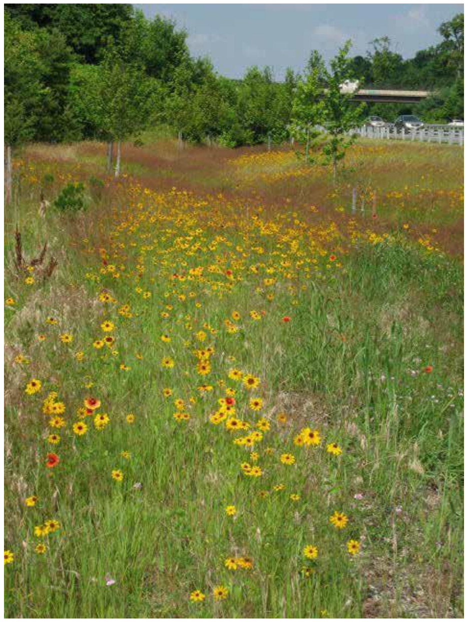
MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Non-tidal Back River Watershed Sediment TMDL Implementation Plan

March 06, 2019



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NON-TIDAL BACK RIVER 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 Best Management Practices (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.

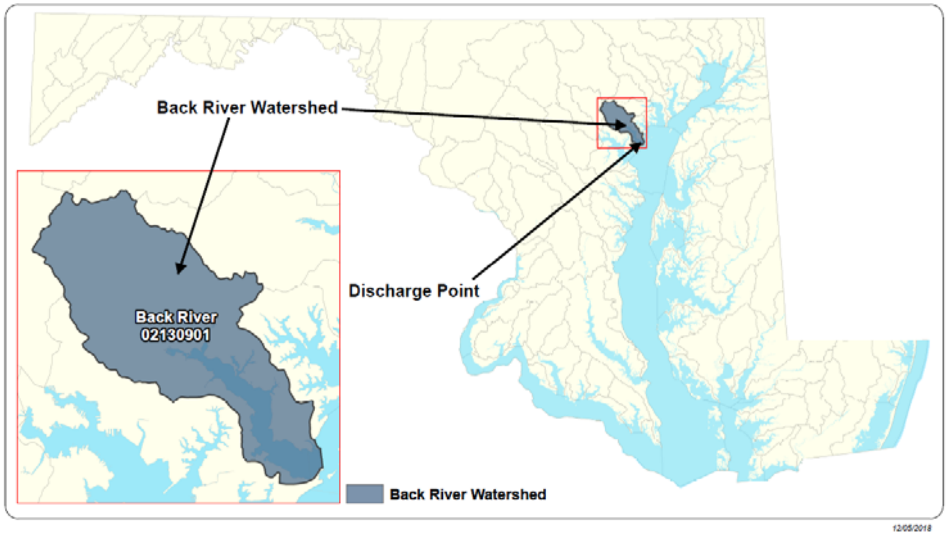


Figure 1: Maryland 8-digit Watershed Example

County Watershed Assessments

Each MS4 county is required to perform detailed assessments of local watersheds as a part of its MS4 permit requirements. These assessments determine current water quality conditions and include visual inspections; 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 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 in this Plan 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 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:

- On-going coordination meetings with each of the MS4 counties to discuss potential partnerships with the mutual goal of improving water quality;
- Perform visual watershed inspections as described below;
- Model MDOT SHA load reductions within the watershed based on MDOT SHA land uses and ROW; and
- Maximize 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 to ensure that it is thoroughly assessed. 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 MDOT SHA data. MDOT SHA has created a grid system of 1.5 mile square cells to track the progress of the visual watershed inspections, allowing prioritized areas to be targeted first. With this grid system, many spatial data sets are reviewed to determine the most cost-effective use of each potential restoration site. The sites are documented geographically and stored in Geographic Information Systems (GIS) to then 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 Back River 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 from the field analysis. A standardized field inspection form is used.

D. BENCHMARKS AND DETAILED COSTS

Benchmarks and deadlines demonstrating progress toward meeting all applicable stormwater WLAs are provided in the watershed discussion 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.

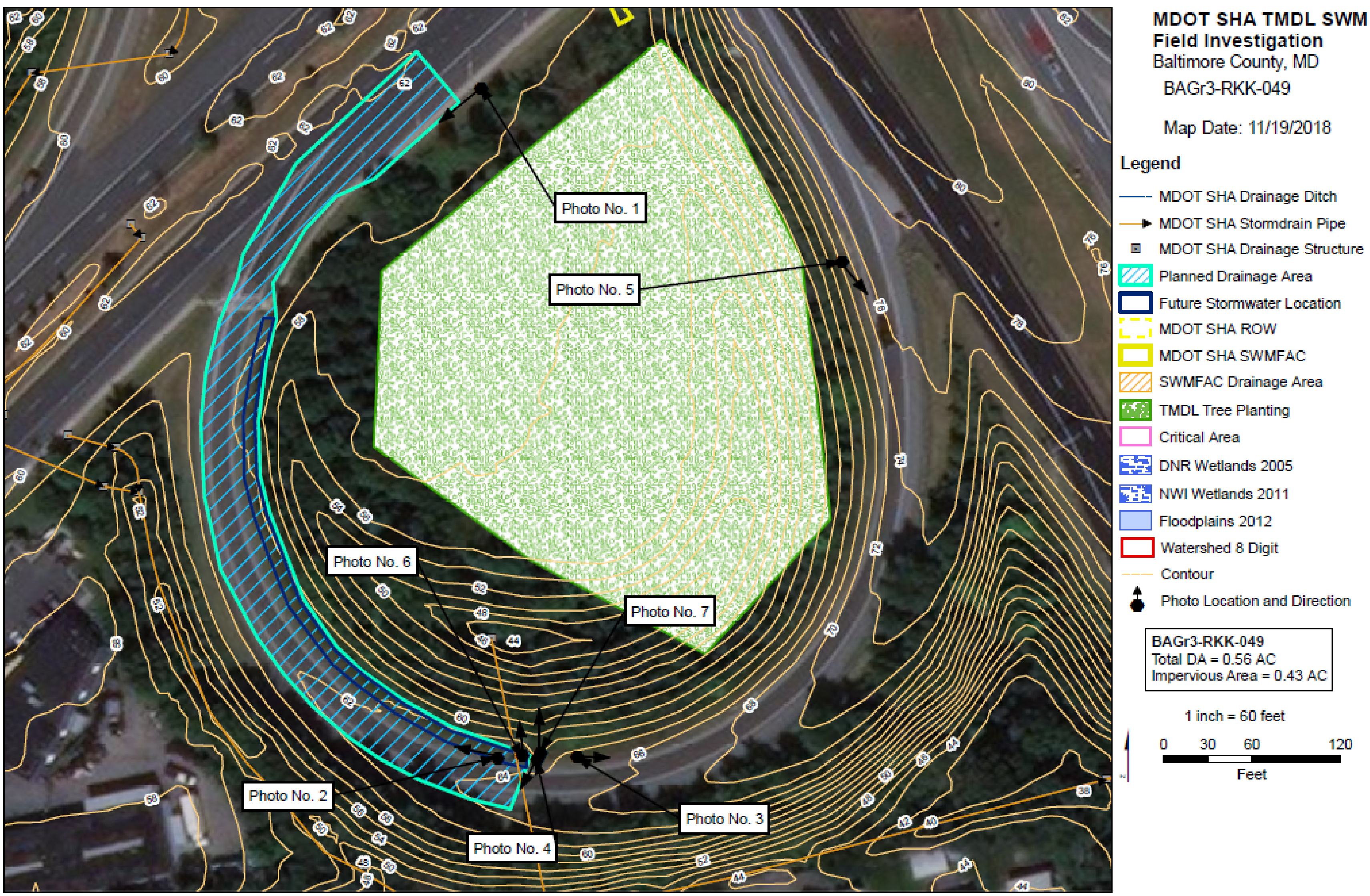


Figure 2: Example Field Investigation Summary Map

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.

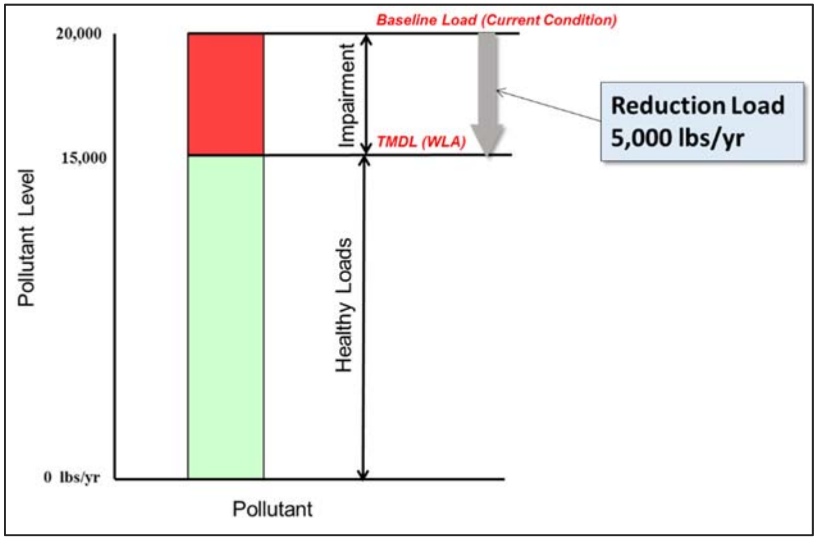


Figure 3: Example Wasteload Allocation and Reduction Requirement

Modeling Parameters

MDE requires that pollutant modeling follow the guidance in the MDE's *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014b); 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 2016 Annual Report. Updates to this protocol will be periodically implemented and resubmitted for MDE consideration. This protocol, *MDOT SHA Automated 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, 2018) 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

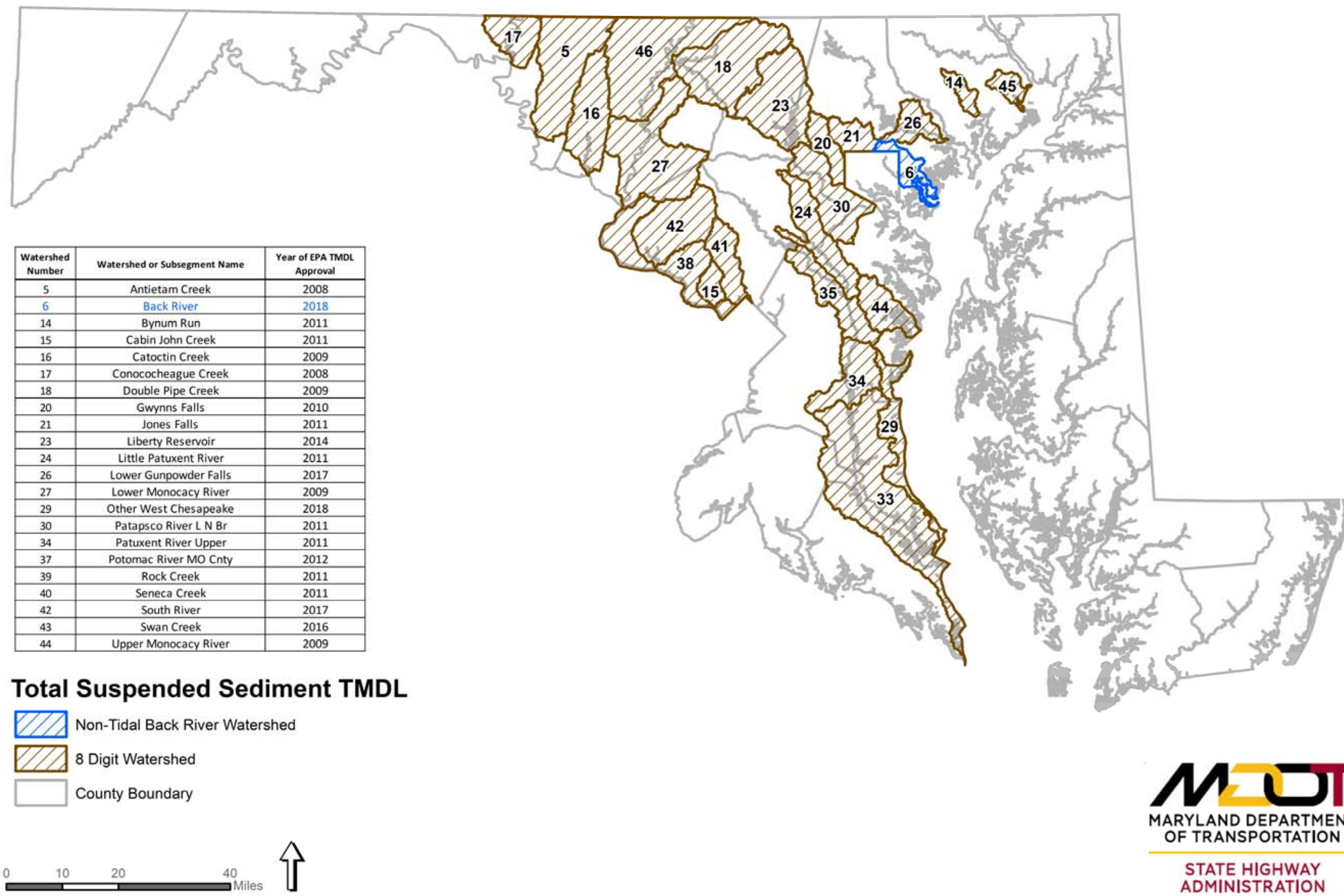
E.2.a. Sediment TMDLs Affecting MDOT SHA

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 Back River Watershed, Baltimore County and Baltimore City, Maryland, approved by EPA on May 5, 2018.*

In **Table 2,** the MDOT SHA reduction target for the Non-tidal Back River sediment TMDL is 75 percent, or 242,234 lbs./yr. The watershed can safely receive 80,745 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 Back River 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 83,435 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.



Watershed Number	Watershed or Subsegment Name	Year of EPA TMDL Approval
5	Antietam Creek	2008
6	Back River	2018
14	Bynum Run	2011
15	Cabin John Creek	2011
16	Catoctin Creek	2009
17	Conococheague Creek	2008
18	Double Pipe Creek	2009
20	Gwynns Falls	2010
21	Jones Falls	2011
23	Liberty Reservoir	2014
24	Little Patuxent River	2011
26	Lower Gunpowder Falls	2017
27	Lower Monocacy River	2009
29	Other West Chesapeake	2018
30	Patapsco River L N Br	2011
34	Patuxent River Upper	2011
37	Potomac River MO Cnty	2012
39	Rock Creek	2011
40	Seneca Creek	2011
42	South River	2017
43	Swan Creek	2016
44	Upper Monocacy River	2009

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Figure 4: MDOT SHA Sediment TMDL Responsibilities in Local Watersheds

Table 2: MDOT SHA Non-tidal Back River Watershed Sediment Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	WLA Type	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction	MDOT SHA Proposed 2025 Interim Reduction	% 2020 Reduction Achieved Relative to Baseline	% 2025 Reduction Achieved Relative to Baseline	Target Year
Non-tidal Back River	02130901	BA	Sediment	3/5/2018	Individual WLA	2009	Lbs./yr.	322,978	75.0%	242,234	49,479	83,435	20.4	34.4	2045

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 (CBWM). 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.

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, 2014b; EPA, 2010b; Hoos et al., 2000; and Schueler, 2011.		

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.

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.

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. To date, adequate numbers of practices have not been identified that reach 100% of the reduction requirement for the Non-tidal Back River; however, MDOT SHA believes that it will be able to reach the reduction target by 2045. We 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 Back River sediment WLA end date.

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

F.1. Watershed Description

The Non-tidal Back River watershed (MD 8-digit Basin Code: 02130901) encompasses 55 square miles (approximately 35,000 acres) in the western shore region of Maryland within the City of Baltimore and Baltimore County. The Non-tidal Back River watershed drains into the Back River, which ultimately discharges into the Chesapeake Bay. Major tributary creeks and streams of the Non-tidal Back River watershed include Armistead Run, Biddison Run, Bread and Cheese Creek, Brien's Run, Chinquapin Run, Deep Creek, Duck Creek, Herring Run, Moore's Run, Northeast Creek, Redhouse Run, Stemmers Run, and Tiffany Run. The Non-tidal Back River watershed is comprised of the Upper Back River (UBR) subwatershed and the Tidal Back River (TBR) subwatershed excluding the tidal waters of Back River. The UBR subwatershed accounts for 78 percent of the Non-tidal Back River watershed and the TBR subwatershed accounts for the remaining 22 percent.

The designated uses of the Non-tidal Back River are Use Class I – Water Contact Recreation and Protection of Nontidal Warmwater Aquatic Life and Use Class IV – Recreational Trout Waters.

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

- Chlordane;
- Chlorides;
- Fecal Coliform;
- Nitrogen (Total);
- PCB in Fish Tissue;
- PCBs;
- Phosphorus (Total);
- Sulfates; and
- Total Suspended Solids (TSS).

There are 869.3 centerline miles of MDOT SHA roadway located within the Non-Tidal Back River watershed. The associated ROW encompasses approximately 1,532.3 acres, of which approximately 718.4 acres are impervious. MDOT SHA facilities located within the watershed consist of two (2) highway garage and/or shops, and three (3) salt storage facilities.

See **Figure 5** for a map of MDOT SHA facilities within the watershed.

F.2. MDOT SHA TMDLs within Non-tidal Back River Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2017), with a reduction requirement of 75 percent, as shown in **Table 2**. This TMDL only applies to the non-tidal portion of the watershed. There are also nitrogen and phosphorous TMDLs with MDOT SHA WLAs for this watershed that will be addressed in a separate implementation plan.

While the Non-tidal Back River watershed is located in both Baltimore City and Baltimore County, Baltimore City is currently outside of the MDOT SHA's jurisdiction. Therefore, **Section F.3.**, **Section F.4.**, and **Section F.5.** below only pertain to the portion of the Non-tidal Back River watershed in Baltimore County.

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 Back River watershed is shown in **Figure 6** which illustrates that 31 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 205 locations as potential new structural stormwater (SW) control locations. Further analysis of these locations resulted in:

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

Tree Planting

Preliminary evaluation identified 151 locations as potential tree planting locations. Further analysis of these locations resulted in:

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

Stream Restoration

Preliminary evaluation identified seven (7) sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Seven (7) sites deemed not viable for stream restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 101 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 23 new structural SW controls constructed or under contract.
- Two (2) additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 76 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

No outfall stabilization sites were identified within this watershed for potential restoration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified six (6) existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Retrofit of two (2) existing structural SW controls constructed or under contract.
- Four (4) retrofit sites deemed not viable for retrofit and have been removed from consideration.

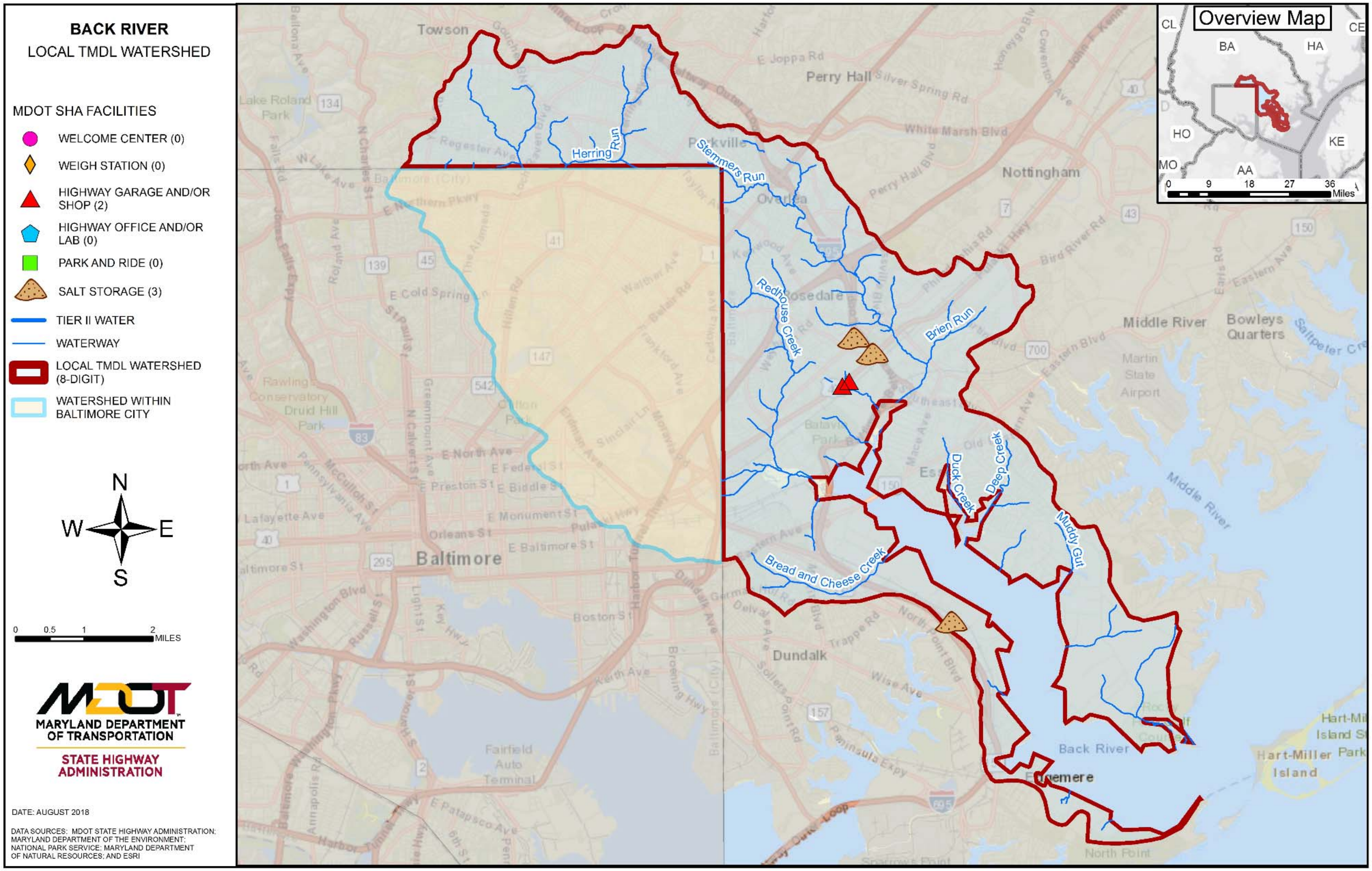

Figure 5: MDOT SHA Facilities within Non-tidal Back River Watershed

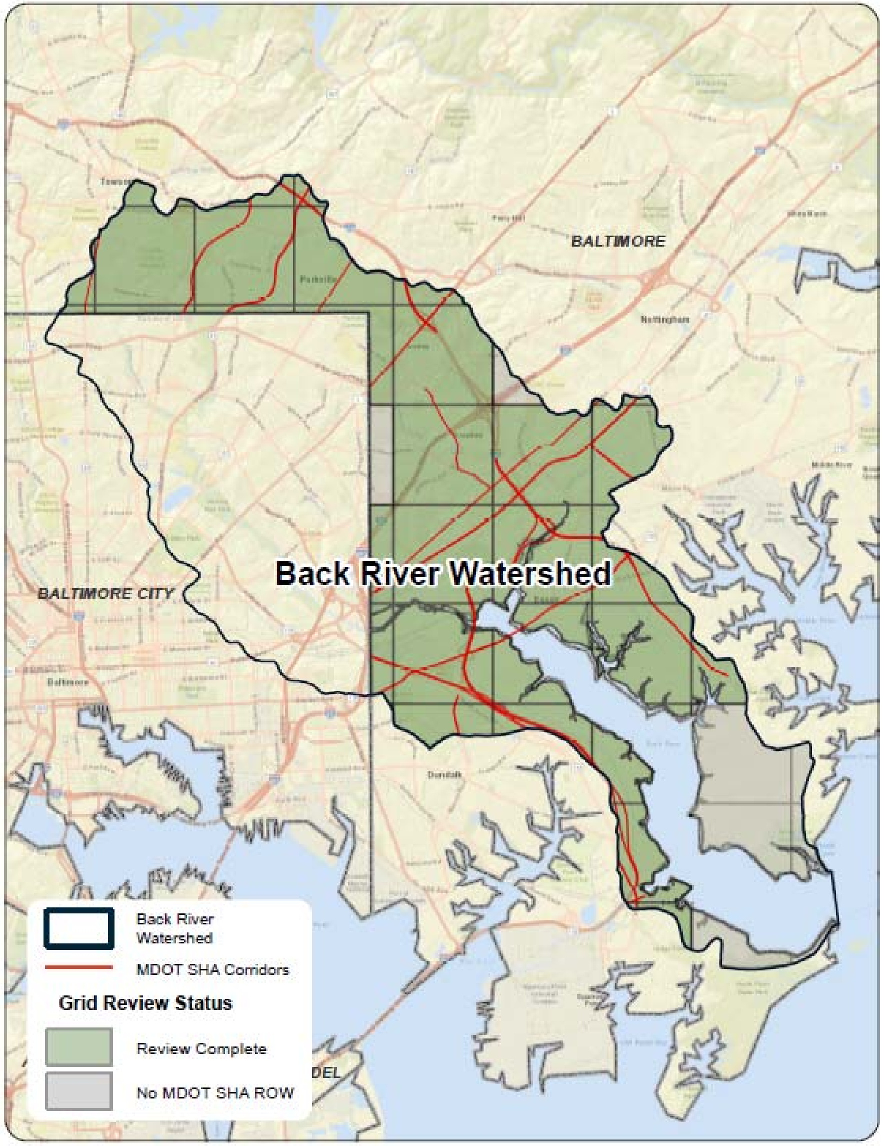

Figure 6: Non-tidal Back River Site Search Grids

F.4. Summary of County Assessment Review

As previously stated in **Section F.1.**, the Non-tidal Back River watershed is divided into two subwatersheds: the non-tidal UBR and the estuary TBR. Baltimore County completed a Small Watershed Action Plan (SWAP) for the UBR watershed in 2008 and the TBR watershed in 2010. Baltimore City is not currently under MDOT SHA MS4 Phase I Permit Coverage; therefore, only Baltimore County's watershed assessments will be summarized in this section.

In November 2008, the Baltimore County Department of Environmental Protection and Resource Management (BA-DEPRM) in consultation with the Upper Back River SWAP Steering Committee completed the *Upper Back River Small Watershed Action Plan* (BA-DEPRM, 2008a)—hereinafter referred to as the "UBR SWAP."

In February 2010, on behalf of the BA-DEPRM, Parsons Brinckerhoff (PB) completed the *Tidal Back River Small Watershed Action Plan* (PB, 2010)—hereinafter referred to as the "TBR SWAP."

The UBR watershed is a 43.3 square-mile area located in the southeastern region of Baltimore County and northeastern portion of Baltimore City. It represents 78 percent of the total Non-tidal Back River watershed and is broken down into 14 subwatersheds. Jurisdictionally, 44.5 percent of the UBR is in the City and 55.5 percent is in the County. Land use within the UBR watershed is as follows: Residential (55.4 percent), Forest (11.5 percent), Commercial (9.9 percent), Institutional (8.0 percent), Industrial (6.5 percent), and Open Urban (6.2 percent). The total impervious cover at the time the UBR SWAP was published (November 2008) was 30.7 percent of the watershed (BA-DEPRM, 2008a).

The TBR watershed consists of approximately 12 square miles or 22 percent of the entire Non-tidal Back River watershed. It is divided into

10 subwatersheds. The land use within the watershed is as follows: Residential (34.0 percent), Forest (32.1 percent), Other Urban (11.4 percent), Commercial (7.2 percent), Institutional (4.4 percent), Agriculture (4.4 percent), Industrial (3.5 percent), and Water/Wetlands (3.0 percent). The total impervious cover at the time the TBR SWAP was published (February 2010) was 18.4 percent of the watershed. (PB, 2010).

The UBR watershed is within the Piedmont and the Coastal Plain regions on the State. The majority (57.2 percent) of slopes within the watershed are categorized as low-medium (3-8 percent). The most common Hydrologic Soil Group is Group D (46.7 percent); this group has the highest runoff potential as it has very low infiltration rates. Overall, the watershed has a fairly even distribution of soil erodibility, with a large proportion of the soils being prone to at least moderate or high soil erodibility. The watershed contains 3,187.4 acres of forest, 11.5 percent of the total area. The combination of high runoff potential, moderate and high soil erodibility, and a small percentage of forest cover may pose a challenge to reducing sediment loads within the watershed (BA-DEPRM, 2008a).

The TBR watershed is within the Coastal Plain region of the State. The Hydrologic Soils Group is diverse: Group C (40.8 percent), Group B (32.3 percent), Group D (25.4 percent), and Group A (1.5 percent) (PB, 2010).

The UBR SWAP lays out eight main goals:

1. Improve and Maintain Healthy Streams;
2. Restore and Maintain Aquatic Biology and Habitat;
3. Improve Stream Corridors for Water Quality, Biological, and Habitat Enhancement;
4. Increase Tree Cover;
5. Reduce Stormwater Impacts from Impervious Surfaces;
6. Increase the Use of Public Facilities and Properties as Models of Good Best Management Practices (BMPS);
7. Improve Access to Streams; and
8. Enhance Unused Green Space.

The TBR SWAP lays out six main goals:

1. Improve and Maintain Clean Water;
2. Reduce Trash and Promote Recycling;
3. Increase Citizen Participation with Restoration Projects;
4. Restore and Maintain Fisheries and Habitat;
5. Encourage Safe Recreational Boating and Public Access; and
6. Enhance Natural Resources on Public Property.

Many of these goals from both SWAPs assist in directly and indirectly decreasing TSS throughout the entire watershed. Of the UBR goals, goal three most directly affects sediments through increasing forest cover that is adjacent to streams which will in turn reduce sedimentation through the filtering of groundwater and absorption of flood flows. In addition, goal five also directly influences sediment loading. The UBR watershed has 31 percent cover from roads or buildings. These impervious surfaces are channels by which stormwater and the sediments and other pollutants that may be carried by stormwater reaches streams. The two main objectives of goal five, reducing impervious cover and disconnecting impervious surfaces from the stormwater drain system, will directly remove sediments from entering streams. Both the UBR and TBR SWAPs have goals involving public access and increased involvement. These goals will indirectly lead to decreased TSS by the government leading as example to inspire and encourage others to employ BMPs, by providing access and awareness of waterways, and by creating a personal connection for citizens that will lead to changed behavior and a sense of personal responsibility (BA-DEPRM, 2008a; PB, 2010).

In addition, both SWAPs prioritized their subwatersheds based on ranking criteria in order to identify which subwatersheds have the greatest need and potential for restoration. For the UBR subwatershed, Chinquapin Run, Tiffany Run, Herring Run Mainstem, Armistead Run,

Biddison Run, Moore's Run, and Redhouse Run were rated "very high" and West Branch Herring Run, East Branch Herring Run, and an unnamed tributary were rated "high" in terms of restoration need and potential (BA-DEPRM, 2008a). For the TBR subwatershed, Deep Creek, Duck Creek, and Bread and Cheese Creek were rated "very high" and Lynch Point Cove, Back River-G, and Muddy Gut were rated "high" in terms of restoration need and potential. In the UBR subwatershed, all sites assessed by Baltimore City (42) and County (25) had BIBI scores in the "poor" or "very poor" categories (BA-DEPRM, 2008b).
For the purposes of planning, the County SWAPS suggest the following generalized restoration strategies to aid in meeting restoration goals within the Non-tidal Back River watershed:

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

The County also identified numerous potential restoration sites within each subwatershed by conducting neighborhood source assessments, hotspot site investigations, institutional site investigations, and pervious area assessments. In addition, the County identified multiple potential stormwater conversions within each subwatershed: 91 for the UBR subwatershed and 3 for the TBR subwatershed. Detailed information on site locations can be found in the SWAPs.

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

Table 4: Potential Stream Restoration Sites in the Non-tidal Back River Watershed

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

Sources: BA-DEPRM (2008a); PB (2010)

F.5. MDOT SHA Pollutant Reduction Strategies

Proposed practices to meet the sediment reduction in the Non-tidal Back River watershed are shown in **Table 5**. Projected sediment reductions using these practices are 83,435 lbs./yr. which is 34 percent of the required reduction. The following 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;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025.

The currently programmed BMPs will not meet the reduction requirement shown in **Table 2**. MDOT SHA will work to increase the excepted reduction requirement achievement for the sediment TMDL in this watershed through strategies identified in Section E.2.c.

Estimated Capital Budget costs to design and construct the programmed practices within the Non-tidal Back River watershed total $5,447,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP type. See **Table 6** for summary of estimated BMP costs.

Figure 7 is a map of MDOT SHA's restoration practices in this watershed and includes those that are under design or construction. This map does not include projected strategies for which locations have not been identified. Inlet cleaning and street sweeping are annual areawide practices and are not reflected on this map.

Table 5: Non-Tidal Back River Restoration Sediment BMP Implementation

BMP	Unit	Baseline (Before 2009)	Restoration BMPs			
			2020	2025	Future	Total
New Stormwater	drainage area acres	307.3	7.0	14.7	TBD	21.7
Retrofit	drainage area acres		12.3		TBD	12.3
Impervious Disconnects	credit acres	5.9			TBD	0.0
Tree Planting	acres of tree planting		44.8	2.6	TBD	47.4
Stream Restoration	linear feet		770.0	782.4	TBD	1,552.4
Outfall Stabilization	linear feet		1.6	400.0	TBD	401.6
Inlet Cleaning[1]	dry tons		17.5		TBD	17.5
Street Sweeping[1]	acres swept		31.1		TBD	31.1
Load Reductions	TSS EOS lbs/yr.		50,294.1	33,141.0	**242,234**	
				Total Projected Reduction	**242,234**	

[1] ***Inlet cleaning and street sweeping are annual practices.***

Table 6: Non-Tidal Back River Restoration BMP Cost

BMP	2020	2025	Total
New Stormwater	$466,000	$1,160,000	$1,626,000
Retrofits	$399,000		$399,000
Tree Planting	$1,370,000	$79,000	$1,449,000
Stream Restoration	$514,000	$522,000	$1,036,000
Outfall Stabilization	$3,000	$787,000	$790,000
Inlet cleaning	$100,000		$100,000
Street Sweeping	$47,000		$47,000
Total	$2,899,000	$2,548,000	$5,447,000

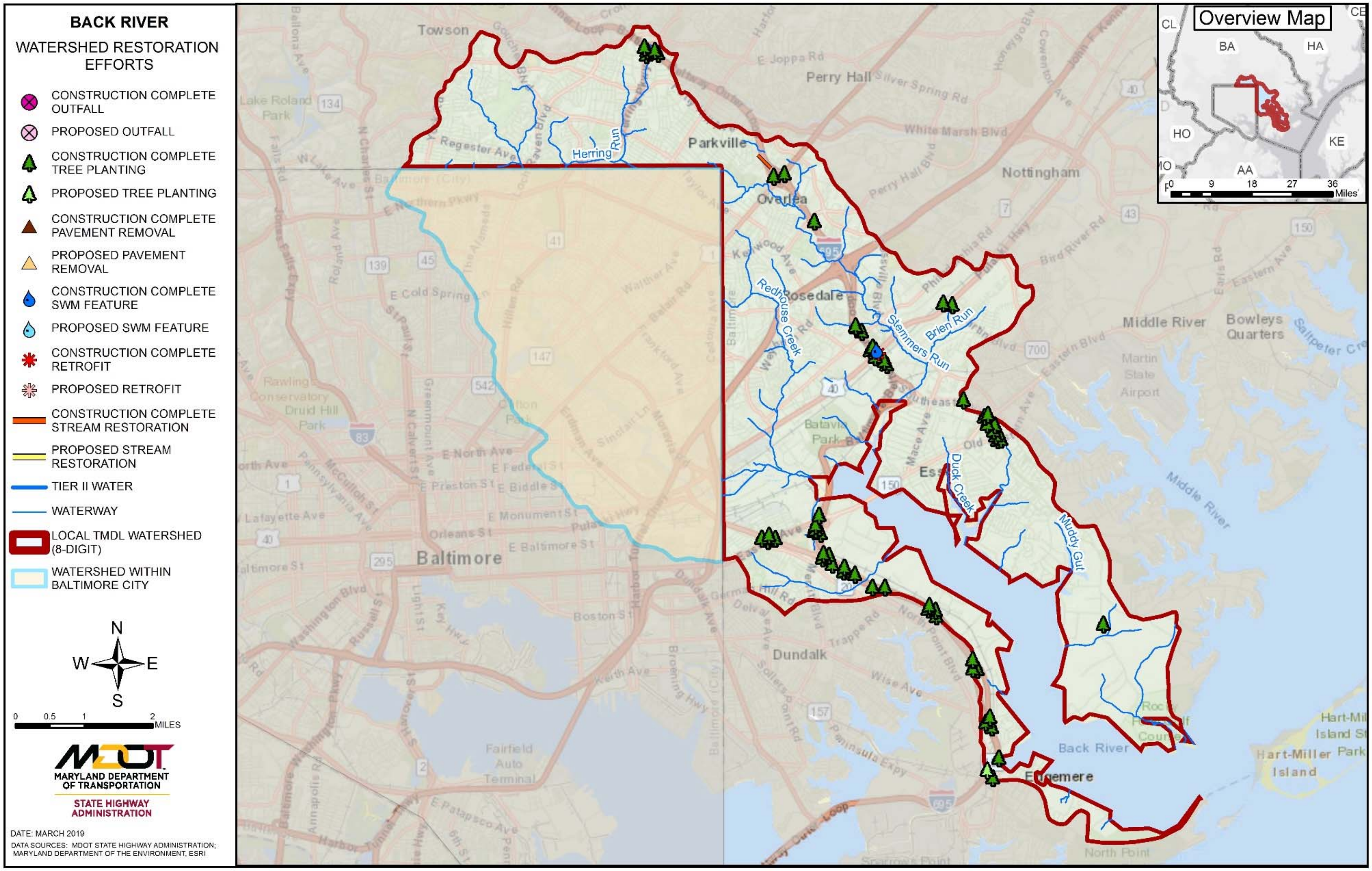

Figure 7: MDOT SHA Programmed Restoration Strategies within the Non-tidal Back River Watershed

ABBREVIATIONS

Note: This list of abbreviations was developed for the MDOT SHA 2016 Impervious Restoration and Coordinated TMDL Implementation plan (available at www.roads.maryland.gov). Many of the abbreviations may not apply to this document.

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

DRMO	Defense Reutilization and Marketing Office
ECD	Environmental Compliance Division (MDOT SHA)
E. coli	*Escherichia coli*
ED	Extended Detention
EMC	Event Mean Concentration
EMS	Environmental Management System
EOS	Edge of Stream
EPA	United States Environmental Protection Agency
EPD	Environmental Programs Division
ESC	Erosion and Sediment Control
ESD	Environmental Site Design
FC	Fecal Coliform
FC-DPW	Frederick County, Division of Public Works
FEMA	Federal Emergency Management Administration
FIB	Fecal Indicator Bacteria
FIBI	Fish Index of Biotic Integrity
FMD	Facility Maintenance Division (MDOT SHA)
FR	Frederick (County)
FY	Fiscal Year
GIS	Geographic Information System
HA	Harford (County)
HC-DPW	Harford County, Department of Public Works
HO	Howard (County)
HUC	Hydrologic Unit Code
HWG	Horsley Witten Group, Inc.
ICPRB	Interstate Commission on the Potomac River Basin
IDDE	Illicit Discharge Detection and Elimination
ISWBMPDB	International Stormwater BMP Database
LA	Load Allocations
lbs	Pounds (weight)
LF	Linear Feet
LN	Lower North
LNB	Lower North Branch
LRE	Loch Raven East subwatershed
LJF	Lower Jones Falls (Watershed)
LU	Land Use
MAA	Maryland Aviation Administration
MAST	Maryland Assessment Scenario Tool
MC-DEP	Montgomery County, Department of Environmental Protection
MD	Maryland
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDOT	Maryland Department of Transportation
MDP	Maryland Department of Planning
MEP	Maximum Extent Practicable
MEPA	Maryland Environmental Policy Act
MGF	Middle Gwynns Falls (Watershed)
MO	Montgomery (County)
MOS	Margin of Safety
MPR	Maximum Practicable Reduction
MS4	Municipal Separate Storm Sewer System
NBOD	Nitrogenous Biochemical Oxygen Demand
NEPA	National Environmental Policy Act

NFHL	National Flood Hazard Layer
NJF	Northeastern Jones Falls (Watershed)
NPDES	National Pollutant Discharge Elimination System
NSQD	National Stormwater Quality Database
OCRI	Office of Customer Relations and Information (MDOT SHA)
OED	Office of Environmental Design (MDOT SHA)
OOM	Office of Maintenance (MDOT SHA)
OP	Orthophosphate
OPPE	Office of Planning and Preliminary Engineering (MDOT SHA)
PACD	Pennsylvania Association of Conservation Districts
PB	Parsons Brinckerhoff
PCB	Polychlorinated Biphenyl
P_E	Rainfall Target Used To Size ESD Practices
PERC	Perchloroethylene
PG	Prince George's (County)
PGC-DoE	Prince George's County, Department of the Environment
RBP	Rapid Bioassessment Protocol
RGP	Regional General Permit
ROW	Rights-Of-Way
Reqd	Required
RR	Runoff Reduction
RSPSC	Regenerative Step Pool System Conveyance
SAH	Sponsor-A-Highway
SB	Spring Branch subwatershed
SCA	Stream Corridor Assessment
SFEI	San Francisco Estuary Institute
SGW	Submerged Gravel Wetlands
SHA	State Highway Administration
SPR	State Planning and Research
SSO	Sanitary Sewer Overflow
ST	Stormwater Treatment
SW	Stormwater
SWAP	Small Watershed Action Plan
SWM	Stormwater Management
SWS	Subwatershed
SW-WLA	Stormwater Wasteload Allocation
TBD	To Be Determined
TBR	Tidal Back River (Watershed)
TBS	To Be Specified
TCWG	Toxic Contaminants Work Group
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
tPCB	Total Polychlorinated Biphenyl
TSS	Total Suspended Solids
TWGCB	Toxics Work Group Chesapeake Bay Partnership
UBR	Upper Back River (Watershed)
UGF	Upper Gwynns Falls (Watershed)
UJF	Upper Jones Falls (Watershed)
US	United States
USACE	United States Army Corps of Engineers

USDA-NRCS	United States Department of Agriculture, Natural Resources Conservation Service
USGS	United States Geological Survey
USWG	Urban Stormwater Work Group
WA	Washington (County)
WC-DPW	Washington County, Division of Public Works
WCSCD	Washington County Soil Conservation District
WIP	Watershed Implementation Plan
WLA	Wasteload Allocation
WPD	Water Programs Division (MDOT SHA)
WQLS	Water Quality Limited Segment
WQSs	Water Quality Standards
WQv	Water Quality Volume
WQGIT	Water Quality Goal Implementation Team
WRAS	Watershed Restoration Action Strategy
WTM	Watershed Treatment Model
WTWG	Watershed Technical Work Group
WWTP	Waste Water Treatment Plant
yr	Year
12-SW	Maryland General Permit for Discharges from Stormwater Associated with Industrial Activities

MDE

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

Watershed Name	Non-Tidal Back River
County Name	Baltimore
Date	12/04/2018

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	519
Pervious Acres in Implementation Baseline Year	659

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	75.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2018**	**Target Year**			**2045**	
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2018				Planned reductions from 2018 to 2045			
		BMP Name	**Type**	**Unit**	BMPs installed before 2009	BMPs installed from 2009 to 2018	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2018 to 2045	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										-
				Pervious Acre Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	28.0					6.2			3,968.9	34.2
				Pervious Acre Treated	50.8					9.4				60.2
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.0									7.0
				Pervious Acre Treated	14.8									14.8
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Filtering Practices (ST) - Bioretention	Cumulative	Impervious Acres Treated	1.9									1.9
				Pervious Acre Treated	13.2									13.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	6.4			1,471.6					6.4
				Pervious Acre Treated	n/a	5.9								5.9
		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	12.6	1.3			517.0					13.9
				Pervious Acre Treated	178.9	2.7								181.6

Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		31.1			3,289.0					31.1
		Inlet Cleaning	Annual **	Dry tons removed		17.5			7,364.7					17.5
		Impervious Urban Surface Elimination	Cumulative	Impervious acre converted to pervious										-
		Urban Tree Planting	Cumulative	Acre planted on pervious		43.6			2,187.1	3.8			180.3	47.4
		Urban Stream Restoration	Cumulative	Linear feet restored		0.0			34,650.0	782.4			11,736.0	782.4
		Outfall Enhancement	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Outfall Stabilization	Cumulative	Linear feet						401.6			18,070.5	401.6
		Impervious Disconnects	Cumulative	Credit acres	5.9									5.9
				REDUCTIONS:		TOTAL	0	0	49,479	TOTAL	0	0	33,956	

* 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
		322,978
This represents the load from the watershed at the baseline year of the implementation plan		

TMDL Reductions		
TN	TP	TSS
0.0%	0.0%	75.0%
From top of worksheet		

Current Load		
TN	TP	TSS
0	0	273,499
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
TN	TP	TSS
0	0	239,543
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

Target Load		
TN	TP	TSS
0	0	80,745
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 FY2018 progress reductions which are defined as reductions achieved between baseline year and FY2018.

REFERENCES

Note: This list of references was developed for the MDOT SHA 2016 Impervious Restoration and Coordinated TMDL Implementation plan (available at www.roads.maryland.gov). Many of the references may not apply to this document.

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