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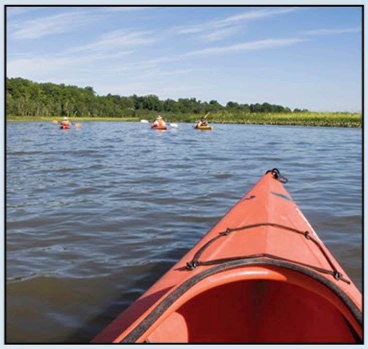
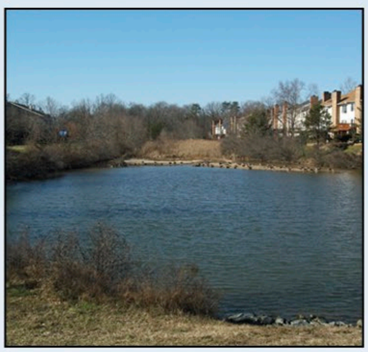
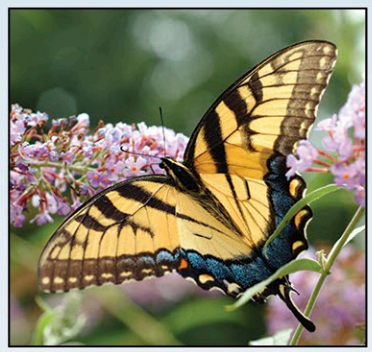
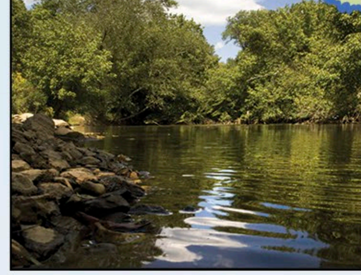
COUNTY EXECUTIVE

Prince George's County
DEPARTMENT OF THE
ENVIRONMENT

December 31, 2014

Watershed Existing Condition Report for the Upper Patuxent River, Western Branch, and Rocky Gorge Reservoir Watersheds

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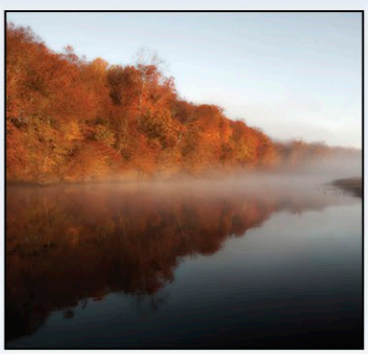
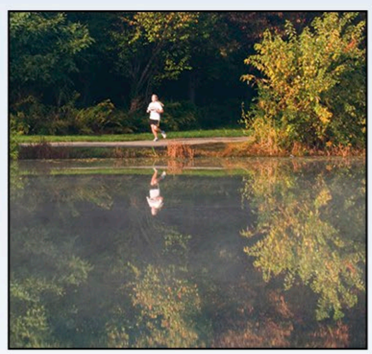


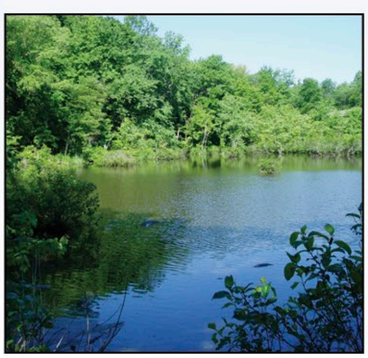

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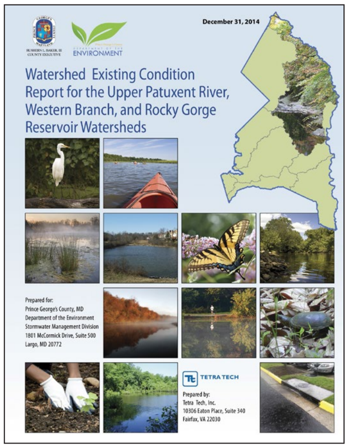

Watershed Existing Condition Report for the Upper Patuxent River, Western Branch, and Rocky Gorge Reservoir Watershed

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Prepared for:
Prince George's County, Maryland
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ACRONYMS AND ABBREVIATIONS

ANC	acid neutralizing capacity
B-IBI	Benthic Index of Biotic Integrity
BMP	best management practice
BOD	biochemical oxygen demand
BSID	Biological Stress Identification
cfs	cubic feet per second
COMAR	Code of Maryland Regulations
DA	drainage area
DMR	discharge monitoring report
DO	dissolved oxygen
EPA	Environmental Protection Agency
FA	future allocation
GIS	Geographic Information System
LAs	load allocations
lb/yr	pound per year
LID	low impact development
MBSS	Maryland Biological Stream Surveys
MD DNR	Maryland Department of Natural Resources
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
mL	milliliter
mg/L	milligrams per liter
MGS	Maryland Geological Survey
MOS	margin of safety
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NADP	National Atmospheric Deposition Program
NASA	National Aeronautics and Space Administration
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
SR3	Sewer Repair, Replacement and Rehabilitation
SSO	sanitary sewer overflow
STORET	STOrage and RETrieval
STP	sewage treatment plant
TMDL	Total Maximum Daily Load

TP	total phosphorus
TSS	total suspended solids
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WIP	Watershed Implementation Plan
WLAs	wasteload allocations
WSSC	Washington Suburban Sanity Commission
WWTP	wastewater treatment plant

1 INTRODUCTION

On January 2, 2014, the Maryland Department of the Environment (MDE) issued Prince George's County (the County) a new municipal separate storm sewer system (MS4) permit. An MS4 is a series of stormwater sewers owned by a municipal entity (e.g., the County) that discharges the conveyed stormwater runoff into a water body (e.g., Western Branch).

The County's new MS4 permit requires that the County develop local restoration plans to address each U.S. Environmental Protection Agency (EPA)-approved total maximum daily load (TMDL) with stormwater wasteload allocations (WLAs).

As a result of the County's new MS4 permit, restoration plans are being developed for all water bodies in the County that are subject to TMDL WLAs associated with the MS4 system. The County's MS4 system has been assigned WLAs in 10 separate TMDLs addressing pollutants in 5 water body systems:

- Anacostia River
- Mattawoman Creek
- Upper Patuxent River (including Rocky Gorge Reservoir)
- Potomac River
- Piscataway Creek

This report is an initial step in the restoration plan development process for the portions of the Patuxent River watershed (includes Upper Patuxent River, Western Branch and Rocky Gorge Reservoir) that are within the County. It characterizes the watershed, includes a compilation and inventory of available information, provides a review of existing reports and data, and presents some additional data and spatial analyses. Unless otherwise noted, when the report references the "Upper Patuxent River watershed," it refers to only the portions of Upper Patuxent River and Rocky Gorge Reservoir drainage areas within the County.

1.1 Purpose of Report and Restoration Planning

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (codified at Title 40 of the *Code of Federal Regulations* Part 130) require states to develop TMDLs for impaired water bodies. A TMDL identifies the maximum amount of pollutant load that the water body can receive and still meet water quality criteria. TMDLs provide the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of the state's water resources (USEPA 1991).

Figure 1-1 shows a generalized TMDL schematic. The bar on the left represents the current pollutant load (sometimes called the baseline) that exists in a water body before a TMDL is developed. The elevated load causes the water body to exceed water quality criteria. The bar on the right represents the amount that the pollutant load will need to be reduced for the water body to meet water quality criteria. Another way to convey the required load reduction is by identifying the *percent reduction* needed.

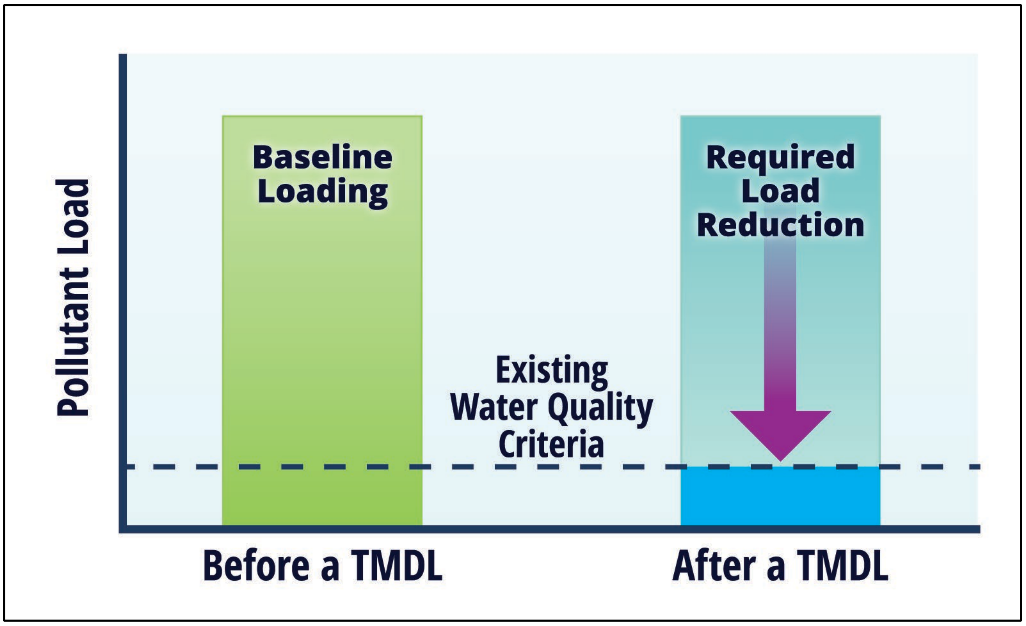


Figure 1-1. Schematic for typical pollution diet (TMDL).

A TMDL for a given pollutant and water body is composed of the sum of individual WLAs for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body. The TMDL components are illustrated using the following equation:

$$TMDL = \Sigma\ WLAs + \Sigma\ LAs + MOS$$

A WLA is the portion of the overall pollution diet that is assigned to permitted dischargers, such as the County's MS4 stormwater system. The County's new MS4 permit requires that the County develop local restoration plans to address each EPA-approved TMDL with stormwater WLAs.

A restoration plan is a strategy for managing the natural resources within a geographically defined watershed. For the County's Department of the Environment, this means managing urban stormwater (i.e., water from rain storms) to restore and protect the County's water bodies. Stormwater management is most effective when viewed in the watershed context—watersheds are land areas and their network of creeks that convey stormwater runoff to a common body of water. Successful stormwater management consists of both structural practices (e.g., vegetated roadway swale) and public outreach (e.g., pet waste campaigns and education) at both the public and private levels. The restoration plan development process will address changes to the County's priorities to comply with water quality regulations, to improve the health of the streams in the County, and to create value for neighborhoods in the County's watersheds.

The overall goals of restoration planning are to:

- Protect, restore, and enhance habitat in the watershed.
- Restore watershed functions, including hydrology, water quality, and habitat, using a balanced approach that minimizes negative impacts.
- Support compliance with regional, state, and federal regulatory requirements.
- Increase awareness and stewardship within the watershed, including encouraging policymakers to develop policies that support a healthy watershed.

The first stage in completing these goals is to develop restoration plans. These plans typically:

- Identify causes and sources of pollution.
- Estimate pollutant load reductions.
- Describe management options and identify critical areas.
- Estimate technical and financial assistance needed.
- Develop an education component.
- Develop a project schedule.
- Describe interim, measurable milestones.
- Identify indicators to measure progress.
- Develop a monitoring component.

This report begins the process by collecting data needed for restoration planning and characterization of the watersheds. This will help identify potential sources and causes of the pollution.

1.2 Impaired Water Bodies and TMDLs

MDE has included the Patuxent River and its tributaries on its Section 303(d) list of impaired streams due to the following pollutants (TMDL year and reference in parentheses):

- Biochemical oxygen demand (BOD) – Western Branch of Patuxent River (MDE 2000)
- Phosphorus – Rocky Gorge Reservoir (MDE 2008)
- Fecal coliform bacteria – Upper Patuxent River (MDE 2010a)
- Sediments – Upper Patuxent River (MDE 2011)

MDE developed TMDLs to address impairments caused by the violation of water quality standards for fecal coliform bacteria, BOD, total phosphorus (TP), and sediment. The percent reduction WLAs for both fecal coliform bacteria (*Escherichia coli*) and sediment in the Patuxent River, Upper Basin are 53.4 percent and 11.4 percent, respectively. The percent reduction WLA for total phosphorus in the Rocky Gorge Reservoir is 15 percent. In addition, EPA recently (USEPA 2010) developed an overall TMDL for the Chesapeake Bay watershed for nitrogen, phosphorus, and sediment. The percent reduction WLAs for nitrogen, phosphorus, and sediment varies by water body ranging from 10 percent to 26 percent for total nitrogen; 32 percent to 41 percent for total phosphorus; and 29 percent to 31 percent for total suspended solids. The County has developed a Watershed Implementation Plan (WIP) in response to the Chesapeake Bay TMDL (PGC DER 2012).

While the sediment TMDL characterized the 54,533 acres, the fecal coliform TMDL explicitly included only 18,362 acres within Bowie, Davidsonville, and Mitchellville and lumped the upper areas including watersheds to Patuxent River reservoirs as upstream sources.

This report covers the MDE TMDLs for TP (Rocky Gorge Reservoir), sediment and fecal coliform bacteria (Upper Patuxent River), and BOD (Western Branch). Appendix A contains fact sheets on these TMDLs. The fact sheets include information on the TMDLs' technical approaches, allocations, and other information.

1.2.1 Water Quality Standards

Water quality standards consist of designated uses, criteria to protect those uses, and antidegradation policies to protect waters from pollution. States assign designated uses based on their goals and expectations for water bodies. Each water body is assigned a designated use that should be attainable. Water quality criteria consist of narrative statements or numeric values designed to protect the designated uses. Water quality criteria describe the physical, chemical, and biological conditions necessary to support each designated use and might not be the same for all uses.

Portions of the Patuxent River have the following designated uses (*Code of Maryland Regulations* [COMAR] 26.08.02.08 O):

- Use Class I-P: Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply – Rocky Gorge Reservoir and Upper Patuxent River
- Use Class I – Water Contact Recreation, and Protection of Non-tidal Warm Water Aquatic Life – Upper Patuxent River and Western Branch
- Use Class IV-P – Recreational Trout Waters and Public Water Supply – Rocky Gorge Reservoir

Maryland's General Water Quality Criteria states that "the waters of this State may not be polluted by…any material, including floating debris, oil, grease, scum, sludge and other floating materials attributable to sewage, industrial waste, or other waste in amounts sufficient to be unsightly; produce taste or odor; change the existing color to produce objectionable color for aesthetic purposes; create a nuisance; or interfere directly or indirectly with designated uses" [COMAR 26.08.02.03B(2)]. Specific water quality criteria also apply for the specific pollutants addressed in the TMDLs for the Upper Patuxent River and Western Branch watersheds and are discussed below.

Bacteria Water Quality Criterion

Table 1-1 presents the Maryland water quality standards for bacteria used for all areas. Only the *E. coli* standard is applicable for Upper Patuxent River TMDL segments.

Table 1-1. Maryland bacteria water quality criteria

Indicator	Steady State Geometric Mean Indicator Density
Freshwater	
E. coli	126 MPN/100 mL
Enterococci[a]	33 MPN/100mL
Marine Water	
Enterococci	35 MPN/100 mL

Notes:
MPN/100mL=most probable number (MPN) per 100 milliliters.
[a]Used in the Upper Patuxent River TMDL analysis.

Nitrogen/Phosphorus Water Quality Criterion

Maryland does not have numeric criteria for nitrogen or phosphorus; therefore, other parameters, such as dissolved oxygen (DO) are used in the TMDL process. Table 1-2 summarizes the Maryland DO criteria applicable to the nutrients and BOD TMDL.

Table 1-2. Maryland dissolved oxygen water quality criteria

Designated Use	Period Applicable	DO Criteria
MD Use I-P/Use I	Year-round	≥ 5 mg/L (instantaneous)
MD Use IV/IV-P	Year-round	≥ 5 mg/L (instantaneous)

Note: DO = dissolved oxygen; mg/L= milligrams per liter.

Sediment Water Quality Criterion

Non-tidal portions of the watershed are subject to Maryland's General Water Quality Criteria, for the protection of aquatic life. For tidal portions, it is based on average Secchi disk depth equal to or greater than 0.4 meters for April 1 through October 31 of each year. Secchi depth is a measure of water clarity. The criterion is meant to protect submerged aquatic vegetation in the tidal portions of the watershed.

1.2.2 Problem Identification and Basis for Listing

Documentation for TMDLs includes discussion of the issues driving TMDL development such as a description of the problem, conditions that prompted a Section 303(d) listing, and any monitoring data that were used to document and support the listing. This section provides a summary of the various problems identified in the Upper Patuxent River (including Rocky Gorge) and Western Branch watersheds and the data supporting the impairment decisions.

MDE monitored bacterial water quality at three stations in the Upper Patuxent River watershed from October 2008 to October 2009. Stream flow data available at two U.S. Geological Survey (USGS) gauges within this upper portion were used to identify the flow distribution. A total of 25 observations were recorded at each station and the steady state geometric mean of the fecal coliform indicator bacteria (*E. coli*) was calculated to compare with the criterion shown in Table 1-1 and assess the extent of impairment. The TMDL then established reductions needed in *E. coli* loads from various sources (including urban stormwater) from Prince George's and Anne Arundel counties. The beach season (May 31 to Labor Day) was used as critical conditions in the establishment of this TMDL.

Biological community impairments were identified in the Upper Patuxent River, with MDE placing it on Maryland's Section 303(d) list in 1996. The impairment is supported by the results of two Maryland Biological Stream Surveys (MBSS) performed from 1995–1997 and again from 2000–2004. From the surveys, 11 of 15 stations were listed as having Benthic Index of Biotic Integrity (B-IBI) scores significantly lower than 3 (on a scale of 1–5). Data from the second MBSS round were used in performing the biological stressor analysis for the TMDL, which was established to reduce sediment loads from contributing point and nonpoint sources of pollution.

MDE has included the Rocky Gorge Reservoir on its Section 303(d) list as impaired by the following (years listed in parentheses):

- Nutrients (1998) – due to signs of eutrophication, expressed as high chlorophyll *a* levels
- Impacts to biological communities (2002 and 2004)

The reservoir regularly stratifies in late spring lasting through early fall, during which time bottom waters become hypoxic. Epilimnion depth in summer is generally no greater than 4 feet. Reservoir DO levels are usually above 5 milligrams per liter (mg/L) in surface waters except for times when mixing occurs because of seasonal turnover or reservoir drawdowns. Phosphorus has been identified as the limiting nutrient because the data also showed median TP concentrations at the surface exceeded 0.034 micrograms per liter, which is the Carlson Trophic Index boundary between mesotrophic and eutrophic conditions. This TMDL has established reductions in TP loads from the upstream point and nonpoint sources of pollution.

Western Branch is a major tributary to the Patuxent River and historical monitoring data from two stations (WXT0001 and WXT0045) in this tributary watershed were evaluated to characterize water quality. Available parameters included DO, chlorophyll *a*, dissolved inorganic nitrogen (ammonia, nitrite, and nitrate), and orthophosphate for the period between August 1990 and December 1998. With MDE classifying Western Branch as a Class Use I water body, the data showed that DO levels occasionally fell below the numeric criteria of 5.0 mg/L during summer months and exhibited frequent borderline low levels at other times. This TMDL is for reducing BOD load, which MDE has identified to be the cause for oxygen depletion, from the contributing point and nonpoint sources during critical low flow periods and is a seasonal allocation for the period from April 1 through October 15.

1.2.3 TMDL Identified Sources

Elevated nutrients and BOD are attributed to stormwater runoff, erosion and in-stream scour, subsurface drainages, point source discharges, and sanitary sewer overflows. Sources contributing to low DO levels in Western Branch were primarily thought to be nutrients and BOD from point and nonpoint sources. One dominant point source, the Western Branch Wastewater Treatment Plant (WWTP), contributes most of the nutrients and BOD to the system during low flows. Two other smaller point sources, Croom Manor Housing WWTP and Prince George's County Yardwaste Composting Facility also contribute small amounts of nutrients and BOD to the system. The point source values used in the TMDL analysis were taken from the facilities' discharge monitoring reports (DMRs). The bulk of nonpoint sources (atmospheric deposition, runoff, and septics) of nutrients and BOD are thought to enter at the upstream boundary near station WXT0045.

Sources of sediment in the Upper Patuxent River watershed include primarily agricultural and urban land uses (e.g., regulated stormwater and construction activities). In addition, streambank erosion from increased stormwater is a source of sediment in the watershed.

Sources of phosphorus in the Rocky Gorge Reservoir watershed are associated with nonpoint sources and urban runoff. Modeling for the TMDL represented both nonpoint source and urban stormwater loads and integrates all natural and human-induced sources, including direct atmospheric deposition and loads from septic tanks, which are associated with river baseflow during low flow conditions.

For the Upper Patuxent River watershed, typical sources contributing bacteria include wildlife and domestic animals via nonpoint loading from land surfaces, and humans via septic and sewer systems. The watershed also includes regulated stormwater and might experience sanitary sewer overflows (SSOs), although none were reported during the year in which monitoring data were collected. The regulated stormwater sources also include industrial stormwater and federal MS4s.

1.2.4 Previous Studies

In 2011 the County developed a Countywide WIP in response to the 2010 Chesapeake Bay Nutrient and Sediment TMDL. The WIP was finalized in 2012 and laid out a plan for best management practice (BMP) implementation and other restoration activities through 2017 and 2025. In addition to urban stormwater runoff, the WIP covered agricultural practices and upgrades to wastewater systems (i.e., municipal WWTPs and on-site wastewater systems). Although the plan is Countywide, aspects from it will be used in developing the restoration plan for the Upper Patuxent River and Western Branch watersheds. The County's final WIP (PGC DER 2012) can be viewed at www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/FINAL_PhaseII_Report_Docs/Final_County_WIP_Narratives/PG_WIPII_2012.pdf.[1]

In 2002 the Maryland Department of Natural Resources (MD DNR), through funding from the National Oceanic and Atmospheric Administration, conducted an assessment and prioritization of streams within various watersheds that were in need of restoration and protection, including the County's Western Branch. Four streams including Lottsford Branch, Bald Hill Branch, Collington Branch, and the mainstem of the Western Branch were assessed for biological integrity in this study (MD DNR 2002a) and recommendations were made for watershed restoration and protection.

The MD DNR produced a series of reports on the Upper Patuxent River and Western Branch watersheds. These reports include the (1) Report on Nutrient Synoptic Surveys in the Upper Patuxent River (MD DNR 2002b) and Western Branch (MD DNR 2003a) watersheds as part of a Watershed Restoration Action Strategy; (2) Stream Corridor Assessment Survey in Upper Patuxent River (MD DNR 2003b) and Western Branch (MD DNR 2003c); and (3) Watershed Characterization Reports for Upper Patuxent River (MD DNR 2002c) and Western Branch (MD DNR 2003d). The nutrient synoptic survey and watershed characterization reports for the Upper Patuxent River watershed included drainage areas in adjacent counties also, but the remainder

[1]Accessed June 6, 2014.

reports covered only the County areas. The first pair of reports for these two watersheds looked at data collected during 2002 and 2003 at multiple stations. Nutrient levels were reported to be low and not pose significant problems in both watersheds, although the Western Branch subwatersheds with dense developments had high conductivity levels possibly from road salt application. The second pair of reports assessed the conditions of the stream channels by looking at several environmental degradation factors such as inadequate stream buffers, channel alterations, trash dumping, exposed pipes and pipe outfalls, erosion, in- or near-stream construction sites, and fish migration barriers. A number of opportunities for restoration and protection were identified. The last pair of reports were earlier watershed characterization efforts pursued by MD DNR, which covered several similar topics to this report.

The County and the City of Bowie used information presented in the MD DNR reports to develop a watershed restoration action strategy for Western Branch (PGC DER and Bowie 2004). This study developed a prioritized listing of subwatershed projects that would address the watershed restoration and protection goals, high-priority projects on a watershed-wide scale, and potential programmatic changes to protect and preserve this watershed. In addition to participating in the larger restoration action strategy project with the County, the City of Bowie (Bowie Maryland, 2004) published a separate action strategy report outlining the city ordinance revisions and implementation strategies.

Versar (2012) developed a WIP on behalf of Montgomery County for the portion of the Upper Patuxent River upstream of the Triadelphia and Rocky Gorge reservoirs. A watershed treatment model was developed and applied to evaluate different scenarios of BMPs to reduce sediment and phosphorus loads into these reservoirs. Restoration projects with high to low priority levels were also identified to guide the implementation process.

The County also pursued flood mitigation and water quality improvement efforts in the Bear Branch watershed mostly within Laurel, Maryland (D&D 2003, 2006). This tributary to the Upper Patuxent River watershed is in the northern portion of the County. Excessive sedimentation, turbidity habitat impairment, and flooding within the Laurel Lakes complex were the focus of the D&D (2003) assessment, and D&D (2006) developed specific management measures including active stream bed and bank erosion measures, retrofitting existing stormwater ponds, and implementing BMPs in upland areas to reduce sediments.

2 WATERSHED DESCRIPTION

The Upper Patuxent River segment flows southeast from the Rocky Gorge Reservoir on the northwestern side of the County until it joins the Patuxent River. The Upper Patuxent River segment is 28 miles long, and the lower and middle Patuxent River segments constitute the remainder of non-tidal and tidal portions of the river. This watershed encompasses drainage areas within Howard, Montgomery, Anne Arundel, and Prince George's counties. The County includes 57 percent of the watershed, with 39 percent in Anne Arundel County. As shown in Figure 2-1, the Upper Patuxent River serves as boundary between the two counties. Therefore, the drainage areas are hydrologically distinct and have been characterized by the two counties separately and jointly in various studies.

Both the Rocky Gorge Reservoir and the Little Patuxent River empty into the upstream end of the Upper Patuxent River. Water (stream, ponds, and the like) covers approximately 305 acres in the County, with 32,008 acres constituting the various land uses that contribute to waterway pollution.

The Upper Patuxent River watershed includes the municipalities of Laurel, South Laurel, West Laurel, Mitchellville, Davidsonville, and Bowie. The watershed also contains a large area of federal land (Patuxent Research Refuge) owned and maintained by the U.S. Fish and Wildlife Service. This refuge is the only national wildlife refuge dedicated to wildlife research and the Upper Patuxent River's County portion includes the central and south tracts of the refuge.

The Patuxent River reservoirs include the Rocky Gorge Reservoir with an area of 35,000 acres. The County includes a small portion of the Rocky Gorge Reservoir watershed of about 595 acres (0.93 square miles).

The Western Branch Watershed is entirely contained within the County. It encompasses a drainage area of about 110 square miles and includes portions of Bowie, District Heights, Glenn Dale, Goddard, Kettering, Marlton, Mitchellville, New Carrollton, Rosaryville, Springdale, Upper Marlboro, Walker Mill, and Woodmore. This watershed also includes some federal lands (e.g., portions of Andrews Air Force Base and the National Aeronautics and Space Administration [NASA] Goddard Space Flight Center) and state lands (e.g., Rosaryville State Park). It has a dense network of streams with approximately 185 miles of mapped streams, and is primarily non-tidal with the lower 5 miles (roughly the area below the Route 4 bridge) influenced by tidal boundary conditions from the Patuxent River.

The population of the Upper Patuxent River watershed is about 200,000 persons, with the County portion containing 94,050 persons. Similarly, the Rocky Gorge Reservoir portion contains 856 persons and the Western Branch watershed has 177,920 persons (2010 U.S. Census). Figure 2-2 presents the population density (2010 U.S. Census population per square mile of the census tract). Small pockets of the Upper Patuxent River and Western Branch have population densities exceeding 8,000 persons per square mile, with the remainder area with lesser population density ranging from 85 to less than 8,000 persons per square mile.

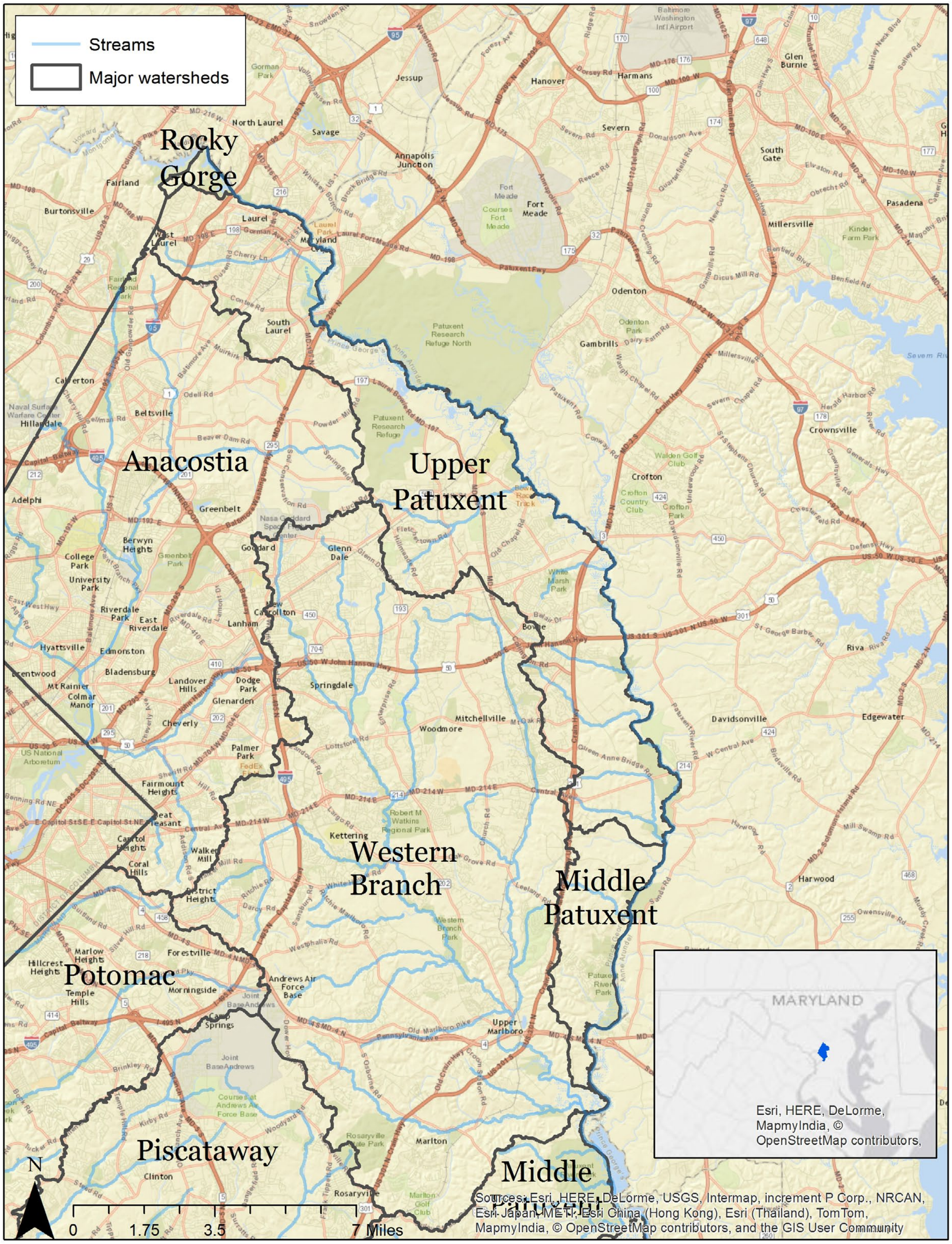
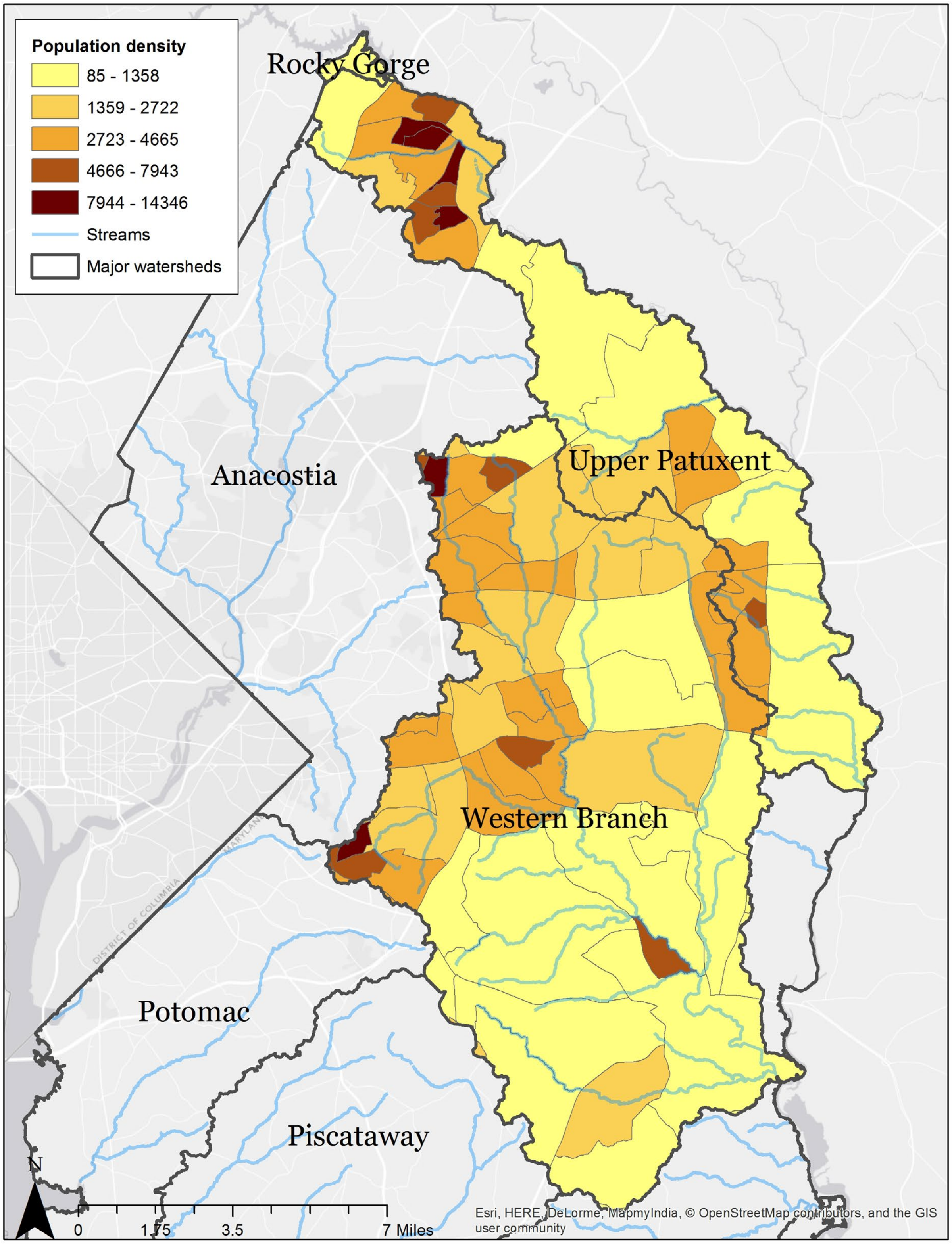


Figure 2-1. Location of the Upper Patuxent River and Western Branch watersheds.



Source: Population data is from 2010 US Census

Figure 2-2. Population density (people per square mile) in the Upper Patuxent River and Western Branch watersheds.

2.1 Physical and Natural Features

2.1.1 Hydrology

The Upper Patuxent River watershed is made up of more than12 subwatersheds, including Bear Branch, Thomas Branch, Horsepen Branch, White Marsh Branch, Ropers Branch, Green Branch, Mill Branch, Kings Branch, Davidsonville Branch, Honey Branch, Mount Nebo Branch, and Stocketts Run. Out of these, Bear Branch, Horsepen Branch, White Marsh Branch, Green Branch, Mill Branch, Honey Branch, and Mount Nebo Branch are on the County portion.

The Western Branch is a tributary to the Patuxent River, contained entirely within the County. This river is approximately 20 miles long, with a depth ranging about 1 to 2 feet in the upper reaches and about 3 to 4 feet near its confluence with the Patuxent River. The Western Branch watershed includes fifteen 12-digit subwatersheds, including Turkey Branc, Northeast Branch, Southwest Branch, Collington Branch, Charles Branch, Cabin Branch, and Bald Hill Branch.

2.1.2 Climate/Precipitation

The Upper Patuxent River and Western Branch watersheds are in a temperate area. The National Weather Service Forecast Office (2014b) reports a 30-year average annual precipitation of 39.74 inches. No strong seasonal variation in precipitation exists. On average, winter is the driest with 8.48 inches, and summer is the wettest with 10.44 inches (National Weather Service Forecast Office 2014a).The average annual temperature is 58.2 degrees Fahrenheit. The January normal low is 28.6 °F and the July normal high is 88.4 °F.

Evapotranspiration accounts for water that evaporates from the land surface (including water bodies) or is lost through plant transpiration. Evapotranspiration varies throughout the year because of climate, but is greatest in the summer. Potential evapotranspiration (Table 2-1) is the environmental demand for evapotranspiration.

Table 2-1. Average monthly (1975–2004) potential evapotranspiration (inches)

January	February	March	April	May	June
0.60	0.86	1.69	2.74	3.86	4.30
July	**August**	**September**	**October**	**November**	**December**
4.59	4.01	2.85	1.88	0.98	0.62

Source: NRCC 2014

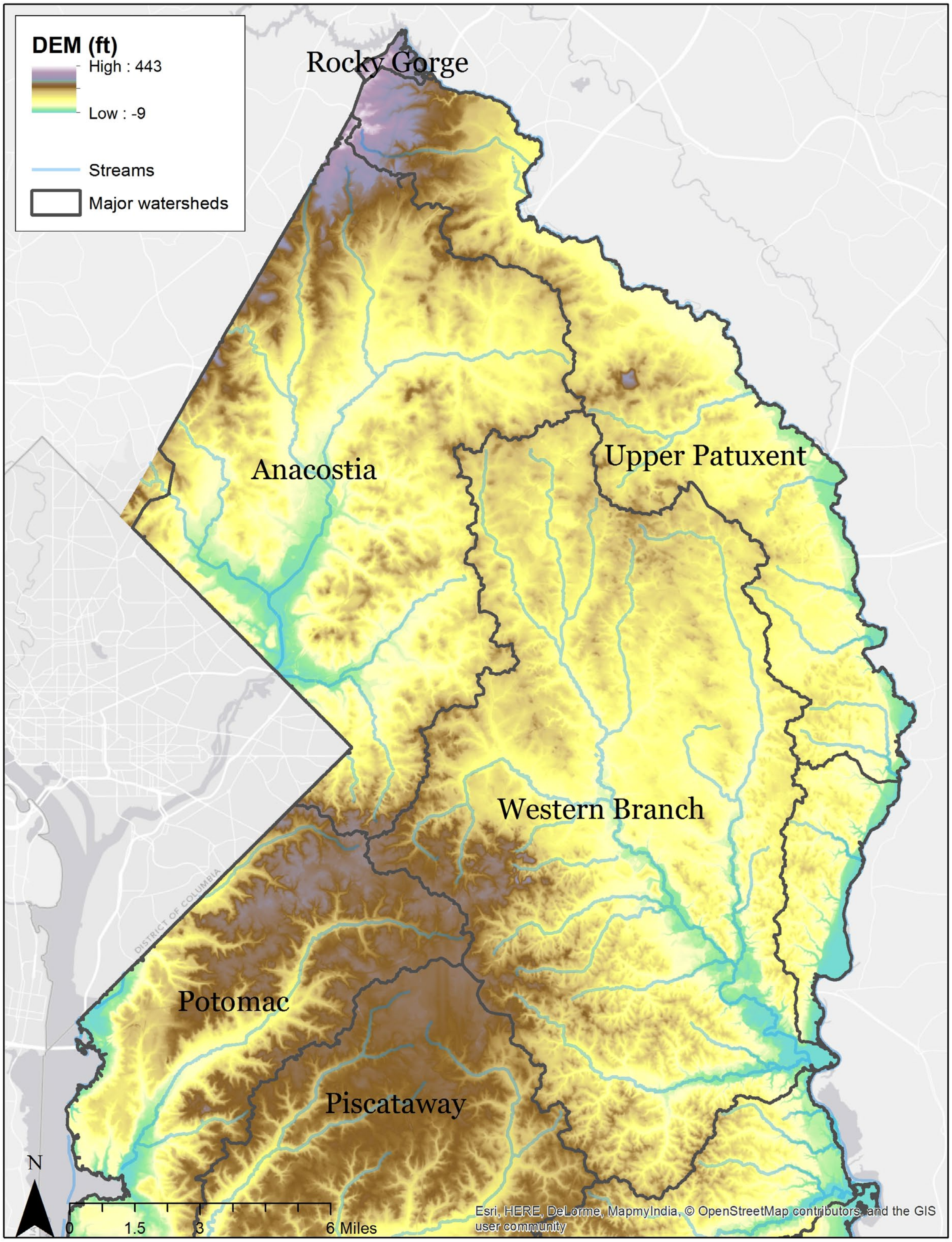
2.1.3 Topography/Elevation

According to the Maryland Geological Survey (MGS), the Fall Line between the Atlantic Coastal Plain and the Piedmont approximates the boundary between Prince George's and Montgomery counties. Based on MGS (2014), the entire Upper Patuxent River lies within the coastal plain geologic province (characterized by gentle slopes and drainage, and deep sedimentary soil complexes) of Maryland, with its northwestern tip (including Rocky Gorge Reservoir's drainage area) extending slightly into the Piedmont geologic province (characterized by gentle to steep rolling topography, low hills, and ridges).

The Upper Patuxent River is relatively flat with elevations mostly between sea level and 200 feet. The highest elevations in the watershed are in the northwestern portion near Rocky Gorge

Reservoir, reaching more than 400 feet. The lowest elevations are near the municipalities of Bowie and Davidsonville in the lower end of the watershed (Figure 2-3). All of Rocky Gorge Reservoir watershed within the County is at the highest elevation of more than 400 feet.

The Western Branch is also relatively flat, with higher elevations in the range of 200 feet in the upper portions of Southwest Branch, Turkey Branch and Cabin Branch, and with lower elevations in the remainder of the these subwatersheds and other subwatersheds of the Western Branch. As a result, the upper part experiences some high stream velocities with a slow flowing downstream section. Tides in the downstream section are quite weak and variable, with the head of tide near the Route 301 bridge below Upper Marlboro.



Source: DEM is from Prince George's County

Figure 2-3. Elevation in the Upper Patuxent River and Western Branch watersheds.

2.1.4 Soils

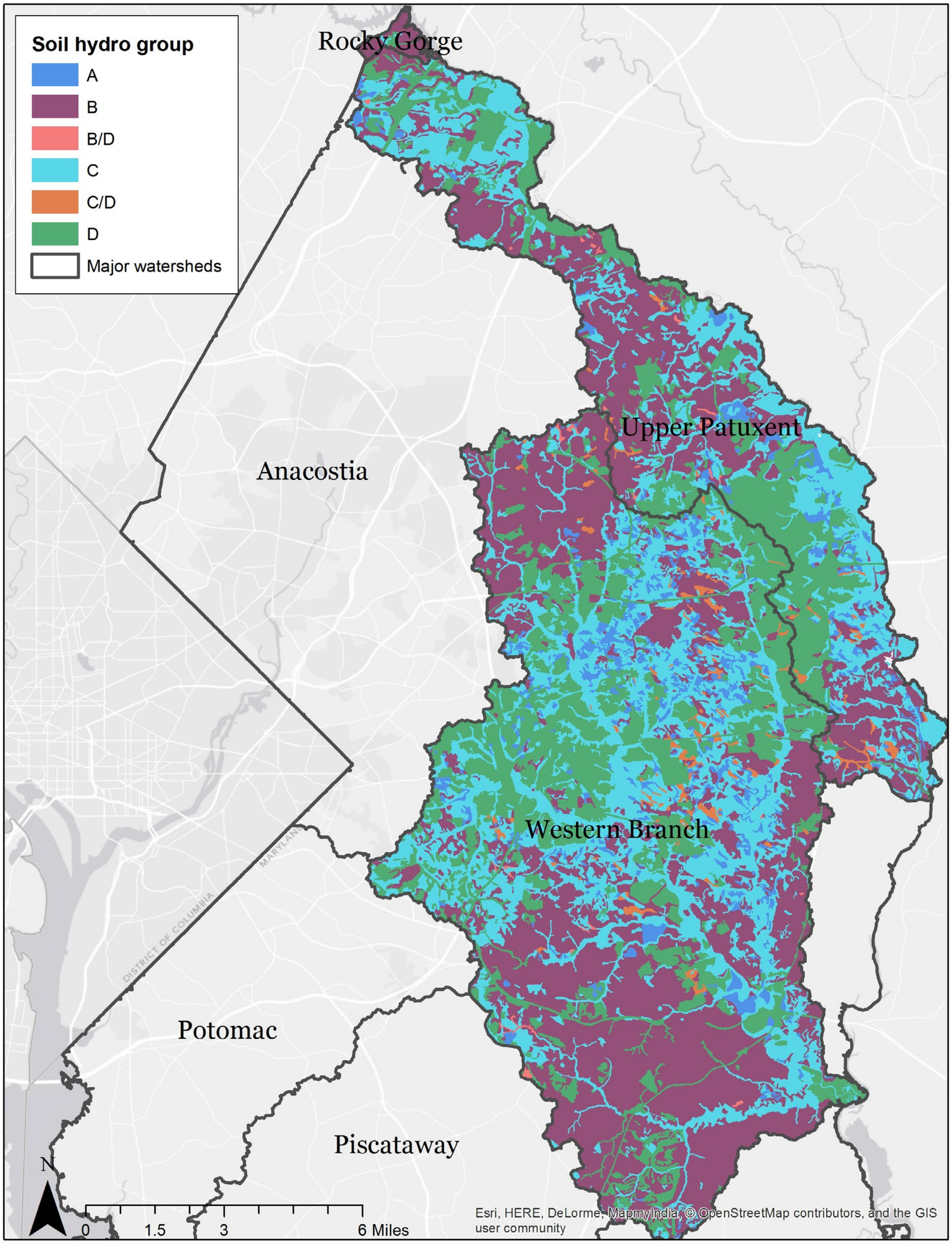
The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service has defined four hydrologic soil groups providing a means for grouping soils by similar infiltration and runoff characteristics during periods of prolonged wetting (SCS 1974). Poorly drained clay soils (Group D) have the lowest infiltration rates, resulting in the highest amount of runoff, while well-drained sandy soils (Group A) have high infiltration rates with little runoff.

Figure 2-4 presents the USDA hydrologic soil group data. For some areas, the USDA data were null; therefore, the information was filled in with State Soil Geographic Database data. Almost all of the Rocky Gorge Reservoir watershed and large portions of both the Upper Patuxent River and Western Branch watersheds are underlain by hydrologic group B soils. Hydrologic soil group A is the least represented in these watersheds. A combination of group C and D soils are seen in the remaining portions of Upper Patuxent River and Western Branch areas.

Specifically, the Upper Patuxent River watershed is comprised of 47 percent group B type soils, followed by group C (27 percent), group D (18 percent), and group A soils (8 percent) (USDA 2006). Similarly, the Western Branch has group B soils as predominant soil cover, followed by group C and D soils.

The Coastal Plain Province is underlain by a wedge of unconsolidated sediments including gravel, sand, silt, and clay (MGS 2012). Based on another soil classification used by MDE (2010b), the Upper Patuxent has Baile, Chester, and Beltsville series of soils. The Baile series are poorly drained soils essentially seen in upland depressions and footslopes, with moderately low to moderately high saturated hydraulic conductivity. The Chester series are well drained soils seen in uplands, with moderately high to high saturated hydraulic conductivity. Finally, the Beltsville series is moderately well drained soils with a saturated hydraulic conductivity in the low to moderately low range (MDE 2010b).

Soils in the urbanized portions of the two watersheds are frequently also classified as urban land complex or udorthent soils. These are soils that have been altered by disturbance because of land development activities. Soils affected by urbanization can have a higher density because of compaction during construction activities, and might be more poorly drained. Natural pervious land covers on group B soils have very little runoff compared to that from disturbed soils.



Source: 2002 Soils are from USDA NRCS

Figure 2-4. Hydrologic soil groups in the Upper Patuxent River and Western Branch watersheds.

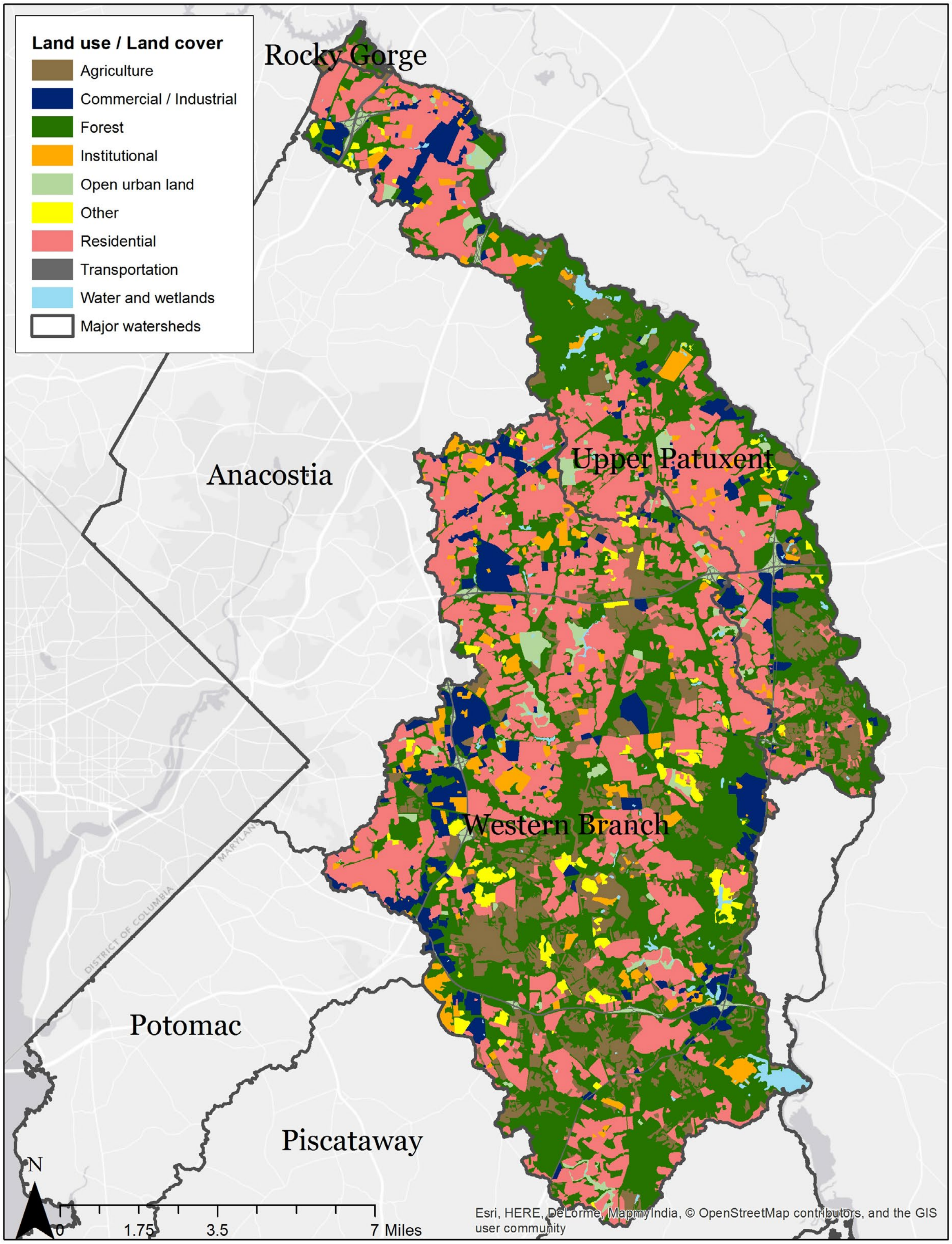
2.2 Land Use and Land Cover

Land use, land cover, and impervious area are some of the most important factors that influence the amount of pollution entering the County's water bodies. Pollutants, like excess nitrogen or bacteria, vary on the basis of different land uses (e.g., commercial, agriculture, and parks). Increased impervious area increases the amount of runoff a rain event produces, thus transporting more pollutants to a water body in a shorter time.

2.2.1 Land Use Distribution

Land use information for the Upper Patuxent River and Western Branch watersheds are available from the previous watershed reports, TMDL reports, and previous restoration planning efforts, in addition to the Maryland Department of Planning (MDP) 2010 land use update. Only the MDP (2010) land use data are available as geographic information system (GIS) data, so these data will be used in the restoration plan. Land uses are made of many different land covers, such as roads, roofs, turf, and tree canopy. The proportion of land covers in each land use control the hydrologic and pollutant loading response of such uses.

Figure 2-5 shows the 2010 MDP land use for the watersheds. The large forest and agriculture area in the middle of the Upper Patuxent River watershed is the Patuxent River Research Refuge. Table 2-2 summarizes the areas.



Source: MDP 2010

Figure 2-5. Land use in the Upper Patuxent River and Western Branch watersheds.

Table 2-2. Upper Patuxent River and Western Branch watersheds 2010 MDP land use in Prince George's County

Land Use	Rocky Gorge			Upper Patuxent			Western Branch		
	Land Use (acre)	% Total	% of Group	Land Use (acre)	% Total	% of Group	Land Use (acre)	% Total	% of Group
Agriculture	**109**	**18.3%**	**100%**	**2,720**	**8.5%**	**100%**	**8,578**	**12.1%**	**100%**
Agricultural building	0	0.0%	0.0%	9	0.0%	0.3%	33	0.0%	0.4%
Cropland	54	9.1%	49.8%	1,745	5.5%	64.2%	5,896	8.3%	68.7%
Feeding operations	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%
Large lot subdivision (agriculture)	30	5.1%	28.0%	136	0.4%	5.0%	235	0.3%	2.7%
Orchards/vineyards/horticulture	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%
Pasture	24	4.1%	22.2%	830	2.6%	30.5%	2,299	3.2%	26.8%
Row and garden crops	0	0.0%	0.0%	0	0.0%	0.0%	115	0.2%	1.3%
Forest	**304**	**51.1%**	**100%**	**12,245**	**38.4%**	**100%**	**25,648**	**36.1%**	**100%**
Brush	15	2.5%	4.9%	258	0.8%	2.1%	1,373	1.9%	5.4%
Deciduous forest	212	35.6%	69.6%	6,822	21.4%	55.7%	22,262	31.4%	86.8%
Evergreen forest	22	3.7%	7.3%	578	1.8%	4.7%	208	0.3%	0.8%
Large lot subdivision (forest)	44	7.3%	14.3%	635	2.0%	5.2%	992	1.4%	3.9%
Mixed forest	11	1.9%	3.8%	3,952	12.4%	32.3%	814	1.1%	3.2%
Other	**0**	**0.0%**	**NA**	**327**	**1.0%**	**100%**	**1,799**	**2.5%**	**100%**
Bare ground	0	0.0%	NA	209	0.7%	63.9%	1,799	2.5%	100.0%
Beaches	0	0.0%	NA	0	0.0%	0.0%	0	0.0%	0.0%
Extractive	0	0.0%	NA	118	0.4%	36.1%	0	0.0%	0.0%
Urban	**136**	**22.9%**	**100%**	**16,222**	**50.9%**	**100%**	**34,267**	**48.3%**	**100%**
Commercial	0	0.0%	0.0%	1,511	4.7%	9.3%	1,981	2.8%	5.8%
High-density residential	0	0.0%	0.0%	1,648	5.2%	10.2%	3,167	4.5%	9.2%
Industrial	0	0.0%	0.0%	625	2.0%	3.9%	2,927	4.1%	8.5%
Institutional	0	0.0%	0.0%	1,007	3.2%	6.2%	2,846	4.0%	8.3%
Low-density residential	120	20.2%	88.1%	2,879	9.0%	17.7%	7,656	10.8%	22.3%
Medium-density residential	10	1.6%	7.2%	7,209	22.6%	44.4%	13,509	19.0%	39.4%
Open urban land	6	1.0%	4.4%	876	2.7%	5.4%	1,419	2.0%	4.1%
Transportation	0	0.1%	0.3%	467	1.5%	2.9%	762	1.1%	2.2%
Water and wetlands	**46**	**7.7%**	**100%**	**367**	**1.2%**	**100%**	**696**	**1.0%**	**100%**
Water	46	7.7%	100.0%	277	0.9%	75.5%	402	0.6%	57.7%
Wetlands	0	0.0%	0.0%	90	0.3%	24.5%	294	0.4%	42.3%

Source: MDP 2010.

Overall, the urban areas in the Upper Patuxent River and Western Branch watersheds are largely residential land (about 50 percent in each), with the majority being medium-density residential (23 percent in the Upper Patuxent River and 19 percent in the Western Branch). There are also significant areas of forested land (38 percent in the Upper Patuxent River and 36 percent in the

Western Branch), and agriculture (8.5 percent in the Upper Patuxent River and 12 percent in the Western Branch). Knowing this information will help during later stages in restoration planning because it will influence what types of water quality control practices—commonly known as BMPs—and where they can be installed. For instance, certain BMPs are preferred in medium-density residential areas, while other types are preferred in industrial areas.

2.2.2 Percent Imperviousness

According to Prince George's County Code, impervious area means an area that is covered with solid material or is compacted to the point where water cannot infiltrate into underlying soils (e.g., parking lots, roads, houses, patios, swimming pools, compacted gravel areas, and so forth) and where natural hydrologic patterns are altered.

Impervious areas are important in urban hydrology because the increased paved areas (e.g., parking lots, rooftops, and roads) decrease the amount of water infiltrating the soils to become ground water and increase the amount of water flowing to the stream channels in the watershed. This increased flow not only brings additional nutrients and other pollutants, but also increases the velocity of the streams, which causes erosion and increased sediment making the water muddy during periods of elevated flow, such as during rain events.

Impervious area is made up of several types including buildings (e.g., roofs), parking lots, driveways, and roads. Each type has different characteristics and contribute to increased runoff and pollutant loadings in different ways. For instance driveways have a higher nutrient loading potential to waterways than roofs, due to factors such as grass clippings and potential fertilizer (accidentally spread on the drive way). Sidewalks will have a higher bacteria loading than driveways due to the amount of dogs that are walked along sidewalks. Besides the different types of impervious area, there are two subgroups of impervious land: connected and disconnected. On connected impervious land, rainwater runoff flows directly from the impervious surface to stormwater sewers, which in turn flow directly to streams. In disconnected impervious cover areas, rainwater runoff flows over grass, meadows, or forest areas before being intercepted by stormwater sewers, which then flow to streams. Directly connected impervious cover is substantially more detrimental to stream health and quality than disconnected land cover because the highly efficient conveyance system (stormwater pipes) associated with directly connected impervious cover increases both flow and pollutant transport to nearby streams.

Similar to the land use data, information on impervious area is available from the previous reports, in addition to 2009 County-specific information. Data from previous reports (and the 2009 County data) are presented below for comparison and to illustrate how impervious area has changed in the watershed. Only the 2009 County impervious data are available as GIS data; therefore, these data will be used in the restoration plan.

The Upper Patuxent River characterization study (MD DNR 2002c) assessed the overall imperviousness to be 15.6 percent. Similar characterization for Western Branch (MD DNR 2003d) showed that the percent imperviousness varied from very low (0.7 percent) in the lower Western Branch to high levels over 20 percent in subwatersheds such as Bald Hill Branch and the upper Southwest Branch. The 2009 GIS database was reviewed extensively for building footprints, paved roads, and parking lots.

Based on the County GIS data, 16.6 percent of the total Upper Patuxent River watershed is impervious surface, which is about 1 percent larger than 15.6 percent reported in MD DNR (2002c). For the Western Branch watershed, the total imperviousness is about 15.5 percent. The buildings in low-density residential areas and any impervious surfaces in forest and agricultural lands are considered disconnected impervious surfaces.

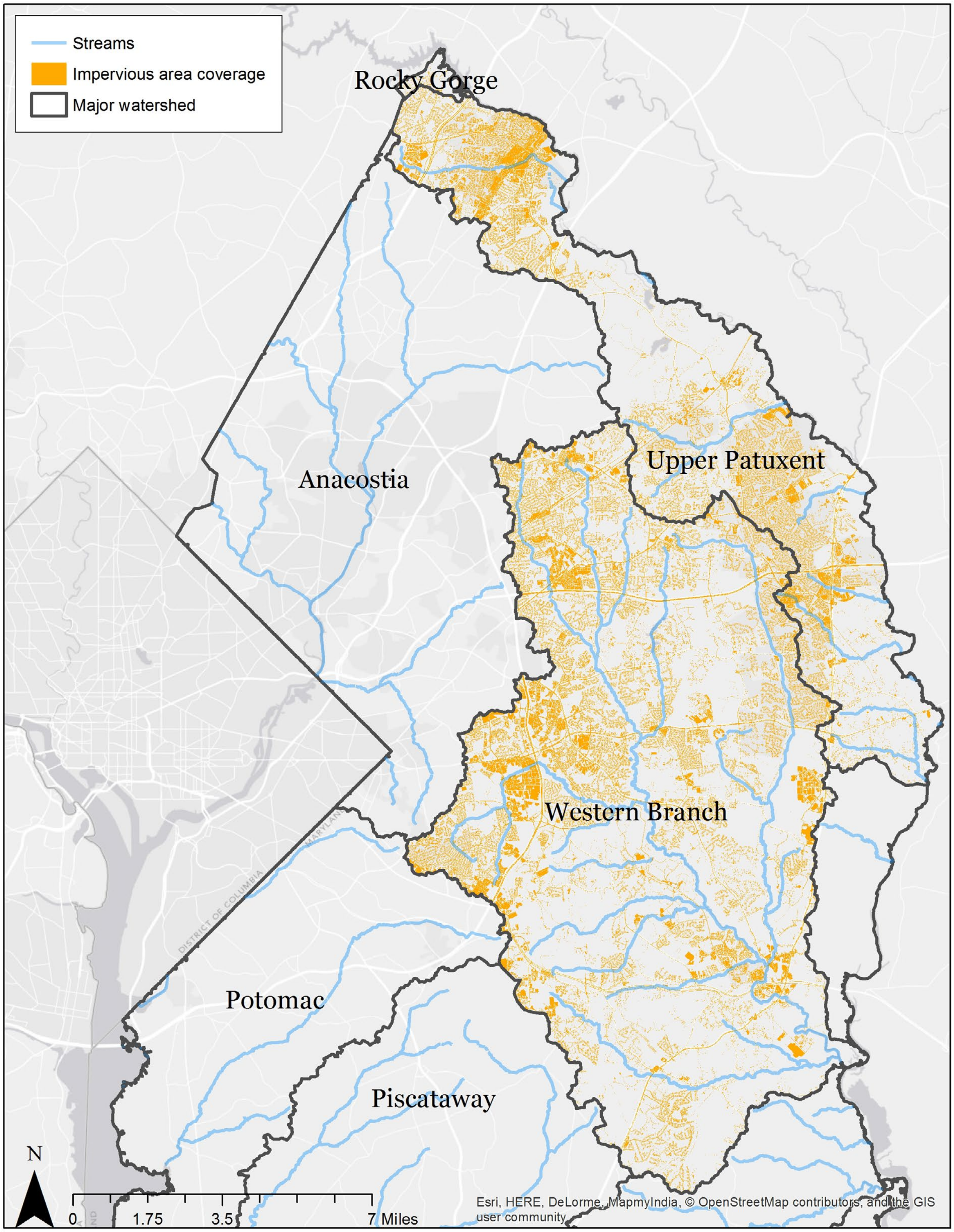
Table 2-3 presents impervious area information for the County's portion of the watershed. Currently, there are no estimates of connected impervious area in the 2009 County GIS data for comparison to previous data. This information will be estimated at a later phase of the restoration process. The majority of the impervious area in the watershed is buildings (26–29 percent of impervious area); roads (28–29 percent of the impervious area in the Upper Patuxent River and Western Branch); and parking lots (21–22 percent of the impervious area in the Upper Patuxent River and Western Branch).

Table 2-3. Upper Patuxent River and Western Branch watersheds impervious area in Prince George's County

Watershed	Rocky Gorge			Upper Patuxent			Western Branch		
Impervious Type	Acres	% of Imp	% of total watershed area	Acres	% of Imp	% of total watershed area	Acres	% of Imp	% of total watershed area
Aviation	0	0.0%	0.0%	0	0.00%	0.0%	23.1	0.2%	0.0%
Bridges	0.0	0.1%	0.0%	11.4	0.20%	0.0%	19.8	0.2%	0.0%
Buildings	9.4	25.8%	1.6%	1,644.4	28.62%	5.2%	3,237.0	27.1%	4.6%
Driveways	8.4	23.2%	1.4%	545.6	9.49%	1.7%	1,146.1	9.6%	1.6%
Gravel surfaces	0.2	0.6%	0.0%	74.3	1.29%	0.2%	124.6	1.0%	0.2%
Other	1.0	2.8%	0.2%	58.5	1.02%	0.2%	85.1	0.7%	0.1%
Other concrete surfaces	0.6	1.5%	0.1%	83.4	1.45%	0.3%	164.1	1.4%	0.2%
Parking lots	2.7	7.4%	0.5%	1,194.4	20.78%	3.7%	2,605.4	21.8%	3.7%
Patios	1.2	3.4%	0.2%	91.7	1.59%	0.3%	164.7	1.4%	0.2%
Pools	0.4	1.2%	0.1%	19.0	0.33%	0.1%	28.8	0.2%	0.0%
Railroads	0	0.0%	0.0%	1.8	0.03%	0.0%	1.8	0.0%	0.0%
Roads and highways	11.6	31.9%	1.9%	1,629.7	28.36%	5.1%	3,505.2	29.4%	4.9%
Track and athletic	0	0.0%	0.0%	62.2	1.08%	0.2%	95.1	0.8%	0.1%
Walkways	0.7	2.0%	0.1%	330.2	5.75%	1.0%	728.9	6.1%	1.0%
Total	36.3	100%	6.1%	5,746.6	100.0%	18.0%	11,929.8	100%	16.8%

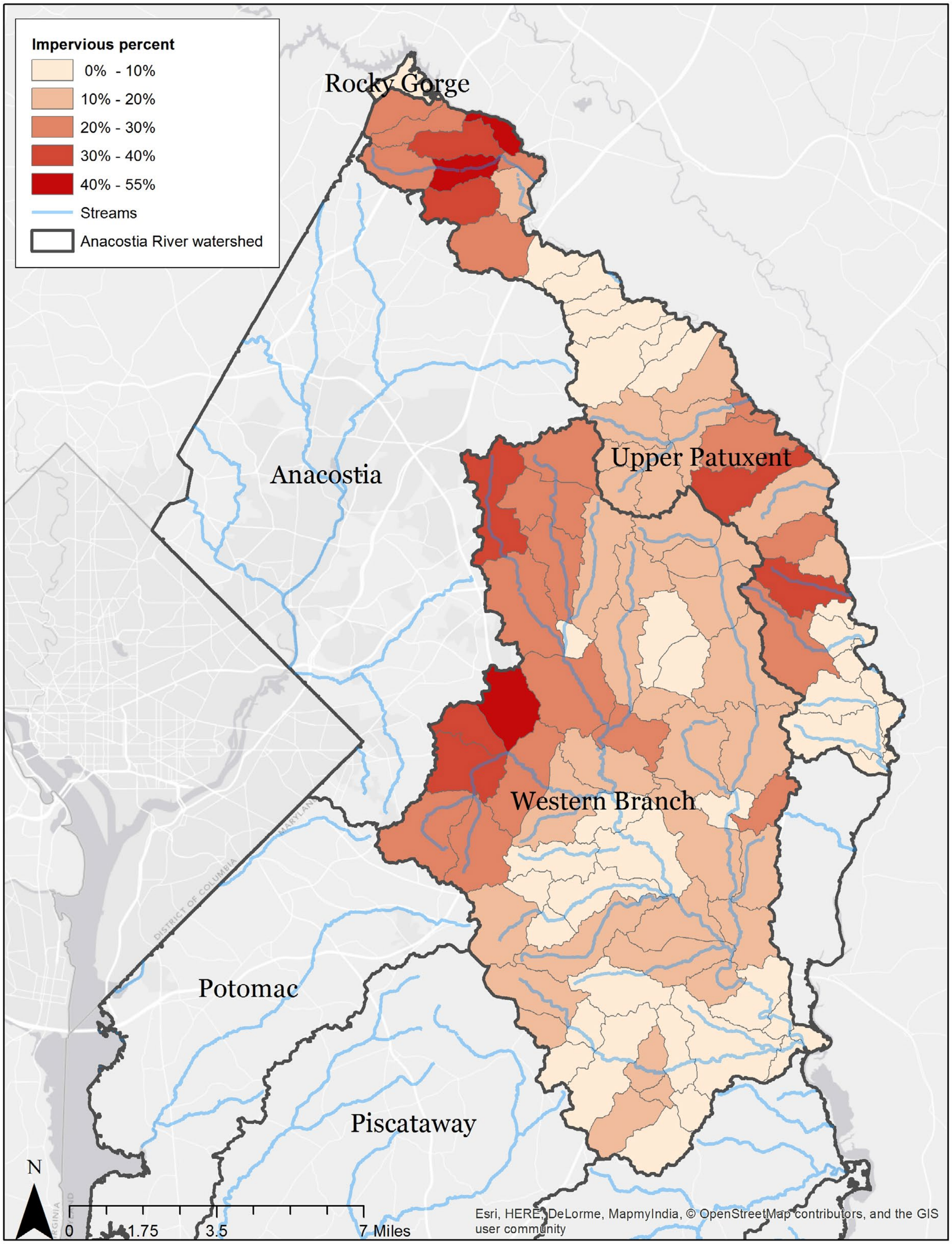
Source: M-NCPPC 2014.

Figure 2-6 presents the 2009 County impervious area GIS information for the watershed, while Figure 2-7 shows the corresponding percentage impervious area calculated for each subwatershed, being used in the restoration planning process. As the figures illustrate, impervious areas are most concentrated in the upper portions of the Upper Patuxent River and Western Branch watersheds, along with the middle portion of the Upper Patuxent River that also shows higher levels of impervious area coverage. These essentially correspond to the location of the majority of the urban areas. As with land use, the impervious areas are important to know for restoration planning.



Source: 2009 impervious area from M-NCPPC 2014.

Figure 2-6. Impervious areas in the Upper Patuxent River and Western Branch watersheds.



Source: 2009 impervious area from M-NCPPC 2014.

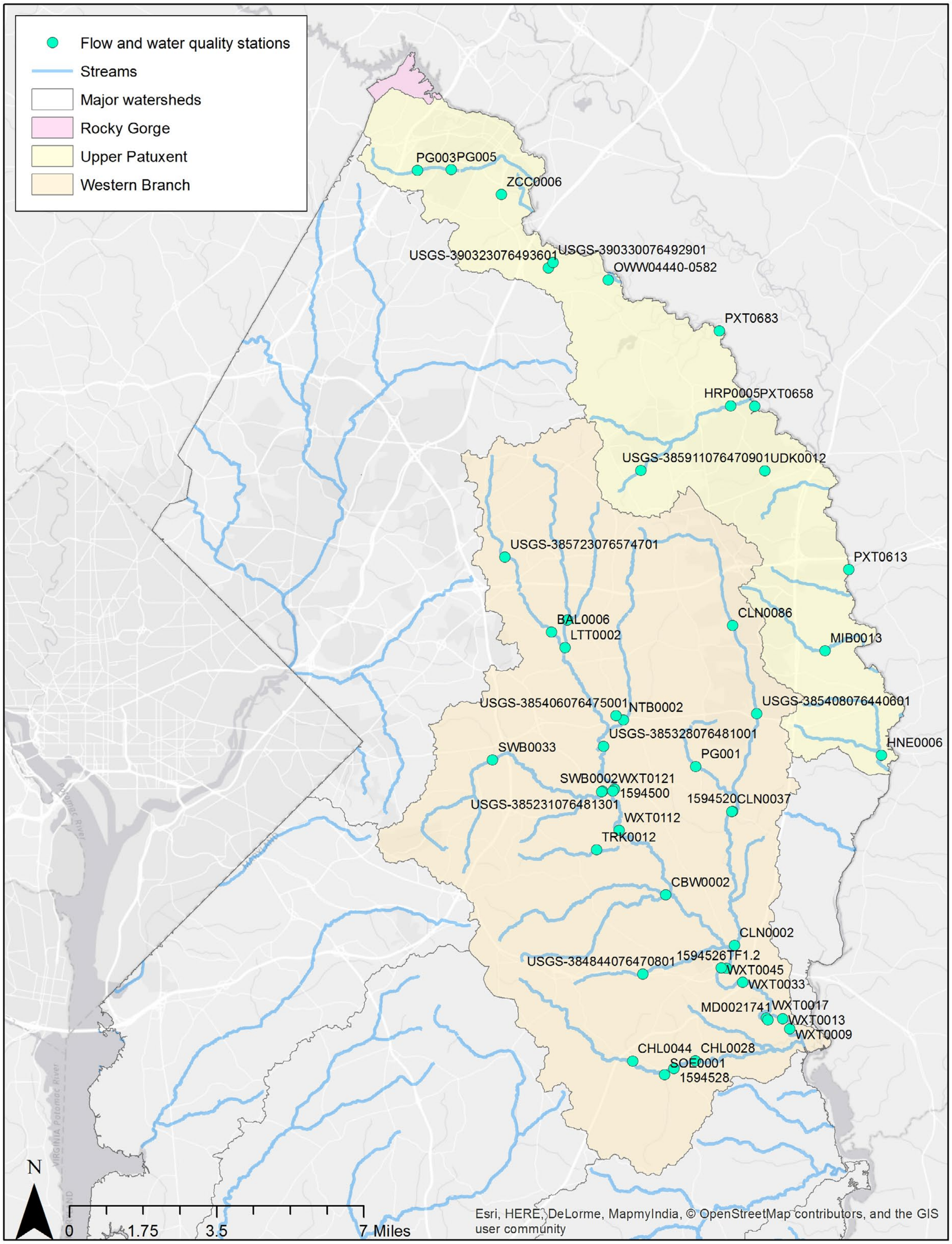
Figure 2-7. Percent impervious areas in the Upper Patuxent River and Western Branch watersheds.

3 Water Quality and Flow Conditions

Water quality and flow information are important parts of TMDL development and restoration planning. The water quality data helps illustrate the health of a water body. Flow data is important because it shows how water moves through the watershed. Historical flow data can also show the increase of urban stormwater runoff entering into water bodies, where, before development, the water infiltrated into the soils. Figure 3-1 shows the locations of water quality and flow monitoring stations within the Upper Patuxent River and Western Branch watersheds.

Water quality and flow data are available from several sources. The TMDL reports provide the water quality information used in their development. These reports were the sole source of polychlorinated biphenyl (PCB) water quality data. Data were also obtained from the *Water Quality Portal* (www.waterqualitydata.us/). This source is sponsored by EPA, USGS, and the National Water Quality Monitoring Council and collects data from more than 400 federal, state, local, and tribal agencies. EPA's STORET (STOrage and RETrieval) Data Warehouse was also searched for additional information. MDE was contacted and provided supplemental recent data that were not found in the *Water Quality Portal* or STORET. The final data source was the County's MS4 long-term monitoring program.

The County implements its biological monitoring program to provide credible data and valid, defensible results to address questions related to the status and trends of stream and watershed ecological condition. Biological monitoring data are used to provide problem identification; documentation of the relationships among stressor sources, stressors, and response indicators; and evaluation of environmental management activities, including restoration.



Source: USGS and EPA Water Quality Portal

Figure 3-1. Flow and water quality monitoring stations in the Upper Patuxent River and Western Branch watersheds.

3.1 Water Quality Data

3.1.1 Fecal Bacteria

Pathogens are microscopic organisms known to cause disease or sickness in humans. Pathogen-induced diseases are easily transmitted to humans through contact with contaminated surface waters, often through recreational contact or ingestion. Fecal bacteria (e.g., fecal coliforms, *E. coli*, fecal streptococci, and enterococci) are microscopic single-celled organisms found in the wastes of warm-blooded animals. Excessive amounts of fecal bacteria in surface waters have been shown to indicate an increased risk of pathogen-induced illness to humans, causing gastrointestinal, respiratory, eye, ear, nose, throat, and skin diseases (USEPA 1986). In water quality analysis, fecal bacteria are used to indicate the potential for pathogen-contaminated waters. Two in particular, *E. coli* and enterococci, have shown a strong correlation with swimming-associated gastroenteritis; thus, EPA recommends their use in water quality criteria for protecting against pathogen-induced illness in association with primary contact recreational activities.

Table 3-1 presents data summaries for stations only within the Upper Patuxent River watershed, which was listed for fecal coliform bacteria. The highest bacteria levels were reported at the two stations within Bear Branch at the upstream end of the Upper Patuxent River in Laurel, Maryland.

Figure 3-2 presents *E. coli* data over time for the five stations with the most data. In the 4 years, the two stations within Bear Branch had the most monitoring data at Contee Road (PG003) and above Laurel Lakes (PG005). Fecal coliform levels were quantified at these two locations, in addition to *E. coli*. Because the TMDL is based on *E. coli*, the figure shows only this data.

The next three stations with the largest number of observations include PXT0630 in the Upper Patuxent River at Route 3 Bridge, PXT0613 on the Upper Patuxent River, and PXT0561 on the Upper Patuxent River at Queen Anne Bridge Road. It must be noted that the data from these stations formed the basis for fecal coliform TMDL in the Upper Patuxent River. The five stations have monitoring data for *E. coli*. Maximum values observed at each of the stations for which data are plotted in Figure 3-2 are well above the single sample threshold for *E. coli* bacteria and do not show any definite trends over time, except for PG005 above Laurel Lakes that appear to decrease during 2002 and 2003.

Table 3-1. Summary of available bacteria data in the Upper Patuxent River watershed

Station ID	Station Name/ Description	Parameter	Date		Number of Records	Value (count/100mL)		
			Min.	Max.		Min.	Mean	Max.
PG003	Bear Branch at Contee Road	*E. coli*	10/15/09	09/27/13	57	2	2,392	87,522
PG005	Bear Branch above Laurel Lakes	*E. coli*	10/15/09	09/27/13	57	2	2,528	82,487
PXT0561	Patuxent River at Queen Anne Bridge Rd	*E. coli*	10/23/08	10/22/09	25	20	636	5,790
PXT0613	Patuxent River	*E. coli*	11/04/03	10/22/09	49	10	1,482	17,330

Station ID	Station Name/ Description	Parameter	Date		Number of Records	Value (count/100mL)		
			Min.	Max.		Min.	Mean	Max.
PXT0630	Upper Patuxent River at Route 3 Bridge	*E. coli*	10/23/0 8	10/22/0 9	50	10	1,227	19,86 0
PG003	Bear Branch at Contee Road	Fecal Coliform	11/13/0 8	03/09/1 0	13	2	2,523	16,00 0
PG005	Bear Branch above Laurel Lakes	Fecal Coliform	11/13/0 8	03/09/1 0	13	2	2,273	13,70 7

Note: mL = milliliter.

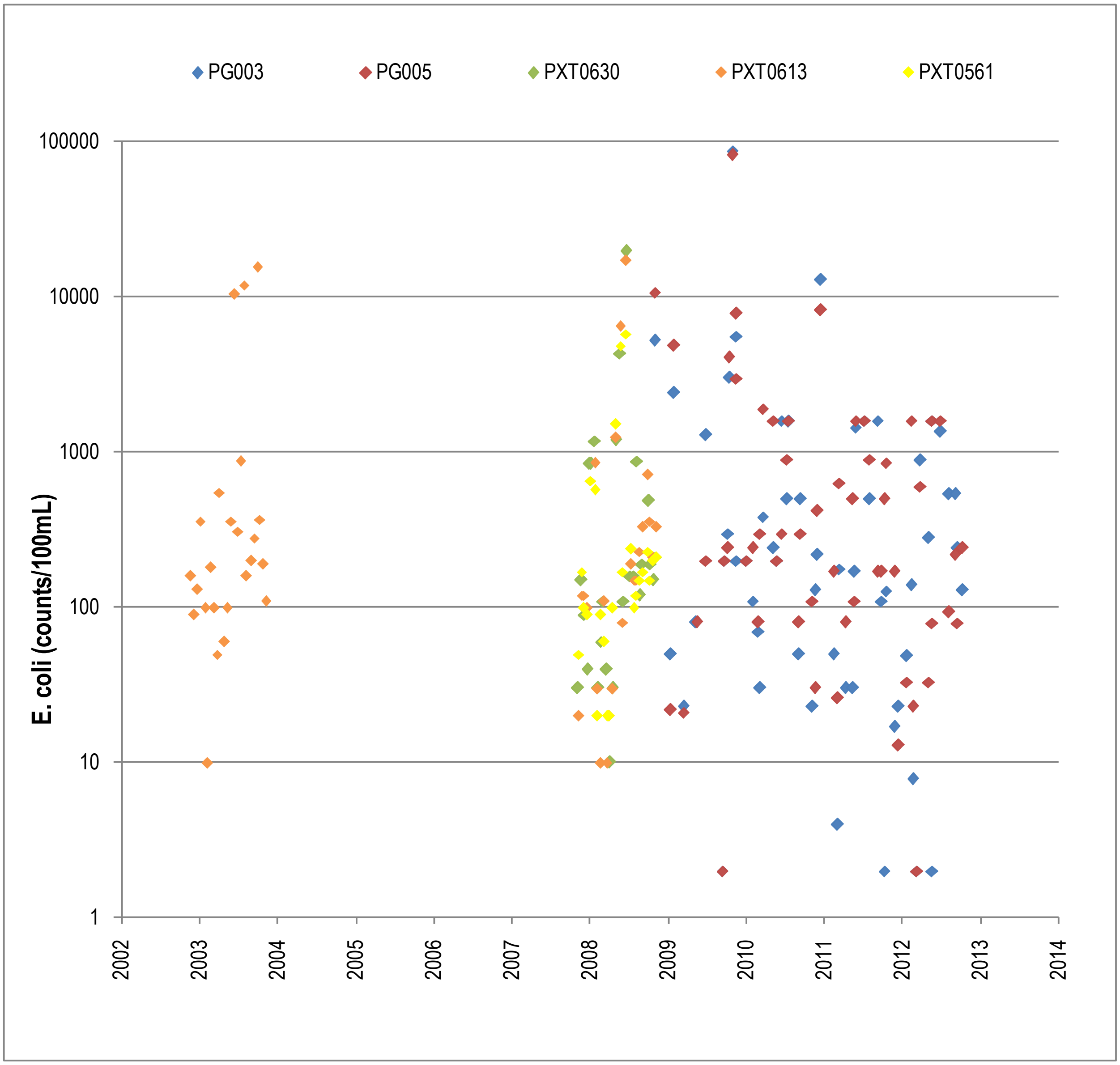


Figure 3-2. Plot of *E. coli* over time in the Upper Patuxent River watershed.

3.1.2 DO and BOD

DO and BOD are parameters of concern commonly associated with nutrient impairments and eutrophication-impacted water bodies.

Aquatic organisms require adequate DO concentrations for survival. DO levels are typically cyclical because they are influenced by temperature and photosynthesis, with levels often falling at night in impaired water bodies. Maryland has numeric criteria for DO that specify minimum concentrations.

BOD is used as an indicator of organic pollution in a water body. It is determined by measuring the DO used by microorganisms during the decomposition of organic matter over time (typically 5 days) at a temperature of 20 degrees Celsius. It is often associated with the discharge streams of WWTPs but can be attributed to stormwater runoff, agriculture feed lots, and septic systems as well as more natural sources such as leaves, woody debris and dead plants and animals. Maryland does not have numeric criteria for BOD; however, water quality modeling can be used to estimate appropriate BOD levels for streams given available information for flows and source loads. Unpolluted surface waters typically have BOD values of 2 mg/L or less.

Table 3-2 presents data summaries for stations only for Western Branch, which was listed for BOD. Some stations have very limited and outdated data (e.g., TF1.2, WXT0001, and WXT009). The USGS station (1594525) at Upper Marlboro had the most available data on BOD, but this data is from 1985–2000. Some tributaries such as Black Branch showed average and maximum BOD levels well below the 2 mg/L threshold. This Black Branch location has the most recent data available on BOD. The USGS location showed an average BOD below 2 mg/L; however, there were several values above this threshold during the monitoring period.

Figure 3-3 presents BOD data and Figure 3-4 presents DO data over time for the five stations with the most data. The two locations along the mainstem of the Western Branch, TF1.2 and WXT0001, have the most DO data. Summer periods experience DO levels below the threshold of 5 mg/L, but the rest of the periods show healthy DO levels as high as 14 mg/L. Many tributaries show minimum DO levels in excess of 5 mg/L, although some including Bald Hill Branch and Lottsford Branch show minimum values to be less than the 5 mg/L threshold.

Table 3-2. Summary of available BOD and DO data in the Western Branch watershed

Station ID	Station Name/Description	Parameter	Date		Number of Records	Value (mg/L)		
			Min.	Max.		Min.	Mean	Max.
PG001	Black Branch	BOD	11/08/06	02/01/08	11	0.05	0.145	0.20
TF1.2	TF1.2	BOD	09/22/86	09/22/86	1	4.60	4.60	4.60
USGS-1594526	Western Branch at Upper Marlboro, MD	BOD	10/09/85	09/28/00	91	0.00	1.56	3.40
WXT0001	Western Branch	BOD	12/15/97	12/17/97	2	1.70	1.95	2.20
WXT0009	Western Branch	BOD	12/15/97	12/17/97	2	1.40	1.60	1.80
WXT0013	Western Branch	BOD	12/15/97	09/19/00	7	0.90	2.81	5.30
WXT0017	Western Branch	BOD	12/15/97	12/17/97	2	1.30	1.60	1.90
WXT0033	Western Branch	BOD	12/15/97	09/19/00	7	1.30	2.54	5.80

Station ID	Station Name/Description	Parameter	Date		Number of Records	Value (mg/L)		
			Min.	Max.		Min.	Mean	Max.
WXT0045	Western Branch	BOD	12/15/97	12/17/97	2	2.40	2.45	2.50
BAL0006	Bald Hill Branch	DO	01/24/07	11/16/11	23	4.30	7.81	12.80
CBW0002	Cabin Branch	DO	01/24/07	11/16/11	21	5.10	9.33	13.70
CHL0028	Charles Branch	DO	01/24/07	12/19/07	10	5.40	9.01	12.20
CHL0044	Charles Branch	DO	01/24/07	11/16/11	20	5.00	9.25	12.50
CLN0002	Collington Branch	DO	01/24/07	11/16/11	23	6.80	9.16	13.20
CLN0037	Collington Branch	DO	01/24/07	11/16/11	23	5.70	8.95	13.60
CLN0086	Collington Branch	DO	01/24/07	11/16/11	23	4.30	7.90	13.60
LTT0002	Lottsford Branch	DO	01/24/07	11/16/11	23	3.20	8.14	13.40
MD0021741	Western Branch WWTP	DO	04/02/08	09/04/08	2	7.90	8.65	9.40
NTB0002	Northeast Branch Western Branch Patuxent River	DO	01/24/07	11/16/11	23	5.50	8.52	13.40
SOE0001	Southwest Branch	DO	01/24/07	11/16/11	21	3.90	8.88	12.70
SWB0002	Southwest Branch Western Branch Patuxent River	DO	01/24/07	11/16/11	23	5.90	8.67	14.10
SWB0033	Southwest Branch Western Branch Patuxent River	DO	01/24/07	11/16/11	23	5.10	8.55	12.90
TF1.2	TF1.2	DO	01/09/85	12/03/12	444	5.70	9.56	14.1
TRK0012	Turkey Branch	DO	01/24/07	12/19/07	12	6.40	9.49	13.80
WXT0001	Western Branch	DO	10/09/90	12/03/12	328	3.80	8.11	12.6
WXT0009	Western Branch	DO	12/15/97	09/19/00	7	6.60	8.39	12.00
WXT0013	Western Branch	DO	12/15/97	09/19/00	9	6.90	8.26	10.60
WXT0017	Western Branch	DO	12/15/97	12/17/97	2	12.50	12.75	13.00
WXT0033	Western Branch	DO	12/15/97	11/16/11	30	5.40	8.78	13.00
WXT0045	Western Branch	DO	12/15/97	12/17/97	2	12.60	12.65	12.70
WXT0112	Western Branch Patuxent River	DO	01/24/07	12/19/07	12	5.90	8.86	13.10
WXT0121	Western Branch Patuxent River	DO	01/24/07	11/16/11	23	5.10	7.97	13.00

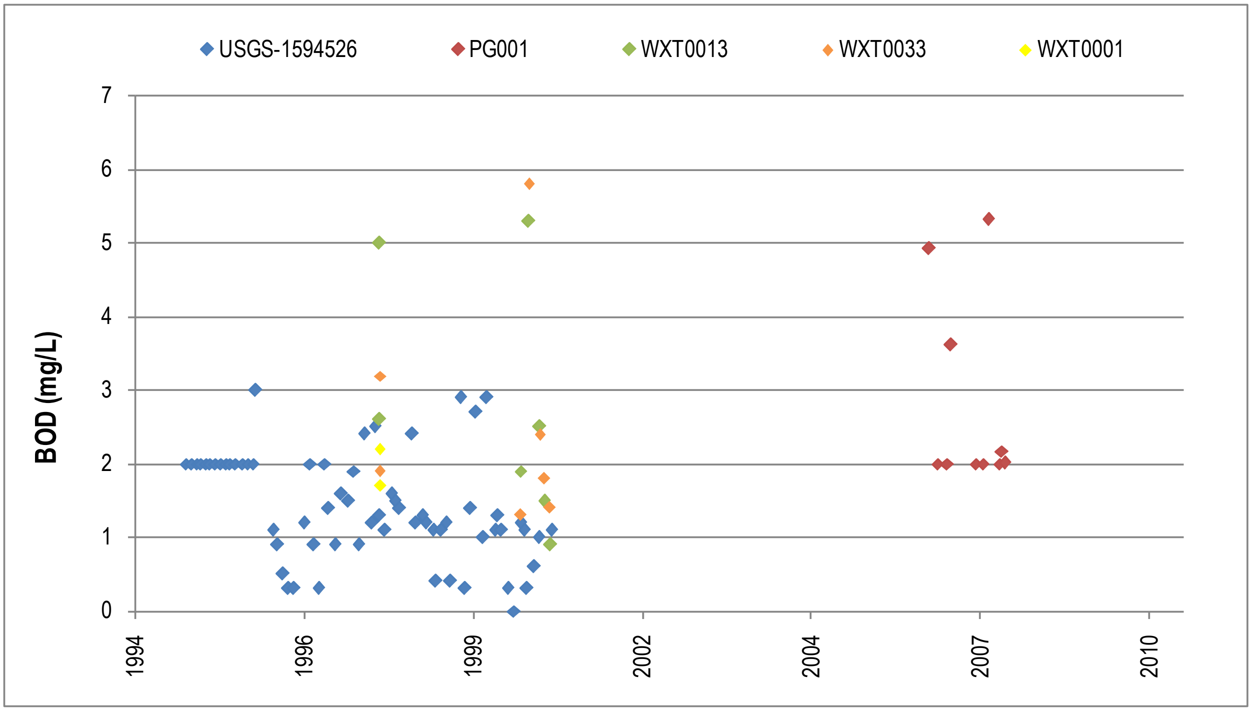


Figure 3-3. Plot of BOD over time in the Western Branch watershed.

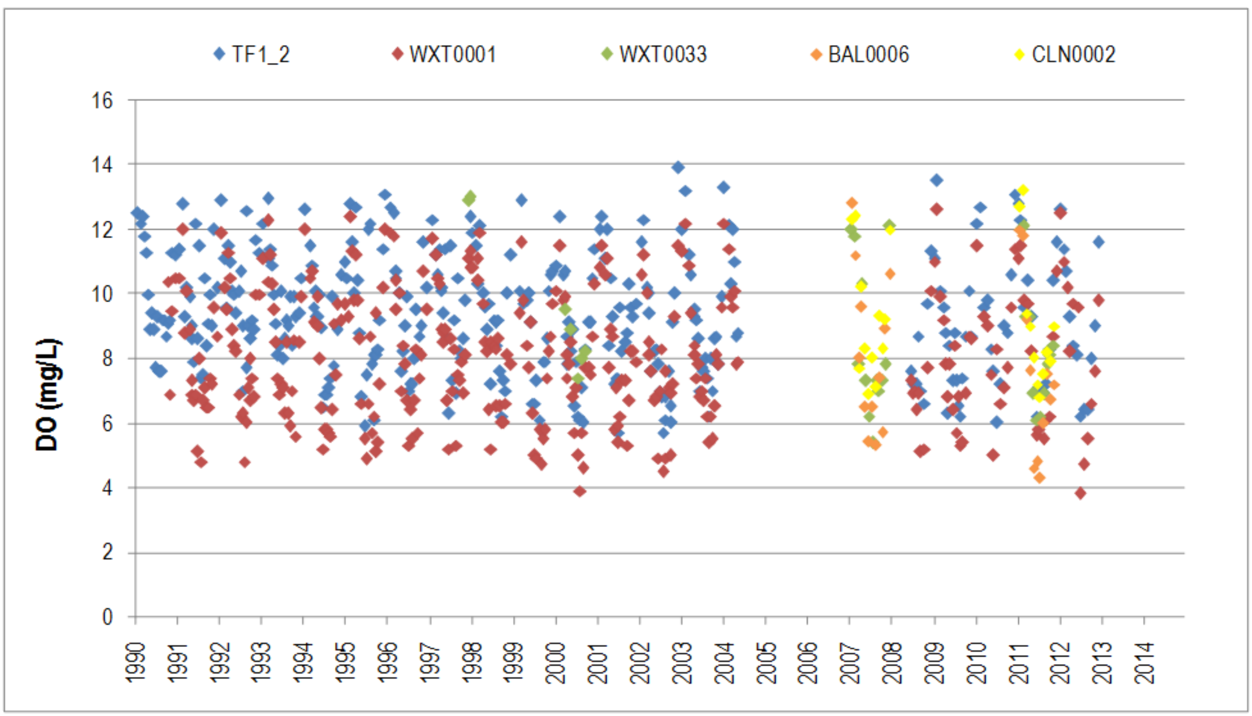


Figure 3-4. Plot of DO over time in the Western Branch watershed.

3.1.3 Phosphorus

Like nitrogen, excessive loading of phosphorus into surface water bodies can lead to eutrophication by fueling aquatic plant growth. Phosphorus in fresh and marine waters exists in organic and inorganic forms. The most readily available form for plants is soluble inorganic phosphorus ($H_2PO_4^-$, HPO_4^{2-}, and PO_4^3), also commonly referred to as soluble reactive phosphorus. Phosphorus is also able to sorb to sediment particles and is carried into water bodies by upland and streambank erosional processes. Maryland does not have numeric criteria for phosphorus.

Phosphorus TMDLs have been developed for the Patuxent River reservoirs. The Rocky Gorge Reservoir has very limited and outdated data on TP, and the TMDL was developed using water quality modeling of the Triadelphia and Rocky Gorge Reservoir systems.

MDE (2008) indicates that the nutrients are transported to the Patuxent River estuary with minimal losses due to settling in the upper reaches of the river, leading to excessive eutrophication and dips in DO levels in the Patuxent River estuary during summer months.

3.1.4 Sediment

Sediment is a natural component of water bodies, but like nutrients, sediment in excess amounts can impair designated uses. Sediments deposited on stream beds and lake bottoms impair fish spawning ability and food sources and reduce habitat complexity and cover from prey. Very high levels of sediment can affect the ability of fish to find prey and can also clog gills. High levels of sediment impair water clarity and adversely affect aesthetics, among other things. In addition, because of the ability of phosphorus to sorb to sediment, it can serve as a source of phosphorus to water bodies. Sediment is a common cause of impairment for water bodies listed for biological impairments. Maryland does not have numeric sediment or total suspended solids (TSS) criteria.

Table 3-3 presents data summaries for stations within the Upper Patuxent River watershed that has a TMDL for sediment (MDE 2011). Figure 3-5 presents TSS data over time for five stations with the most data, TF1.0 and PXT0613 on the mainstem of the Upper Patuxent River; PG003 and PG005 on Bear Branch; and HNE0006 on Honey Branch. Long-term TSS data at TF1.0 does not show an increasing trend; however, Bear Branch shows concentrations that are an order of magnitude higher than the mainstem values measured at TF1.0.The concentrations are shown in logarithmic scale in this figure.

Table 3-3. Summary of available TSS data in the Upper Patuxent River watershed

Station ID	Station Name/Description	Date		Number of Records	Value (mg/L)		
		Min.	Max.		Min.	Mean	Max.
HNE0006	Honey Branch	01/23/07	12/18/07	12	2.40	24.02	195
HRP0005	Horsepen Branch	01/23/07	12/18/07	12	2.40	42.26	280
MIB0013	Mill Branch	01/23/07	12/18/07	12	2.40	7.50	22.00
OWW04440-0582	Patuxent River	10/14/04	10/14/04	1	2.40	2.40	2.40
PG003	Bear Branch at Contee Road	11/13/08	09/21/13	83	1.50	93.41	691.6

Station ID	Station Name/Description	Date		Number of Records	Value (mg/L)		
		Min.	Max.		Min.	Mean	Max.
PG005	Bear Branch above Laurel Lakes	11/13/08	09/21/13	80	1.00	178	1,610
PXT0613	Patuxent River	11/04/03	12/18/07	36	3.20	30.09	278
PXT0630	Upper Patuxent River at Route 3 Bridge	03/27/00	09/19/00	5	4.80	9.52	14.40
PXT0683	Upper Patuxent River	01/23/07	12/18/07	11	2.40	10.55	38.00
PXT0748	Upper Patuxent River	03/20/00	09/18/00	6	2.90	4.98	11.20
PXT0771	Upper Patuxent River at Brock Bridge Road	01/23/07	12/18/07	12	2.80	13.00	99.00
TF1.0	TF1.0	01/09/85	12/03/12	967	1.00	21.94	500
UDK0012	Unnamed Tributary to Patuxent River	01/23/07	12/18/07	12	2.40	6.81	20.40
ZCC0006	Unnamed Tributary to Crow Branch	01/23/07	12/18/07	12	2.40	41.04	278

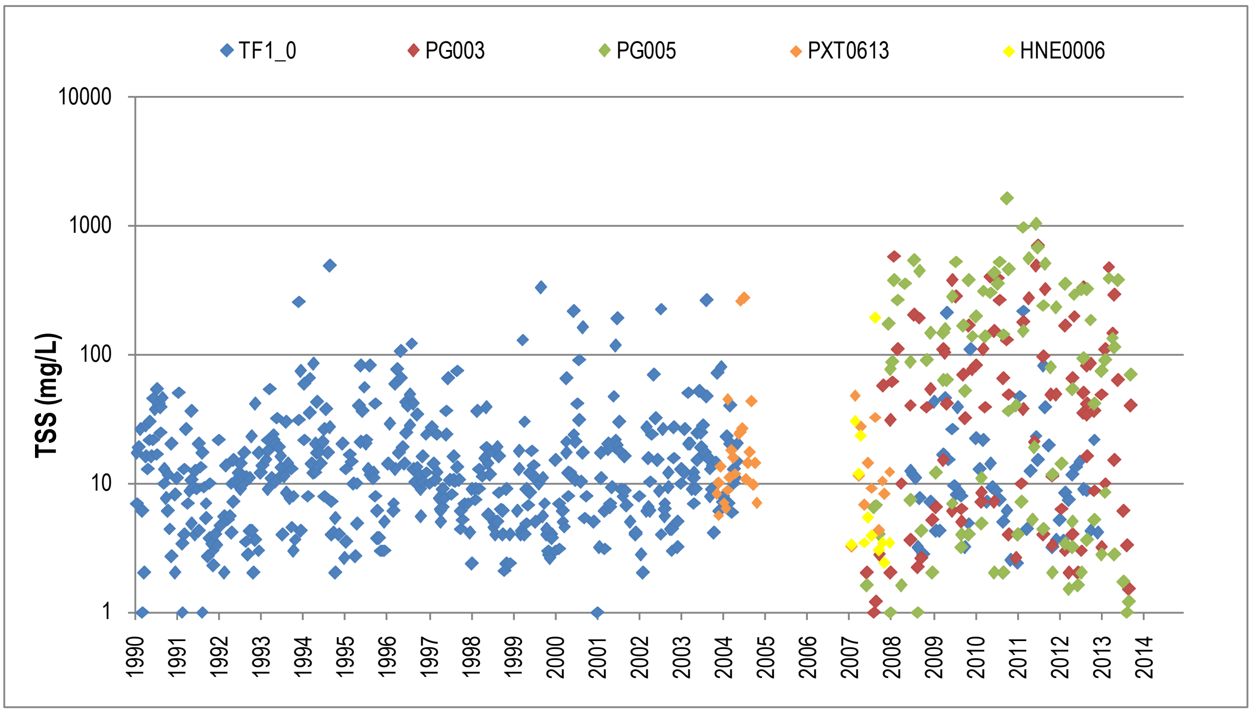


Figure 3-5. Plot of TSS over time in the Upper Patuxent River watershed.

3.2 Biological Station Data

Since 1999 two rounds of a Countywide bioassessment study have been completed; the first round from 1999 to 2003 and the second round from 2010 to 2013. In 2013, the third and final year of Round 2, 10 subwatersheds or subwatershed groups were assessed, including 1 in the Anacostia River basin, 5 in the Patuxent River basin, and 4 in the Potomac River basin (Millard et al. 2013). Using the MD DNR B-IBI, approximately 50 percent of the sites assessed during Year 3 were rated biologically impaired (Poor or Very Poor B-IBI rating).

Figure 3-6 provides results of the benthic invertebrate and B-IBI sampling in the Upper Patuxent River and Western Branch watersheds (Millard et al. 2013). Specific assessments in three sites (subwatersheds) are summarized below.

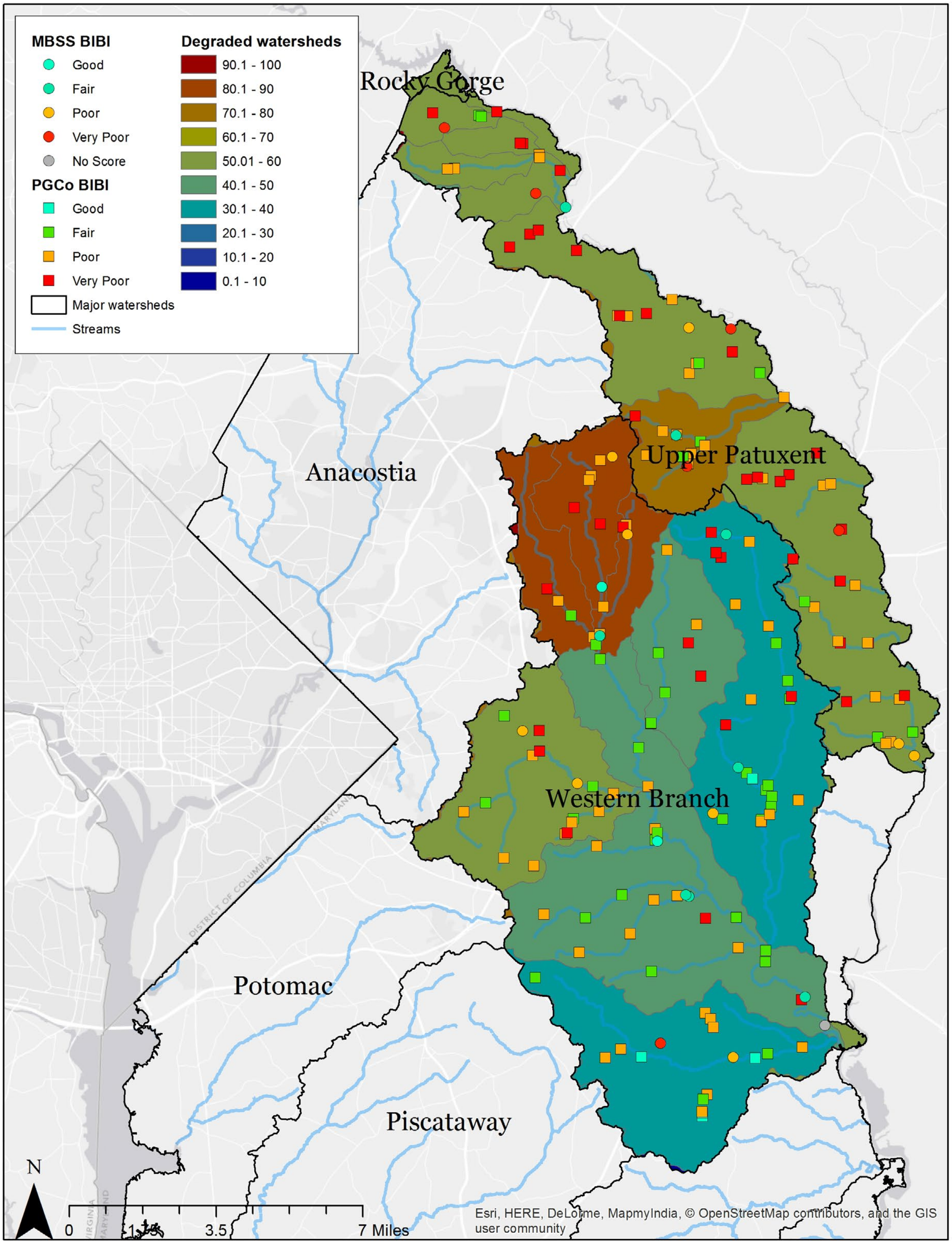
- Horsepen Branch: This subwatershed is 8.1 square miles in size with 9.9 miles of stream channel. The developed land increased by approximately 3 percent between 2001 and 2006, while forested land decreased by 2 percent. Four sites were sampled in 2013, with three sites yielding a B-IBI rating of Poor and one Fair rating. Physical habitat scores for Horsepen Branch were "supporting" or "comparable" to reference conditions at 75 percent of the sites. The estimated number of biologically degraded stream miles increased from 33 percent in Round 1 to 75 percent in Round 2.

- Southwest Branch: This is 9.8 square miles in size with 17.3 miles of stream channel. Similar to the Horsepen Branch, there is an increase of 3 percent in developed land in 2006, with a reduction of 2 percent in forested and agricultural areas since 2001. Six first-order sites and one second-order site were assessed; and among these, one rated as Very Poor, three as Poor, and the remaining as Fair. Habitat scores fell in the "partially supporting" range. The estimated number of biologically degraded stream miles decreased from 100 percent to 57 percent between Round 1 and Round 2.

- Collington Branch: This subwatershed encompasses an area of 31 square miles. Between 2001 and 2006, developed land increased by 7 percent, with a corresponding reduction of 8 percent in the total forested and agricultural land. A total of 12 sites were sampled in 2013, with one site being rated as Very Poor, three sites as Poor, seven as Fair, and one as Good based on the B-IBI scores. Physical habitat scores indicated "supporting" range, with only one site being rated as "non-supporting," with low scores of channel flow, substrate, and riparian conditions. The percent of stream miles classified as biologically impaired went from 58 percent in Round 1 to 33 percent in Round 2, showing an improvement in the subwatershed's biological health.

MDE performed a biological stress identification (BSID) study in the nearby Mattawoman Creek watershed published in March 2014 (MDE 2014). The parameters used in the BSID analysis were segregated into land use sources, and stressors representing sediment, in-stream habitat, riparian habitat, and water chemistry conditions. Through the BSID analysis, MDE identified land use sources and water chemistry parameters significantly associated with degraded fish or benthic biological conditions (MDE 2012; USEPA 2013). Sediment conditions, riparian habitat conditions, and in-stream habitat conditions did not show significant association with Poor to Very Poor stream biological conditions (i.e., removal of stressors would result in improved biological community). Specifically, high chlorides, high conductivity, low field pH, and acid neutralizing capacity (ANC) below chronic level have been identified to show a high level of correlation with Poor to Very Poor stream biological conditions.

Many stressors identified in MDE (2014) are applicable to the Upper Patuxent River and Western Branch watersheds. One of the stressors is the application of road salts during winter seasons that can become a source of chlorides and high conductivity levels. On-site septic systems and stormwater discharges are also likely sources of elevated concentrations of chlorides, sulfates, and conductivity. Currently there are no specific numeric criteria in Maryland that quantify the impacts of these stressors on non-tidal stream systems. Low ANC below chronic level can be caused by repeated additions of acidic materials, like those found in atmospheric deposition (NADP 2012). The results of the National Atmospheric Deposition Program/National Trends Network (NADP 2012) indicate that Maryland is in or near the region of most acidic precipitation and receives some of the highest concentrations of sulfate and nitrate deposition in the United States (MD DNR 2010).



Source: Biotic Integrity from MD DNR, degraded watersheds from Tetra Tech
MBSS = Maryland Biological Stream Survey

Figure 3-6. Results of benthic invertebrate and B-IBI sampling in the Upper Patuxent River Western Branch watersheds.

3.3 Flow Data

Flow in a water body is the result of several factors, with the most significant being rainfall and subsequent runoff; snow melt; ground water inflow into a water body; and release of water from upstream holding facilities such as reservoirs or stormwater detention systems. Flow can change over time as urbanization occurs. Urbanization results in increased impervious area (e.g., roof tops, parking lots, and roads). This area prevents water from infiltrating into the ground, resulting in more water flowing to streams during rainfall events, creating higher peak flows. These peak flows can bring higher levels of sediment and other pollutants into the water body.

Table 3-4 presents flow and related stream change information for the Upper Patuxent River and Western Branch watersheds. Figure 3-7 and Figure 3-8 present the flow data over time for the two USGS flow gauges with a logarithmic scale. USGS1594526 is on the Western Branch near Upper Marlboro and USGS1592500 is on the Patuxent River near Laurel. The logarithmic scale helps show the instantaneous flow data with a wide range of values, in this case from less than 1.1 cubic feet per second (cfs) to more than 10,200 cfs in Western Branch; and 8.6 cfs to about 240 cfs in the Upper Patuxent River near Laurel. Although there is a large gap in the data record for the Western Branch, recent data appears to have larger peak flows than older data. This could be representative of larger amounts of impervious area in the watershed. The Upper Patuxent River gauge does not have long-term data to assess any trends.

Table 3-4. Summary of available flow and stream data in the Upper Patuxent River and Western Branch watersheds

Station ID	Station Name/Description	Parameter	Units	Date		Number of Records	Value		
				Min.	Max.		Min.	Mean	Max.
Rocky Gorge Reservoir									
PXT0809	Upper Patuxent River at Base of Rocky Gorge Dam	Flow	cfs	10/14/99	09/18/00	15	20.34	45.61	161
PXT0831	Rocky Gorge Reservoir	Depth	feet	03/20/00	09/18/00	6	52.49	66.05	71.19
Upper Patuxent River									
USGS1592500	Patuxent River near Laurel, MD	Depth	feet	10/17/74	06/13/02	138	3.14	11.44	447
USGS1592500	Patuxent River near Laurel, MD	Flow, instantaneous	cfs	10/17/74	06/13/02	45	8.60	37.35	243
USGS1592500	Patuxent River near Laurel, MD	Flow, mean. Daily	cfs	07/01/63	04/14/64	24	9.70	45.20	155
PXT0561	Patuxent River at Queen Anne Bridge Rd	Flow	cfs	10/23/08	10/22/09	25	1.51	57.50	90.40
PXT0613	Patuxent River	Flow	cfs	10/23/08	10/22/09	25	1.51	57.50	90.40
PXT0630	Upper Patuxent River at Route 3 Bridge	Flow	cfs	10/23/08	10/22/09	25	1.51	57.50	90.40
PXT0748	Upper Patuxent River	Flow	cfs	03/20/00	09/18/00	4	24.05	26.17	29.60
TF1.0	TF1.0	Depth	feet	01/06/11	01/06/11	1	2.62	2.62	2.62
USGS1594450	Patuxent River at Hardesty, MD	Flow	cfs	06/27/63	04/13/64	26	48.00	294	2,180

Station ID	Station Name/Description	Parameter	Units	Date		Number of Records	Value		
				Min.	Max.		Min.	Mean	Max.
USGS385911076470901	Horsepen Branch at Bowie, MD	Flow, instantaneous	cfs	05/10/00	05/10/00	1	0.0	0.0	0.0
Western Branch									
MD0021741	Western Branch WWTP	Flow	cfs	04/02/08	04/02/08	1	6.13	6.13	6.13
TF1.2	TF1.2	Depth	feet	07/14/03	01/06/11	3	1.31	1.86	2.62
USGS1594520	Collington Branch near Kidwells Corner, MD	Flow, instantaneous	cfs	08/14/95	08/14/95	1	0.600	0.600	0.600
USGS1594526	Western Branch at Upper Marlboro, MD	Depth	feet	10/09/85	09/28/00	684	0.740	3.67	15.39
USGS1594526	Western Branch at Upper Marlboro, MD	Flow, instantaneous	cfs	10/09/85	09/28/00	370	1.10	408	10,200
USGS1594528	Charles Branch near Croom, MD	Flow, instantaneous	cfs	08/11/95	08/11/95	1	1.20	1.20	1.20
USGS384844076470801	Federal Spring at Upper Marlboro, MD	Flow, instantaneous	cfs	04/07/00	04/07/00	1	0.790	0.790	0.790
USGS-385231076481301	Southwest Branch near Largo, MD	Flow, instantaneous	cfs	05/01/00	05/01/00	1	11.00	11.00	11.00
USGS385328076481001	Western Branch 2 near Kolbes Corner, MD	Flow, instantaneous	cfs	04/12/00	04/12/00	1	0.940	0.940	0.940
USGS385406076475001	Northeast Branch at Kolbes Corner, MD	Flow, instantaneous	cfs	04/12/00	04/12/00	1	0.340	0.340	0.340
USGS385408076440601	Collington Branch at Bowie, MD	Flow, instantaneous	cfs	04/24/00	04/24/00	1	0.860	0.860	0.860
USGS385605076490701	Lottsford Branch near Glenarden, MD	Flow, instantaneous	cfs	05/08/00	05/08/00	1	2.40	2.40	2.40
USGS385723076574701	Bald Mill Branch at Lanham, MD	Flow, instantaneous	cfs	05/03/00	05/03/00	1	0.	0.	0.
WXT0001	Western Branch	Depth	feet	03/23/92	12/03/12	216	0.656	3.54	16.40
WXT0009	Western Branch	Depth	feet	03/27/00	09/19/00	5	2.30	3.08	4.27
WXT0013	Western Branch	Depth	feet	03/27/00	09/19/00	5	2.95	3.81	4.27
WXT0045	Western Branch	Depth	feet	09/30/92	09/30/92	1	3.28	3.28	3.28
WXT0045	Western Branch	Flow	cfs	12/15/97	12/17/97	2	40.90	41.25	41.60

Note: cfs = cubic feet per second.

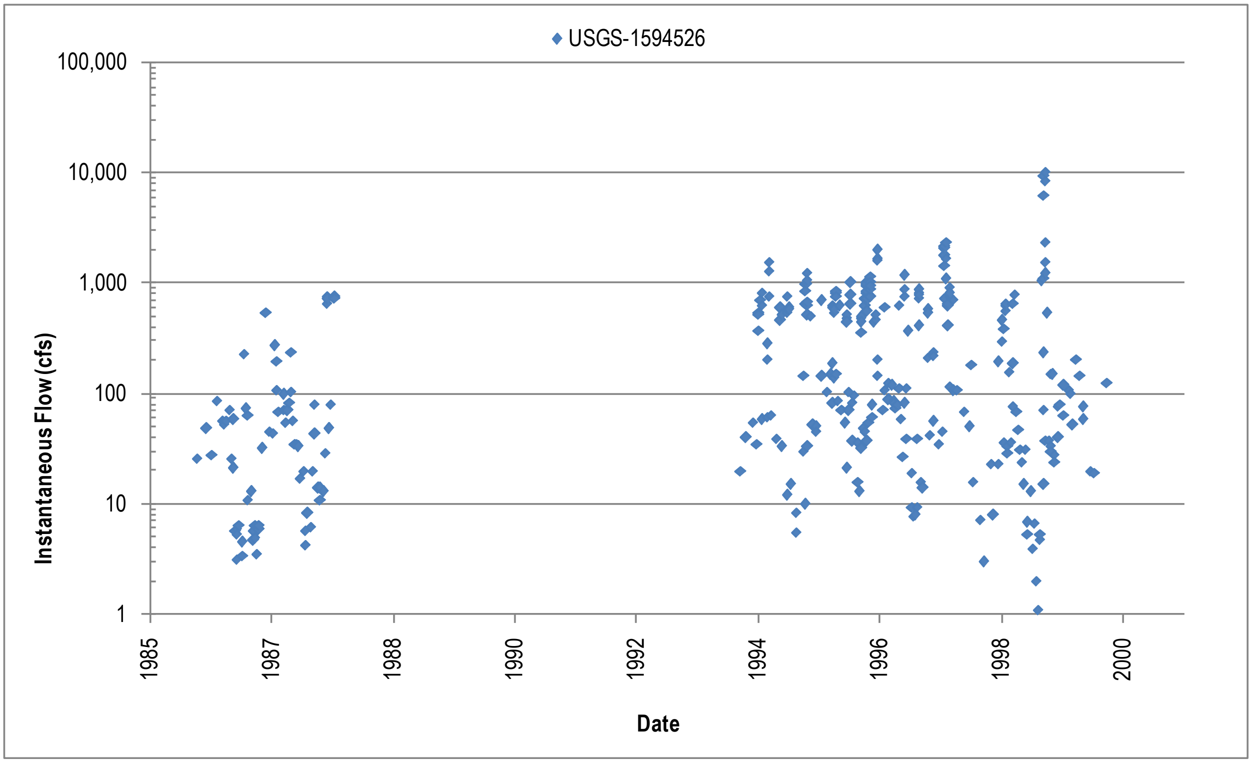


Figure 3-7. Plot of river flow over time in the Western Branch watershed.

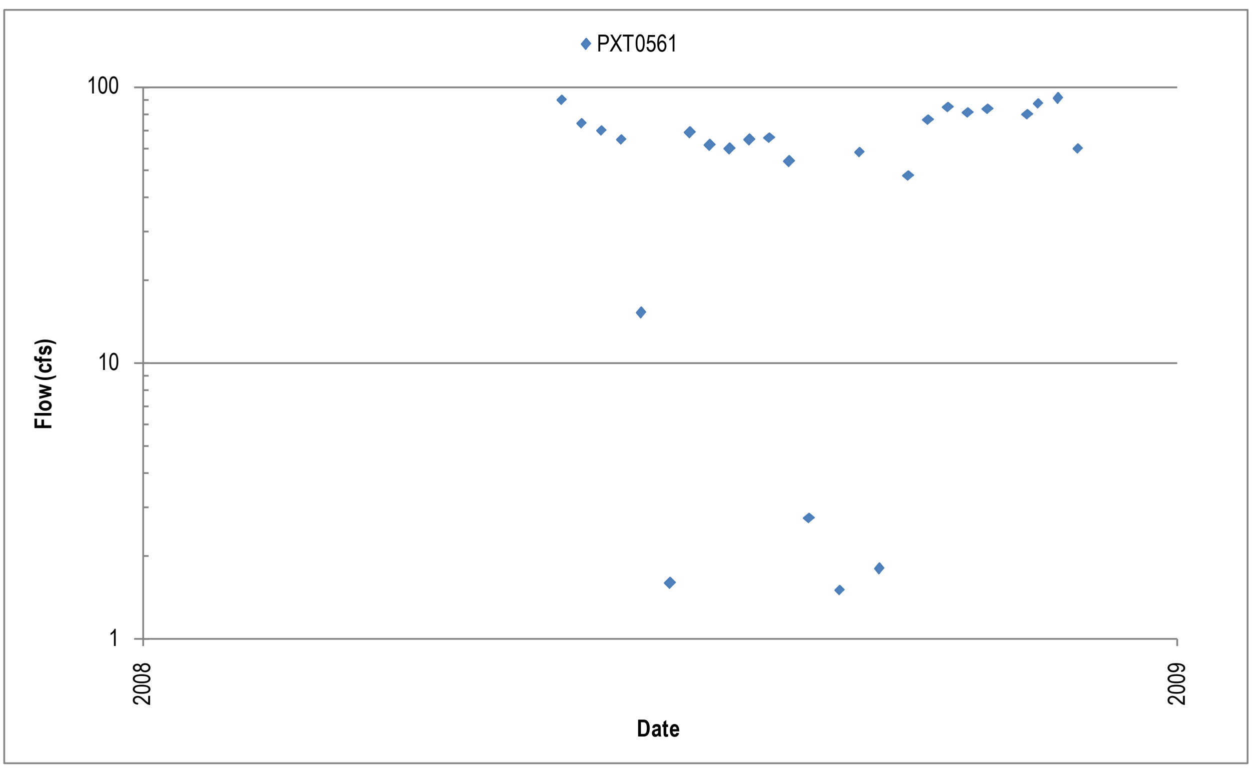


Figure 3-8. Plot of river flow over time in the Upper Patuxent River.

4 Pollutant Source Assessments

Point sources are permitted through the National Pollutant Discharge Elimination System (NPDES) program. Nonpoint sources are diffuse sources that typically cannot be identified as entering a water body through a discrete conveyance at one location. Nonpoint sources can originate from land activities that contribute nutrients or TSS to surface water as a result of rainfall runoff. For the TMDLs in this report, all sources of pollutant loading not regulated by NPDES permits are considered nonpoint sources.

4.1 NPDES Permitted Facilities

Under Title 40 of the *Code of Federal Regulations* section 122.2, a *point source* is described as a discernible, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The NPDES program, established under Clean Water Act sections 318, 402, and 405, requires permits for the discharge of pollutants from point sources, including urban stormwater systems, known as MS4s. The County is an MS4-permitted discharger.

4.1.1 MS4 (Phase I, Phase II, MDOT, Federal)

Stormwater discharges are generated by runoff from urban land and impervious areas such as paved streets, parking lots, and rooftops during precipitation events. These discharges often contain high concentrations of pollutants that can eventually enter nearby water bodies.

Under the NPDES stormwater program, operators of large, medium, and regulated small MS4s must obtain authorization to discharge pollutants. The Stormwater Phase I Rule (55 *Federal Register* 47990, November 16, 1990) requires all operators of medium and large MS4s to obtain an NPDES permit and develop a stormwater management program. Medium and large MS4s are defined by the size of the population in the MS4 area, not including the population served by combined sewer systems. A medium MS4 has a population between 100,000 and 249,999. A large MS4 has a population of 250,000 or more. The Stormwater Phase II Rule (64 *Federal Register* 68722, December 8, 1999) applies to operators of regulated small MS4s with a population less than 100,000 not already covered by Phase I; however, the Phase II Rule is more flexible and allows greater variability of regulated entities than does the Phase I Rule. Regulated, small MS4s include those within boundaries of urbanized areas as defined by the U.S. Census Bureau and those designated by the NPDES permitting authority. The NPDES permitting authority may designate a small MS4 under any of the following circumstances: the MS4's discharges do or can negatively affect water quality; population exceeds 10,000; population density is at least 1,000 people per square mile; or contribution of pollutant loadings to a physically interconnected MS4 is evident.

The following are the Phase II municipal Phase II MS4 entities in the Upper Patuxent River and Western Branch watersheds:

- Bowie
- Capitol Heights
- District Heights
- Glenarden
- Greenbelt
- Hyattsville
- Laurel
- New Carrollton
- Upper Marlboro

In addition to municipalities, certain federal, state, and other entities are also required to obtain a Phase II MS4 permit. Table 4-1 presents these permitted other entities within the Upper Patuxent River and Western Branch watersheds.

Table 4-1. Phase II MS4 permitted federal, state, and other entities in Upper Patuxent River and Western Branch watersheds

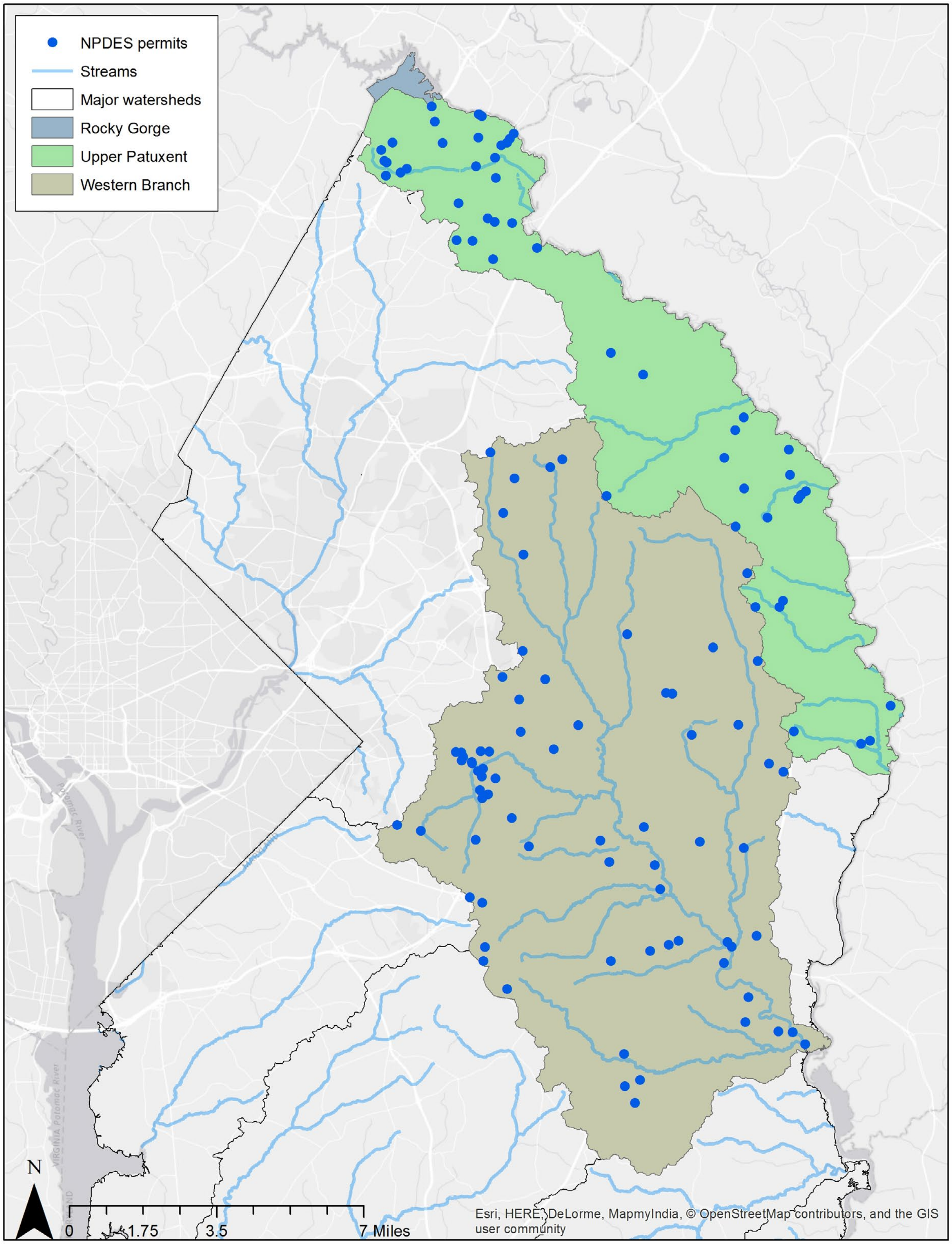
Agency	Installation/Facility
U.S. Department of the Air Force	Andrews Air Force Base
Maryland Air National Guard	Multiple Properties
Washington Suburban Sanitary Commission	Multiple Properties
Maryland Transit Administration	Multiple Properties
National Aeronautics & Space Administration	Goddard Space Flight Center
Maryland State Highway Administration	Multiple (outside Phase I Jurisdictions)
Washington Metropolitan Area Transit Authority	Multiple Metro Rail Stations
Maryland Transportation Authority	Multiple Properties
Maryland Department of Transportation Motor Vehicle Administration	Multiple Properties

4.1.2 Other NPDES Permitted Facilities

NPDES permit information was obtained from MDE's website and EPA's Integrated Compliance Information System. Figure 4-1 shows the locations of the permitted facilities that discharge to surface water in the Upper Patuxent River and Western Branch watersheds. Because of the number of facilities, information on the facilities and their available information is listed in Appendix C. Depending on permit conditions, a discharger is required to submit a DMR that reports pollutant concentration or loading data along with other information, such as flow or pH. The required information varies by discharger, and depends on the type of facility. Appendix B includes summaries of available relevant permit limit and DMR data.

The permit review revealed that there are 51 permitted facilities in the Upper Patuxent River watershed and 75 facilities in the Western Branch watershed. Of these, more than half are listed as discharging stormwater. Other facilities are permitted for discharging from construction sites, mining facilities, de-watering activities, refuse sites, and swimming pools. There were also 11 facilities that were found that were not permitted.

The County maintains stormwater pollution prevention plans (SWPPP) for its facilities. There currently are ten County facilities and nine other municipal facilities covered by the NPDES General Industrial permit and which require a SWPPP. The County currently conducts field verification of these facilities to assure that each SWPPP accurately reflects the environmental and industrial operations of the facility. If deficiencies in the SWPPP are noted, the County provides the required technical support to upgrade the plans. The County also monitors all SWPPP implementation activities through its database tracking system and provides MDE with an annual report documenting the status of each County-owned facility SWPPP.



Source: MDE and EPA ICIS database

Figure 4-1. Permitted discharges in the Upper Patuxent River and Western Branch watersheds.

4.1.3 Wastewater

Wastewater facilities may include those publicly owned treatment works providing wastewater treatment and disinfection for sanitary sewer systems, or industrial facilities providing treatment of process waters. In the Upper Patuxent River and Western Branch watersheds, there is one federal facility being permitted to discharge treated sanitary wastewater (MD0065358, the National Wildlife Visitor Center). These facilities do not fall under the purview of the MS4 permit.

Table 4-2. Wastewater treatment plants in the Upper Patuxent River and Western Branch watersheds

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
Upper Patuxent River						
MD0021628	City of Bowie WWTP	NPDES Individual Permit	WWTP	07/07/10	08/01/10	07/31/15
MD0021725	Parkway WWTP	NPDES Individual Permit	WWTP	n/a	n/a	n/a
MD0065358	National Wildlife Visitor Center	NPDES Individual Permit	WWTP	03/28/12	05/01/12	04/30/17
MDG911499	The Patuxent River 4-H Center	General Permit	Sewerage Systems	04/01/98	04/01/98	03/31/03
MDL021628	City of Bowie STP	Associated Permit Record	Sewerage Systems	01/01/94	01/01/94	12/31/99
Western Branch						
MD0021741	Western Branch WWTP	NPDES Individual Permit	WWTP	09/14/10	10/01/10	09/30/15

Note: WWTP = wastewater treatment plant; STP = sewage treatment plant; n/a = not available.

Sanitary sewers occasionally unintentionally discharge raw sewage to surface waters in events called sanitary sewer overflows (SSOs). These events contribute nutrients, bacteria, and solids into local waterways. SSOs can be caused by sewer blockages, pipe breaks, defects, and power failures. The Maryland Reported Sewer Overflow Database contains bypasses, combined sewer overflows, and SSOs reported to MDE from January 2005 through the most recent update. Data on SSOs in the County were obtained from the database and are summarized in Table 4-3. Since 2005 an estimated 41.8 million gallons of sanitary overflows have been reported in the County within Western Branch watershed, and another 208,397 gallons in the Upper Patuxent River watershed. For that period, the average amount of annual overflow has been 4.6 million gallons for Western Branch and 23,155 gallons for the Upper Patuxent River.

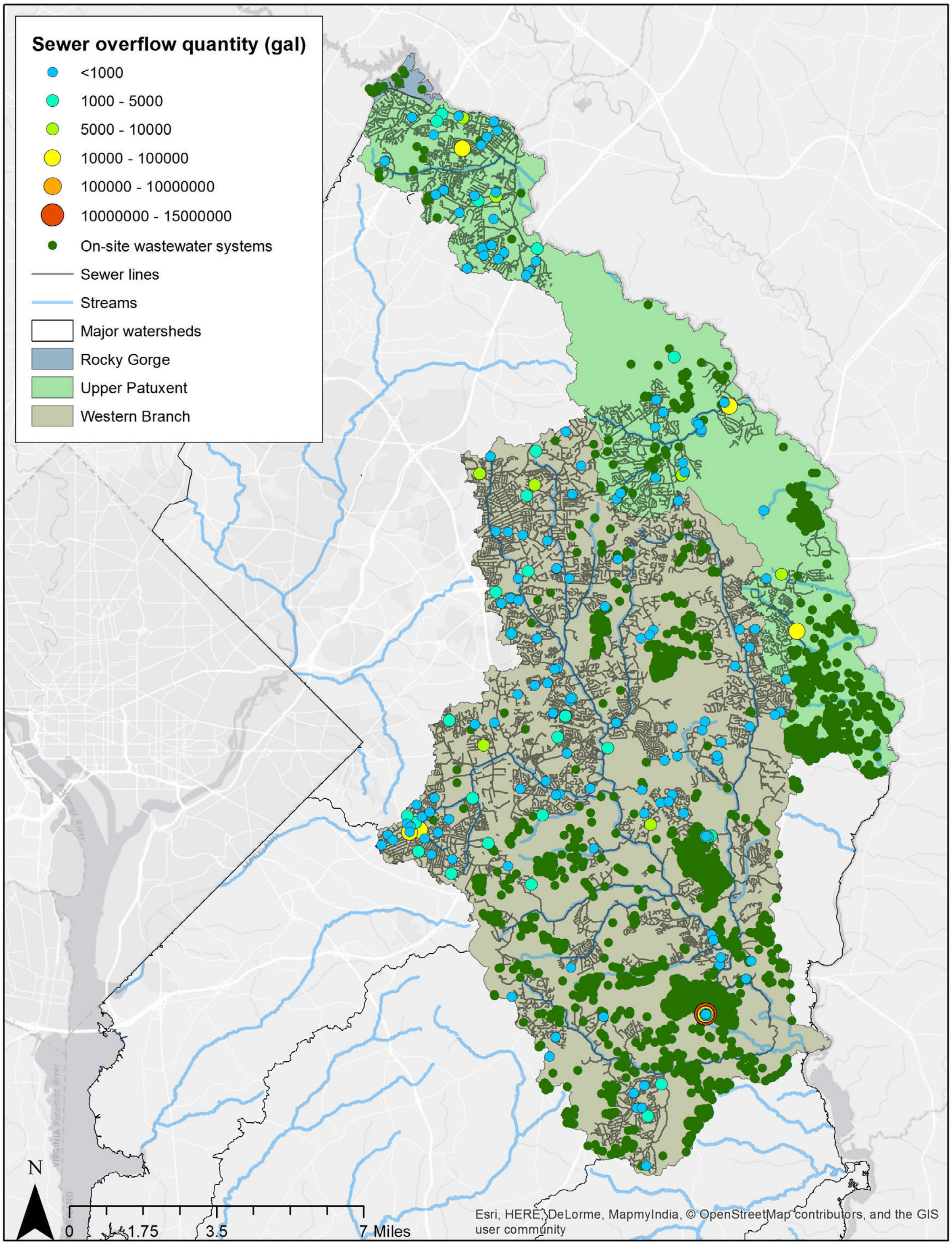
Figure 4-2 shows the locations of SSOs. The Washington Suburban Sanity Commission (WSSC) is currently addressing problems that cause SSOs through their Sewer Repair, Replacement and Rehabilitation (SR3) Program.

Table 4-3. Summary SSO overflow (gallons) in the Upper Patuxent River and Western Branch watersheds by year

Causes	2005	2006	2007	2008	2009	2010	2011	2012	2013
Upper Patuxent Total	**9,124**	**70,735**	**22,005**	**2,038**	**72,470**	**406**	**20,208**	**9,088**	**2,323**
Blockage	2,840		10		52	15	10,097	1	151
Construction Activity					30,000				
Defective Equipment/Workmanship				34	2,000				
Equipment Failure	5,100	18,000		650			7,767	7,708	9
Grease	720	5,651	763		20,608	207		812	
High Flow/Precipitation		0							5
Mechanical Failure					3,000				
Other	464	1,584		1,199	5,199			5	525
Power Loss		45,000	20,000						
Roots			1,232	154			2,178		145
Roots/Grease				1		159	166		1,488
Third Party Damage					11,570				
Unknown		500			41	25		562	
Western Branch Total	**60,867**	**17,609**	**8,046,345**	**20,002,418**	**25,360**	**1,219**	**13,605,848**	**19,320**	**11,941**
Blockage	375	2,149	1,686	1,150	4,283		605	1,586	85
Construction Activity	1,000								
Defective Equipment/Workmanship					1,588				
Equipment Failure		200	12,618				592		10
Equipment Ware					300				
Grease	3,992	12,309	24,682	20	18,935	608	4,402	3,811	6,285
High Flow/Precipitation	50,000	0	8,002,200	20,000,000			13,600,000		
Mechanical Failure	500		80		0				
Other	5,000	1,360				22			
Roots		1,260			131		20	375	
Roots/Grease				362		218	154	7,740	4,461
Stream Erosion								3,968	
Third Party Damage				145		8			
Unknown	0	331	5,079	741	123	363	75	1,840	1,100

County data from 2011 indicate that there are 13 on-site wastewater systems in the Rocky Gorge Reservoir watershed, 579 in the Upper Patuxent River watershed, and 1,430 in the Western Branch watershed. Although these systems are typically not considered point sources, they are included in this section to provide a complete picture of sanitary wastewater in the watershed. These types of systems can contribute nitrogen loadings to nearby water bodies through their normal operation. Failing on-site systems can increase nitrogen, phosphorus, and bacteria levels.

No information is currently available as to the age, maintenance, or level of treatment of the systems. Figure 4-2 shows the locations of on-site wastewater systems.



Source: Storm sewer pipes are from DoE and overflows from MDE, June 2014.

Figure 4-2. Sanitary sewer lines, overflow sites, and on-site wastewater systems in the Upper Patuxent River and Western Branch watersheds.

4.2 Nonpoint and Other Sources

Nonpoint sources can originate from rainfall runoff (in non-urban areas) and landscape-dependent characteristics and processes that contribute sediment, organic matter, and nutrient loads to surface waters. Nonpoint sources include diffuse sources that cannot be identified as entering the water body at a specific location. Because the County is considered a Phase I MS4, for TMDL purposes, all urban areas within the County are considered to be point sources and allocated loads are considered under the WLA component. Mechanisms under which urban or MS4 loads are generated are the same as other rainfall-driven nonpoint sources. Potential sources vary greatly and include agriculture-related activities, atmospheric deposition, on-site treatment systems, streambank erosion, wildlife, and unknown sources.

Atmospheric deposition occurs by two main methods: wet and dry. Wet deposition occurs through rain, fog, and snow. Dry deposition occurs from gases and particles. Particles and gases from dry deposition can be washed into streams from trees, roofs, and other surfaces by precipitation after it is deposited. Winds blow the particles and gases contributing to atmospheric deposition over far distances, including political boundaries, such as state boundaries.

Streams and rivers can be vulnerable to nutrient inputs from wildlife. Wild animals with direct access to streams include deer, raccoons, other small mammals, and avian species. This access to streams contributes bacteria and nitrogen to water bodies.

Development in the watershed has altered the landscape from pre-settlement conditions, which included grassland and forest, to post-settlement conditions, which include cropland, pasture, and urban/suburban areas. This conversion has led to increased runoff and flow into streams versus pre-settlement conditions, as well as streambank erosion and straightening of meandering streams. The increased erosion not only increases sediment loading to water bodies but also increases loadings of nutrients and other pollutants (e.g., PCBs) that are adsorbed to the particles.

4.3 Existing BMPs

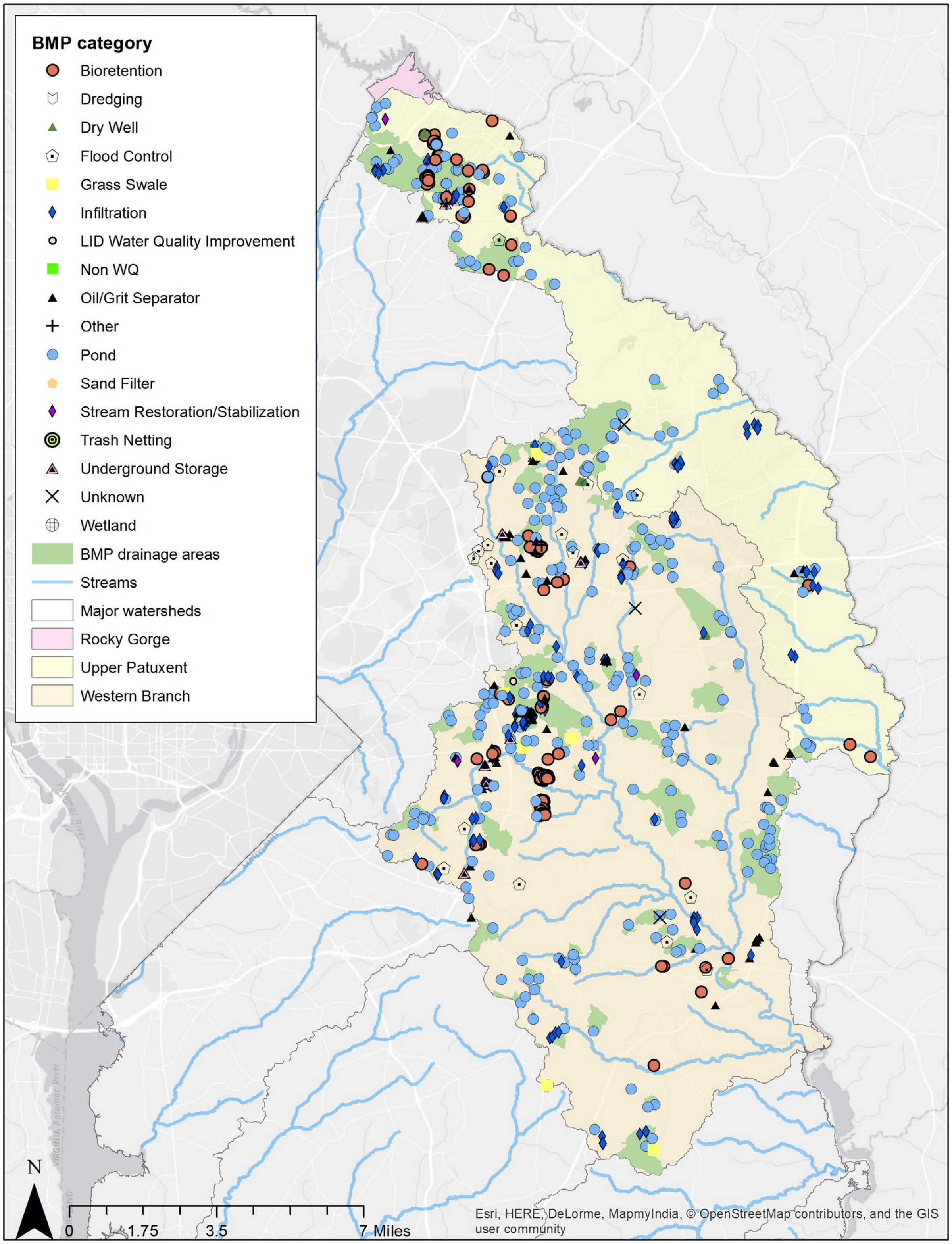
BMPs are measures used to control and reduce sources of pollution. They can be structural or nonstructural and are used to address both urban and agricultural sources of pollution. Structural practices include practices that are constructed and installed such as detention ponds, porous pavement, or bioretention systems. Nonstructural BMPs include institutional, educational, or pollution prevention practices that when implemented work to reduce pollutant loadings. Examples of nonstructural BMPs include implementation of strategic disconnection of impervious areas in a municipality, street sweeping, homeowner and landowner education campaigns, and nutrient management. Different types of BMPs remove pollutants at different levels of efficiency. Ponds tend to have lower efficiencies (but can treat larger areas) while bioretention systems and infiltration practices tend to have higher efficiencies (but can only treat smaller areas).

The County has implemented both structural and nonstructural BMPs in furtherance of a variety of programmatic goals and responsibilities including permit compliance, TMDL WLAs, flood mitigation, and others. Table 4-4 presents the list of known public and private structural BMPs in the County's portion of the Upper Patuxent River and Western Branch watersheds. Figure 4-3 presents the locations of the BMPs in the watershed. The County also engages in street sweeping, public outreach to promote environmental awareness, green initiatives, and community involvement in protecting natural resources. Past public outreach activities include educational brochures on stormwater pollution awareness, outreach in schools, *Can the Grease* program to decrease SSOs, and recycling programs.

Table 4-4. List of BMP types in the Upper Patuxent River Western Branch watersheds

	Upper Patuxent				Western Branch			
BMP Type	Total	Total w/DA	Total Acres Treated	Avg. Acres Treated	Total	Total w/DA	Total Acres Treated	Avg. Acres Treated
Bioretention	43	26	49.38	1.90	160	116	119.53	1.03
Dredging	1	0	0.00	0.00	0	0	0.00	0.00
Dry Well	6	0	0.00	0.00	10	10	4.26	0.43
Flood Control	2	0	0.00	0.00	17	0	0.00	0.00
Grass Swale	0	0	0.00	0.00	7	5	6.64	1.33
Infiltration	39	20	71.95	3.60	113	86	181.94	2.12
LID Water Quality Improvement	0	0	0.00	0.00	1	0	0.00	0.00
Oil/Grit Separator	7	4	4.23	1.06	66	52	121.25	2.33
Other	1	0	0.00	0.00	1	0	0.00	0.00
Pond	72	65	4,438.93	68.29	215	190	9,153.18	48.17
Sand Filter	0	0	0.00	0.00	1	1	0.75	0.75
Stream Restoration/Stabilization	2	1	6.96	6.96	3	2	10.91	5.45
Underground Storage	4	3	6.14	2.05	8	7	22.48	3.21
Unknown	1	0	0.00	0.00	2	0	0.00	0.00
Total	178	119	4,577.59	38.47	604	469	9,620.94	20.51

Note: DA=drainage area



Source: BMPs from DoE, June 2014

Figure 4-3. BMPs and associated drainage areas in the Upper Patuxent/Western Branch watersheds.

4.4 Existing Condition Analysis

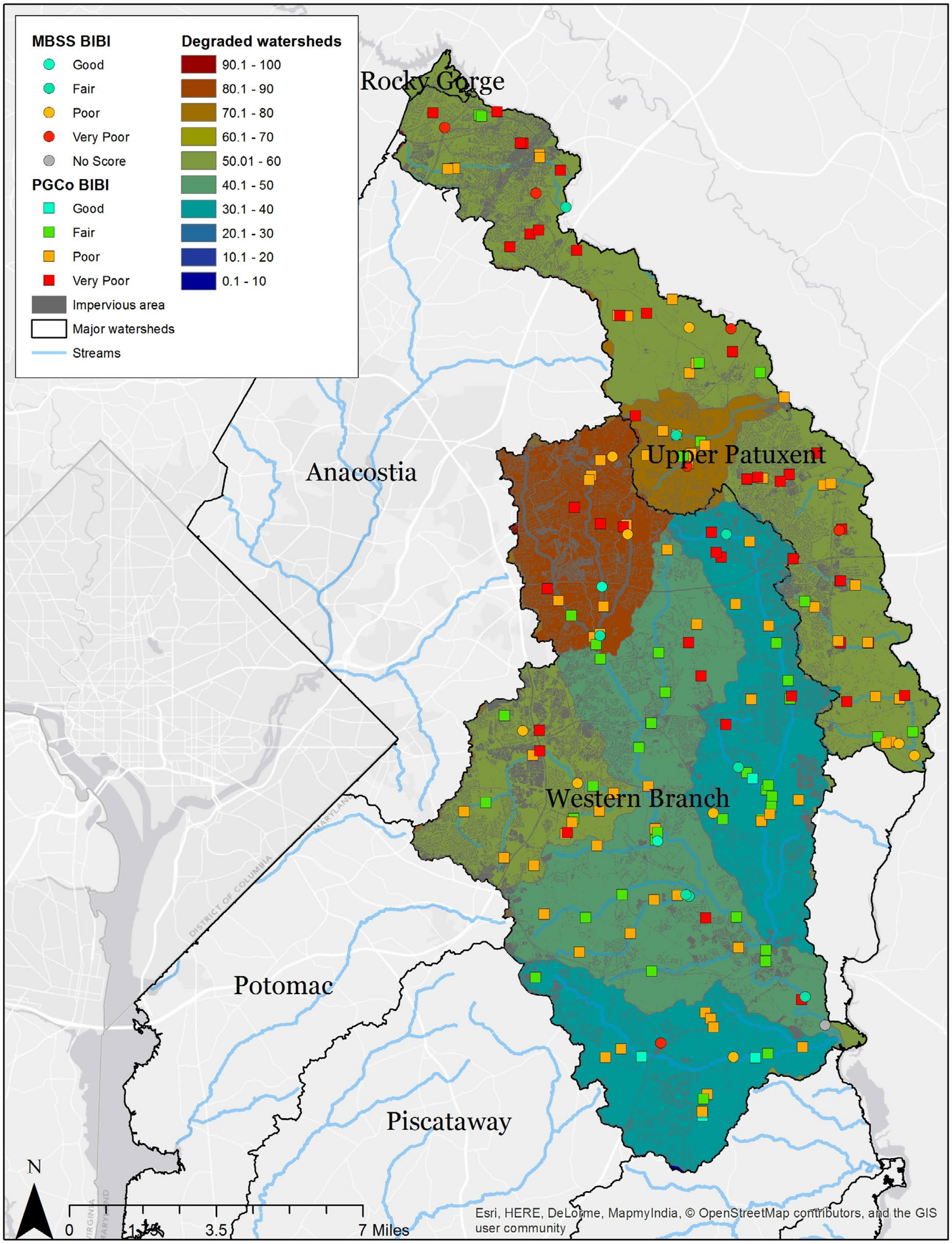
Water quality and the health of biological communities are affected by watershed characteristics such as land use and percentage of impervious cover. Multiple studies have shown that as impervious cover increases, peak runoff volumes and velocities increase, along with streambank erosion (Arnold and Gibbons 1996; Schueler 1994). The purpose of this section is to examine how landscape and physical characteristics in the County might influence conditions in other portions of the County. Available data were reviewed to examine relationships between biological index scores and impervious cover and BMP locations. In addition, BMP locations are examined in relation to current land uses and impervious areas.

- Figure 4-4 compares biological scores to impervious areas
- Figure 4-5compares biological scores to BMP locations
- Figure 4-6 compares BMP locations to the current storm drain network
- Figure 4-7compares BMP locations to impervious areas
- Table 4-5 looks at BMPs, their drainage areas, and what land use(s) they treat

Overall the watershed has biological integrity values of Poor, Very Poor, and some Fair and Good. The monitoring locations with Poor and Very Poor scores tend to be in the impervious areas. The monitoring locations with scores of Good are in the lower Western Branch where the imperviousness is very low. The other Good scores are in areas surrounded by areas that have more pervious surfaces, such as turf or forested patches.

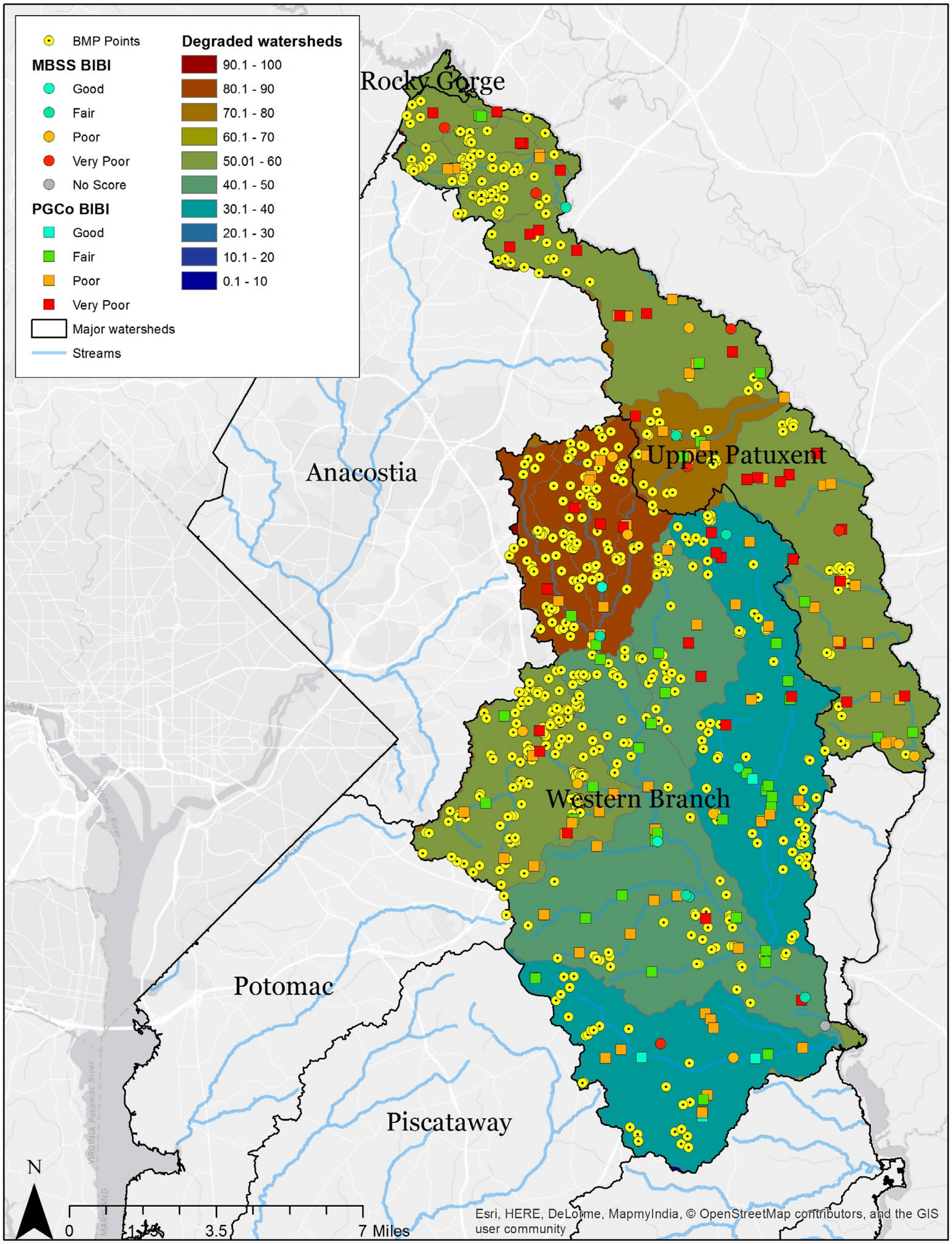
Figure 4-6 and Figure 4-7 show that there are impervious areas that have storm sewers that are not treated by BMPs, particularly in the mid to lower portions of the Upper Patuxent River watershed. These areas might be candidate locations for BMP placement during the restoration plan development.

Table 4-5 is a compilation of BMP types in the Upper Patuxent River and Western Branch watersheds and the land uses they drain. Stormwater ponds are the most implemented BMP. They usually treat residential and non-urban areas. Infiltration practices are the second most implemented stormwater control elements. They tend to treat smaller areas, but with greater pollutant removal efficiency. Oil and grit separators are listed as treating more total area and impervious area than infiltration practices; however, in reality, the separators have much lower removal efficiencies than infiltration practices.



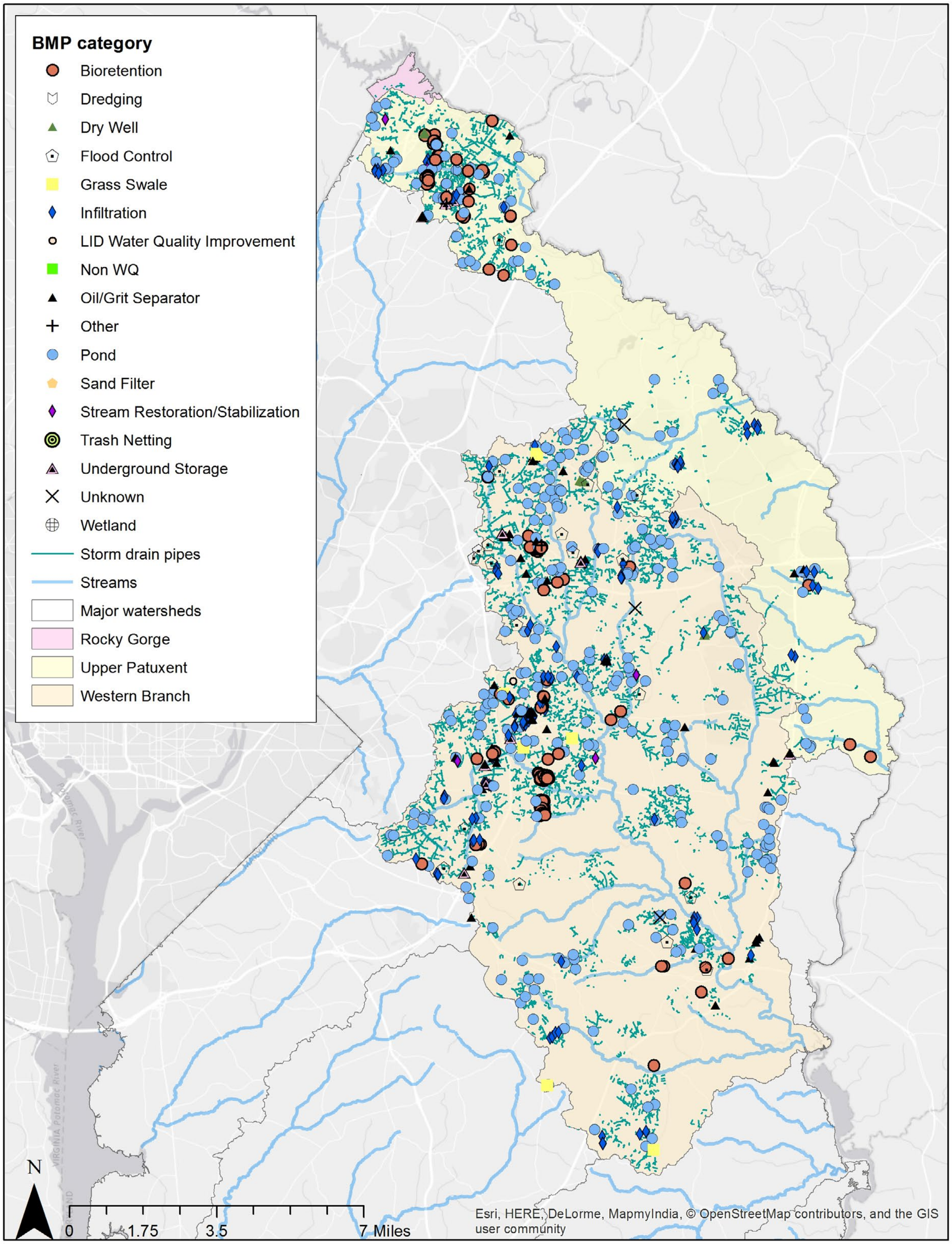
Source: Biotic Integrity from MD DNR, degraded watersheds from Tetra Tech, 2009 impervious area from M-NCPPC 2014

Figure 4-4.Comparison of biological conditions and impervious areas in the Upper Patuxent River and Western Branch watersheds.



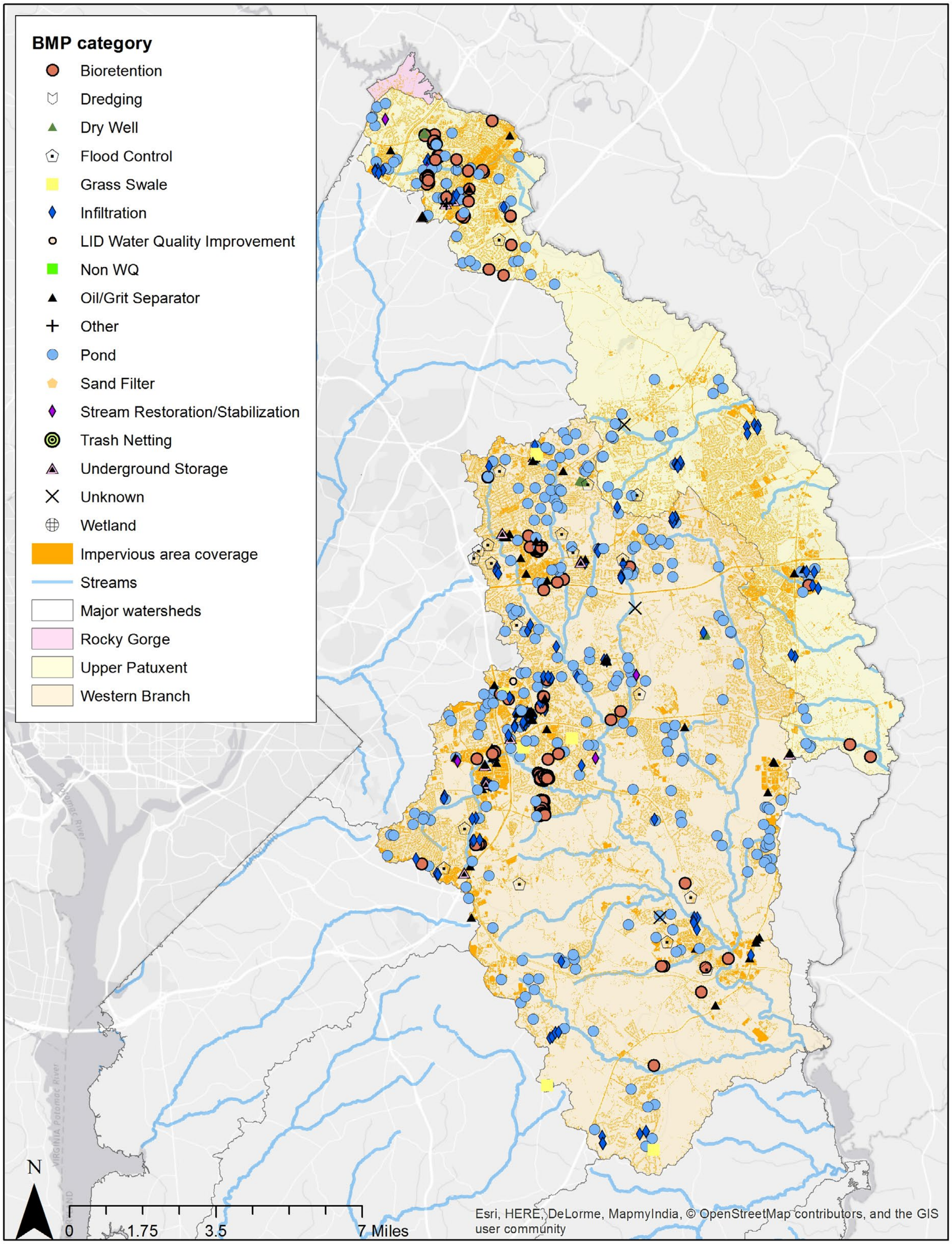
Source: BMPs are from DoE, June 2014, Biotic Integrity from MD DNR, degraded watersheds from Tetra Tech

Figure 4-5. Comparison of biological conditions and BMP locations in the Upper Patuxent River and Western Branch watersheds.



Source: BMPs and storm sewer pipes are from DoE, June 2014

Figure 4-6. Comparison of BMP locations and storm drain network in the Upper Patuxent River and Western Branch watersheds.



Source: 2009 impervious area from M-NCPPC 2014, BMPs are from DoE, June 2014

Figure 4-7. Comparison of BMP locations and impervious areas in the Upper Patuxent River and Western Branch watersheds.

Table 4-5. Summary of known BMP drainage areas, land uses, and impervious areas

BMP Type	Statistic	Com-mercial	Industrial	Institut-ional	Non-urban	Open urban	Resi-dential	Trans-portation
Upper Patuxent River								
Bioretention	Count	2	5	4	4	1	15	0
	DA (acres)	12.31	5.67	3.91	1.43	1.03	18.00	0.00
	Imp DA (acres)	6.95	3.66	3.05	0.74	0.57	7.32	0
Infiltration	Count	4	2	1	2	0	17	0
	DA (acres)	65.17	29.25	10.32	4.36	0.00	105.01	0.00
	Imp DA (acres)	41.68	18.78	3.99	1.36	0.00	43.57	0
Oil/Grit Separator	Count	3	1	0	0	0	0	0
	DA (acres)	15.13	1.78	0.00	0.00	0.00	0.00	0.00
	Imp DA (acres)	12.02	1.00	0.00	0.00	0.00	0.00	0
Other	Count	1	2	0	0	0	2	0
	DA (acres)	0.32	5.61	0.00	0.00	0.00	0.21	0.00
	Imp DA (acres)	0.09	3.58	0.00	0.00	0.00	0.16	0
Pond	Count	21	12	11	37	10	50	6
	DA (acres)	1,130.49	2,027.34	1,114.45	5,904.39	794.30	10,266.08	723.14
	Imp DA (acres)	569.96	1,113.69	444.27	306.54	49.47	3,160.01	0
Stream Restoration/ Stabilization	Count	0	0	0	0	0	1	0
	DA (acres)	0.00	0.00	0.00	0.00	0.00	24.01	0.00
	Imp DA (acres)	0.00	0.00	0.00	0.00	0.00	3.86	0
Western Branch								
Bioretention	Count	5	11	12	19	0	92	0
	DA (acres)	1.87	18.67	15.74	10.06	0.00	72.08	0.00
	Imp DA (acres)	1.01	11.62	8.52	4.33	0.00	27.03	0
Dry Well	Count	0	0	0	1	0	10	0
	DA (acres)	0.00	0.00	0.00	0.06	0.00	4.19	0.00
	Imp DA (acres)	0.00	0.00	0.00	0.02	0.00	1.14	0
Grass Swale	Count	1	3	0	1	0	2	0
	DA (acres)	0.87	3.28	0.00	0.11	0.00	2.37	0.00
	Imp DA (acres)	0.55	1.79	0.00	0.00	0.00	0.41	0
Infiltration	Count	26	10	10	14	0	50	0
	DA (acres)	82.13	17.87	133.18	53.35	0.00	252.18	0.00

BMP Type	Statistic	Com-mercial	Industrial	Institut-ional	Non-urban	Open urban	Resi-dential	Trans-portation
	Imp DA (acres)	66.00	15.25	60.65	8.48	0.00	93.62	0
Oil/Grit Separator	Count	30	21	4	11	0	7	1
	DA (acres)	172.26	61.99	22.01	102.20	0.00	126.39	0.09
	Imp DA (acres)	113.20	48.10	5.80	23.63	0.00	66.59	0
Other	Count	5	3	0	2	0	1	0
	DA (acres)	14.79	6.02	0.00	1.43	0.00	0.01	0.00
	Imp DA (acres)	11.79	4.84	0.00	0.61	0.00	0.00	0
Pond	Count	36	33	44	130	19	155	8
	DA (acres)	1,153.03	4,045.68	2,164.67	12,847.15	687.91	24,630.31	313.14
	Imp DA (acres)	647.65	1,997.70	902.82	884.15	95.10	7,456.78	0
Sand Filter	Count	0	1	0	0	0	0	0
	DA (acres)	0.00	0.75	0.00	0.00	0.00	0.00	0.00
	Imp DA (acres)	0.00	0.69	0.00	0.00	0.00	0.00	0
Stream Restoration/ Stabilization	Count	0	1	0	1	0	2	0
	DA (acres)	0.00	1.71	0.00	2.67	0.00	20.85	0.00
	Imp DA (acres)	0.00	0.95	0.00	1.52	0.00	3.56	0

Note: This table only includes information for BMPs with geospatial drainage area information.

4.5 Stressor Loading Analysis

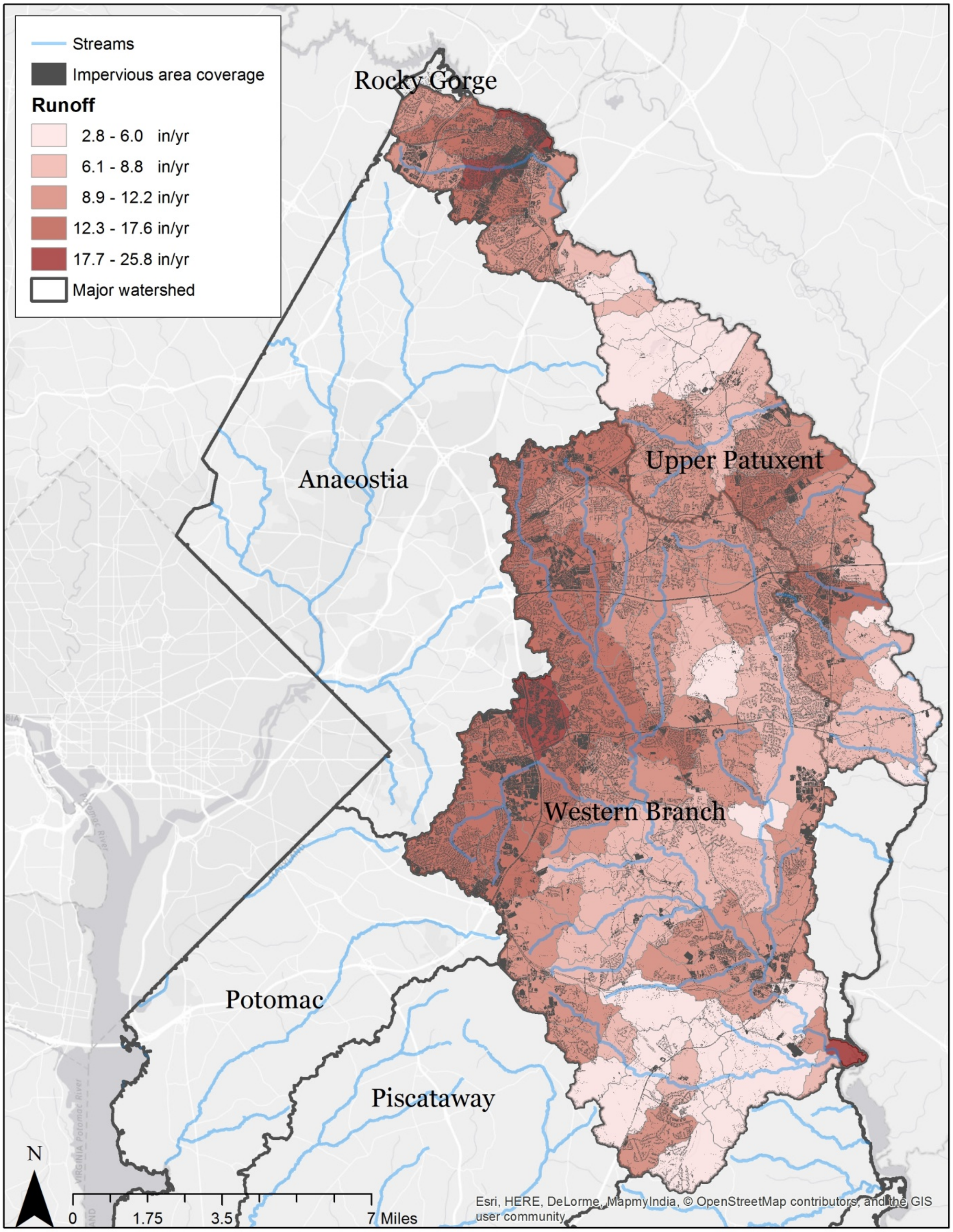
As described above, water quality and the health of biological communities are affected by watershed characteristics such as land use and percentage of impervious cover. On the basis of land cover characteristics, there is substantial literature on annual median concentrations for connected impervious, disconnected impervious, and pervious areas. Multiplied by annual runoff volumes from each of these land covers, this develops the projected runoff loads of the various stressors. These stressors are total nitrogen, total phosphorus, TSS, BOD, and fecal coliforms. The first four parameters are measured in pounds per acre per year, while the latter is measured by billion counts (MPN) per acre per year.

The purpose of this section is to examine how these landscape and physical characteristics in the watershed might influence conditions in their local watershed. Given their individual characteristics, this analysis highlights subwatersheds (smaller portions of the watershed) where runoff and pollutant loads are elevated. The most elevated subwatersheds are candidates for increased restoration activities to help restore watershed functions. The least elevated watersheds are candidates for preservation measures. The following figures relate how impervious surfaces are closely correlated to the extent of stressor loading.

- Figure 4-8 presents the variation in runoff amount throughout the watershed.
- Figure 4-9 presents the variation in total nitrogen loading rates throughout the watershed.
- Figure 4-10 the variation in total phosphorus loading rates throughout the watershed.
- Figure 4-11 presents the variation in TSS loading rates throughout the watershed.
- Figure 4-12 presents the variation in BOD loading rates throughout the watershed.
- Figure 4-13 presents the variation in fecal coliform loading rates throughout the watershed.

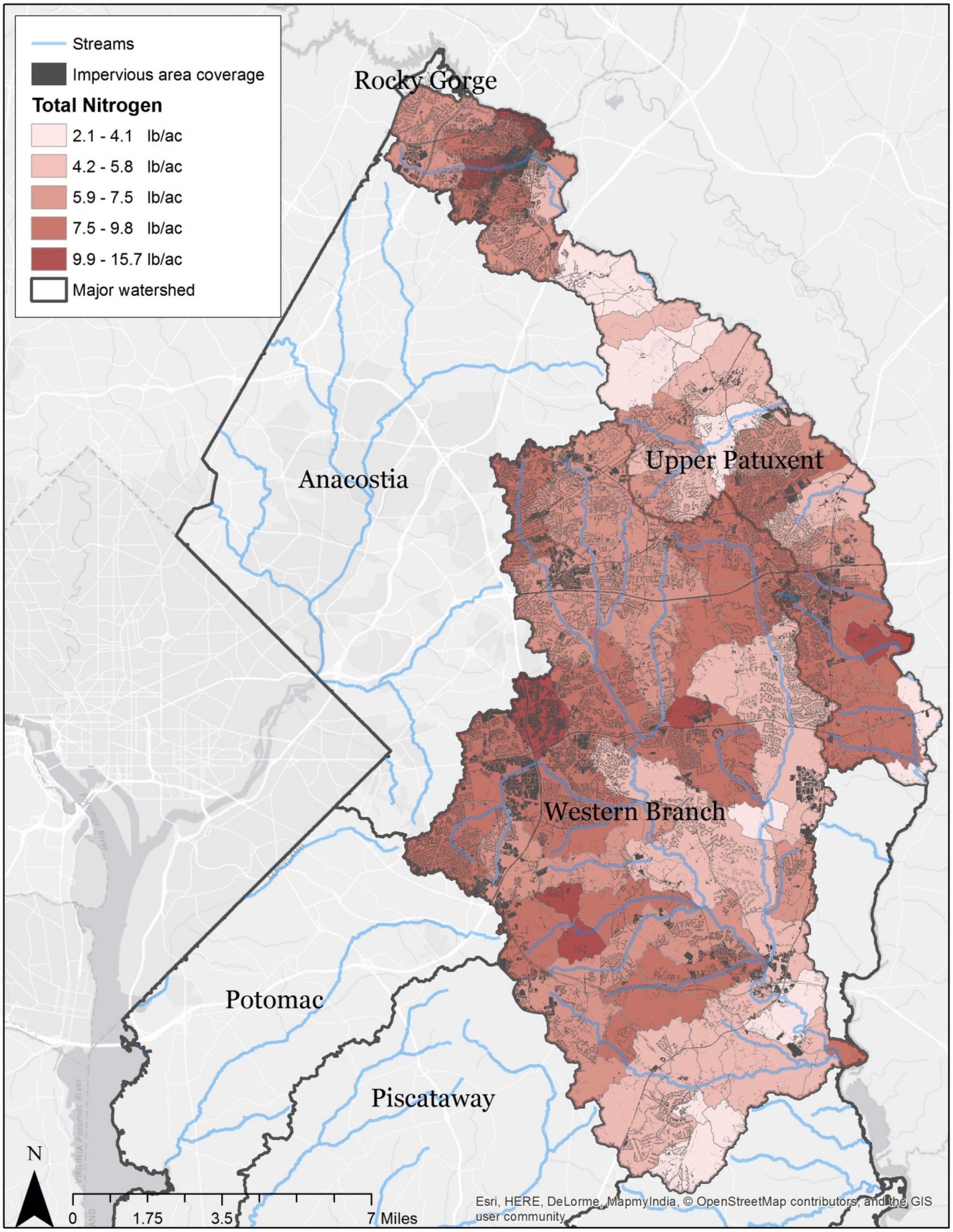
Figure 4-8 illustrates how runoff is affected impervious cover. The watersheds covered in this report (Upper Patuxent River, Western Branch, and Rocky Gorge Reservoir) are in the impaired waters list for different pollutants, however, the BMPs implemented to control a specific pollutant should help in reducing other pollutant loads also.

The urban areas of Laurel and Bowie within the Upper Patuxent River watershed show the largest volumes of runoff generated due to higher percent impervious cover. Similarly, the drainage areas for tributaries such as Bald Hill Branch and Southwest Branch within the Western Branch watersheds (with over 20 percent impervious cover) also exhibit larger volumes of runoff. The lower portion of the Upper Patuxent River and Western Branch watersheds with primarily agricultural and forestry land covers show higher levels of nutrient loads. The subwatersheds with relatively larger density of on-site wastewater systems do exhibit larger BOD and nutrient loads. The subwatersheds with larger nutrient, fecal coliform, sediment and BOD loads will be focused on in the restoration planning, in the respective watersheds.



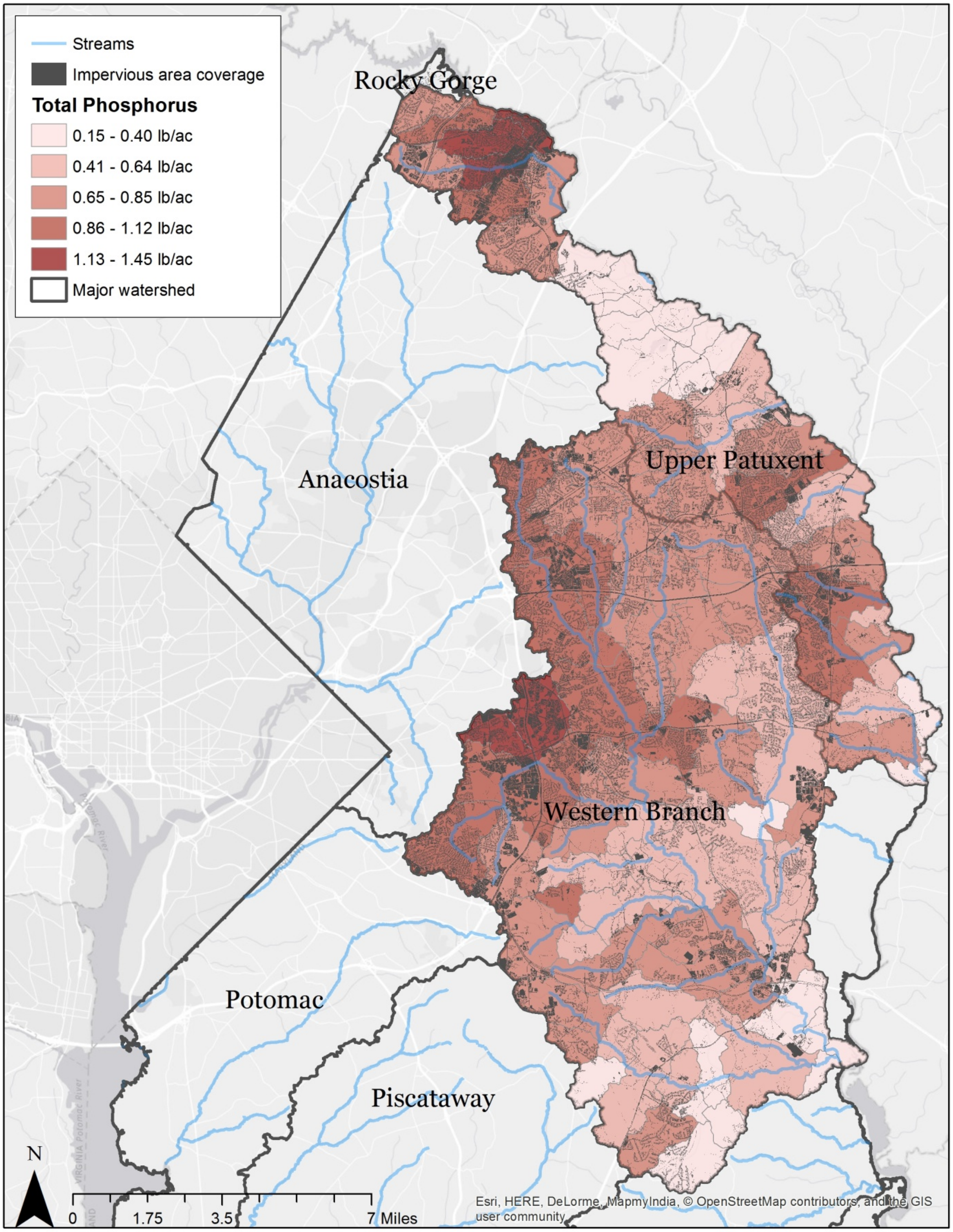
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-8. Comparison of runoff amount and impervious areas in the Upper Patuxent River/Western Branch watersheds.



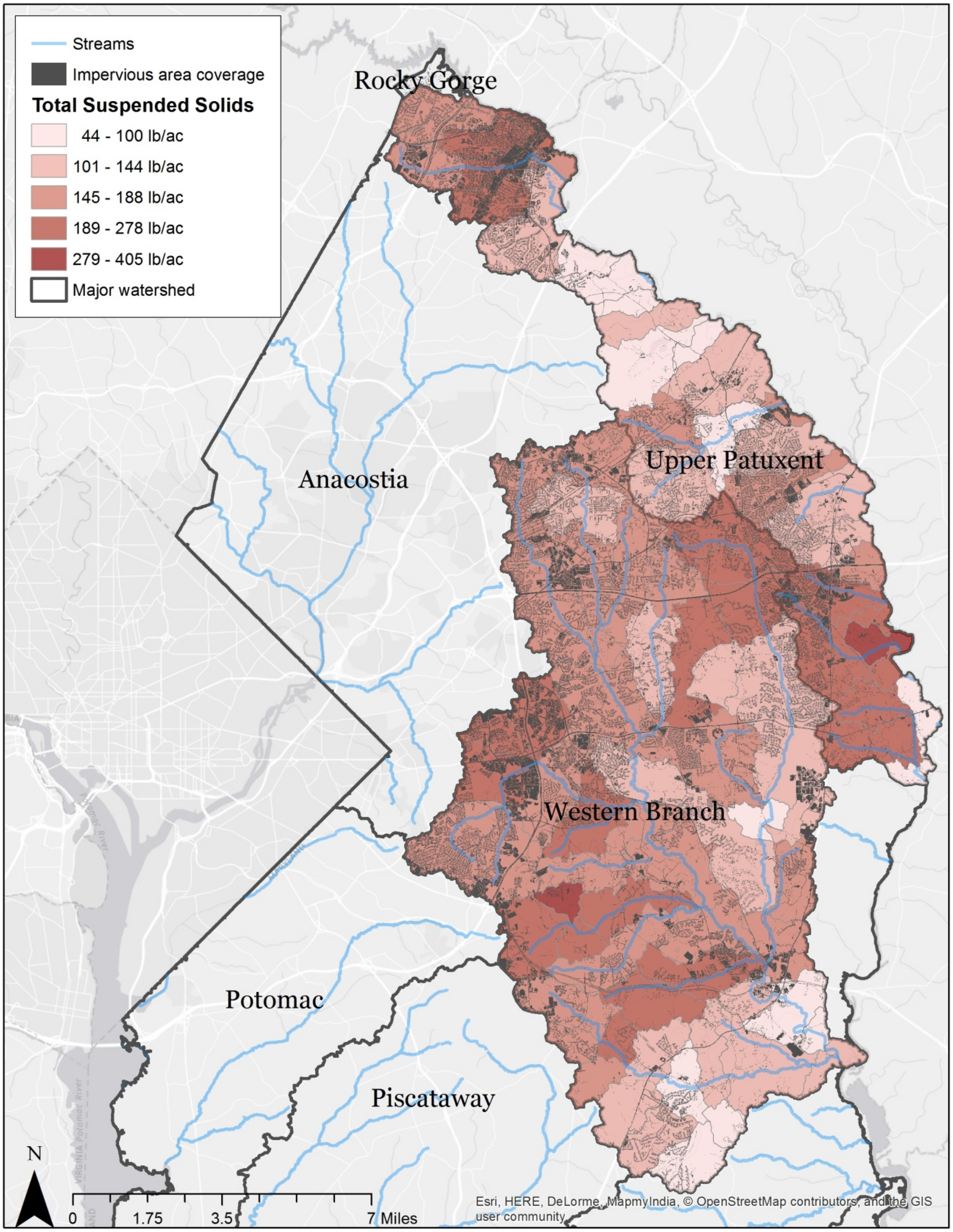
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-9. Comparison of total nitrogen loading rates and impervious areas in the Upper Patuxent River/Western Branch watersheds.



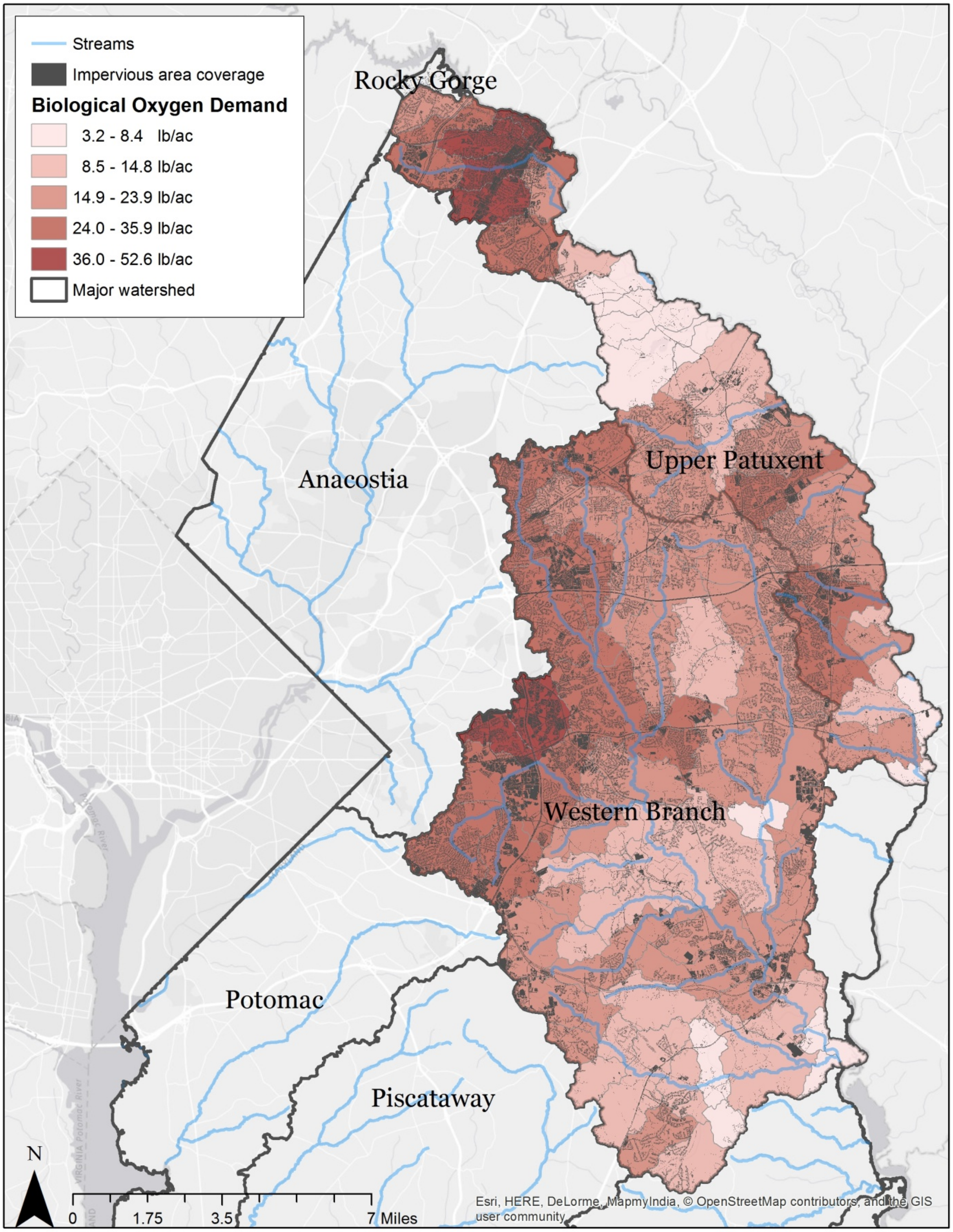
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-10. Comparison of total phosphorus loading rates and impervious areas in the Upper Patuxent River/Western Branch watersheds.



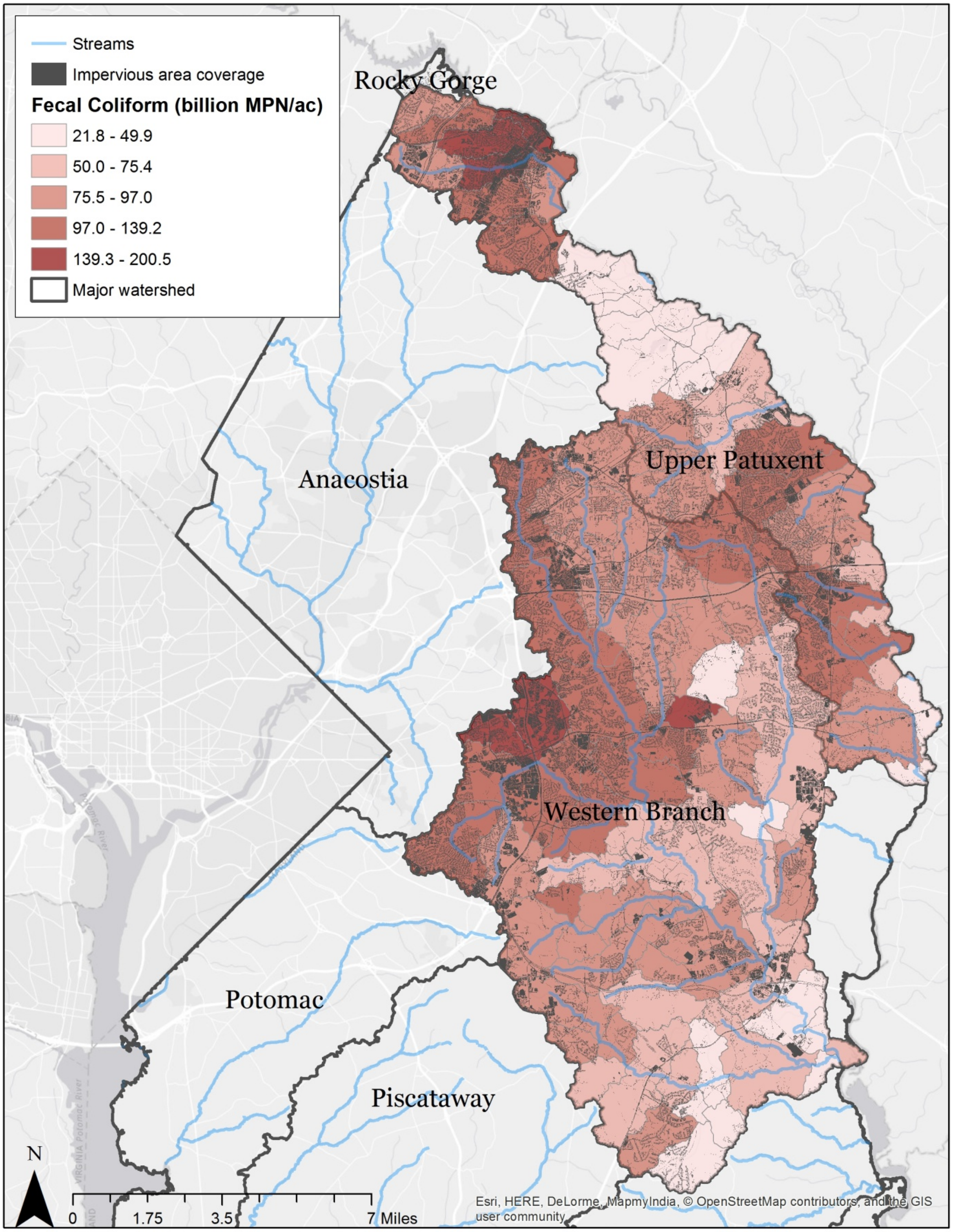
Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-11. Comparison of total suspended sediments loading rates and impervious areas in the Upper Patuxent River/Western Branch watersheds.



Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-12. Comparison of BOD loading rates and impervious areas in the Upper Patuxent River/Western Branch watersheds.



Source: 2009 impervious area from M-NCPPC 2014.

Figure 4-13. Comparison of fecal coliform loading rates and impervious areas in Upper Patuxent River/Western Branch watersheds.

5 Next Steps

As previously discussed, the County is in the beginning phases of developing restoration plans for the EPA-approved TMDLs in the County. This is a multistep process and this report represents the initial phase of the plan development process by collecting the necessary data and beginning to process the information. Additional phases will be completed through the remainder of 2014, culminating in final plans submitted to MDE by January 2, 2015. Future phases include analyses to (1) look at the amount of pollutant loads that need to be reduced; (2) estimate reductions from the current and past County restoration activities; (3) determine the current load reduction gap; and (4) estimate the remaining amount of restoration activities that are still required to meet TMDL goals. The restoration plans will be developed once these analyses are complete.

Restoration plans typically:

- Identify causes and sources of pollution.
- Estimate pollutant load reductions.
- Describe management options and identify critical areas.
- Estimate technical and financial assistance needed.
- Develop an education component.
- Develop a project schedule.
- Describe interim, measurable milestones.
- Identify indicators to measure progress.
- Develop a monitoring component.

The restoration plans will be developed over the summer and early fall and expected to be available for public comment in November. For more information concerning the restoration plans or the public meeting, please visit the County's Department of the Environment website at www.princegeorgescountymd.gov/sites/stormwatermanagement or contact Lilantha Tennekoon at 301-883-6198 or ltennekoon@co.pg.md.us.

Once finalized, the restoration plans will lead to additional BMP implementation, public outreach, and opportunities for the public to help in the watershed restoration process. The County is already conducting many of the activities that will be described in the plans, but the rate of implementation activities will increase. BMPs will be installed through the County's Public-Private Partnership Program, capital improvement projects, and grants. Additional BMPs are expected to be implemented from Rain Check Rebates and the Alternative Compliance program through the County's recently implemented Clean Water Act Fee. There will also be an increase in pollutant-focused public outreach initiatives. The public will also be encouraged to take small steps that will add up to be part of the restoration solution.

The restoration plan will explore different ways the County can monitor, track, and report restoration progress towards meeting the TMDL reduction goals. There are several different options for monitoring and tracking progress. The County expects to use a combination of monitoring activities. The County will report annual progress as part of its NPDES MS4 permit reporting requirements. In addition, the restoration plans describe adaptive approaches that will reevaluate current strategies on the basis of the progress that has occurred and possibly suggest new implementation strategies.

The County's NPDES MS4 permit also requires the County to develop detailed watershed assessments for each County watershed by January 2019. These assessments will be larger studies that will build off the initial watershed characterization reports and restoration plans. The assessments will include the current water quality conditions, identification and ranking of water quality problems, prioritized water quality improvement projects, and load reduction benchmarks for meeting applicable TMDL reduction goals.

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APPENDIX A: TMDL FACTSHEETS

Chesapeake Bay Watershed Nutrient and Sediment TMDL

Rocky Gorge Reservoir Phosphorus TMDL

Upper Patuxent River Fecal Coliform Bacteria TMDL

Upper Patuxent River Sediment TMDL

Western Branch Patuxent River Biological Oxygen Demand TMDL

Chesapeake Bay Watershed Nutrient and Sediment TMDL

Source Document:	U.S. Environmental Protection Agency, Region 3, Water Protection Division and Region 3, Chesapeake Bay Program Office and Region 2 Division of Environmental Planning and Protection. 2008. Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment. December 29, 2010.
Water Body Type:	Chesapeake Bay tidal and non-tidal watershed and contributing subwatersheds.
Pollutant:	Total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS)
Designated Uses:	Migratory fish spawning and nursery, open water fish and shellfish, and shallow water Bay grasses.
Size of Watershed:	64,000 square miles
Water Quality Standards:	**Dissolved oxygen (DO)**: See Table 3-4 of report. **Chlorophyll *a***: Concentrations of chlorophyll *a* in free-floating microscopic aquatic plants (algae) shall not exceed levels that result in ecologically undesirable consequences—such as reduced water clarity, low DO, food supply imbalances, proliferation of species deemed potentially harmful to aquatic life or humans or aesthetically objectionable conditions—or otherwise render tidal waters unsuitable for designated uses **Secchi depth:** See Table 3-5 of report.
Analytical Approach:	Chesapeake Bay Airshed Model (wet deposition regression, and Community Multiscale Air Quality Model); SPARROW; Phase 5.3 Chesapeake Bay Watershed Model (HSPF)
Date Approved:	Approved December 29, 2010

Introduction

The Total Maximum Daily Load (TMDL) analysis for the Chesapeake Bay watershed (Figure 1) addresses TN, TP, and sediment loads on an annual average basis. Reductions in these pollutants will address DO, chlorophyll *a*, and clarity impairments in the Chesapeake Bay.

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

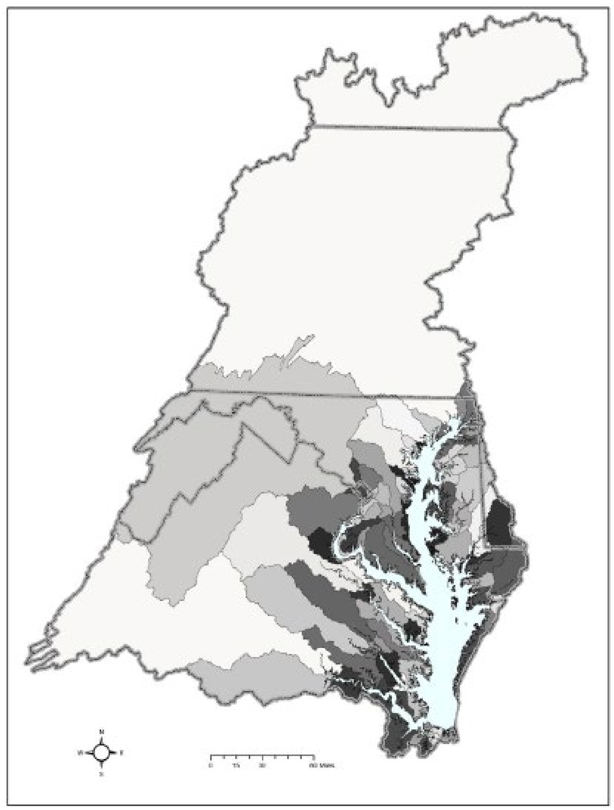

Figure 1. Overall Chesapeake Bay watershed and segment subwatersheds.
Source: USEPA 2010.

Problem Identification and Basis for Listing

Water quality impacts from excessive nutrients and sediment throughout the Chesapeake Bay watershed cause excessive algal growth, low DO, and reduced water clarity in the Chesapeake Bay. Suspended sediment reduces light availability, impacting underwater Bay grass communities. In addition, sediment can transport other pollutants, such as bacterial and phosphorus. Most of the Chesapeake Bay tidal segments were listed as impaired or threatened water that requires a TMDL. Factors for their listing included low DO, insufficient submerged aquatic vegetation, excess chlorophyll *a*, biological/nutrient indicators, TN, TP, TSS, biological oxygen demand, and pH. Many of the impaired segments are addressed by either consent decree or memoranda of understanding with the states.

Applicable Data

The Chesapeake Bay tidal monitoring program was established in 1984 to collect water quality data monthly at more than 150 stations throughout the 92 Chesapeake Bay tidal segments in Delaware, the District of Columbia, Maryland, and Virginia. Twenty-six parameters are monitored, and various other data are also collected, including shallow water monitoring benthic infaunal communities, Bay grass surveys, phytoplankton and zooplankton monitoring, and fisheries population monitoring. The monitoring is designed to support the bay states' 303(d) listing decision-making. In addition to tidal monitoring, there is a network of streamflow gauges and water quality sampling sites throughout the Chesapeake Bay watershed. These data were used to calibrate and verify the Phase 5.3 Chesapeake Bay Watershed Model.

Sources

Point sources of nutrients and sediment include municipal wastewater facilities, industrial wastewater facilities, combined sewer overflow systems, sanitary sewer overflow systems, National Pollution Discharge Elimination System (NPDES) permitted stormwater, and Concentrated Animal Feeding Operations. Nonpoint sources of nutrients and sediment include agricultural runoff, atmospheric deposition, on-site treatment system (septics), stormwater runoff, runoff from forested areas, streambank and tidal shoreline erosion, and wildlife and natural background.

Technical Approach

The two primary models used in the development of the TMDL were the Phase 5.3 Chesapeake Bay Watershed Model and the Chesapeake Bay Water Quality and Sediment Transport Model. The models are designed to simulate the 10-year hydrologic period from 1991 through 2000. The Watershed Model is responsible for simulating the loading and transport of nutrients and sediment from pollutant sources in the watershed and can provide loading estimates for management scenarios. The Water Quality Model simulates estuarine hydrodynamics, water quality, sediment transport, and living resources in the Chesapeake Bay. The model predicts water quality that results from management scenarios, and ensures that the allocated loads developed in the TMDL will meet water quality standards.

The Phase 5.3 Chesapeake Bay Watershed Model was calibrated for 1985–2005, using streamflow and water quality data from this time period. The segment outlets were intentionally designed to be in proximity to in-stream flow gauges and water quality monitoring stations. The model considers inputs from manure, fertilizers, atmospheric deposition, land use-based nonpoint sources, septic systems, regulated stormwater runoff, and wastewater treatment and discharge facilities.

The Chesapeake Bay Water Quality Model is based on a three-dimensional hydrologic transport model (CH3D) with a eutrophication model (CE-QUAL-ICM) to allow prediction of water quality in the Chesapeake Bay, based on the changes in the loading from the watershed. The hydrodynamic model was calibrated for 1991–2000. The Water Quality Model receives loads from nonpoint sources entering the tidal system at tributary fall lines from each of the Chesapeake Bay segments, based on inputs from the Watershed Model, and directly as runoff below the fall lines. Point sources are also incorporated based on their location in the tidal waters. The model incorporates atmospheric deposition of nutrients directly on the Chesapeake Bay tidal surface waters. Shoreline erosional loads are also included.

Allocations

The baseline scenario represents modeled loads for 2009. Wasteload and load allocations were made at the Chesapeake Bay segment level. Several of the bay segments are partially within Prince George's County. The Maryland Department of the Environment then allocated to the county level. The TMDL scenario represents the maximum nutrients and sediment loads to meet water quality standards. Reductions to each of the sectors is based on a limit of technology upgrades to wastewater treatment plants, no reductions to forest lands, and equal percent reductions from the nonpoint source sectors (MDE 2012). These factors are also modified by credit for existing nutrient and sediment reduction practices that are already in place and consideration for geographic proximity and relative impacts of the local load on Chesapeake Bay water quality. See Table 1 for TMDL allocations and reductions from baseline. Overall, there is a 9.32 percent reduction from baseline to the TMDL TN target, and a 3.61 percent reduction from baseline to the TMDL TP target. Table 2 provides annual allocations to urban loading sources for the County. County-level sediment allocations were not provided.

Table 1. Baseline and annual allocations to Prince George's County (delivered loads)

Sector	TN		
	2009 Load (lbs/year)	TMDL (lbs/year)	% Reduction
Agriculture	198,439	150,520	24.15%
Urban	832,131	628,709	24.45%
Septic	93,098	62,562	32.80%
Forest	200,386	198,993	0.70%
Point sources	1,670,919	1,674,936	-0.24%b
Total	2,994,973	2,715,720	9.32%
Sector	**TP**		
	2009 Load (lbs/year)	**TMDL (lbs/year)**	**% Reduction**
Agriculture	37,275	31,017	16.79%
Urban	106,306	68,923	35.17%
Septic	--[a]	--	--
Forest	6,850	6,744	1.55%
Point sources	61,786	97,880	-58.42%[b]
Total	212,217	204,564	3.61%

Source: DER 2012.

Notes:

[a] Septics are not considered a source of phosphorus in the Chesapeake Bay Model.

[b] Negative reductions account for growth in wastewater treatment plants.

Table 2. Annual allocations to urban loading sources in Prince George's County and percent reductions from 2009

Sector	TN (lbs/year)	% Reduction	TP (lbs/year)	% Reduction
County Phase I/II MS4	360,740	22.56%	29,394	38.58%
Municipal Phase II MS4	101,202	20.21%	8,796	34.65%
Bowie	36,746	18.26%	3,136	30.70%
Other Municipal	64,456	21.28%	5,660	36.65%
Nonregulated	18,807	24.86%	1,122	44.54%
Construction	83,805	37.22%	22,253	30.14%
SHA Phase I/II MS4	41,414	21.18%	3,880	36.02%
State Phase II MS4	10,168	21.57%	877	37.58%
Regulated Industrial	5,027	21.89%	502	36.38%
Extractive	7,546	16.16%	2,099	26.45%
Total	**628,709**	**24.45%**	**68,923**	**35.17%**

Source: DER 2012.

References

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Rocky Gorge Reservoir Phosphorus TMDL

Source Document:	MDE (Maryland Department of the Environment). 2008. Total Maximum Daily Loads of Phosphorus and Sediments for Triadelphia Reservoir (Brighton Dam) and Total Maximum Daily Loads of Phosphorus for Rocky Gorge Reservoir, Howard, Montgomery, and Prince George's Counties, Maryland. Document Version June 13, 2008.
Water Body Type:	Non-tidal stream reaches draining to the Rocky Gorge Reservoir (basin code 02-13-11-07)
Pollutant:	Phosphorus
Designated Uses:	Use I-P – Water Contact Recreation and Protection of Aquatic Life and Use IV-P – Recreational Trout Waters and Public Water Supply
Size of Watershed:	35,000 acres (55 square miles); excluding drainage to Triadelphia Reservoir
Water Quality Standards:	Chlorophyll *a* endpoint consistent with the boundary between mesotrophic and eutrophic conditions (average 10 µg/L)
Analytical Approach:	Linked HSPF – CE-QUAL-W2 modeling framework
Date Approved:	Approved November 24, 2008

Introduction

This Total Maximum Daily Load (TMDL) was developed for the Rocky Gorge Reservoir (Figure 1) to address eutrophication issues attributed to excess phosphorus inputs. Basic physical characteristics are as follows:

- Surface Area: 773 acres
- Normal Reservoir depth: 74 feet
- Volume: 17,000 acre-feet
- Drainage Area:132 square miles (including drainage to Triadelphia Reservoir)
- Average Discharge: 85.9 feet per second

Only a small portion of the drainage area lies in Prince George's County. 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.

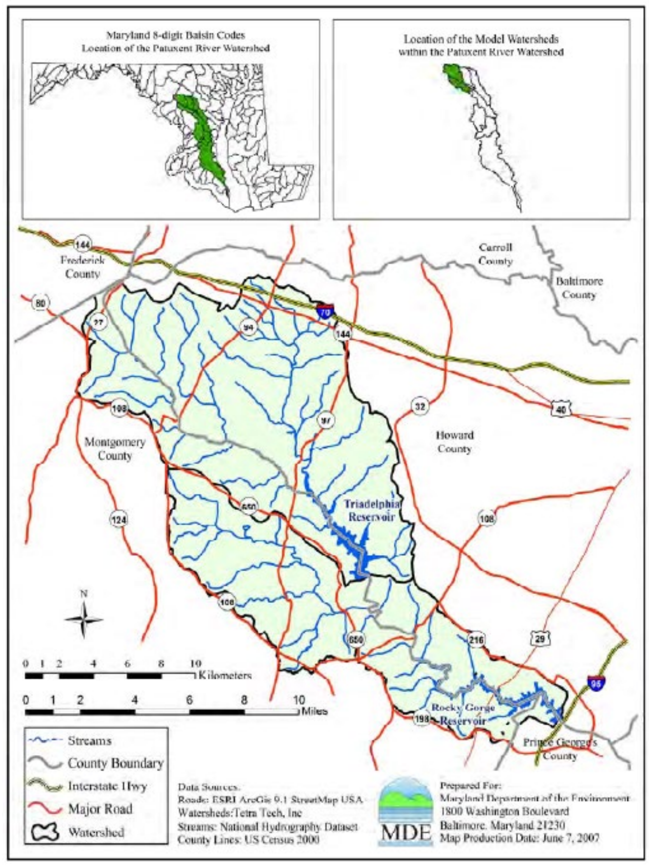

Figure 1. Rocky Gorge Reservoir in the Patuxent River watershed
Source: MDE 2008.

Problem Identification and Basis for Listing

The Rocky Gorge Reservoir has been included by the Maryland Department of the Environment (MDE) on its 303(d) list as impaired by the following (years listed in parentheses):

- Nutrients (1998) – due to signs of eutrophication, expressed as high chlorophyll *a* levels

- Impacts to biological communities (2002 and 2004)

The reservoir regularly stratifies in late spring lasting through early fall, during which time bottom waters become hypoxic. Epilimnion depth in summer is generally no greater than 4 feet. Dissolved oxygen (DO) levels in the reservoir are usually above 5 mg/L in surface waters except for times when mixing occurs because of seasonal turnover or reservoir drawdowns.

Data also showed median total phosphorus (TP) concentrations at the surface exceeded 0.034 µg/L, which is the Carlson Trophic Index boundary between mesotrophic and eutrophic conditions. Observed ammonia concentrations did not exceed Maryland's criteria; however, they were observed to increase significantly during summer months likely due to sediment diagenesis. About 23 percent of samples taken in the reservoir exceeded 10 µg/L chlorophyll *a*; only once did chlorophyll *a* concentrations exceed 30 µg/L.

Applicable Data

Washington Suburban Sanitary Commission (WSSC) and MDE performed reservoir sampling at three locations from 1998–2003.

From March or April through October or November, WSSC conducted generally monthly sampling with some semi-monthly sampling during summer months. Physical parameters measured include temperature and DO at each meter of depth. Water quality samples are collected at the surface, bottom, and middle of the reservoir. During stratification, a middle sample is collected in the metalimnion; otherwise, it is collected at the midpoint of reservoir depth.

Water quality samples are analyzed for ammonia, nitrite, nitrate, total Kjeldahl nitrogen, phosphate, TP, total organic carbon, chlorophyll *a*, iron, manganese, turbidity, and alkalinity. Secchi depth measurements are made at each sampling location.

In 2000 MDE also conducted reservoir sampling to support development of the TMDL at four locations. Parameters measured were generally the same as those measured by WSSC; MDE also measured dissolved and particulate nitrogen, phosphorus, organic carbon species, BOD_5, and total suspended solids.

Sources

Sources of phosphorus in the watershed are associated with nonpoint sources and urban runoff. Modeling for the TMDL represents both nonpoint source and urban stormwater loads and integrates all natural and human-induced sources, including direct atmospheric deposition, and loads from septic tanks, which are associated with river baseflow during low-flow conditions.

Model Appendix A provides loading rates by land use by reservoir segment that could be averaged together for purposes of estimating TP loading rates for developed land uses (Table 1). Alternatively, if it were understood which segments of the reservoir model correspond to the County's area, the loading rates for those segments could be considered.

Table 1. Modeled TP land use loading rates to Rocky Gorge Reservoir

Segment	TP Loading Rate (lbs/yr)	
	Developed	Impervious
20	1,138	3,718
30	530	518
50	431	791
51	62	185
52	87	209
53	37	126
54	38	44
55	97	110
56	77	75
57	114	140
Total	2,610	5,915

Source: MDE 2008.

Technical Approach

Based on the data analysis and problem conditions, the target for the Rocky Gorge TMDL was set as chlorophyll *a* levels consistent with a desired trophic state. Specifically, "the chlorophyll *a* endpoints are (1) a ninetieth percentile instantaneous chlorophyll *a* concentration not to exceed 30 µg/L in the surface layers, and (2) a 30-day moving average concentration not to exceed 10 µg/L in the surface layers. A concentration of 10 µg/L corresponds to a score of approximately 53 on the Carlson Trophic State Index (TSI). This is the approximate boundary between mesotrophic and eutrophic conditions, which is an appropriate trophic state at which to manage these reservoirs" (MDE 2008).

The TMDL was developed using a linked modeling framework of Hydrological Simulation Program—FORTRAN (HSPF) to simulate watershed contributions of flow, nutrients and sediment and CE-QUAL-W2 to simulate effects of loadings in the reservoir.

A laterally averaged two-dimensional CE-QUAL-W2 (version 3.2) reservoir model was used to simulate hydrodynamics, temperature, DO, and eutrophication dynamics. The simulation period was 1998–2003. Existing loads from nonpoint sources, urban runoff, and the one wastewater treatment plant (WWTP) in the watershed were determined from the calibrated HSPF model of the Patuxent River watershed, which was also set up to include the same simulation period as the CE-QUAL-W2 model. Setup and parameterization of the HSPF model were performed by adapting an HSPF model of the Patuxent River watershed completed by Tetra Tech in 2000 and using many of the same assumptions as the Chesapeake Bay Program watershed model related to pollutant parameterization.

Allocations

The TMDL provides a TP allocation to the Rocky Gorge Reservoir on an average annual basis (Table 2). General source allocations are provided in the TMDL (Table 3).

Table 2. Rocky Gorge total phosphorus baseline, TMDL and percent reduction

TP Baseline Load (lb/yr)	TP TMDL (lb/yr)	% Reduction
50,846	24,406	48

Source: MDE 2008.

Table 3. TMDL components

Allocation	Rocky Gorge Reservoir (lb/yr)
NPS	15,757
PS	7,429
MOS	1,220
TMDL	24,406

Source: MDE 2008.
Note: NPS= nonpoint source; PS = point source; MOS = margin of safety.

Finally, the Point Source Technical Memo produced by MDE to accompany the TMDL further allocates the point source allocation among the various National Polllutant Discharge Elimination System (NPDES)-regulated entities (Table 4).

Table 4. PGC MS4 Allocation

Point Source	NPDES ID	TP Load (lb/yr)
FEMA WWTP	MD0025666	182
Howard County	MD0068322	1,512
Montgomery County	MD0068349	5,581
Prince George's County	MD0068284	154
Total		7,429

Source: MDE 2008.

TMDL Appendix E provides the distribution of loads among sources and jurisdictions for the baseline scenario, as well as one possible scenario for distributing the TMDL allocated loads among various sources for the jurisdictions. Table 5 presents the baseline load and TMDL loads for the County. Based on these distributions, the average percent reduction to TP loads from developed lands in the County is 15 percent.

Table 5. Baseline and TMDL loads for Prince George's County

Source Type	Baseline Load (lbs/yr)	TMDL (lbs/yr)
Crop	0	0
Developed (MS4)	181	154
Forest	97	97
Animal Waste	0	0
Pasture	0	0
Scour	24	8
Total	302	259

Source: MDE 2008.

References

MDE (Maryland Department of the Environment). 2008. Technical Memorandum: Significant Phosphorus and Sediment Point Sources in the Triadelphia Reservoir and Rocky Gorge Reservoir Watersheds. Document Version June 13, 2008.

Upper Patuxent River Fecal Coliform Bacteria TMDL

Source Document:	MDE (Maryland Department of the Environment). 2006. Total Maximum Daily Loads of Fecal Bacteria for the Patuxent River Upper Basin in Anne Arundel and Prince George's Counties, Maryland FINAL. Document Version September 16, 2010.
Water Body Type:	Non-tidal stream reaches of the Upper Patuxent River Basin in Maryland
Pollutant:	Fecal coliform bacteria
Designated Uses:	Use I Water Contact Recreation, and Protection of Non-tidal Warm Water Aquatic Life
Size of Watershed:	28.7 square miles (342 square miles located upstream)
Water Quality Standards:	Freshwater: *E. coli*: 126 MPN / 100 mL Steady state geometric mean Enterococci: 33 MPN / 100 mL
Indicators:	*E. coli*
Analytical Approach:	Flow duration curve with bacterial source tracking used to determine proportional contributions from sources.
Date Approved:	Approved August 9, 2011

Introduction

This Total Maximum Daily Load (TMDL) was developed to address the fecal coliform impairment in the Upper Patuxent River watershed. The listed portion begins at the confluence with the Little Patuxent River and ends at the crossing of Queen Anne Bridge Road. The watershed includes portions of Bowie, Mitchellville, and Davidsonville (Figure 1).

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.

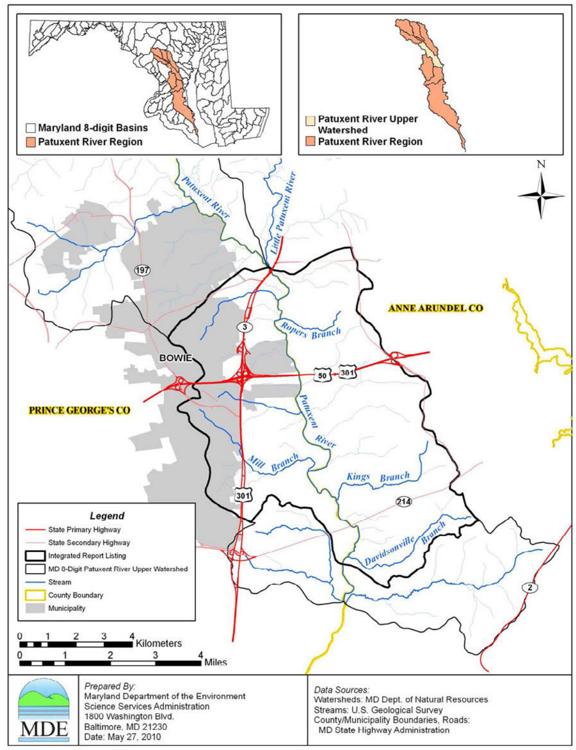

Figure 1. Upper Patuxent River watershed.

Source: MDE 2006.

Problem Identification and Basis for Listing

The watershed was originally assessed using fecal coliform bacteria. The Maryland Department of the Environment (MDE) conducted monitoring at three stations in the Upper Patuxent River watershed from October 2008 to October 2009; 25 observations were recorded at each station. Two U.S. Geological Survey (USGS) gages were used to identify flow strata (USGS 01592500 and USGS 01594440).

In Maryland, determination of impairment due to fecal bacteria is done by calculating the steady state geometric mean using data collected during the previous 2–5 years. Samples must be from steady state, dry-weather conditions and during the beach season (May 31–Labor Day) to be representative of critical conditions. Data collected for each of the three stations resulted in steady state geometric means exceeding 126 MPN/100 mL (Table 1).

Table 1. Impairment Analysis Results

Station	N	Dry-Weather geometric mean (MPN/100 mL)	Criterion (MPN /100 mL)
PXT0630- Pax R at Rte. 3	5	159	126
PXT0613 - Pax R at Governor Bridge Rd	5	193	126
PXT0561- Pax R at Queen Anne Bridge Rd	5	160	126

Source: MDE 2006.

Applicable Data

TMDL analysis was performed using the data collected from October 2008 to October 2009, specifically for the TMDL.

Sources

Typical sources contribute bacteria in this watershed including wildlife and domestic animals via nonpoint loading from land surfaces, and humans via septic and sewer systems. The watershed also includes regulated stormwater and may experience sanitary sewer overflows, although none were reported during the year in which monitoring data were collected. The regulated stormwater sources also include industrial stormwater and federal municipal separate storm sewer systems (MS4s). No wastewater treatment plants discharge in the watershed. There is no separate accounting for federal lands in this TMDL.

Technical Approach

The TMDL used a flow duration curve approach coupled with bacteria source tracking at each monitoring station to identify baseline loads and the proportion of source contributions. Baseline loads are estimated first for each subwatershed by using bacteria monitoring data and long-term flow data. These baseline loads were divided into four bacteria source categories, using the results of bacteria source assessment analysis. Next, the percent reduction required to meet the water quality criterion in each subwatershed is estimated from the observed bacteria concentrations after accounting for critical condition and seasonality. Finally, TMDLs for each subwatershed were estimated by applying these percent reductions.

Allocations

Practicable Reduction Targets

After bacteria source distributions and baseline loads were determined for each of the three monitoring stations, MDE applied a process to identify practicable reduction targets. The process is based on review of the available literature and best professional judgment to identify reduction percentages to each source and subwatershed that is what MDE considers the maximum practicable reduction (MPR). Table 2 presents the MPR targets.

Table 2. MPR target reductions by source category

MPR per source	Human	Domestic (pet)	Livestock	Wildlife
Target percent reduction	95	75	75	0

Source: MDE 2006.

In the analysis of the MPR scenario, it was found that all three subwatersheds could meet water quality criteria under the MPR (Table 3).

Table 3. Required percent reduction by source category

Sub	Applied Reductions %				Total Reduction Percent
	Pet	Human	Live-stock	Wild	
0630	46.3	95	75	0	50.1
0613sub	66.2	95	75	0	49.9
0561sub	45.4	95	71.6	0	44.6

Source: MDE 2006.

Regulated Stormwater Baseline Loads, Allocations and Reductions

The TMDL report provides a baseline, TMDL, and percent reduction at the two monitoring stations (Table 4). The entire watershed is subject to MS4. Regulated stormwater includes other sources in addition to the County's MS4 (e.g., industrial stormwater); however, the TMDL provides no additional listing or accounting of sources, such as a list of affected permits.

Table 4. MS4 baseline loads, allocated loads, and percent reductions

Subwatershed	Baseline	Allocation	% Reduction
	(Billion MPN E. coli / yr)		
PXT0613	55,633.00	20,838.00	37%
PXT0561	55,584.00	30,995.00	56%

Source: MDE 2006.

Upper Patuxent River Sediment TMDL

Source Document: MDE (Maryland Department of the Environment). 2011. Total Maximum Daily Load of Sediment in the Patuxent River Upper Watershed, Anne Arundel, Howard and Prince George's Counties, Maryland. Document Version September 30, 2011.

Water Body Type: Non-tidal stream reaches of the Upper Patuxent River watershed (basin number 02131104)

Pollutant: Sediment

Designated Uses: Use I-P – Water Contact Recreation and Protection of Aquatic Life

Size of Watershed: 56,446 acres (88 square miles)

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 through the use of the Index of Biotic Integrity (IBI)

Analytical Approach: Used the Chesapeake Bay Watershed Model (Phase 5.2) in a reference watershed analysis to calculate land use-specific loading rates and losses from edge of field to the main channel. Spatially aggregated to Maryland's 8-digit watersheds.

Date Approved: Approved September 30, 2011

Introduction

The Total Maximum Daily Load (TMDL) addresses the 1996 sediment impairment. To support the TMDL, a data solicitation was issued and data collected for the prior 5 years were considered. The TMDL's objective was to ensure that watershed sediment loads are at a level to support the Use I designation for the Upper 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.

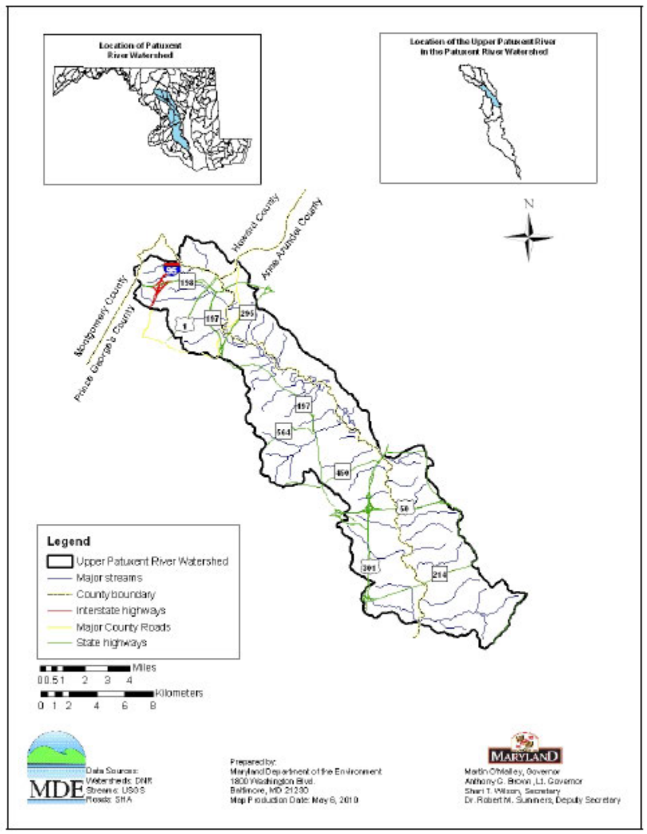

Figure 1. Upper Patuxent River watershed

Source: MDE 2011.

Problem Identification and Basis for Listing

Biological community impairments were identified, prompting placement of the Upper Patuxent River on Maryland's 303(d) list in 1996. The impairment is supported by the results of two Maryland Biological Stream Surveys (MBSS) performed from 1995–1997 and again from 2000–2004. From the surveys, 11 of 15 stations were listed as having Benthic Index of Biotic Integrity (BIBI) scores significantly lower than 3 (on a scale of 1–5). Data from the second MBSS round were used in performing the biological stressor analysis for the TMDL. The stressor analysis confirmed that individual stressors within the sediment and habitat parameter groupings were contributing to the biological impairment in the watershed and were statistically significantly associated with biologically impaired communities at approximately 40 percent and 65 percent, respectively, of the sites with BIBI scores significantly less than 3.0 (on 1 to 5 scale) throughout the watershed.

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 Upper 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 10 stations in the watershed under the Round Two MBSS in 2004. 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 and streambank erosion. Unregulated runoff includes runoff from agricultural and forested land uses. Point sources include regulated stormwater and six facilities with total suspended solid-limited National Pollutant Discharge Elimination System (NPDES) permits that continuously discharge process water. The TMDL also accounts for two upstream sources, the Little Patuxent (from the Little Patuxent Sediment TMDL) and Rocky Gorge Reservoir upstream loads. Table 1 presents the baseline loads for sources determined by the modeling approach used to develop the TMDL.

Table 1. Baseline sediment loads

Source	Baseline Sediment Load (ton/yr)
Little Patuxent-Upstream watershed	37,066.5
Rocky Gorge-Upstream watershed	7,689.0
Nonpoint Source (unregulated stormwater)	11,956.1
Regulated Stormwater (MS4)[a]	9,102.0
Process Water	607.5
Total Baseline	66,421.1

Source: MDE 2011.

Note: [a] Includes barren, pervious, and impervious surfaces.

The majority of the sediment load is from urban land (42 percent) and crop land (41 percent). The next largest sediment sources are forest (10.3 percent) and pasture (1.7 percent). Land use-specific loads are presented on page 16 of the TMDL. Individual land use edge-of-stream loads are calculated as a product of the land use area, land use target loading rate, and loss from the edge-of-field (EOF) to the main stream channel. The loss from the EOF to the main channel is the sediment delivery ratio and is defined as the ratio of the sediment load reaching a basin outlet to the total erosion within the basin. A sediment delivery ratio is estimated for each land use type based on the proximity of the land use to the main channel. Thus, as the distance to the main channel increases, more sediment is stored within the watershed (i.e., sediment delivery ratio decreases). Details of the data sources for the unit loading rates can be found in the TMDL report.

Technical Approach

The TMDL was developed using a modeling approach to identify a sediment loading threshold consistent with support of aquatic life. Average annual edge-of-stream loading rates was identified for six reference (unimpaired) watersheds using the Chesapeake Bay Program's Phase 5.2 watershed model.

Because the Patuxent watershed lies almost entirely within the Coastal Plain region, reference watersheds which 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.

Six reference watersheds were selected and the forest-normalized sediment loads were calculated using CBP P5.2 2000 land (to maintain consistency with MBSS sampling years). The median value of the reference watershed forest-normalized sediment loads (4.8) was calculated and established as the sediment loading threshold for the TMDL. Appendix A of the TMDL provides additional discussion of the methodology.

The forest-normalized sediment load for the Upper Patuxent River watershed (estimated as 5.1) was calculated using CBP P5.2 2005 land use, to best represent current conditions. A comparison of the Upper 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 (determined from watersheds with a healthy biological community) and the Upper Patuxent River all-forested sediment load. Table 2 provides the watershed baseline and TMDL loads and percent reduction. These were averaged at the 8-digit watershed scale; some subbasins might require higher reductions than others.

Table 2. Baseline and TMDL loads and percent reduction

Baseline Load (ton/yr)	TMDL (ton/yr)	Percent reduction
66,421.1	56,607.1	14.8%

Source: MDE 2011.

Urban land, high-till crops, low-till crops, and hay were identified as the predominant controllable sources in the watershed. In addition, all urban land in the Upper Patuxent River watershed is considered to represent regulated stormwater sources (i.e., all urban stormwater is regulated via a permit).

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 Upper Patuxent River watershed, a specific WLA is specified for the Prince George's County Phase I municipal separate storm sewer system (MS4) and the jurisdictional Phase II MS4 WLA is specified (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 P5.2 urban land use. The methodology associates MDP urban land use classifications with the different types of NPDES-regulated stormwater Phase I and II permits (MDE 2009).

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

Baseline Load (ton/yr)	WLA (ton/yr)	Percent reduction
9,102.0	8,064.6	11.4%

Source: MDE 2011.

Table 4. Specific WLAs for MS4s

	Baseline Load (ton/yr)	WLA (ton/yr)	Percent reduction
PGC Phase I MS4	1,680.7	1,489.2	11.4%
Phase II Jurisdictional MS4s	3,473.3	3,077.4	11.4%

Source: MDE 2011.

References

MDE (Maryland Department of the Environment). 2009. Memorandum: Maryland's Approach for Calculating Nutrient and Sediment Stormwater Wasteload Allocations in Local Nontidal Total Maximum Daily Loads and the Chesapeake Bay Total Maximum Daily Load.

MDE (Maryland Department of the Environment). 2011. Technical Memorandum: Significant Sediment Point Sources in the Patuxent River Upper Watershed. Document Version September 30, 2011.

Western Branch Patuxent River Biological Oxygen Demand TMDL

Source Document:	MDE (Maryland Department of the Environment). 1999. Total Maximum Daily Load for Biological Oxygen Demand in the Western Branch of the Patuxent River. Document Version December 3, 1999.
Water Body Type:	Tidal and non-tidal tributary to the Patuxent River
Pollutant:	Biochemical oxygen demand (BOD)
Designated Uses:	Use I – Water Contact Recreation, and Protection of Non-tidal Warm Water Aquatic Life
Size of Watershed:	71,420 acres (111 square miles) Length: approx. 20 miles
Water Quality Standards:	5 mg/L minimum
Indicators:	Dissolved oxygen (DO)
Analytical Approach:	Water Analysis Simulation Program (WASP) 5.1
Date Approved:	Approved June 6, 2000

Introduction

This Total Maximum Daily Load (TMDL) was developed to address low DO levels in the Western Branch of the Patuxent River (Figure 1) due to BOD. Because this is a low-flow TMDL, and stormflow contributions are not contributing to the problem condition, it is not as critical to municipal separate storm sewer system implementation planning as other TMDLs affecting streams in Prince George's County.

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.

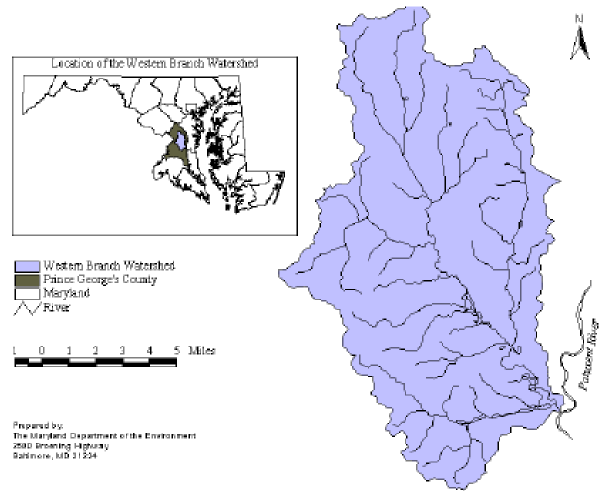

Figure 1. Western Branch of the Patuxent drainage area

Problem Identification and Basis for Listing

Historical monitoring data from two stations (WXT0001 and WXT0045) in the Western Patuxent drainage were evaluated to characterize water quality. Available parameters included DO, chlorophyll *a*, dissolved inorganic nitrogen (ammonia, nitrite, and nitrate), and ortho-phosphate for the period between August 1990 and December 1998. Data showed that DO levels occasionally fell below the numeric criteria of 5.0 mg/L during summer months and exhibited frequent borderline low levels at other times.

Applicable Data

TMDL analysis was performed using the data collected from August 1990 to December 1998. Dry-weather sampling in the Western Branch watershed from 1995–1998 showed average in-stream concentrations of BOD to be 2.0 mg/L, which was assumed to be representative of the nonpoint contribution.

Sources

Sources contributing to low DO levels were primarily thought to be nutrients and BOD from point and nonpoint sources. One dominant point source, the Western Branch Wastewater Treatment Plant (WWTP), contributes most of the nutrients and BOD to the system during low flows. Two other smaller point sources, Croom Manor Housing WWTP and Prince George's County Yardwaste Composting Facility also contribute small amounts of nutrients and BOD to the system. The point source values used in the TMDL analysis were taken from the facilities' discharge monitoring reports. The bulk of nonpoint sources (atmospheric deposition, runoff, septics) of nutrients and BOD are thought to enter at the upstream boundary near station WXT0045.

Technical Approach

Steady state simulations using the WASP 5.1 model were conducted using the Eutro 5.1 module to simulate effects of eutrophication. The upper boundary of the model is Station WXT0045 and the lower boundary is the confluence with the Patuxent River. The model simulates entry of two nonpoint source loads. One enters at station WXT0045. The second, Charles Branch, enters just before the confluence of the Western Branch with the Patuxent River. These nonpoint source loads represent all loading from atmospheric deposition; septic tanks; and loads from urban development, agriculture, and forest land. The Western Branch WWTP is represented as a direct discharge to the Western Branch, and the Croom Manor Housing WWTP is represented as a direct discharge at the same location as the entrance of Charles Branch.

Steady state simulations representing three groups of scenarios were conducted:

- Beginning condition scenarios – represented the future conditions of the system with no reductions in point or nonpoint source loads.
- Impairing substance determination scenarios – analyzed the sensitivity of the system to several different nutrient and BOD loading conditions, which showed BOD to be the primary factor behind the low DO concentrations.
- Final condition scenarios – represented the projected maximum point and nonpoint source loads

Allocations

Analyzing the various model scenarios resulted in a final loading allocation of 84,840 lb/month BOD for April 1–October 15 (Table 1). Allocations were developed for the 7Q10 critical flow and are applicable only during the specified period. Nonpoint source allocations are small because they are assumed to be very small during the critical condition. In addition, during times of rainfall where stormwater runoff is occurring, DO concentrations are not a problem. The TMDL also included a future allocation and an explicit margin of safety.

Table 1. BOD Allocations (lb/month)

Allocations	NPS	PS	Future	MOS
BOD	1,040	75,080	4,680	4,040

Note: NPS = nonpoint source; PS = point source; MOS = margin of safety.

Table 1 uses the assumption that the Western Branch WWTP will continue meeting its current National Pollutant Discharge Elimination System (NPDES) discharge limits for nitrogen, ammonia, and phosphorus, and that the Croom Manor WWTP will continue meeting its NPDES limit for nitrogen. In addition, this TMDL indicates that water quality standards will be met if DO concentrations from the Western Branch WWTP are increased to 7 mg/L; revising limits was to be addressed during the permit renewal process.

For the nonpoint source allocation, the low-flows (7Q10 flows) are attributable to baseflow contributions. The 2.0 mg/L concentration was multiplied by the 7Q10 flow (3 cubic feet per second) at the upper boundary of the Western Branch and the Charles Branch to produce the nonpoint source load allocations for the TMDL.

Reference

MDE (Maryland Department of the Environment). 1999. Total Maximum Daily Load for Biological Oxygen Demand in the Western Branch of the Patuxent River.

APPENDIX B: NPDES PERMITTED DISCHARGERS

Table B-1. Active NPDES permits in the Upper Patuxent River and Western Branch watersheds in Prince George's County

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
Upper Patuxent River						
MD0021628	City of Bowie WWTP	NPDES Individual Permit	WWTP	07/07/10	08/01/10	07/31/15
MD0021725	Parkway WWTP	NPDES Individual Permit	WWTP	n/a	n/a	n/a
MD0065358	National Wildlife Visitor Center	NPDES Individual Permit	WWTP	03/28/12	05/01/12	04/30/17
MD0071480	WSSC/T Howard Duckett Dam	NPDES Individual Permit	Dewatering Non-Construction	03/16/12	04/15/12	03/15/17
MD12S0285	ICC Contract D/E	NPDES Individual Permit	Highway And Street Construction	06/22/12	06/22/12	06/21/17
MD1499Q84	Patuxent River 4-H Center Foundation, Inc.	General Permit	Amusement And Recreation/WWTP	02/28/12	04/01/12	03/31/17
MD3215Q03	FDA - Center For Veterinary Medicine	General Permit	Admin. Of Public Health Programs/Aquaculture	10/24/11	12/01/11	11/30/16
MDG343976	Carroll Ind. Fuel Co,Inc.Laurel	General Permit	Petroleum Bulk Stations & Terminals	02/06/08	02/06/08	12/12/12
MDG344261	Laurel Fuel Oil & Heating Co,I	General Permit	Petroleum Bulk Stations & Terminals	08/01/00	08/01/00	04/22/02
MDG491754	the Recycling Center	General Permit	Mineral Mine	12/01/11	12/01/11	04/30/15
MDG679504	Washington Suburban Sanitary Commission	General Permit	Not reported	06/22/12	06/22/12	02/28/17
MDG679557	City of Bowie Water System	General Permit	Hydrostatic Testing	02/15/13	02/15/13	02/28/17
MDG766000	Laurel Municipal Pool	General Permit	Swimming Pool	10/05/07	10/05/07	05/13/12
MDG766138	Whitehall Pool & Tennis Club	General Permit	Swimming Pool	n/a	n/a	n/a
MDG766165	Bowie Sport Fit	General Permit	Swimming Pool	01/16/13	01/16/13	09/30/17
MDG766394	Pallotti Early Learning Center	General Permit	Swimming Pool	08/05/02	08/05/02	12/27/06
MDG766402	Willow Lake Apartments	General Permit	Swimming Pool	11/19/07	12/01/07	05/13/12
MDG766463	Meridian at Bowie	General Permit	Swimming Pool	12/14/11	12/14/11	05/13/12
MDG766495	LAUREL PARK	General Permit	Swimming Pool	10/11/02	10/11/02	12/27/06
MDG766591	Deerfield Run Apartments	General Permit	Apartment Building Operators/Swimming Pool	03/14/13	03/14/13	09/30/17
MDG766679	Belair Swim & Racquet Club	General Permit	Physical Fitness Facilities/Swimming Pool	09/19/08	10/01/08	05/31/12

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
MDG766698	Hampton Inn - Laurel	General Permit	Swimming Pool	03/06/13	03/06/13	09/30/17
MDG766718	ARBORY CONDOMINIUM	General Permit	Swimming Pool	06/10/03	06/10/03	12/27/06
MDG766806	BROOKMILL POOL	General Permit	Swimming Pool	12/09/03	12/09/03	12/27/06
MDG766825	Montpelier Oaks H.O.A.	General Permit	Swimming Pool	04/05/04	04/05/04	12/27/06
MDG766933	Covington Recreation Center	General Permit	Apartment Building Operators/Swimming Pool	08/13/04	08/13/04	12/27/06
MDG766934	Laurel Square Apartments	General Permit	Swimming Pool	03/20/08	04/01/08	05/13/12
MDG766959	Bowie Towers Condo/Woodlawn La	General Permit	Civic And Social Associations/Swimming Pool	04/19/05	04/19/05	12/27/06
MDG767045	Montpelier Community Association Pool	General Permit	Swimming Pool	05/22/09	06/01/09	05/31/12
MDG767072	Greenview Drive Pool Complex	General Permit	Swimming Pool	08/27/10	09/01/10	05/13/12
MDG767076	Saddlebrook West	General Permit	Swimming Pool	01/31/13	01/31/13	09/30/17
MDG911499	the Patuxent River 4-H Center	General Permit	Sewerage Systems	04/01/98	04/01/98	03/31/03
MDL021628	City of Bowie STP	Associated Permit Record	Sewerage Systems	01/01/94	01/01/94	12/31/99
MDR000118	Parkway WWTP	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDR000314	Sandy Hill Municipal Landfill	General Permit	Stormwater Discharge	03/11/03	03/11/03	11/30/07
MDR000596	Roadway Express, Inc. - Laurel	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDR000841	Central Small Car Salvage	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDR000846	Bowie Used Auto Parts, Inc	General Permit	Stormwater Discharge	03/21/03	03/21/03	11/30/07
MDR000857	United Parcel Service	General Permit	Stormwater Discharge	02/25/03	02/25/03	11/30/07
MDR000859	United Parcel Service - Burtonsville	General Permit	Stormwater Discharge	02/25/03	02/25/03	11/30/07
MDR001120	B & B Auto Salvage, Ltd.	General Permit	Stormwater Discharge	02/13/03	02/13/03	11/30/07
MDR001324	SHA - Laurel Maintenance Shop	General Permit	Stormwater Discharge	06/04/03	06/04/03	11/30/07
MDR001325	SHA - Marlboro Shop	General Permit	Stormwater Discharge	06/04/03	06/04/03	11/30/07
MDR001738	WSSC - Laurel Garage	General Permit	Stormwater Discharge	04/29/03	04/29/03	11/30/07
MDR001841	City of Laurel DPW Maintenance Facility	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDR001858	Aggregate & Dirt Solutions - Flester Pit	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
MDR001913	HD Builder Solutions Group FL0047	General Permit-Stormwater	No Exposure Certification	n/a	n/a	n/a
MDR002089	First Transit, Inc.- 5315	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDR002310	D.C. Materials Daisy Lane Yard	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDSSOWSSC	Washington Suburban Sanitary Commission	General Permit	Sanitary sewer overflow	12/01/12	12/01/12	11/30/17
MDU000135	Bowie Race Track	Unpermitted Facility	Not reported	--	--	--
Western Branch						
MD0021741	Western Branch WWTP	NPDES Individual Permit	WWTP	09/14/10	10/01/10	09/30/15
MD0063410	Arcal Chemicals Inc.	NPDES Individual Permit	Not reported	03/14/08	04/01/08	03/31/13
MD0065111	Prince George's County Yard Waste Composting Facility	NPDES Individual Permit	Stormwater Discharge	04/06/10	05/01/10	04/30/15
MD0069124	Forestville Asphalt Company	NPDES Individual Permit	Vehicle Wash	11/17/10	12/01/10	11/30/15
MD0069523	Ritchie Land Reclamation, LLC	NPDES Individual Permit	Rubble Landfill	10/01/07	10/01/07	09/30/12
MD0069774	WMATA - Largo Operations Building	NPDES Individual Permit	Local And Suburban Transit	12/22/11	02/01/12	01/31/17
MD0071536	Osborne Shopping Center	NPDES Individual Permit	Not reported	08/20/12	10/01/12	09/30/17
MD09I0097	Radisson Inglewood Business Community	NPDES Individual Permit	Not reported	06/08/09	06/08/09	06/07/14
MD09I0150	St. Joseph's Fire Station	NPDES Individual Permit	Fire Protection	06/12/09	06/12/09	06/11/14
MD09I0193	Prince George's County Correctional Center	NPDES Individual Permit	Not reported	07/09/09	07/09/09	07/08/14
MD09I0273	the Preserve at Woodmore Estates	NPDES Individual Permit	Not reported	08/17/09	08/17/09	08/16/14
MD10I0001	Staybridge Hotel Lot 2 Eastgate Shopping Center	NPDES Individual Permit	Not reported	09/30/09	09/30/09	09/29/14
MD3784Q13	Clagett Farm Chesapeake Bay Foundation	General Permit	County Facility	04/23/13	06/01/13	05/31/18
MDG498014	Maryland Reclamation, LLC - Hammett Property	General Permit	Construction Sand And Gravel/Mineral Mine	10/01/11	10/01/11	05/31/15
MDG498034	Andrews Air Force Base	General Permit	Mineral Mine	11/10/10	11/10/10	04/30/15
MDG498079	Andrews Air Force Base - Atlantic Contracting Batch Plant	General Permit	Stormwater Discharge	n/a	n/a	n/a

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
MDG499737	Schuster Portable Plant # 4	General Permit	Not reported	12/16/03	12/16/03	10/16/05
MDG499738	Portable Plant # 5	General Permit	Not reported	12/01/11	12/01/11	04/30/15
MDG499873	Chaney Enterprises - Upper Marlboro	General Permit	Mineral Mine	12/01/11	12/01/11	04/30/15
MDG675092	NASA Goddard Space Flight Center	General Permit	Hydrostatic Testing	05/21/12	05/21/12	02/28/17
MDG675093	SHA - Marlboro Shop	General Permit	Not reported	12/05/12	12/05/12	02/28/17
MDG766058	Prince George's Community College	General Permit	Swimming Pool	03/27/08	04/01/08	05/13/12
MDG766161	Brandywine Station T H Asso.	General Permit	Swimming Pool	06/05/02	06/05/02	12/27/06
MDG766381	Hampton Inn - Bowie	General Permit	Swimming Pool	09/27/02	09/27/02	12/27/06
MDG766386	Berkley Estates	General Permit	Swimming Pool	08/05/02	08/05/02	12/27/06
MDG766449	Days Inn - Capitol Heights	General Permit	Swimming Pool	02/13/09	03/01/09	05/13/12
MDG766539	Southlake @ Lake Arbor	General Permit	Swimming Pool	12/04/02	12/04/02	12/27/06
MDG766540	Carleton East Apartments	General Permit	Swimming Pool	12/04/02	12/04/02	12/27/06
MDG766542	Belair Bath and Tennis	General Permit	Physical Fitness Facilities/Swimming Pool	04/05/13	04/05/13	09/30/17
MDG766677	Largo Center Apartments	General Permit	Apartment Building Operators/Swimming Pool	05/06/03	05/06/03	12/27/06
MDG766678	The Country Cl@ Woomore Swim P	General Permit	Swimming Pool	05/06/03	05/06/03	12/27/06
MDG766736	Ridgewood Park H.O.A.	General Permit	Swimming Pool	06/20/03	06/20/03	12/27/06
MDG766929	Woods of Marlton	General Permit	Swimming Pool	08/16/04	08/16/04	12/27/06
MDG766998	Collington Station Recreation	General Permit	Swimming Pool	03/20/08	04/01/08	05/13/12
MDG767059	C. Elizabeth Rieg Regional School	General Permit	Swimming Pool	06/09/10	06/09/10	05/13/12
MDG767069	H. Winship Wheatley Center	General Permit	Swimming Pool	n/a	n/a	n/a
MDG767093	Six Flags America	General Permit	Swimming Pool	11/29/12	11/29/12	09/30/17
MDG767111	Marlton Community Pool	General Permit	Swimming Pool	02/27/13	02/27/13	09/30/17
MDG767145	Ramblewood HOA	General Permit	Swimming Pool	03/29/13	03/29/13	09/30/17
MDG910893	Seabrook Citgo	General Permit	Gasoline Service Stations	12/08/08	01/01/09	12/31/12
MDG913111	Brown Station Road Maintenance Facility	General Permit	Refuse Systems	12/22/08	01/01/09	12/31/12
MDG915217	Andrews Afb/ 89 Ces/ Cevr	General Permit	Refuse Systems	03/18/08	04/10/08	12/12/12
MDG916845	Marlboro Texaco	General Permit	Refuse Systems	08/03/98	08/03/98	04/30/02
MDR000121	Western Branch WWTP	General Permit	Stormwater Discharge	04/07/03	04/07/03	11/30/07

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
MDR000238	Oceaneering Technologies, Inc.	General Permit	Stormwater Discharge	02/10/03	02/10/03	11/30/07
MDR000312	Prince George's County Vehicle Audit Unit	General Permit	Stormwater Discharge	03/11/03	03/11/03	11/30/07
MDR000401	Brown Station Road Sanitary Landfill	General Permit	Stormwater Discharge	04/07/03	04/07/03	11/30/07
MDR000511	the Bechdon Company, Inc	General Permit	Stormwater Discharge	05/29/03	05/29/03	11/30/07
MDR000521	Prince George's County DPW & Transportation	General Permit	Stormwater Discharge	03/11/03	03/11/03	11/30/07
MDR000649	Murry's, Inc.	General Permit	Stormwater Discharge	01/27/03	01/27/03	11/30/07
MDR000844	Foreign Car Parts, Inc.	General Permit	Stormwater Discharge	03/21/03	03/21/03	11/30/07
MDR000937	U.S. Postal Service - Southern VMF	General Permit	Stormwater Discharge	10/09/03	10/09/03	11/30/07
MDR001064	Ripples Service, Inc.	General Permit	Stormwater Discharge	03/05/03	03/05/03	11/30/07
MDR001092	BFI Waste Services - Washington Metro	General Permit	Stormwater Discharge	03/06/03	03/06/03	11/30/07
MDR001222	PG County Public Works- Northern Ave	General Permit	Stormwater Discharge	03/11/03	03/11/03	11/30/07
MDR001224	Prince George's County - Recycling Facility	General Permit	Stormwater Discharge	03/24/03	03/24/03	11/30/07
MDR001933	Marlboro Auto Parts	General Permit	Stormwater Discharge	10/13/05	10/13/05	11/30/07
MDR002141	City of District Heights	General Permit	Stormwater Discharge	11/30/07	11/30/07	11/30/07
MDR002173	Prince George's County Central Services - Fleet Vm	General Permit	Stormwater Discharge	11/30/07	11/30/07	11/30/07
MDR002177	Williams &Heintz Map Corporation	General Permit-Stormwater	No Exposure Certification	n/a	n/a	n/a
MDR002323	Six Flags America	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDR002343	Clean Earth of Greater Washington, LLC	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDR002344	Arcal Chemicals, Inc	General Permit	Concrete Products	04/10/13	04/10/13	04/10/13
MDR002382	First Transit, Inc #55440 - Capitol Heights	General Permit	Stormwater Discharge	09/06/13	09/06/13	09/06/13
MDR002401	WMATA Metro Access	General Permit-Stormwater	Stormwater Discharge	n/a	n/a	n/a
MDU000065	Posner Industries	Unpermitted Facility	Industrial Buildings And Warehouses	--	--	--
MDU000066	Prince George’s County Landfill	Unpermitted Facility	Refuse Systems	--	--	--
MDU000073	Falco Industries	Unpermitted Facility	Lumber And Other Building Materials	--	--	--

NPDES ID	Facility Name	Permit Type	Facility Type	Date Issued	Effective Date	Expiration Date
MDU000086	Bfi (Ritchie Road)	Unpermitted Facility	Local Trucking, Without Storage	--	--	--
MDU000095	Brandywine Foreign Car Parts	Unpermitted Facility	Motor Vehicle Parts, Used	--	--	--
MDU000167	Shipley Farm	Unpermitted Facility	Not reported	--	--	--
MDU000170	Westphalia Row	Unpermitted Facility	Not reported	--	--	--
MDU000171	Palisades at Oak Creek	Unpermitted Facility	Not reported	--	--	--
MDU000172	Beechtree - Phase 2 Home Development	Unpermitted Facility	Not reported	--	--	--
MDU766715	Wild World	Unpermitted Facility	Not reported	--	--	--

Table B-2. Available permit limits for NPDES permits in the Upper Patuxent River and Western Branch watersheds in Prince George's County

NPDES ID	Outfall	Parameter	Minimum	Maximum	Unit	Statistical Base
Upper Patuxent River						
MD0021628	001	Ammonia	2.9	5.1	mg/L	Maximum Monthly Average
MD0021628	001	Ammonia	2.9	5.1	mg/L	Monthly Average
MD0021628	001	Ammonia	80	140	lb/d	Maximum Monthly Average
MD0021628	001	Ammonia	80	140	lb/d	Monthly Loading
MD0021628	001	BOD	30	30	mg/L	Maximum Monthly Average
MD0021628	001	BOD	45	45	mg/L	Maximum Weekly Average
MD0021628	001	BOD	30	30	mg/L	Monthly Average
MD0021628	001	BOD	45	45	mg/L	Weekly Average
MD0021628	001	BOD	830	830	lb/d	Maximum Monthly Average
MD0021628	001	BOD	1,200	1,200	lb/d	Maximum Weekly Average
MD0021628	001	BOD	930	930	lb/d	Monthly Average
MD0021628	001	BOD	930	930	lb/d	Monthly Loading
MD0021628	001	BOD	1,200	1,200	lb/d	Weekly Average
MD0021628	001	BOD	1,200	1,200	lb/d	Weekly Maximum
MD0021628	001	*E. coli*	126	126	MPN/100mL	Geometric Mean
MD0021628	001	*E. coli*	126	126	MPN/100mL	Monthly Geometric
MD0021628	001	Fecal Coliform	200	200	MPN/100mL	Logarithmic Monthly Median
MD0021628	001	Flow	3.3	3.3	Mgpd	Average
MD0021628	001	Total Nitrogen	40,201	40,201	lb/yr	Cumulative Total
MD0021628	001	Total Phosphorus	1	1	mg/L	Maximum Monthly Average
MD0021628	001	Total Phosphorus	1.5	1.5	mg/L	Maximum Weekly Average
MD0021628	001	Total Phosphorus	1	1	mg/L	Monthly Average
MD0021628	001	Total Phosphorus	1.5	1.5	mg/L	Weekly Average
MD0021628	001	Total Phosphorus	28	28	lb/d	Maximum Monthly Average

NPDES ID	Outfall	Parameter	Minimum	Maximum	Unit	Statistical Base
MD0021628	001	Total Phosphorus	41	41	lb/d	Maximum Weekly Average
MD0021628	001	Total Phosphorus	28	28	lb/d	Monthly Average
MD0021628	001	Total Phosphorus	28	28	lb/d	Monthly Loading
MD0021628	001	Total Phosphorus	41	41	lb/d	Weekly Average
MD0021628	001	Total Phosphorus	41	41	lb/d	Weekly Maximum
MD0021628	001	Total Phosphorus	3,015	3,015	lb/yr	Cumulative Total
MD0021725	001	Ammonia	2	7.7	mg/L	Maximum Monthly Average
MD0021725	001	Ammonia	2	7.7	mg/L	Monthly Average
MD0021725	001	Ammonia	3	3	mg/L	Weekly Average
MD0021725	001	Ammonia	130	480	lb/d	Maximum Monthly Average
MD0021725	001	Ammonia	130	130	lb/d	Monthly Average
MD0021725	001	Ammonia	130	480	lb/d	Monthly Loading
MD0021725	001	Ammonia	190	190	lb/d	Weekly Average
MD0021725	001	BOD	20	30	mg/L	Maximum Monthly Average
MD0021725	001	BOD	30	45	mg/L	Maximum Weekly Average
MD0021725	001	BOD	20	30	mg/L	Monthly Average
MD0021725	001	BOD	30	45	mg/L	Weekly Average
MD0021725	001	BOD	1,300	1,900	lb/d	Maximum Monthly Average
MD0021725	001	BOD	1,900	2,800	lb/d	Maximum Weekly Average
MD0021725	001	BOD	1,300	1,900	lb/d	Monthly Average
MD0021725	001	BOD	1,300	1,900	lb/d	Monthly Loading
MD0021725	001	BOD	1,900	2,800	lb/d	Weekly Average
MD0021725	001	BOD	1,900	2,800	lb/d	Weekly Maximum
MD0021725	001	*E. coli*	126	126	MPN/100mL	Geometric Mean
MD0021725	001	*E. coli*	126	126	MPN/100mL	Monthly Geometric Maximum
MD0021725	001	Fecal Coliform	200	200	MPN/100mL	Logrithmic Monthly Median
MD0021725	001	Total Nitrogen	7	7	mg/L	Maximum Monthly Average
MD0021725	001	Total Nitrogen	11	11	mg/L	Maximum Weekly Average
MD0021725	001	Total Nitrogen	7	7	mg/L	Monthly Average
MD0021725	001	Total Nitrogen	11	11	mg/L	Weekly Average
MD0021725	001	Total Nitrogen	440	440	lb/d	Maximum Monthly Average
MD0021725	001	Total Nitrogen	690	690	lb/d	Maximum Weekly Average
MD0021725	001	Total Nitrogen	440	440	lb/d	Monthly Average
MD0021725	001	Total Nitrogen	440	440	lb/d	Monthly Loading
MD0021725	001	Total Nitrogen	690	690	lb/d	Weekly Average
MD0021725	001	Total Nitrogen	690	690	lb/d	Weekly Maximum
MD0021725	001	Total Nitrogen	91,367	91,367	lb/yr	Cumulative Total
MD0021725	001	Total Phosphorus	1	1	mg/L	Maximum Monthly Average
MD0021725	001	Total Phosphorus	1.5	1.5	mg/L	Maximum Weekly Average
MD0021725	001	Total Phosphorus	1	1	mg/L	Monthly Average

NPDES ID	Outfall	Parameter	Minimum	Maximum	Unit	Statistical Base
MD0021725	001	Total Phosphorus	1.5	1.5	mg/L	Weekly Average
MD0021725	001	Total Phosphorus	63	63	lb/d	Maximum Monthly Average
MD0021725	001	Total Phosphorus	94	94	lb/d	Maximum Weekly Average
MD0021725	001	Total Phosphorus	63	63	lb/d	Monthly Average
MD0021725	001	Total Phosphorus	63	63	lb/d	Monthly Loading
MD0021725	001	Total Phosphorus	94	94	lb/d	Weekly Average
MD0021725	001	Total Phosphorus	94	94	lb/d	Weekly Maximum
MD0021725	001	Total Phosphorus	6,853	6,853	lb/yr	Cumulative Total
MD0065358	001	Ammonia	12	12	mg/L	Maximum Monthly Average
MD0065358	001	Ammonia	0.67	0.67	lb/d	Maximum Monthly Average
MD0065358	101	Ammonia	12	12	mg/L	Maximum Monthly Average
MD0065358	101	Ammonia	0.67	0.67	lb/d	Maximum Monthly Average
MD0065358	001	BOD	30	30	mg/L	30-Day Average
MD0065358	001	BOD	45	45	mg/L	7-Day Average
MD0065358	001	BOD	30	30	mg/L	Maximum Monthly Average
MD0065358	001	BOD	45	45	mg/L	Maximum Weekly Average
MD0065358	001	BOD	1.7	1.7	lb/d	30-Day Average
MD0065358	001	BOD	2.5	2.5	lb/d	7-Day Average
MD0065358	001	BOD	1.7	1.7	lb/d	Maximum Monthly Average
MD0065358	001	BOD	2.5	2.5	lb/d	Maximum Weekly Average
MD0065358	001	BOD	1.7	1.7	lb/d	Monthly Loading
MD0065358	002	BOD	30	30	mg/L	Monthly Average
MD0065358	002	BOD	45	45	mg/L	Weekly Average
MD0065358	002	BOD	1.7	1.7	lb/d	Monthly Loading
MD0065358	002	BOD	2.5	2.5	lb/d	Weekly Maximum
MD0065358	101	BOD	30	30	mg/L	Maximum Monthly Average
MD0065358	101	BOD	45	45	mg/L	Maximum Weekly Average
MD0065358	101	BOD	1.7	1.7	lb/d	Maximum Monthly Average
MD0065358	101	BOD	2.5	2.5	lb/d	Maximum Weekly Average
MD0065358	101	*E. coli*	126	126	MPN/100mL	Maximum Monthly Geometric Mean
MD0065358	001	Fecal Coliform	200	200	MPN/100mL	Maximum (Data Migration)
MD0065358	002	Fecal Coliform	200	200	MPN/100mL	Logrithmic Monthly Median
MD0065358	101	Fecal Coliform	200	200	MPN/100mL	Maximum Monthly Geometric Mean
MD0065358	001	Flow	0.0067	0.0067	gpd	Average (Data Migration)
MD0065358	001	Total Phosphorus	0.04	0.04	lb/d	30-Day Average
MD0065358	001	Total Phosphorus	0.06	0.06	lb/d	7-Day Average
MD0065358	001	Total Phosphorus	0.04	0.04	lb/d	Maximum Monthly Average
MD0065358	001	Total Phosphorus	0.06	0.06	lb/d	Maximum Weekly Average
MD0065358	001	Total Phosphorus	0.04	0.04	lb/d	Monthly Loading
MD0065358	101	Total Phosphorus	0.04	0.04	lb/d	Maximum Monthly Average

NPDES ID	Outfall	Parameter	Minimum	Maximum	Unit	Statistical Base
MD0065358	101	Total Phosphorus	0.06	0.06	lb/d	Maximum Weekly Average
MD1499Q84	001	BOD	70	70	mg/L	Maximum Monthly Average
MD1499Q84	001	Fecal Coliform	200	200	MPN/100mL	Maximum Monthly Average
MD1499Q84	001	Flow	0.01575	0.01575	Mgpd	Cumulative Total
MDG911499	001	BOD	70	70	mg/L	Monthly Average
MDG911499	001	Fecal Coliform	200	200	MPN/100mL	Monthly Average
MDG911499	001	Flow	15,750	15,750	gpd	Annual Average
Western Branch						
MD0021741	001	Ammonia	1.5	5.5	mg/L	Maximum Monthly Average
MD0021741	001	Ammonia	1.5	5.5	mg/L	Monthly Average
MD0021741	001	Ammonia	380	1380	lb/d	Maximum Monthly Average
MD0021741	001	Ammonia	380	1380	lb/d	Monthly Loading
MD0021741	001	Ammonia	580	580	lb/d	Weekly Maximum
MD0021741	001	BOD	9	30	mg/L	Maximum Monthly Average
MD0021741	001	BOD	14	45	mg/L	Maximum Weekly Average
MD0021741	001	BOD	9	30	mg/L	Monthly Average
MD0021741	001	BOD	14	45	mg/L	Weekly Average
MD0021741	001	BOD	2,300	7,500	lb/d	Maximum Monthly Average
MD0021741	001	BOD	3,500	11,300	lb/d	Maximum Weekly Average
MD0021741	001	BOD	2,300	7,500	lb/d	Monthly Loading
MD0021741	001	BOD	11,300	11,300	lb/d	Weekly Average
MD0021741	001	BOD	3,500	11,300	lb/d	Weekly Maximum
MD0021741	001	*E. coli*	126	126	MPN/100mL	Maximum Monthly Geometric Mean
MD0021741	001	*E. coli*	126	126	MPN/100mL	Monthly Geometric Maximum
MD0021741	001	Flow	0.3	0.3	Mgpd	Annual Average
MD0021741	001	Total Nitrogen	3	3	mg/L	Maximum Monthly Average
MD0021741	001	Total Nitrogen	4.5	4.5	mg/L	Maximum Weekly Average
MD0021741	001	Total Nitrogen	3	3	mg/L	Monthly Average
MD0021741	001	Total Nitrogen	4.5	4.5	mg/L	Weekly Average
MD0021741	001	Total Nitrogen	750	750	lb/d	Maximum Monthly Average
MD0021741	001	Total Nitrogen	1,130	1,130	lb/d	Maximum Weekly Average
MD0021741	001	Total Nitrogen	750	750	lb/d	Monthly Loading
MD0021741	001	Total Nitrogen	1,130	1,130	lb/d	Weekly Maximum
MD0021741	001	Total Phosphorus	1	1	mg/L	Maximum Monthly Average
MD0021741	001	Total Phosphorus	1	1	mg/L	Monthly Average
MD0021741	001	Total Phosphorus	250	250	lb/d	Maximum Monthly Average
MD0021741	001	Total Phosphorus	250	250	lb/d	Monthly Loading

Note: BOD = biochemical oxygen demand; mg/L= milligrams per liter; lb/d = pounds per day; lb/yr = pounds per year; MPN/100mL= most probable number (MPN) per 100 milliliters; gpd = gallons per day; Mgpd=million gallons per day.

Table B-3. Summary of available discharge information for NPDES permits in the Upper Patuxent River and Western Branch watersheds in Prince George's County

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
Upper Patuxent River							
MD0021628	001	Ammonia	0.1	0.268	2.3	mg/L	Maximum Monthly Average
MD0021628	001	Ammonia	0.10	2.52	13.26	mg/L	Monthly Average
MD0021628	001	Ammonia	1.00	3.46	27.70	lb/d	Maximum Monthly Average
MD0021628	001	Ammonia	4.00	35.87	141.50	lb/d	Monthly Average
MD0021628	001	Ammonia	1.66	41.11	178.30	lb/d	Monthly Loading
MD0021628	001	BOD	1.00	2.13	8.30	mg/L	Maximum Monthly Average
MD0021628	001	BOD	1.00	3.23	12.50	mg/L	Maximum Weekly Average
MD0021628	001	BOD	2.00	4.96	13.00	mg/L	Monthly Average
MD0021628	001	BOD	2.00	6.66	25.00	mg/L	Weekly Average
MD0021628	001	BOD	10.30	30.75	97.30	lb/d	Maximum Monthly Average
MD0021628	001	BOD	11.00	45.93	172.90	lb/d	Maximum Weekly Average
MD0021628	001	BOD	39.00	91.69	211.00	lb/d	Monthly Average
MD0021628	001	BOD	31.00	65.58	145.70	lb/d	Monthly Loading
MD0021628	001	BOD	46.0	117.5	403.0	lb/d	Weekly Average
MD0021628	001	BOD	31.50	88.85	268.00	lb/d	Weekly Maximum
MD0021628	001	DO	5.00	6.78	8.90	mg/L	Instantaneous Minimum
MD0021628	001	DO	5.20	6.86	8.60	mg/L	Minimum
MD0021628	001	*E. coli*	1.00	2.64	16.00	MPN/100mL	Geometric Mean
MD0021628	001	*E. coli*	1.00	1.63	11.56	MPN/100mL	Monthly Geometric
MD0021628	001	Fecal Coliform	1.00	4.09	46.00	MPN/100mL	Logrithmic Monthly Median
MD0021628	001	Flow	1.69	2.27	20.03	Mgpd	Annual Average
MD0021628	001	Flow	1.68	1.94	2.61	Mgpd	Average
MD0021628	001	Flow	1.60	2.45	7.35	Mgpd	Daily Maximum
MD0021628	001	Flow	1.22	1.89	2.78	Mgpd	Monthly Average
MD0021628	001	Flow	37.91	54.71	74.62	Mgpm	Monthly Total
MD0021628	001	Flow	631.3	655.2	679.2	MgpY	Annual Total
MD0021628	001	Nitrite + Nitrate	0.50	2.30	15.84	mg/L	Monthly Average
MD0021628	001	Nitrite + Nitrate	6.90	35.18	220.50	lb/d	Monthly Average
MD0021628	001	Nitrite + Nitrate	8.20	33.11	96.20	lb/d	Monthly Loading
MD0021628	001	Org Nitrogen	0.05	1.96	19.50	mg/L	Monthly Average
MD0021628	001	Org Nitrogen	0.90	36.89	297.60	lb/d	Monthly Average
MD0021628	001	Org Nitrogen	5.40	92.95	4,177.00	lb/d	Monthly Loading
MD0021628	001	OrthoPhosphate	0.007	0.352	27	mg/L	Monthly Average
MD0021628	001	OrthoPhosphate	0.15	2.50	7.20	lb/d	Monthly Average
MD0021628	001	OrthoPhosphate	0.50	3.21	15.80	lb/d	Monthly Loading
MD0021628	001	Total Nitrogen	2.12	5.10	17.53	mg/L	Monthly Average
MD0021628	001	Total Nitrogen	38.80	58.14	128.50	lb/d	Monthly Average
MD0021628	001	Total Nitrogen	5.70	97.24	289.20	lb/d	Monthly Loading
MD0021628	001	Total Nitrogen	1,188	1,701	2,438	lb/m	Monthly Total

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MD0021628	001	Total Nitrogen	18,421	20,289	22,157	lb/yr	Annual Total
MD0021628	001	Total Nitrogen	1,429	10,332	22,157	lb/yr	Cumulative Total
MD0021628	001	Total Phosphorus	0.1	0.211	0.37	mg/L	Maximum Monthly Average
MD0021628	001	Total Phosphorus	0.1	0.544	4	mg/L	Maximum Weekly Average
MD0021628	001	Total Phosphorus	0.1	0.235	0.96	mg/L	Monthly Average
MD0021628	001	Total Phosphorus	0.1	0.335	2	mg/L	Weekly Average
MD0021628	001	Total Phosphorus	1.20	3.76	12.70	lb/d	Maximum Monthly Average
MD0021628	001	Total Phosphorus	1.50	4.48	10.80	lb/d	Maximum Weekly Average
MD0021628	001	Total Phosphorus	1.60	3.17	7.10	lb/d	Monthly Average
MD0021628	001	Total Phosphorus	1.50	4.28	14.20	lb/d	Monthly Loading
MD0021628	001	Total Phosphorus	1.80	4.03	12.00	lb/d	Weekly Average
MD0021628	001	Total Phosphorus	1.80	6.21	21.40	lb/d	Weekly Maximum
MD0021628	001	Total Phosphorus	36.30	89.10	305.00	lb/m	Monthly Total
MD0021628	001	Total Phosphorus	776	1,151	1,526	lb/yr	Annual Total
MD0021628	001	Total Phosphorus	43.4	538.4	1,526	lb/yr	Cumulative Total
MD0021725	001	Ammonia	0.1	0.187	0.5	mg/L	Maximum Monthly Average
MD0021725	001	Ammonia	0	0.253	3.2	mg/L	Monthly Average
MD0021725	001	Ammonia	0	0.373	6.3	mg/L	Weekly Average
MD0021725	001	Ammonia	5.00	10.67	27.00	lb/d	Maximum Monthly Average
MD0021725	001	Ammonia	0.00	6.65	56.00	lb/d	Monthly Average
MD0021725	001	Ammonia	0.00	5.15	75.00	lb/d	Monthly Loading
MD0021725	001	Ammonia	0.00	8.06	123.00	lb/d	Weekly Average
MD0021725	001	BOD	2.00	2.60	6.00	mg/L	Maximum Monthly Average
MD0021725	001	BOD	2.00	3.33	12.00	mg/L	Maximum Weekly Average
MD0021725	001	BOD	2.00	4.30	23.00	mg/L	Monthly Average
MD0021725	001	BOD	2.00	5.96	71.00	mg/L	Weekly Average
MD0021725	001	BOD	92.0	150.2	389.0	lb/d	Maximum Monthly Average
MD0021725	001	BOD	95.0	200.8	785.0	lb/d	Maximum Weekly Average
MD0021725	001	BOD	42.00	98.00	573.00	lb/d	Monthly Average
MD0021725	001	BOD	33.00	99.39	237.00	lb/d	Monthly Loading
MD0021725	001	BOD	55.0	145.0	1,779	lb/d	Weekly Average
MD0021725	001	BOD	39.0	132.8	351.0	lb/d	Weekly Maximum
MD0021725	001	DO	5.80	7.41	8.20	mg/L	Instantaneous Minimum
MD0021725	001	DO	5.00	7.73	8.90	mg/L	Minimum
MD0021725	001	*E. coli*	1.00	10.11	46.00	MPN/100mL	Geometric Mean
MD0021725	001	*E. coli*	2.00	12.93	69.00	MPN/100mL	Monthly Geometric Maximum
MD0021725	001	Fecal Coliform	2.00	12.00	59.00	MPN/100mL	Logrithmic Monthly Median
MD0021725	001	Flow	4.99	7.10	17.10	Mgpd	Annual Average
MD0021725	001	Flow	5.44	8.55	17.35	Mgpd	Daily Maximum
MD0021725	001	Flow	5.00	6.20	8.30	Mgpd	Monthly Average
MD0021725	001	Flow	153.5	198.6	234.2	Mgpm	Total

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MD0021725	001	Nitrite + Nitrate	1.20	2.86	10.70	mg/L	Monthly Average
MD0021725	001	Nitrite + Nitrate	28.0	117.3	611.0	lb/d	Monthly Average
MD0021725	001	Nitrite + Nitrate	27.00	59.64	139.00	lb/d	Monthly Loading
MD0021725	001	Org Nitrogen	0.60	1.08	1.90	mg/L	Monthly Average
MD0021725	001	Org Nitrogen	16.00	47.94	115.00	lb/d	Monthly Average
MD0021725	001	Org Nitrogen	14.00	25.92	53.00	lb/d	Monthly Loading
MD0021725	001	OrthoPhosphate	0	0.184	1.6	mg/L	Monthly Average
MD0021725	001	OrthoPhosphate	0.00	5.93	36.00	lb/d	Monthly Average
MD0021725	001	OrthoPhosphate	0.00	3.47	18.00	lb/d	Monthly Loading
MD0021725	001	Total Nitrogen	2.10	3.77	5.80	mg/L	Maximum Monthly Average
MD0021725	001	Total Nitrogen	2.20	4.16	6.10	mg/L	Maximum Weekly Average
MD0021725	001	Total Nitrogen	2.00	4.38	12.80	mg/L	Monthly Average
MD0021725	001	Total Nitrogen	2.70	4.17	10.10	mg/L	Weekly Average
MD0021725	001	Total Nitrogen	95.0	202.2	320.0	lb/d	Maximum Monthly Average
MD0021725	001	Total Nitrogen	96.0	224.2	330.0	lb/d	Maximum Weekly Average
MD0021725	001	Total Nitrogen	59.0	241.5	6,868	lb/d	Monthly Average
MD0021725	001	Total Nitrogen	54.00	90.42	229.00	lb/d	Monthly Loading
MD0021725	001	Total Nitrogen	65.0	100.2	194.0	lb/d	Weekly Average
MD0021725	001	Total Nitrogen	57.00	90.44	173.00	lb/d	Weekly Maximum
MD0021725	001	Total Nitrogen	2,841	7,681	22,139	lb/m	Monthly Average
MD0021725	001	Total Nitrogen	5,079	55,139	103,513	lb/yr	Cumulative Total
MD0021725	001	Total Phosphorus	0.04	0.199	0.4	mg/L	Maximum Monthly Average
MD0021725	001	Total Phosphorus	0.04	0.232	0.6	mg/L	Maximum Weekly Average
MD0021725	001	Total Phosphorus	0	0.246	0.7	mg/L	Monthly Average
MD0021725	001	Total Phosphorus	0.1	0.378	1.5	mg/L	Weekly Average
MD0021725	001	Total Phosphorus	2.00	11.11	22.00	lb/d	Maximum Monthly Average
MD0021725	001	Total Phosphorus	3.00	13.27	29.00	lb/d	Maximum Weekly Average
MD0021725	001	Total Phosphorus	3.00	6.46	15.00	lb/d	Monthly Average
MD0021725	001	Total Phosphorus	1.00	5.66	17.00	lb/d	Monthly Loading
MD0021725	001	Total Phosphorus	3.00	10.04	37.00	lb/d	Weekly Average
MD0021725	001	Total Phosphorus	1.00	7.93	27.00	lb/d	Weekly Maximum
MD0021725	001	Total Phosphorus	69.0	336.5	684.0	lb/m	Monthly Average
MD0021725	001	Total Phosphorus	88	2,388	6,468	lb/yr	Cumulative Total
MD0065358	101	Ammonia	0.10	3.39	7.30	mg/L	Maximum Monthly Average
MD0065358	101	Ammonia	0.00000	0.01000	0.02000	lb/d	Maximum Monthly Average
MD0065358	001	BOD	5.00	13.36	24.00	mg/L	30-Day Average
MD0065358	001	BOD	7.00	30.71	67.00	mg/L	7-Day Average
MD0065358	001	BOD	0.01	0.049	0.12	lb/d	30-Day Average
MD0065358	001	BOD	0.01	0.286	1.2	lb/d	7-Day Average
MD0065358	002	BOD	2.00	8.73	28.00	mg/L	Monthly Average
MD0065358	002	BOD	3.00	16.11	66.00	mg/L	Weekly Average
MD0065358	002	BOD	0.01	0.114	2.2	lb/d	Monthly Loading

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MD0065358	002	BOD	0.01	0.357	7.8	lb/d	Weekly Maximum
MD0065358	101	BOD	3.00	9.18	17.00	mg/L	Maximum Monthly Average
MD0065358	101	BOD	4.00	15.71	29.00	mg/L	Maximum Weekly Average
MD0065358	101	BOD	0.01	0.052	0.24	lb/d	Maximum Monthly Average
MD0065358	101	BOD	0.01	0.178	0.93	lb/d	Maximum Weekly Average
MD0065358	001	DO	5.30	6.83	9.40	mg/L	Minimum
MD0065358	002	DO	5.00	8.06	10.90	mg/L	Minimum
MD0065358	101	DO	4.30	7.20	8.50	mg/L	Instantaneous Minimum
MD0065358	101	*E. coli*	1.00	8.07	41.00	MPN/100mL	Maximum Monthly Geometric Mean
MD0065358	001	Fecal Coliform	6.0	171.5	751.0	MPN/100mL	Maximum (Data Migration)
MD0065358	002	Fecal Coliform	0.10	12.53	188.00	MPN/100mL	Logrithmic Monthly Median
MD0065358	101	Fecal Coliform	2.00	5.00	11.00	MPN/100mL	Maximum Monthly Geometric Mean
MD0065358	001	Flow	0.00020	0.00110	0.00330	gpd	Average (Data Migration)
MD0065358	002	Flow	0.00001	0.00131	0.01010	Mgpd	Monthly Average
MD0065358	101	Flow	0.00221	0.00387	0.00969	Mgpd	Daily Maximum
MD0065358	101	Flow	0.00010	0.00029	0.00065	Mgpd	Monthly Average
MD0065358	001	Total Phosphorus	0.003	0.011	0.02	lb/d	30-Day Average
MD0065358	001	Total Phosphorus	0.005	0.034	0.2	lb/d	7-Day Average
MD0065358	002	Total Phosphorus	0	0.024	0.41	mg/L	Monthly Average
MD0065358	002	Total Phosphorus	0	0.014	0.25	lb/d	Monthly Loading
MD0065358	101	Total Phosphorus	0.00010	0.00648	0.01000	lb/d	Maximum Monthly Average
MD0065358	101	Total Phosphorus	0.0001	0.014	0.031	lb/d	Maximum Weekly Average
MD1499Q84	001	BOD	2.00	5.33	14.00	mg/L	Maximum Monthly Average
MD1499Q84	001	BOD	2.00	5.33	14.00	mg/L	Weekly Average
MD1499Q84	001	Fecal Coliform	2.00	93.58	525.00	MPN/100mL	Maximum Monthly Average
MD1499Q84	001	Fecal Coliform	2.00	93.58	525.00	MPN/100mL	Weekly Average
MD1499Q84	001	Flow	0.000621	0.026	0.0711	Mgpd	Cumulative Total
MD1499Q84	001	Flow	0.00026	0.00123	0.00249	Mgpd	Weekly Average
MD1499Q84	001	TKN	0	0.867	2.1	mg/L	Monthly Average
MD1499Q84	001	TKN	0	0.867	2.1	mg/L	Weekly Average
MD1499Q84	001	Total Nitrogen	0	0.933	2.1	mg/L	Monthly Average
MD1499Q84	001	Total Nitrogen	0	0.933	2.1	mg/L	Weekly Average
MD3215Q03	001	Flow	13,600	43,866	716,000	gpd	Monthly Average
MDG343976	001	Flow	0.00	75.71	150.00	gpd	Daily Maximum
MDG343976	001	Flow	0.00	72.68	150.00	gpd	Quarterly Average
MDG344261	001	Flow	0.42	77.41	1,404.00	gpd	Annual Average
MDG344261	001	Flow	14.4	144.0	208.0	gpd	Daily Maximum
MDG766165	001	Flow	1,900	12,075	22,250	gpd	Daily Maximum
MDG766402	001	Flow	631	20,873	25,933	gpd	Daily Maximum
MDG766402	001	Flow	631	20,873	25,933	gpd	Quarterly Average
MDG766402	002	Flow	103,733	103,733	103,733	gpd	Daily Maximum

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MDG766591	001	Flow	300.0	562.5	825.0	gpd	Daily Maximum
MDG766591	001	Flow	275.0	275.0	275.0	gpd	Monthly Average
MDG766591	001	Flow	275.0	275.0	275.0	gpd	Quarterly Average
MDG766591	002	Flow	70.00	70.00	70.00	gpd	Daily Maximum
MDG766698	002	Flow	17,100	17,100	17,100	gpd	Daily Maximum
MDG911499	001	BOD	2.40	3.80	5.00	mg/L	Monthly Average
MDG911499	001	Fecal Coliform	13.00	29.67	54.00	MPN/100mL	Monthly Average
MDG911499	001	Flow	0	9,571	23,837	gpd	Annual Average
Western Branch							
MD0021741	001	Ammonia	0.1	0.354	4	mg/L	Maximum Monthly Average
MD0021741	001	Ammonia	0	0.403	7.9	mg/L	Monthly Average
MD0021741	001	Ammonia	8.00	64.83	665.00	lb/d	Maximum Monthly Average
MD0021741	001	Ammonia	0.00	33.76	653.00	lb/d	Monthly Loading
MD0021741	001	Ammonia	0.00	58.42	846.00	lb/d	Weekly Maximum
MD0021741	001	BOD	2.00	2.98	7.00	mg/L	Maximum Monthly Average
MD0021741	001	BOD	2.00	4.63	19.00	mg/L	Maximum Weekly Average
MD0021741	001	BOD	0.03	2.74	13.00	mg/L	Monthly Average
MD0021741	001	BOD	0.00	4.14	18.00	mg/L	Weekly Average
MD0021741	001	BOD	296.0	516.7	1,350	lb/d	Maximum Monthly Average
MD0021741	001	BOD	282.0	818.1	3,173	lb/d	Maximum Weekly Average
MD0021741	001	BOD	23.0	210.5	1,106	lb/d	Monthly Loading
MD0021741	001	BOD	152.0	461.3	1,344	lb/d	Weekly Average
MD0021741	001	BOD	22.0	300.3	1,367	lb/d	Weekly Maximum
MD0021741	001	DO	5.40	7.32	8.40	mg/L	Instantaneous Minimum
MD0021741	001	DO	5.30	7.21	8.60	mg/L	Minimum
MD0021741	001	DO	8.30	8.98	10.00	mg/L	Minimum Weekly Average
MD0021741	001	DO	8.20	8.84	9.60	mg/L	Monthly Average Minimum
MD0021741	001	*E. coli*	3.00	30.24	311.00	MPN/100mL	Maximum Monthly Geometric Mean
MD0021741	001	*E. coli*	1.00	9.98	91.00	MPN/100mL	Monthly Geometric Maximum
MD0021741	001	Flow	0.02	12.28	25.66	Mgpd	Annual Average
MD0021741	001	Flow	2.20	24.13	71.00	Mgpd	Daily Maximum
MD0021741	001	Flow	0.19	18.48	27.40	Mgpd	Monthly Average
MD0021741	001	Flow	492	42,065	581,130	Mgpm	Monthly Total
MD0021741	001	Nitrite + Nitrate	0.20	1.85	17.00	mg/L	Monthly Average
MD0021741	001	Nitrite + Nitrate	22.0	162.2	1,079	lb/d	Monthly Loading
MD0021741	001	Org Nitrogen	0.4	0.934	2.6	mg/L	Monthly Average
MD0021741	001	Org Nitrogen	22.0	111.4	626.0	lb/d	Monthly Loading
MD0021741	001	OrthoPhosphate	0	0.387	1	mg/L	Monthly Average
MD0021741	001	OrthoPhosphate	2.00	36.62	95.00	lb/d	Monthly Loading
MD0021741	001	Total Nitrogen	1.00	1.83	3.00	mg/L	Maximum Monthly Average
MD0021741	001	Total Nitrogen	1.10	2.57	5.30	mg/L	Maximum Weekly Average

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MD0021741	001	Total Nitrogen	1.00	3.36	18.00	mg/L	Monthly Average
MD0021741	001	Total Nitrogen	1.40	2.73	15.10	mg/L	Weekly Average
MD0021741	001	Total Nitrogen	146.0	307.0	567.0	lb/d	Maximum Monthly Average
MD0021741	001	Total Nitrogen	161.0	475.8	1,596	lb/d	Maximum Weekly Average
MD0021741	001	Total Nitrogen	65.0	319.5	1,279	lb/d	Monthly Loading
MD0021741	001	Total Nitrogen	87.0	216.0	1,225	lb/d	Weekly Maximum
MD0021741	001	Total Nitrogen	5,055	12,422	38,176	lb/m	Monthly Total
MD0021741	001	Total Nitrogen	4,537	9,209	20,001	lb/m	Total
MD0021741	001	Total Nitrogen	10,096	90,733	884,738	lb/yr	Cumulative Total
MD0021741	001	Total Phosphorus	0.2	0.378	0.7	mg/L	Maximum Monthly Average
MD0021741	001	Total Phosphorus	0.2	0.504	3	mg/L	Monthly Average
MD0021741	001	Total Phosphorus	30.00	60.22	116.00	lb/d	Maximum Monthly Average
MD0021741	001	Total Phosphorus	11.00	39.13	74.00	lb/d	Monthly Loading
MD0021741	001	Total Phosphorus	935	1,826	3,596	lb/m	Monthly Total
MD0021741	001	Total Phosphorus	486	11,175	28,182	lb/yr	Cumulative Total
MD0063410	001	Flow	800	6,845	19,000	gpd	Daily Maximum
MD0063410	001	Flow	800	1,100	1,500	gpd	Monthly Average
MD0063410	001	Flow	2,000	8,750	19,000	gpd	Quarterly Average
MD0065111	001	BOD	7.00	60.85	529.00	mg/L	Daily Maximum
MD0065111	001	BOD	17.00	44.85	132.00	mg/L	Monthly Average
MD0065111	001	Flow	0.00127	0.073	1	gpd	Daily Maximum
MD0065111	001	Flow	0.000621	0.038	0.441	gpd	Monthly Average
MD0065111	001	Total Nitrogen	8.40	15.33	24.90	mg/L	Daily Maximum
MD0065111	001	Total Nitrogen	8.40	15.33	24.90	mg/L	Quarterly Average
MD0065111	001	Total Phosphorus	4.10	5.80	7.80	mg/L	Daily Maximum
MD0065111	001	Total Phosphorus	4.10	5.80	7.80	mg/L	Quarterly Average
MD0069124	001	Flow	10.00	10.00	10.00	gpd	Daily Maximum
MD0069124	001	Flow	10.00	10.00	10.00	gpd	Quarterly Average
MD0069774	001	Flow	4,219	34,173	86,293	gpd	Daily Maximum
MD0069774	001	Flow	4,219	45,689	665,933	gpd	Monthly Average
MDG498014	001	Flow	4,800	23,467	44,600	gpd	Daily Maximum
MDG498014	001	Flow	527	3,655	8,271	gpd	Monthly Average
MDG498014	002	Flow	0	19,830	32,700	gpd	Daily Maximum
MDG498014	002	Flow	0	17,881	32,700	gpd	Quarterly Average
MDG499873	001	Flow	60	1,648	7,200	gpd	Daily Maximum
MDG499873	001	Flow	192.0	256.5	321.0	gpd	Monthly Average
MDG499873	001	Flow	60	1,600	7,200	gpd	Quarterly Average
MDG499873	002	Flow	100.0	103.5	107.0	gpd	Daily Maximum
MDG499873	002	Flow	100.0	103.5	107.0	gpd	Monthly Average
MDG766449	002	Flow	42,000	42,000	42,000	gpd	Daily Maximum
MDG766998	002	Flow	170,000	170,000	170,000	gpd	Daily Maximum
MDG910893	001	Flow	7,200	8,668	10,135	gpd	Daily Maximum

NPDES ID	Outfall	Parameter	Minimum	Average	Maximum	Unit	Statistical Base
MDG910893	001	Flow	232	2,204	4,176	gpd	Monthly Average
MDG913111	001	Flow	4,466	9,433	14,400	gpd	Daily Maximum
MDG913111	001	Flow	1,772	8,086	14,400	gpd	Quarterly Average
MDG915217	001	Flow	1,455	8,654	24,381	gpd	Daily Maximum
MDG915217	001	Flow	16	1,370	2,483	gpd	Quarterly Average
MDG916845	001	Flow	1.0	161.2	563.0	gpd	Daily Maximum
MDG916845	001	Flow	1	9,385	50,130	gpd	Quarterly Average

Note: BOD = biochemical oxygen demand; DO = dissolved oxygen; mg/L= milligrams per liter; lb/d = pounds per day; lb/m = pounds per month; lb/yr = pounds per year; MPN/100mL= most probable number (MPN) per 100 milliliters; gpd = gallons per day; Mgpd = million gallons per day; Mgpm = million gallons per month; MgpY = million gallons per year.