Middle Patuxent River Sediment TMDL

Source Document:	MDE (Maryland Department of the Environment). 2018. Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Middle Watershed, Anne Arundel, Calvert, and Prince George's Counties, Maryland. Final ,Document Version April 2018.
Water Body Type:	Non-tidal stream reaches of the Middle Patuxent River watershed (basin number 02131102)
Pollutant:	Sediment
Designated Uses:	Use I – Water Contact Recreation and Protection of Aquatic Life
Size of Watershed:	55,200 acres (86 square miles), plus 640 acres of water
Water Quality Standards:	Non-numeric; aquatic life assessed using Maryland's biocriteria protocol, which evaluates both the amount and diversity of the benthic and fish community using the Index of Biotic Integrity (IBI)
Analytical Approach:	Used the Chesapeake Bay Watershed Model (Phase 5.3.2) in a reference watershed analysis to calculate land use-specific loading rates and losses from edge of field to the main channel. Tabular aggregation to Maryland's 8-digit watersheds.
Date Approved:	July 2, 2018

Introduction

The Total Maximum Daily Load (TMDL) addresses the 2014 sediment impairment. In March 2016, MDE conducted a data solicitation of sediment to support the TMDL and all readily available data were considered for this TMDL. The TMDL's objective was to ensure that watershed sediment loads are at a level to support the Use I designation for the Middle Patuxent River watershed (Figure 1), and more specifically, at a level to support aquatic life.

This fact sheet provides summary data related to the TMDL and includes specific information related to allocations made for Prince George's County, Maryland, regulated stormwater sources.

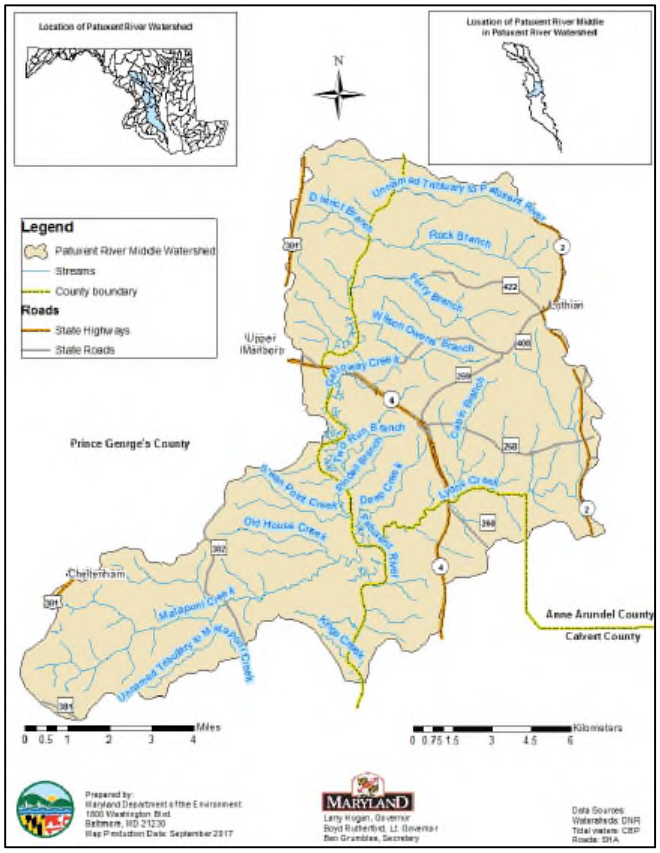

Figure 1. Middle Patuxent River watershed

Source: MDE 2018.

Problem Identification and Basis for Listing

Biological community impairments were identified, prompting placement of the Middle Patuxent River on Maryland's 303(d) list in 2002. The impairment listing was supported by the results of two Maryland Biological Stream Surveys (MBSS) performed from 1995–1997 and again from 2000–2004. From the surveys, 7 of 17 stations were listed as having Benthic Index of Biotic Integrity (BIBI) and/or Fish Index of Biotic Integrity (FIBI) scores significantly lower than 3 (on a scale of 1–5). To refine the impairment listing, biological stressor identification analysis was conducted. Data from the second and third MBSS

rounds were used in performing the biological stressor analysis for the TMDL. The stressor analysis confirmed that individual stressors within the sediment parameter grouping was contributing to the biological impairment in the watershed and were statistically significantly associated with biologically impaired communities at approximately 68 percent of the sites with BIBI and/or FIBI scores significantly less than 3.0 (on 1 to 5 scale) throughout the watershed. Because of the BSID analysis, the Middle Patuxent River was listed as impaired by TSS on the 2014 Integrated Report.

Applicable Data

For listing, the biological stressor identification analysis (BSID) was based primarily on the MBSS. The MBSS is a statewide probability-based sampling survey for assessing the biological conditions of wadeable, non-tidal streams. For purposes of developing the TMDL, the data set has the following benefits: (1) in-stream biological data are paired with chemical, physical, and land use data variables that could be identified as possible stressors; and (2) it uses a probabilistic statewide monitoring design. The impairment listing made use of all 15 stations with physical and biological monitoring data in the Middle Patuxent River watershed in the MBSS program (both rounds).

The BSID analysis (stressor identification) made use of the biological and physical monitoring data collected at the 13 stations in the watershed under the Round Two MBSS and 2 stations under Round Three MBSS. The BSID analysis combines the individual stressors (physical and chemical variables) into three generalized parameter groups to assess how the resulting impacts of these stressors can alter the biological community and structure. The three generalized parameter groups include sediment, habitat, and water chemistry.

Sources

Nonpoint sources addressed by the TMDL include unregulated stormwater runoff from unregulated urban areas, agricultural land, and forested land uses. Point sources include regulated stormwater and wastewater. Table 1 presents the baseline loads for sources determined by the modeling approach used to develop the TMDL.

Most of the sediment load is from cropland (62.2 percent) and regulated urban land (17.3 percent). The next largest sediment sources are forest (12.1 percent) and pasture (3.5 percent). Land use-specific loads are presented on page 15 of the TMDL.

Table 1. Baseline sediment loads

Source	Baseline Sediment Load (ton/yr)
Forest	462
Animal Feeding Operations	7
Pasture	132
Crop	2,369
Nursery	73
Unregulated stormwater	90
Regulated Stormwater (MS4)[a]	661
Industrial Point Sources	10
Municipal Point Sources	3
Total Baseline	3,806

Source: MDE 2018.

Note: [a] Includes barren (construction), pervious and impervious surfaces and extractive.

Technical Approach

The TMDL was developed using a modeling approach to identify a sediment loading threshold consistent with support of aquatic life. Average annual EOS loading rates were identified for seven reference (unimpaired) watersheds using the Chesapeake Bay Program's Phase 5.3.2 watershed model.

Because the Patuxent watershed lies almost entirely within the Coastal Plain region, reference watersheds that were identified as supporting aquatic life were selected from the same region (non-tidal Coastal Plain). The reference watershed loads were all normalized by a constant background condition, the all-forested watershed condition. The normalized load represents how many times greater the current watershed sediment load is than the all-forested sediment load. The forest-normalized sediment load for this TMDL is calculated as the current watershed sediment load divided by the all-forested sediment load.

Seven reference watersheds were selected and the forest-normalized sediment loads were calculated using CBP P5.3.2 2009 Progress Scenario EOS. The median value of the reference watershed forest-normalized sediment loads (3.9) was calculated and established as the sediment loading threshold for the TMDL. Section 4.2 of the draft TMDL provides an overview of the methodology.

The forest-normalized sediment load for the Middle Patuxent River watershed (estimated as 5.7) was calculated using CBP P5.3.2 2009 Progress Scenario land use because it is used as the baseline year in the Chesapeake Bay TMDL. A comparison of the Middle Patuxent River watershed forest-normalized sediment load to the forest-normalized reference sediment load (also referred to as the sediment loading threshold) demonstrates that the watershed exceeds the sediment loading threshold, indicating that it is receiving loads that are above the maximum allowable load that it can sustain and still meet water quality standards.

Allocations

The future conditions of maximum allowable sediment loads that will be at a level to support aquatic life (TMDL scenario) is calculated as the product of the sediment loading threshold (from reference watersheds) and the Middle Patuxent River all-forested sediment load. Table 2 provides the watershed baseline and TMDL loads and percent reduction.

Table 2. Baseline and TMDL loads and percent reduction

Baseline Load (ton/yr)	TMDL (ton/yr)	Percent reduction
3,806	2,617	31%

Source: MDE 2018

Unregulated urban land, cropland, nursery and pasture were identified as the predominant nonpoint sources in the watershed and require reductions. Other nonpoint sources contributed less than 1 percent of the total sediment load and do not require load reductions.

The wasteload allocation (WLA) is allocated between wastewater and stormwater. Wastewater permits with specific TSS limits and flow information are assigend WLAs at their permit limits.

Table 3 provides the baseline and wasteload allocation (WLA) for the regulated stormwater sediment load. In the accompanying technical memorandum related to significant point sources in the Middle Patuxent River watershed, a specific WLA is specified for the Prince George's County Phase I municipal separate storm sewer system (MS4) and other NPDES stormwater permittess (Table 4). To determine these further breakdowns of the WLA by MS4, the Maryland Department of Planning (MDP) urban land use was applied to further refine the CBP P5.3.2 urban land use. The methodology to refine urban land by permittee is described separately (MDE 2011).

Table 3. MS4 sediment baseline load, WLA, and percent reduction

Baseline Load (ton/yr)	WLA (ton/yr)	Percent reduction
661	351	47%

Source: MDE 2018.

Table 4. Specific WLAs for MS4s

Permittee	Baseline Load (ton/yr)	WLA (ton/yr)	Percent reduction
Prince George's County Phase I MS4	158	69	56%
Anne Arundel County Phase I MS4	162	71	56%
SHA Phase I MS4	51	22	56%
Other NPDES Regulated Stormwater	290	189	35%

Source: MDE 2018.

References

MDE (Maryland Department of the Environment). 2011. CBP P5.3.2 Land-Use and MDE Urban Source Sector Delineation – Development Methodology. Baltimore, MD. Maryland Department of the Environment.

MDE (Maryland Department of the Environment). 2018. Technical Memorandum: Point Sources of Sediment in the Non-Tidal Patuxent River Middle Watershed. Document Version April 2018.