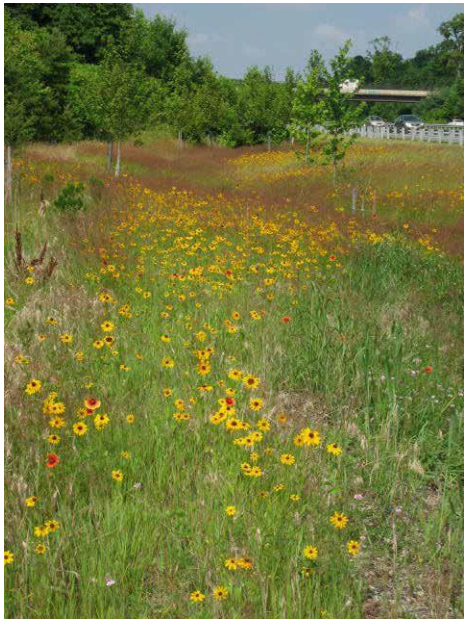
MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Non-Tidal Patuxent River Middle Watershed Sediment TMDL Implementation Plan

July 2, 2019



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

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July 2, 2019

Mr. Stewart Comstock
Sediment, Stormwater and Dam Safety Program
Water and Science Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 440
Baltimore, MD 21230

Dear Mr. Comstock:

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is pleased to submit this Sediment TMDL Implementation Plan for the Non-Tidal Patuxent River Middle Watershed addressing conditions under the MDOT SHA NPDES MS4 permit (1 1-DP-3313) which took effect on October 9, 2015. This submittal covers the permit requirement to submit a coordinated TMDL implementation plan for any subsequent stormwater WLAs within one year of EPA approval.

The EPA approved the TMDL of Sediments in the Non-Tidal Patuxent River Middle Watershed on July 2, 2018. The public comment period for this Sediment TMDL Implementation Plan was held from May 24, 2019 to June 24, 2019. Notices were posted in the classified section of *The Baltimore Sun* and *The Washington Post* on May 24, 2019. The notices provided the MDOT SHA website, http://www.roads.maryland.gov/Index.aspx?PageId=362, where the plan could be downloaded and where instructions for sending comments were provided should the reader so choose. No comments were received during the public comment period. Please find enclosed documentation confirming the posting of these notices.

If you have any questions or need additional information regarding this delivery, please contact Mr. Travis Vance at 410-545-8623 (or via email at tvance@mdot.maryland.gov) or me at 410-545-8407 (or via email at kcoffman@mdot.maryland.gov).

Sincerely,

Karen Coffman, Chief
MDOT SHA OED Water Programs Division

Enclosures: MDOT SHA Non-Tidal Patuxent River Middle Sediment TMDL Implementation Plan
The Baltimore Sun Media Group (BSMG) Legal Notices Proof
Washington Post Media Classified Ad Proof

Cc: Mr. Brian Cooper, MDE WSA SSDSP
Ms. Sonal Ram, Director, MDOT SHA OED
Mr. Kevin P. Wilsey, Deputy Director, MDOT SHA OED
Mr. Travis Vance, MDOT SHA OED WPD

Order ID: 6297205

* Agency Commission not included

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MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

OPPORTUNITY FOR PUBLIC REVIEW AND COMMENT

DRAFT IMPLEMENTATION PLAN FOR THE TOTAL MAXIMUM DAILY LOAD (TMDL) OF SEDIMENT IN THE NON-TIDAL PATUXENT RIVER MIDDLE WATERSHED, ANNE ARUNDEL, CALVERT, AND PRINCE GEORGE'S COUNTIES, MARYLAND

The Maryland Department of Transportation State Highway Administration (MDOT SHA) was issued a National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System (MS4) Permit, (Permit No. 11-DP-3313), by the Maryland Department of the Environment (MDE) on October 9, 2015. This permit covers stormwater discharges from the storm drain system owned or operated by MDOT SHA within Anne Arundel, Baltimore, Carroll, Cecil, Charles, Frederick, Harford, Howard, Montgomery, Prince George's, and Washington Counties. The permit requires MDOT SHA to submit an implementation plan to MDE that addresses Environmental Protection Agency (EPA)-approved stormwater waste load allocations (WLAs) within one year of EPA approval.

EPA approved the *Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Middle Watershed, Anne Arundel, Calvert and Prince George's County, Maryland* on July 2, 2018. The MDOT SHA Office of Environmental Design (OED) is soliciting comments on its draft Implementation Plan to meet this WLA as required under the MS4 Permit. A 30-day public comment period will take place from May 24, 2019 to June 24, 2019. The draft Implementation Plan is available on MDOT SHA's website at http://www.roads.maryland.gov/Index.aspx?PageId=362.

Comments should be submitted to MDOT SHA **on or before June 24, 2019** by emailing to wpd@mdot.maryland.gov, faxing to (410) 209-5003, or mailing to:

Maryland Department of Transportation
State Highway Administration
Office of Environmental Design, C-303
707 N. Calvert Street
Baltimore, MD 21202

Please note that comments should include the name and address of the person submitting the comments. Responses to comments will not be provided directly, but material comments received during the comment period will be considered and the draft Implementation Plan will be revised as appropriate prior to submittal to MDE. A summary of comments received will be included in the MDOT SHA MS4 annual report submitted to MDE annually on October 9 and posted to this website: http://www.roads.maryland.gov/Index.aspx?pageid=336.

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NON-TIDAL PATUXENT RIVER MIDDLE WATERSHED SEDIMENT TMDL IMPLEMENTATION PLAN

A. WATER QUALITY STANDARDS AND DESIGNATED USES

Total Maximum Daily Loads (TMDLs) focus on offsetting the impacts of pollutants to waterway designated uses. The Federal Clean Water Act (CWA) established requirements for each state to develop programs to address water pollution including:

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

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

One means for the United States Environmental Protection Agency (EPA) to enforce these standards is through the National Pollutant Discharge Elimination System (NPDES) program, which regulates discharges from point sources. The Maryland Department of the Environment (MDE) is the delegated authority to issue NPDES discharge permits within Maryland and to develop WQSs for Maryland including the water quality criteria that define the parameters to ensure designated uses are met.

Table 1: Designated Uses in Maryland

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

Source: http://www.mde.maryland.gov/programs/water/TMDL/WaterQualityStandards/Pages/wqs_designated_uses.aspx

MS4 Permit Requirements

The Maryland Department of Transportation State Highway Administration (MDOT SHA) Municipal Separate Storm Sewer System (MS4) Permit requires coordination with county MS4 jurisdictions concerning watershed assessments and development of a coordinated TMDL implementation plan for each watershed that MDOT SHA has a wasteload allocation (WLA). Requirements from the MDOT SHA MS4 Permit specific to watershed assessments and coordinated TMDL implementation plans include *Part IV.E.1.* and *Part IV.E.2.b*., copied below.

Watershed Assessments (Permit Part IV.E.1.)

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

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

Coordinated TMDL Implementation Plans (Permit Part IV.E.2.b.)

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

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

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

B. WATERSHED ASSESSMENT COORDINATION

According to the United States Geological Survey (USGS) (2016):

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

The 8-digit scale is the most common management scale for watersheds across the State, and therefore is the scale at which most of Maryland's local TMDLs are developed. See **Figure 1** for an illustration of the 8-digit watersheds in Maryland.

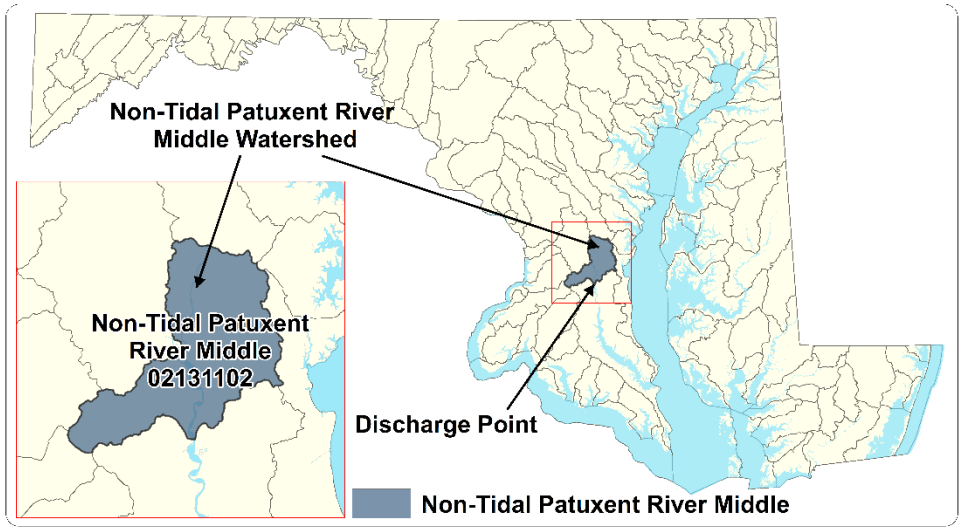


Figure 1: Maryland 8-digit Watershed Example

County Watershed Assessments

Each MS4 county performs detailed assessments of local watersheds as a part of its MS4 permit requirements. These assessments determine current water quality conditions and include visual inspections; the identification and ranking of water quality problems for restoration; the prioritization and ranking of structural and non-structural improvement projects; and the setting of pollutant reduction benchmarks and deadlines that demonstrate progress toward meeting applicable WQSs. MDOT SHA is not required to duplicate this effort, but is required to coordinate with the MS4 jurisdictions to obtain and review watershed assessments. Relying on assessments performed by other jurisdictions avoids redundant analysis and places the responsibility for developing the assessments with the jurisdictions that have a close connection to local communities and watershed groups.

Watershed assessment evaluations conducted by MDOT SHA focus on issues that MDOT SHA can improve through practices targeting MDOT

SHA right-of-way (ROW) or infrastructure. This information is used to determine priority areas for BMP implementation and to identify potential project sites or partnership project opportunities. Summaries of these evaluations are included under **Section F**. MDOT SHA watershed assessment evaluations focus on the following:

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

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

- Coordination meetings with each of the MS4 counties to discuss potential partnerships with the mutual goal of improving water quality;
- Visual watershed inspections as described below; and
- Maximizing existing impervious treatment within new roadway projects (practical design initiative).

C. VISUAL INSPECTIONS TARGETING MDOT SHA ROW

MDOT SHA methodically reviews each watershed for potential restoration projects within MDOT SHA ROW to meet the load reductions for current pollutant WLAs. Each watershed is assessed using a grid system in conjunction with detailed corridor assessments. The watershed review process includes two phases to visually inspect each watershed and identify all structural and non-structural water quality improvement projects to be implemented.

Desktop Evaluation

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

- Aerial imagery;
- Street view mapping;
- Environmental features delineations such as critical area boundary, wetlands buffers, floodplain limits;
- County data such as utilities, storm drain systems, contour and topographic mapping;
- MDOT SHA ROW boundaries;

- Current MDOT SHA stormwater control and restoration practice locations; and
- Drainage area boundaries.

Figure 6, located in **Section F**, illustrates the 1.5-mile grid system for the Non-tidal Patuxent River Middle watershed.

Field Investigations

Phase two is a field investigation of each viable site resulting from the watershed desktop evaluation. MDOT SHA inspects and assesses each site in the field to identify and document existing site conditions, water quality opportunities, and constraints. This information is used to determine potential restoration BMP types as well as estimated restoration credit quantities.

MDOT SHA will continue to prioritize visual inspections in the highest need watersheds. **Figure 2** is an example field investigation summary map that documents observations. A standardized field inspection form is used.

D. BENCHMARKS AND DETAILED COSTS

Benchmarks and deadlines demonstrating progress toward meeting all applicable stormwater WLAs are provided in **Section F**. It contains generalized cost information that includes an overall estimated cost to implement the proposed practices. Detailed costs for specific construction projects are available on MDOT SHA's website (www.roads.maryland.gov) under the Contractors Information Center.

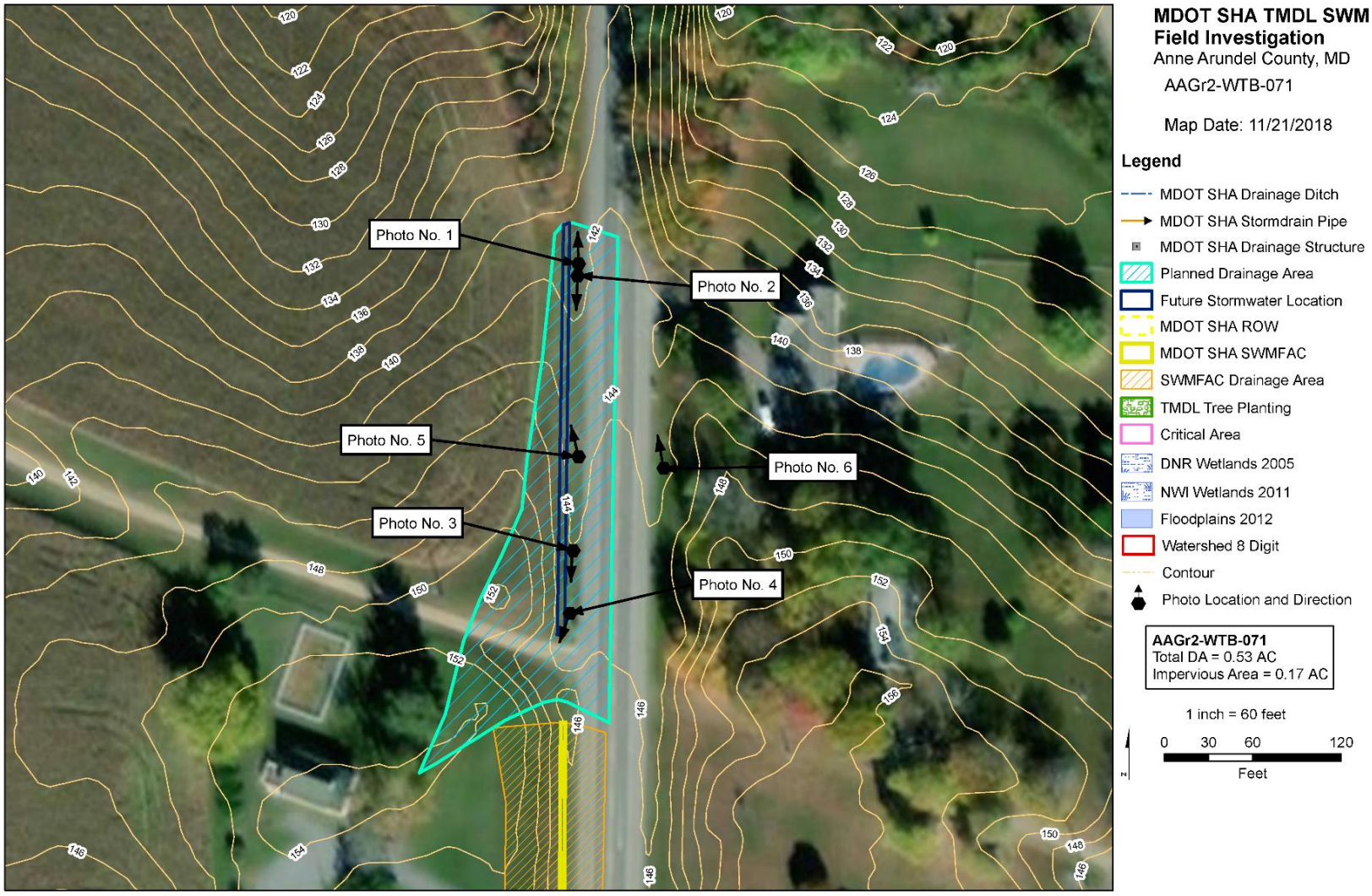


Figure 2: Example Field Investigation Summary Map

E. POLLUTION REDUCTION STRATEGIES

E.1. MDOT SHA TMDL Responsibilities

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

Generally, the formula for a TMDL is:

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

Where:

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

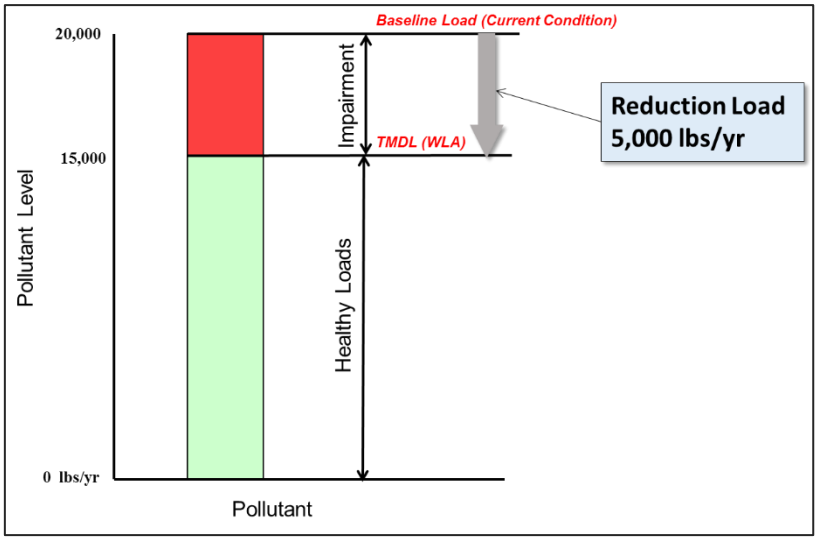


Figure 3: Example Wasteload and Reduction Requirement

Modeling Parameters

MDE requires that pollutant modeling follow the guidance in MDE's *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014); if other methods are employed, they must be approved by MDE. MDOT SHA developed a restoration modeling protocol that describes the methods used for modeling pollutant load reductions for local TMDLs with MDOT SHA responsibility. This protocol was originally submitted to MDE as Appendix E in the 2016 MDOT SHA MS4 annual report. Updates to this protocol will be periodically implemented and resubmitted for MDE consideration. The protocol, *MDOT SHA Restoration Modeling Protocol*, can be found under the "Related Documents" section on the MDOT SHA website, https://www.roads.maryland.gov/Index.aspx?pageid=336.

Different modeling methods are used depending upon the pollutants and current reduction practices in use. Brief descriptions of modeling methods are included in the following section, but the *MDOT SHA*

Restoration Modeling Protocol (MDOT SHA, 2017) should be consulted for a more detailed explanation.

Aggregated Loads

WLAs may be assigned to each MS4 jurisdiction separately or as an aggregated WLA for all urban stormwater MS4 permittees that combines them into one required allocation and reduction target. The modeling approach developed by MDOT SHA uses MDOT SHA data (both impervious and pervious land as well as BMPs built before the TMDL baseline year, also known as baseline BMPs) to calculate baseline loads and calibrated reduction targets. Following this approach, disaggregation is done for each TMDL.

Available Reduction Practices

MDOT SHA reserves the right to implement new BMPs, activities, and other practices that are not currently available to achieve local TMDL load reduction requirements. MDOT SHA will modify reduction strategies as necessary based on new, approved treatment guidance and will include revised strategies in updates to this implementation plan.

E.2. Sediment Pollution Reduction Strategy

E.2.a. Sediment TMDLs Affecting MDOT SHA

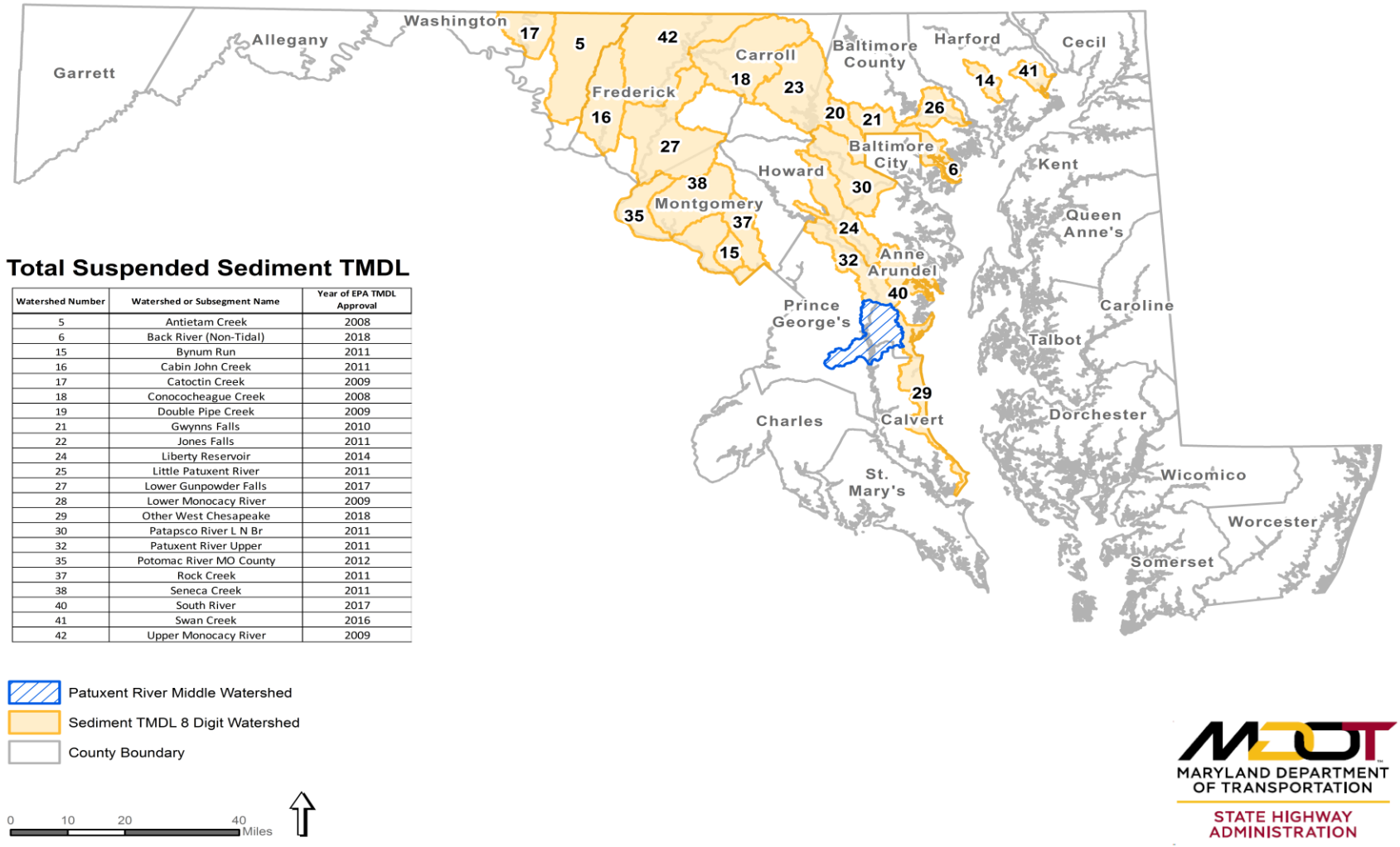
There are many EPA-approved sediment TMDLs within Maryland and **Figure 4** is a map showing MDOT SHA sediment TMDL responsibilities by watershed. The following is a list of TMDL documents for sediment with MDOT SHA responsibility that are addressed in this plan:

- *Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Middle Watershed, Anne Arundel, Calvert, and Prince George's Counties, Maryland, approved by EPA on July 2, 2018.*

In **Table 2,** the MDOT SHA reduction target for the Non-Tidal Patuxent River Middle watershed sediment TMDL is 56 percent, or 58,863 lbs./yr. The watershed can safely receive 46,249 pounds of sediment by MDOT SHA on a yearly basis without being considered impaired. MDOT SHA's reduction target is found by multiplying the MDOT SHA baseline load by the MDOT SHA reduction target percent. The MDOT SHA WLA is found by subtracting the MDOT SHA baseline load by the MDOT SHA target load. The projected reduction achieved is found by modeling the sediment load reduction that will be experienced by the construction of current and future BMPs in the Non-Tidal Patuxent River Middle watershed. These BMPs are either currently under construction or are planned to be constructed in the future. It is estimated that these BMPs will reduce sediment loading by 59,007 pounds to the watershed.

Three dates are shown in **Table 2**: the EPA approval date, the baseline year set by MDE, and the Target Year. The baseline year published on the MDE Data Center will be used for MDOT SHA's implementation planning. This usually correlates to the time period when monitoring data was collected for MDE's TMDL analysis. The Target Year is the year MDOT SHA proposes to meet the WLA.

Although the Patuxent River Middle watershed is located in Anne Arundel, Calvert, and Prince George's Counties, Calvert County is currently outside of the current MDOT SHA NPDES MS4 permit, MD0068276, coverage area. Therefore, sediment loading from MDOT SHA ROW and load reduction experienced by MDOT SHA BMPs in Calvert County are not apart of the reduction target calculation at this time.



Watershed Number	Watershed or Subsegment Name	Year of EPA TMDL Approval
5	Antietam Creek	2008
6	Back River (Non-Tidal)	2018
15	Bynum Run	2011
16	Cabin John Creek	2011
17	Catoctin Creek	2009
18	Conococheague Creek	2008
19	Double Pipe Creek	2009
21	Gwynns Falls	2010
22	Jones Falls	2011
24	Liberty Reservoir	2014
25	Little Patuxent River	2011
27	Lower Gunpowder Falls	2017
28	Lower Monocacy River	2009
29	Other West Chesapeake	2018
30	Patapsco River L N Br	2011
32	Patuxent River Upper	2011
35	Potomac River MO County	2012
37	Rock Creek	2011
38	Seneca Creek	2011
40	South River	2017
41	Swan Creek	2016
42	Upper Monocacy River	2009

Figure 4: MDOT SHA Sediment TMDL Responsibilities in Local Watersheds

Table 2: MDOT SHA Non-Tidal Patuxent River Middle Watershed Sediment Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction	% 2020 Reduction Relative to Baseline	MDOT SHA Proposed 2025 Interim Reduction	% 2025 Reduction Relative to Baseline	MDOT SHA Target Year Reduction	% Target Year Reduction Relative to Baseline	Target Year
Non-Tidal Patuxent River Middle	02131102	AA, CV, PG	Sediment	07/02/2018	2009	Lbs./ yr.	105,112	56.0%	58,863	5,129	8.7%	18,201	30.8%	59,007	56.1%	2040

E.2.b. Sediment Sources

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

MDOT SHA Loading Sources

MDOT SHA-owned land is a small portion of each of the TMDL watersheds and it consists of relatively uniform land uses including roadways and roadside vegetation. In urbanized areas, the MDOT SHA ROW may extend to include sidewalks and portions of driveways. There are also parking areas associated with MDOT SHA land such as park and ride facilities, office complexes, and maintenance facilities.

Of the land uses in **Table 3**, MDOT SHA is a contributor of sediments mostly through urban and natural sources. MDOT SHA has no responsibility for agriculture sources.

Table 3: Nutrient and Sediment Sources from Various References

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

E.2.c. Sediment Reduction Strategies

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

BMP Implementation

As a requirement under the MS4 Permit, MDOT SHA must complete the implementation of restoration efforts for 20 percent of its impervious surface area. MDOT SHA has an extensive program to plan, design, and construct BMPs that offset untreated impervious surfaces in MDOT SHA ROW.

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

Nutrient Credit Trading

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

Cross-Jurisdictional BMPs

MDOT SHA is applying load reductions to the TMDL baseline load from BMPs owned and implemented by adjacent jurisdictions for the amount of MDOT SHA right of way treated. These BMPs can be a mix of various types of stormwater treatment.

TMDL End Date

Currently, MDOT SHA models BMP implementation for restoration practices that can be placed in the watershed based on the visual watershed inspection process. MDOT SHA's current assessment will reach the reduction target by 2040. MDOT SHA will continue assessing this potential and will adjust the end date as needed. MDOT SHA will continue to explore the possibility of nutrient credit trading or partnerships, which cannot be modeled at this time. Also, future changes to current BMP removal rates or efficiencies will be reviewed to determine impacts to our anticipated Non-tidal Patuxent River Middle sediment WLA end date.

F. MDOT SHA NON-TIDAL PATUXENT RIVER MIDDLE WATERSHED SEDIMENT TMDL IMPLEMENTATION PLAN

F.1. Watershed Description

Located in Anne Arundel, Calvert, and Prince George's Counties, the Patuxent River Middle watershed (8-digit Basin Code – 02131102) is an 86.25 square mile area (55,200 acres), not including water/wetlands. Approximately 1.02 square miles (650 acres) of the watershed is covered by water (MDE, 2018a).

The designated use of the Patuxent River Middle watershed's non-tidal tributaries is Use I – Water Contact Recreation and Protection of Aquatic Life (MDE, 2018a).

Waters within the Patuxent River Middle watershed are subject to the following impairments as noted on MDE's 303(d) List (MDE, 2018b):

- Nitrogen (Total);
- PCB in Fish Tissue;
- Phosphorus (Total);
- Sulfates; and
- Total Suspended Solids (TSS).

There are 49 centerline miles of MDOT SHA roadway located within the Non-Tidal Patuxent River Middle watershed. The associated ROW encompasses 718 acres, of which 246 acres are impervious. MDOT SHA facilities located within the watershed consist of 2 weigh stations, 4 park and rides, and 1 salt storage facility.

See **Figure 5** for a map of MDOT SHA facilities within the Non-Tidal Patuxent River Middle watershed.

F.2. MDOT SHA TMDLs within Non-Tidal Patuxent River Middle Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2018a), with a reduction requirement of 56 percent, as shown in **Table 3-2**. This TMDL only applies to the non-tidal portion of the Patuxent River Middle watershed. In addition to the sediment TMDL, there is also a PCB TMDL in the Patuxent River tidal fresh Chesapeake Bay segment.

While the Patuxent River Middle watershed is located in Anne Arundel, Calvert, and Prince George's Counties, Calvert County is currently outside of the MDOT SHA NPDES current permit coverage area. Therefore, **Section F.3.**, **Section F.4.**, and **Section F.5.** below only pertain to the portion of the Patuxent River Middle watershed in Anne Arundel and Prince George's Counties. When MDOT SHA's next permit is issued and if Calvert County becomes a part of the next permit coverage area this implementation plan will be re-evaluated.

F.3. MDOT SHA Visual Inventory of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. For each BMP type, implementation teams have performed preliminary evaluations for each grid and/or major State route corridor within the watershed as part of desktop and field evaluations. The grid-system used for the Non-Tidal Patuxent River Middle watershed is shown in **Figure 6** which illustrates that 35 grid cells have been reviewed, encompassing portions of 16 State route corridors. Results of the visual inventory categorized by BMP type follow.

Structural Stormwater Controls

Preliminary evaluation identified 238 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 13 new structural SW controls constructed.
- 197 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 28 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 57 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 42 sites constructed.
- 13 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 52 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

No stream sites were identified in this watershed for restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 18 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 5 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 13 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 148 outfalls potential for stabilization. Further analysis of these sites resulted in:

- 10 outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- 138 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 3 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Retrofit of 1 existing structural SW controls constructed.
- 2 retrofit sites deemed not viable for retrofit and have been removed from consideration.

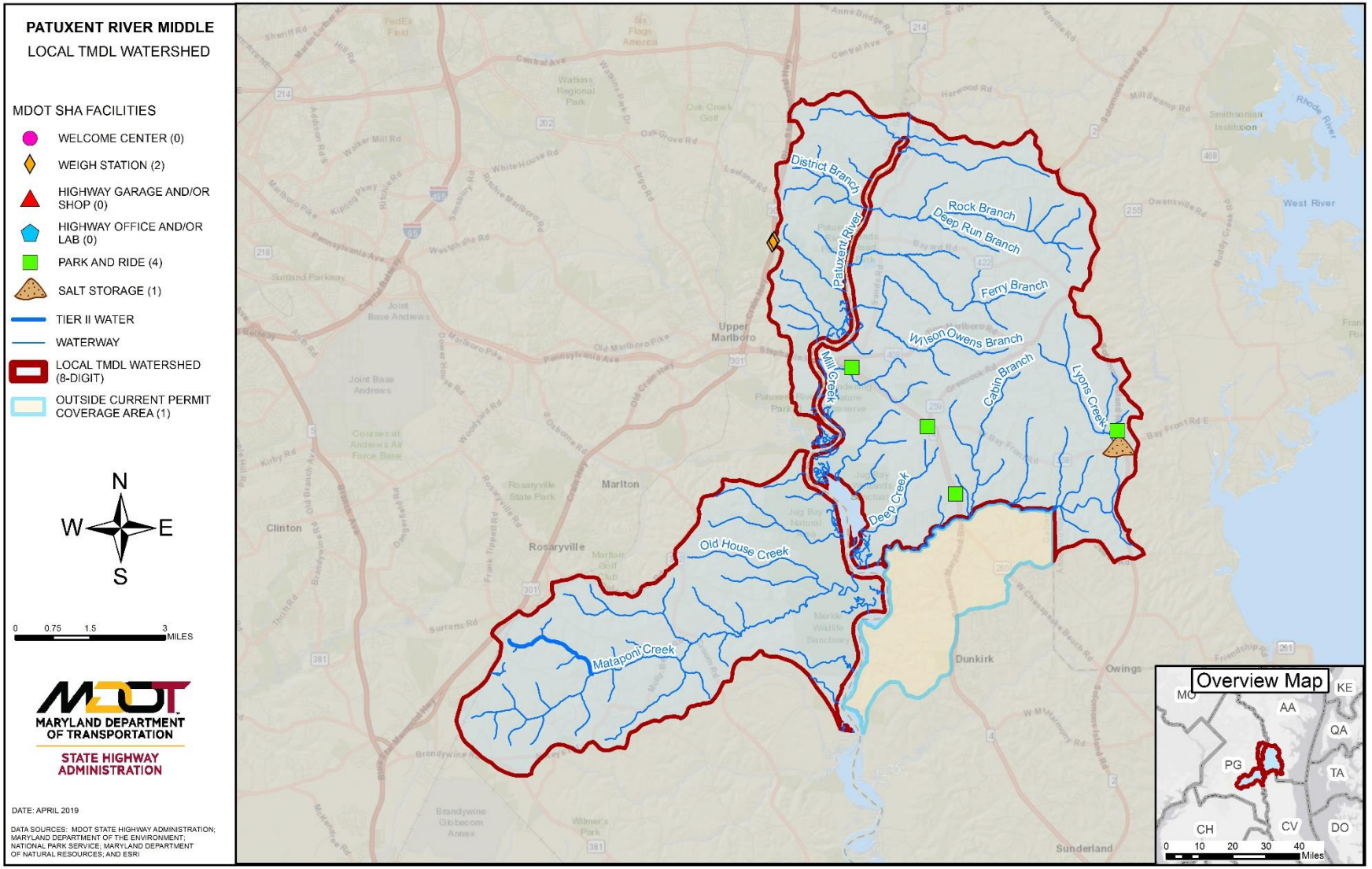


Figure 5: Non-Tidal Patuxent River Middle Watershed

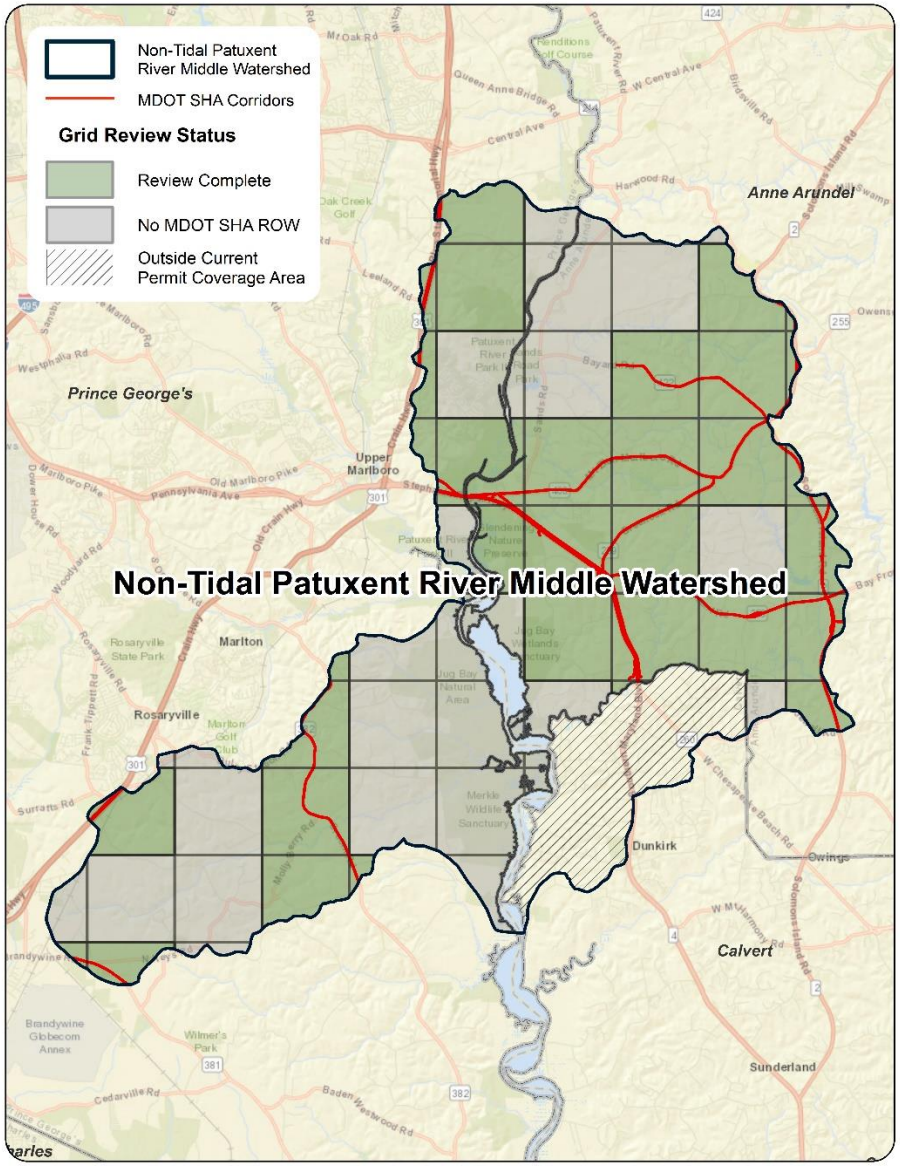


Figure 6: Non-Tidal Patuxent River Middle Site Search Grids

F.4. Summary of County Assessment Review

Anne Arundel County Assessment

The *Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment Comprehensive Summary Report* was published in June 2018 (hereinafter referred to as the "2018 Report"). The 2018 Report was the result of a collaborative effort between the Watershed Protection and Restoration Program within the Anne Arundel County Department of Public Works (AA-DPW), KCI Technologies, Inc., and Coastal Resources, Inc. (AA-DPW et al., 2018). The 2018 Report serves as Anne Arundel County's assessment of the 8-digit Patuxent River Middle watershed portion located within Anne Arundel County (referred to as the "Middle Patuxent" watershed in the 2018 Report).

The Patuxent River Middle watershed is located in the southern portion of the County and divided into 33 subwatersheds. Each subwatershed was given a name to match the surrounding geographic area (stream or landmark) and assigned a number if there were multiple subwatersheds related to that geographic area (e.g., Rock Branch 1, Rock Branch 2, etc.) as well as a three-digit code beginning with "MP" for Middle Patuxent. Ten of the subwatersheds were given numbers: MP0 – MP9; the rest were given letters: MPA, MPB, MPD – W, and MPZ. While not specifically discussed in this summary, MPC, MPX, and MPY are three subwatersheds that are in the Patuxent River Lower watershed that were grouped in with the Patuxent River Middle watershed for analysis and reporting in the 2018 Report. For simplicity, the names, not codes, of the 33 subwatersheds are used in this summary.

The Anne Arundel County portion of the Patuxent River Middle watershed is approximately 29,820 acres in area in the southern portion of the County. The watershed includes several named streams including Rock Branch, Wilson Owens Branch, Lyons Creek, Cabin Branch, Galloway Creek, and the middle branch of the Patuxent River.

In the Patuxent River Middle, the fastest development occurred in the Galloway Creek subwatershed between 1920 and 1999. Development is expected to continue to occur. The majority of future residential development will likely take place in and around the Wilson Owens Branch and Galloway Creek subwatersheds.

Many sensitive environmental features can be found throughout the watershed, including wetlands primarily in the eastern portion of the watershed, greenways, forested areas, Chesapeake Bay Critical Area (CA), and Federal Emergency Management Agency (FEMA) floodplains. These high-quality habitats are sensitive to anthropogenic stress and have been identified as priorities for protection. Soils within the Patuxent Middle watershed hold diverse hydrologic characteristics and erodibility; however, the majority of slopes are categorized as highly erodible (52.1 percent) or potentially highly erodible (30.60 percent). The majority of soils are classified as Hydrologic Group B, which indicates moderately low runoff potential. Land uses within the watershed are as follows (approximately): woods (38 percent); residential (22 percent); row crops (18 percent); commercial, forested wetland, open space, pasture/hay and transportation individually (1-8 percent), and industrial, mining, and utilities individually (less than 1 percent) (AA-DPW et al., 2018).

The stormwater BMPs in the Patuxent River Middle watershed are typically owned by private land owners, the County, or other State agencies, such as the MDOT SHA. While the majority of BMPs in the watershed are privately owned, the MDOT SHA-owned BMPs account for about half of the managed drainage areas within the Patuxent River Middle watershed within Anne Arundel County (AA-DPW et al., 2018). Examples of privately owned BMPs include small bioretention cells and ESD facilities such as rain gardens and downspout disconnection.

Four types of assessments were conducted for the Patuxent River Middle watershed in Anne Arundel County: stream restoration, subwatershed restoration, subwatershed preservation, and parcel scale. All four types of assessments utilized a prioritization rating scale of High, Medium High, Medium, or Low.

Results of the stream restoration showed that when compared with all of the major watersheds in Anne Arundel County, the Patuxent River Middle watershed has relatively few stream reaches rated High for restoration, with most of the reaches falling in the Medium and Low category. The “Lyons Creek 10” subwatershed had the most stream reaches in the High category with four reaches rated as High priority for restoration.

The subwatershed restoration assessment used a suite of indicator ratings that were weighed and combined to obtain a single restoration rating for each subwatershed. The indicators were grouped into one of seven categories: stream ecology, 303(d) list, septics, BMPs, H&H, water quality, and landscape. In the Patuxent River Middle watershed, only 4 subwatersheds out of the 33 subwatersheds received a rating of High for restoration priority: “Galloway Creek,” “Wilson Owens Branch 2,” “Lyons Creek 7,” and “Lyons Creek 8.”

The subwatershed preservation assessment also used a suite of indicator ratings that were weighed and combined to obtain a single preservation rating for each subwatershed. The indicators were grouped into one of five categories: stream ecology, future departure of water quality conditions, soils, landscape, and aquatic living resources. Ten subwatersheds out of the 33 subwatersheds (30 percent) were rated High priority for preservation: “Ferry Branch 1,” “Galloway Creek,” “Cabin Branch 1,” “Two Run Branch 2,” “Pindell Branch,” “Lyons Creek 2,” “Lyons Creek 9,” “Cabin Branch 2,” “Two Run Branch 1,” and “Wilson Owens Branch 4.” The Anne Arundel County Plan further noted that two “Tier II High Quality Waters” stream segments exist in the “Cabin Branch 1” and the “Lyons Creek 10” subwatersheds.

As stated above, the “Cabin Branch 1” subwatershed received a preservation ranking of High. The nearby “Lyons Creek 10” subwatershed received a preservation ranking of Medium High. These two ratings coupled with the fact that several adjacent subwatersheds draining to the reaches in the “Cabin Branch 1” and “Lyons Creek 10” subwatersheds also rated High for preservation makes “…this an

important area for implementing preservation measures" (AA-DPW et al., 2018, p. 90).

Lastly, a parcel scale assessment was conducted. The Anne Arundel County Plan noted that this additional assessment was completed due to the fact that the general land use conditions in the southern portions of Anne Arundel County differ from the rest of the County in that the southern areas are less developed and contain more agricultural and forest cover. Consequently, the amount of impervious surface area in the southern portions of the County is "considerably less" than in other parts of the County (AA-DPW et al., 2018, p. 91). Impervious surface accounts for only 4.8 percent of the total area (1444.7 acres) in the Patuxent River Middle watershed. MDOT SHA owns 211.5 acres of impervious cover or 31 percent of the total impervious land cover in the watershed. Based on this information, the County has recognized that preservation is critical in the Patuxent River Middle watershed. Therefore, the County supplemented its subwatershed preservation assessment with three separate but related prioritization models that identified areas at the parcel level as good candidates for 1 preservation, 2 tree planting and/or riparian buffer restoration, and 3 impervious treatment (removal and conversion to pervious). At the parcel level, there were too many sites identified to provide a meaningful summary. Accordingly, the 2018 Report provides a visual summary of the identified good candidate sites for these actions in the form of several large maps (see Map 4.4 for the good candidate sites for preservation, Map 4.5 for the good candidate sites for reforestation, and Map 4.6 for the good candidate sites for impervious treatment in the 2018 Report).

Calvert County Assessment

Calvert County is currently outside of the MDOT SHA MS4 NPDES current permit coverage area.

Prince George's County Assessment

As of December 2018, a watershed restoration plan for the Patuxent River Middle for portions of the watershed that fall inside the County is not available online on Prince George's Watershed Restoration Planning Site (http://pgcdoe.net/pgcountyfactsheet/Factsheet/Default). A Watershed Existing Conditions Report covering the Patuxent River Middle portion within Prince George's County is also not currently available on the site.

F.5. MDOT SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Non-Tidal Patuxent River Middle watershed are shown in **Table 4**. Projected sediment reductions using these practices are 59,007 lbs. which is 56.1 percent of the required reduction. Four timeframes are included in the table below:

- BMPs built before the TMDL baseline. In this case, the baseline is 2009;
- BMPs implemented after the baseline through fiscal year 2020; and
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- BMPs to be implemented after fiscal year 2025 through the target year, 2040.

MDOT SHA will accomplish the projected reduction to be achieved as a percent of the baseline load presented in **Table 2**.

Estimated costs to design, construct, and implement BMPs within the Non-Tidal Patuxent River Middle watershed total $9,498,000. These projected costs are based on an average cost per impervious acre treated derived from cost history for each BMP type. See **Table 5** for a summary of estimated BMP costs.

Table 4: Non-Tidal Patuxent River Middle Restoration Sediment BMP Implementation

BMP	Unit	Baseline (Before 2009)	Restoration BMPs			
			2020	2025	Target Year	Restoration Total
New Stormwater	Drainage area acres	92.9	11.6	9.4	28.1	49.1
Retrofit	drainage area acres		10.0	4.6	13.9	28.5
Impervious Disconnects	credit acres	7.5				0.0
Tree Planting	acres of tree planting		33.5			33.5
Stream Restoration	linear feet			729	2,186.0	2,915.0
Outfall Stabilization	linear feet			46.5	139.7	186.2
Inlet Cleaning[2]	dry tons		3.4			3.4
Load Reductions	TSS EOS lbs./yr.	19,552.4	5,128.7	13,072.5	40,805.9	59,007.1
					Total Projected Reduction	**59,007.1**

[1] Cross-jurisdictional BMPs may be a mix of various types of stormwater treatment.
[2] Inlet cleaning and street sweeping are annual practices.

Figure 7 is a map of MDOT SHA's restoration practices in the watershed and includes those that are under design and construction. Inlet cleaning is not reflected on this map.

Table 5: Non-Tidal Patuxent River Middle Restoration BMP Cost

BMP	2020	2025	Target Year	Restoration Total
New Stormwater	$1,739,000	$766,500	$2,299,500	$4,805,000
Retrofits	$221,000	$267,000	$801,000	$1,289,000
Impervious Surface Elimination				
Tree Planting	$1,130,000			$1,130,000
Stream Restoration		$453,500	$1,360,500	$1,814,000
Outfall Stabilization		$110,250	$330,750	$441,000
Inlet cleaning	$19,000			$19,000
Street Sweeping				
			Total Cost	**$9,498,000**

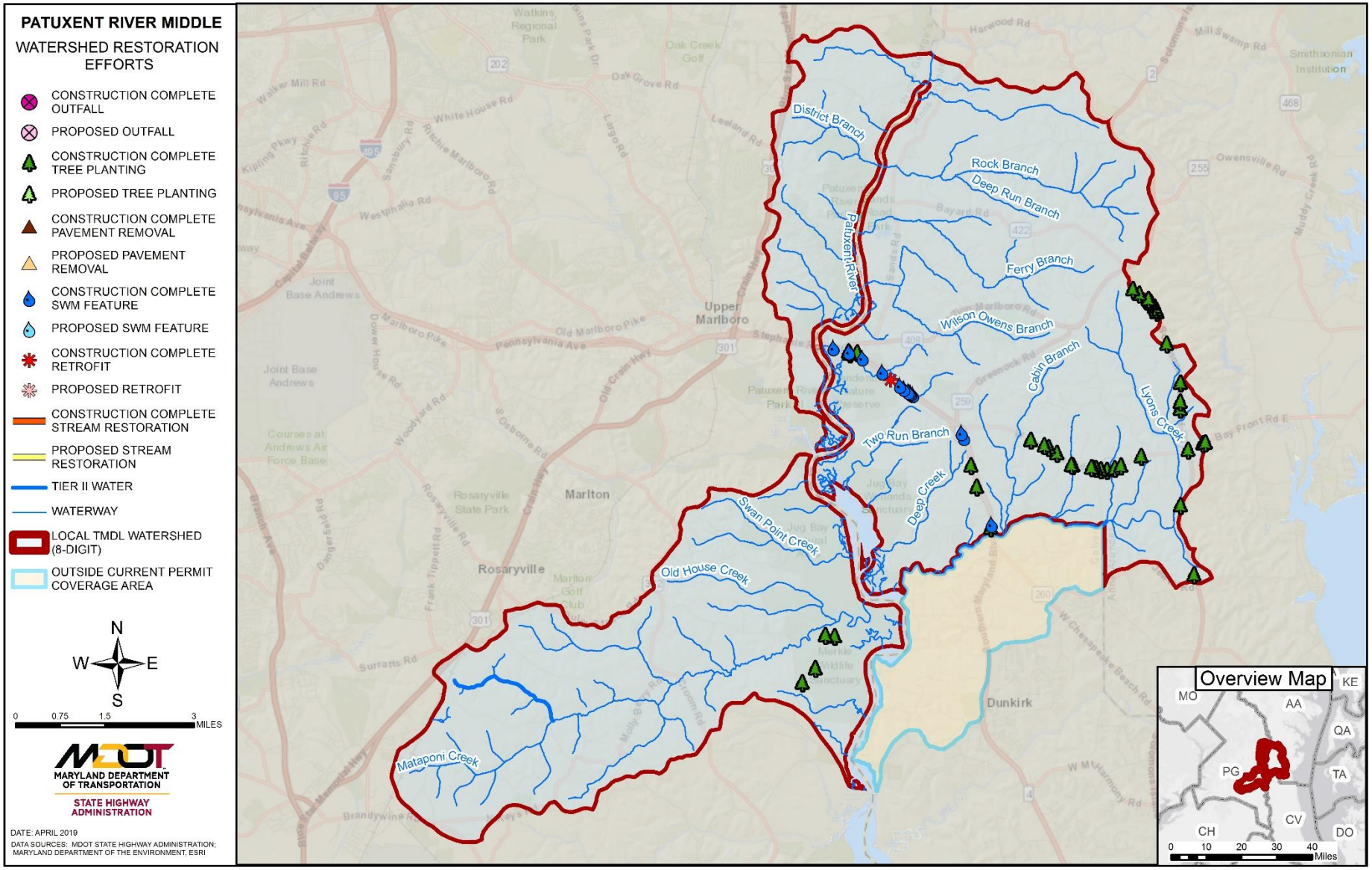


Figure 7: MDOT SHA Programmed Restoration Strategies within the Non-Tidal Patuxent River Middle Watershed

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Patuxent River Middle
County Name	Anne Arundel / Prince George's
Date	4/5/2019

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year (Available on TMDL Data Center WLA Search)	2009
Implementation Plan Baseline Year (If different from TMDL Baseline year, provide explanation in write-up)	2009
Impervious Acres in Implementation Baseline Year	245
Pervious Acres in Implementation Baseline Year	466

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	56.0%
Available on TMDL Data Center WLA Search	

			Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2019**	**Target Year**			**2040**	
				2009	Progress Reductions				Future Reductions				
						Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2040			
		BMP Name	**Type**	**Unit**	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2040	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.4	4.7			2,025.1					5.0
				Pervious Acre Treated	0.5	6.9								7.4
		Grass Swales	Cumulative	Impervious Acres Treated	10.9					15.0			5,018.3	25.9
				Pervious Acre Treated	18.1					22.5				40.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	1.4									1.4
				Pervious Acre Treated	2.6									2.6
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	18.0									18.0
				Pervious Acre Treated	33.1									33.1
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated						7.4			2,342.1	7.4
				Pervious Acre Treated						11.1				11.1
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acre Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acre Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acre Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	3.0	1.3			829.6					4.3
				Pervious Acre Treated	5.1	8.7								13.8

Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Inlet Cleaning	Annual **	Dry tons removed		0.2			88.2	3.2			1,323.0	3.4
		Impervious Urban Surface Elimination	Cumulative	Impervious acre converted to pervious										-
		Urban Tree Planting	Cumulative	Acre planted on pervious		33.5			862.8					33.5
		Urban Stream Restoration	Cumulative	Linear feet restored						2,915.0			43,725.0	2,915.0
		Outfall Stabilization	Cumulative	Linear feet						186.2			2,793.0	186.2
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
				REDUCTIONS:		**TOTAL**	**0**	**0**	**3,806**	**TOTAL**	**0**	**0**	**55,201**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		105,112

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	0	101,306

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	0	46,105

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL | Legend | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	56.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	46,249

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction percentage

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Data as of 2/25/2019

ABBREVIATIONS

AA	Anne Arundel (County)
AA-DPW	Anne Arundel County, Department of Public Works
BMP	Best Management Practice
CA	Chesapeake Bay Critical Area
CBPWM	Chesapeake Bay Program Watershed Model
CWA	Clean Water Act
DNR	Maryland Department of Natural Resources
EPA	United States Environmental Protection Agency
ESD	Environmental Site Design
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
LA	Load Allocations
lbs	Pounds (weight)
LF	Linear Feet
MD	Maryland
MDE	Maryland Department of the Environment
MDOT SHA	Maryland Department of Transportation State Highway Administration
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OED	Office of Environmental Design (MDOT SHA)
PCB	Polychlorinated Biphenyl
ROW	Right-of-Way
SCA	Stream Corridor Assessment
SW	Stormwater
SWM	Stormwater Management
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
tPCB	Total Polychlorinated Biphenyl
TSS	Total Suspended Solids
USGS	United States Geological Survey
WLA	Wasteload Allocation
WPD	Water Programs Division (MDOT SHA)
WQSs	Water Quality Standards
yr	Year

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