River	MP3027	TBD	Stream Restoration	Linear Feet	2,162.9	Planned	TBD
Middle Patuxent River	MPV001	TBD	Stream Restoration	Linear Feet	3,574.4	Planned	TBD
Middle Patuxent River	MPU004	TBD	Stream Restoration	Linear Feet	3,613.0	Planned	TBD
Other West Chesapeake Bay	HB2021	TBD	Stream Restoration	Linear Feet	1,776.6	Planned	TBD
Other West Chesapeake Bay	HBF005	TBD	Stream Restoration	Linear Feet	698.5	Planned	TBD
Other West Chesapeake Bay	HB2026	TBD	Stream Restoration	Linear Feet	831.0	Planned	TBD
Other West Chesapeake Bay	HB2001	TBD	Stream Restoration	Linear Feet	1,039.4	Planned	TBD
Other West Chesapeake Bay	HBQ001	TBD	Stream Restoration	Linear Feet	1,000.0	Planned	TBD
Other West Chesapeake Bay	HB2032	TBD	Stream Restoration	Linear Feet	901.0	Planned	TBD
Other West Chesapeake Bay	HB2035	TBD	Stream Restoration	Linear Feet	1,693.0	Planned	TBD
Other West Chesapeake Bay	HB2102	TBD	Stream Restoration	Linear Feet	1,409.9	Planned	TBD
Other West Chesapeake Bay	HB2039	TBD	Stream Restoration	Linear Feet	1,806.9	Planned	TBD

8 Digit Watershed Name	BMP ID	Project Name	MDE BMP Description	Unit	Treatment	Status	Projected Implementation Year
Other West Chesapeake Bay	HB2040	TBD	Stream Restoration	Linear Feet	1,340.0	Planned	TBD
Other West Chesapeake Bay	HB0010	TBD	Stream Restoration	Linear Feet	1,558.6	Planned	TBD
West River	AA05POI209098	TBD	Stormwater Retrofit	DA Acres	3.9	Planned	TBD
West River	AA00POI209660	TBD	Stormwater Retrofit	DA Acres	5.2	Planned	TBD
West River	AA06POI205805	TBD	Stormwater Retrofit	DA Acres	0.5	Planned	TBD
West River	AA01POI209478	TBD	Stormwater Retrofit	DA Acres	3.4	Planned	TBD
West River	RR9036	TBD	Stream Restoration	Linear Feet	2,800.0	Planned	TBD
West River	RR9068	TBD	Stream Restoration	Linear Feet	1,000.0	Planned	TBD