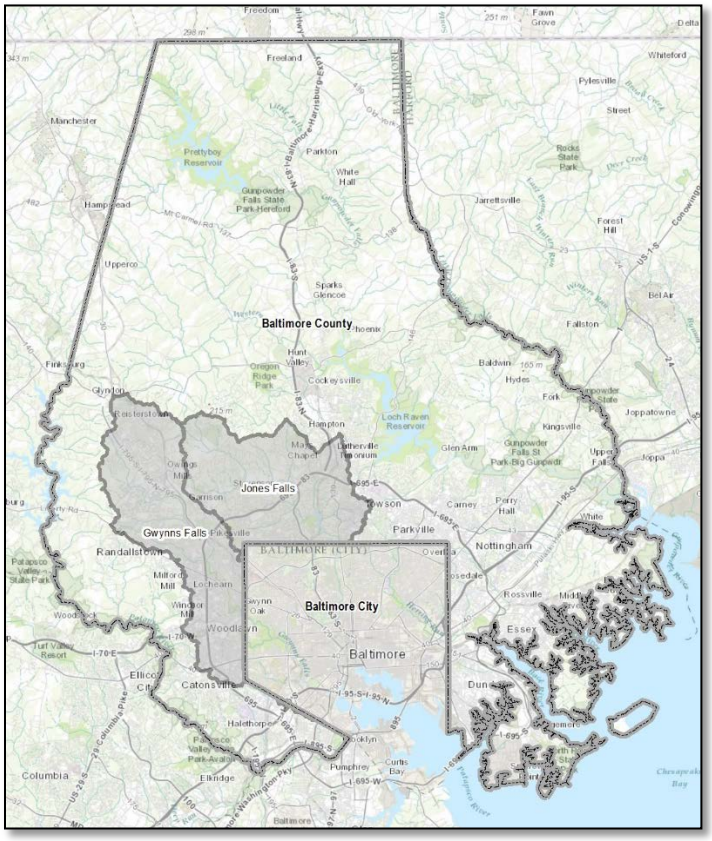
# BALTIMORE COUNTY
# TMDL IMPLEMENTATION PLAN

**Trash and Debris in the Middle Branch and Northwest Branch portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment**




## Baltimore County Executive Kevin Kamenetz
## and the County Council

**Vincent J. Gardina, Director**
**Department of Environmental Protection and Sustainability**

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## List of Abbreviations

| | |
|---|---|
| **ARA** | **Antibiotic Resistance Analysis** |
| **BMP** | **Best Management Practice** |
| **BOD** | **Biological Oxygen Demand** |
| **BSID** | **Biological Stressor Identification** |
| **BST** | **Bacteria Source Tracking** |
| **CBP** | **Chesapeake Bay Program** |
| **CFR** | **Code of Federal Regulations** |
| **Chl a** | **Chlorophyll a** |
| **COMAR** | **Code of Maryland Regulations** |
| **CWA** | **Clean Water Act** |
| **DO** | **Dissolved Oxygen** |
| **DPW** | **Department of Public Works** |
| **ED** | **Extended Detention** |
| **EOF** | **Edge of Field** |
| **EOS** | **Edge of Stream** |
| **EPA** | **U.S. Environmental Protection Agency** |
| **EPS** | **Environmental Protection & Sustainability** |
| **FSA** | **Farm Service Administration** |
| **HSG** | **Hydrologic Soil Groups** |
| **HUC** | **Hydrologic Unit Code** |
| **IP** | **Implementation Plan** |
| **LA** | **Load Allocation** |
| **lbs/yr** | **Pounds per Year** |
| **MAST** | **Maryland Assessment Scenario Tool** |
| **MD** | **Maryland** |
| **MDA** | **Maryland Department of Agriculture** |
| **MDE** | **Maryland Department of Environment** |
| **MDP** | **Maryland Department of Planning** |
| **µg/l** | **Micrograms per Liter** |
| **mg/l** | **Milligrams per Liter** |

| | |
|---|---|
| **MGD** | **Million Gallons per Day** |
| **MGS** | **Maryland Geological Survey** |
| **MOS** | **Margin of Safety** |
| **MPN** | **Most Probable Number** |
| **MPR** | **Maximum Practicable Reduction** |
| **MS4** | **Municipal Separate Storm Sewer System** |
| **NLCD** | **National Land Cover Dataset** |
| **NMP** | **Nutrient Management Plan** |
| **NOAA** | **National Oceanic and Atmospheric Administration** |
| **NPDES** | **National Pollutant Discharge Elimination System** |
| **NPS** | **Nonpoint Source** |
| **NSA** | **Neighborhood Source Assessment** |
| **OIT** | **Office of Information Technology** |
| **PAA** | **Pervious Area Assessment** |
| **PAI** | **Office of Permits Approvals & Inspections** |
| **POM** | **Particulate Organic Matter** |
| **PS** | **Point Source** |
| **RTG** | **Reservoir Technical Group** |
| **SCWQP** | **Soil Conservation and Water Quality Plan** |
| **SSA** | **Science Services Administration** |
| **SSO** | **Sanitary Sewer Overflow** |
| **SWAP** | **Small Watershed Action Plan** |
| **SWM** | **Stormwater Management** |
| **TMDL** | **Total Maximum Daily Load** |
| **TN** | **Total Nitrogen** |
| **TP** | **Total Phosphorus** |
| **TSI** | **Trophic State Index** |
| **TSS** | **Total Suspended Solids** |
| **URDL** | **Urban Rural Demarcation Line** |
| **USGS** | **United States Geological Survey** |
| **USLE** | **Urban Soil Loss Equation** |
| **WAG** | **Watershed Advisory Group** |
| **WIP** | **Watershed Implementation Plan** |

| | |
|---|---|
| **WLA** | **Waste Load Allocation** |
| **WQBEL** | **Water Quality Based Effluent Limitations** |
| **WQIA** | **Water Quality Improvement Act** |
| **WQLS** | **Water Quality Limited Segment** |
| **WQMP** | **Water Quality Management Plan** |
| **WRAS** | **Watershed Restoration Action Strategy** |
| **WWTP** | **Waste Water Treatment Plant** |

This Implementation Plan (IP) has been prepared to address the trash and debris problem in the Middle Branch and Northwest Branch portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment (MB/NWB Patapsco). The amount of trash that needs to be reduced has been determined by a Total Maximum Daily Load (TMDL) developed by Maryland Department of the Environment and, after a public comment period, submitted to US Environmental Protection Agency (EPA) – Region 3 for review and approval. EPA approved the TMDL on January 5, 2015. Final TMDL documents can be found at MDE's website under Current Status of TMDL Development in Maryland. See the document is entitled **Total Maximum Daily Loads of Trash and Debris for the Middle Branch and Northwest Branch Portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment, Baltimore City and County, Maryland**

## 1.1 What is a TMDL

A TMDL has two different meanings. It is the document that is produced by MDE when any Maryland waterbody is listed on the state's 303(d) list of impaired and threatened waters. MDE must then submit the TMDL to EPA for approval. Any time a TMDL document is developed, extensive scientific study is done on the pollutant of concern in the listed waterbody. This study is done with the goal of finding the maximum load of the pollutant that the waterbody can receive and still meet Maryland's water quality standards. It is often thought of as a "pollution diet" for the watershed. All of the studying and monitoring that is done in preparing the TMDL document boils down to a single maximum load number that will be the target for pollution reduction in the waterbody. This number is also called a TMDL. In other words, the goal of the TMDL document is to justify the TMDL number, which can be found within the TMDL document.

The trash TMDL is unique in that, unlike most TMDLs, the Trash TMDL is expressed in terms of quantity to be removed from the water, while normally a TMDL is the maximum pollutant level that can be added to a waterbody each year. The trash TMDL is expressed in terms of removal from the waterbody because the TMDL has been set equal to 100 percent removal of the baseline trash load. The TMDL methodology will be discussed in detail in section 3. The trash removal TMDL must be achieved in addition to existing removal rates, with the exception of structural trash removal BMPs. The distinction between different trash removal BMPs will be discussed in detail in section 8.

All TMDLs are expressed in terms of wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources. Point sources are pollution sources that can be traced to a particular source, such as a pipe, therefore, WLAs have been assigned to municipal separate storm sewer systems and other regulated sources of input. In the trash TMDL, WLAs have been designated as trash items that can typically enter the storm sewer system through storm drains. Nonpoint sources are sources that cannot be traced to a particular input point. LAs have been designated as the larger trash and debris items that cannot enter storm drains and are attributed to activities such as dumping. Typically LAs will also include some level of natural background input, however, it is assumed that there is no natural background input for trash. All TMDLs must also have a margin of safety (MOS) to account for uncertainty. The uncertainty can be due to lack of sufficient data for model calibration, or uncertainty in the model itself. An explicit MOS of 5% was incorporated into the TMDL as well as an explicit MOS from conservative

assumptions incorporated into the allocations. This methodology will be further discussed in section 3.

### *1.1.1 How is the Final TMDL Determined*

The process of determining a TMDL number can be very complex. Pollution data is regularly collected throughout Maryland by many different federal, state, and local government agencies as well as universities and watershed organizations. The agency or organization may send individuals out to the stream to collect and measure information about the watershed as part of a study or regular monitoring program.

The data that was used to calculate the Trash TMDL is unique in that it is mainly data that was collected by monitoring programs of Baltimore City and Baltimore County governments that were specifically designed for use in the TMDL. It was necessary to create programs specifically for the TMDL because the trash loads needed to be collected, dried, and measured in such a way to minimize systematic error. The process of TMDL development will be explained in Section 3.

In all cases, scientists first find a baseline load for the pollutant. The baseline load is how much of the pollutant is in the waterbody at the time of the study, before restoration actions specifically developed to reach the TMDL number are implemented. The calculated target number, that is the TMDL, is the final goal. It could be thought of as the finish line in the TMDL process. That is not to say that other restoration efforts will not continue once that target is reached, but that the waterbody will be able to meet state water quality standards and can be removed from the list of impaired and threatened waters for that particular pollutant.

## 1.2 Geographic Area

Pollution reduction goals are determined by watershed. A watershed is all the land area where all of the water that runs off that land and all the water running under that land drain into the same place. Everything within a watershed is linked by a common water destination. Watersheds exist at many levels: some very large, and some quite small. Identifying your watershed is similar to identifying your current location on a map. You could say you are in the United States, or that you are in Maryland, or that you are in your kitchen at your specific street address. Similarly, you could say that you are in the Mid-Atlantic Region Watershed, which drains to the Atlantic Ocean, Long Island Sound and Riviere Richelieu, a tributary of the St. Lawrence River. You could also say that you are in the Upper Chesapeake Bay Watershed, which includes the area of drainage to the Chesapeake Bay that is north of the Maryland-Virginia line. Both would describe a watershed that you are located in. However, watersheds can become much more specific.

A system was established by the U.S. Geologic Survey for dividing the U.S. into successively smaller hydrologic units. Each hydrologic unit is identified by a Hydrologic Unit Code (HUC), which range from two to twelve digits. The smaller the scale of the watershed, the more digits it has in its code. For example, the Mid-Atlantic Region is a 2-digit watershed and the Upper Chesapeake Bay is a 4-digit watershed. The 6-digit unit, also known as the “basins” unit, is to serve as the common scale for watershed assessments at the national level, but the condition of these basins can be determined based on an aggregation of assessments of even smaller watershed units. Maryland has chosen to go the route of assessing smaller watershed units. As a result, TMDLs are determined at the 8-digit watershed scale. For a further explanation of HUCs or to see maps of watersheds at different HUC levels, go to: USGS Hydrologic Unit Maps. If

you would like to know which Maryland 8-digit watershed you are located in, go to MDE's Find My Watershed Map.

It is important to note that 8-digit watersheds can overlap multiple counties and may, therefore, have several regulating authorities. Also note that the trash TMDL watershed is made up of multiple 8-digit watersheds and does in-fact overlap both Baltimore County and Baltimore City.

### *1.2.1 Trash TMDL Geographic Area*

In Baltimore County, the MB/NWB Patapsco is comprised of the Jones Falls and Gwynns Falls watersheds. The Jones and Gwynns Falls are not listed as impaired for trash, but they drain to the portions of the PATMH shoreline that is listed as impaired. The entire Jones Falls watershed drains into the Northwest Branch impairment and Gwynns Falls watershed of Baltimore County drains into the Middle Branch impairment.

The Jones Falls watershed is located in the Patapsco River region of the Chesapeake Bay watershed in portions of Baltimore County and Baltimore City, Maryland. The Jones Falls watershed comprises approximately 25,933 acres within Baltimore County. The Jones Falls mainstem flows east and south from its headwaters in Garrison, Maryland to its discharge into the Inner Harbor in downtown Baltimore. Several tributaries drain to the Jones Falls including Moores Branch, Roland Run, Towson Run, Western Run, and Stony Run. An impoundment is located at Lake Roland, just north of the Baltimore County/City boundary.

The Gwynns Falls watershed is located within portions of Baltimore County and Baltimore City. The Gwynns Falls watershed comprises approximately 28,654 acres within Baltimore County and is located in the western portion of the county. The watershed includes the towns of Glyndon, Owings Mills, Lochearn, and Woodlawn. Figure 5.1 shows the location of the Jones Falls and Gwynns Falls watersheds within the MB/NWB Patapsco.

This IP only discusses the characteristics of the portions of the watershed located within Baltimore County (Figure 1-1).

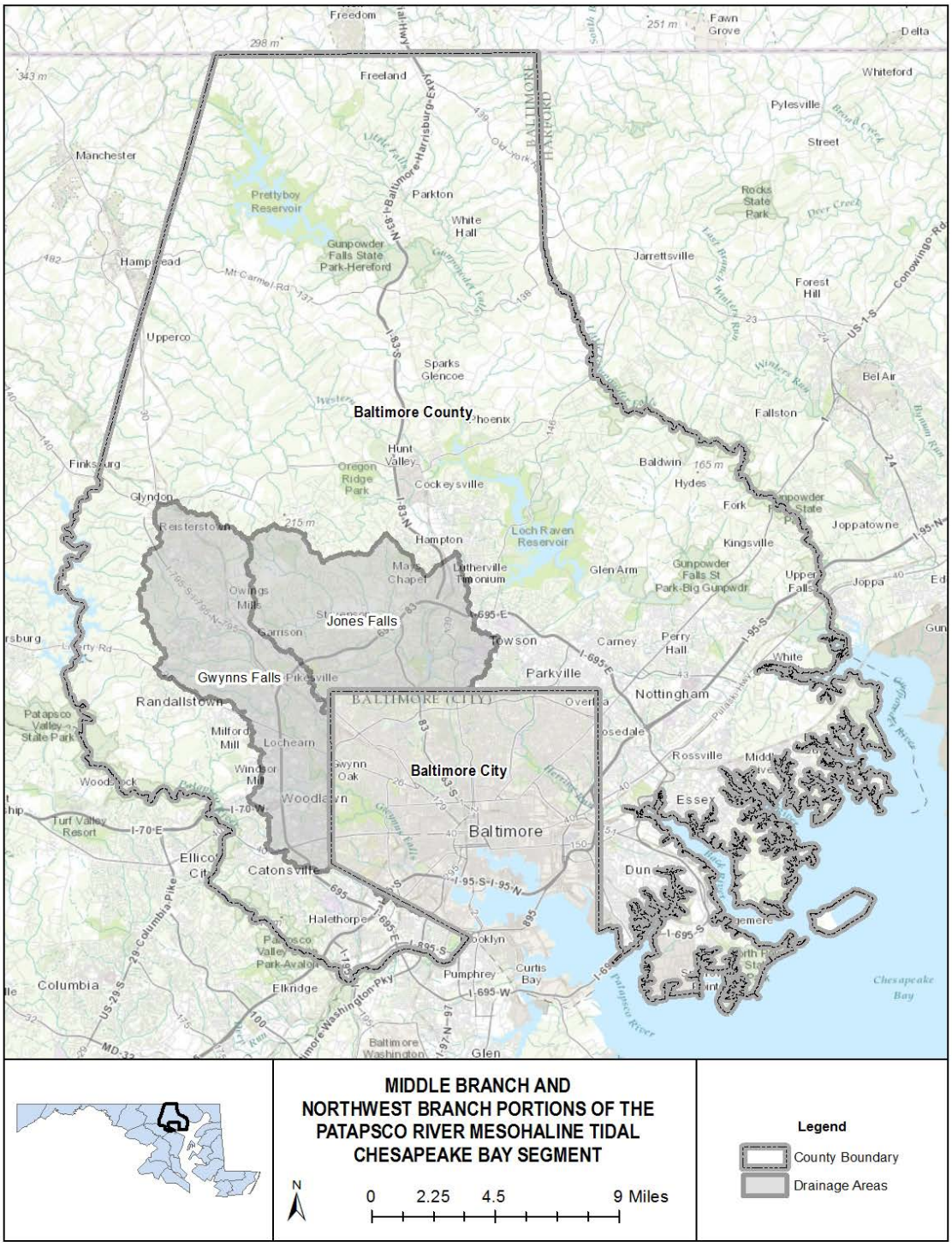


**Figure 1-1: General Location Map of the Middle Branch and Northwest Branch of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment Watershed**

## 1.3 Goal of the TMDL Implementation Actions

TMDL Implementation Plan Objective:

Through a cooperative effort of Baltimore County Department of Environmental Protection and Sustainability, other county agencies, local watershed associations, and the general public, to provide a comprehensive plan of action for achieving TMDL targets and ultimately restoring the health of Baltimore County waters to acceptable water quality standards.

Water quality standard for trash:

There is not a numeric water quality standard for trash. Trash and debris was determined to be a water quality impairment based on a narrative standard set by the regulation of COMAR Title 26 Subtitle 08, Chapter 2, which states that all surface waters of the state shall be protected for water contact recreation, fishing, and protection of aquatic life and wildlife. This chapter also states that stream segments shall be given additional protection required for their use class designations.

Additionally, waters of the state of Maryland may not be polluted by:

1) Substances attributable to sewage, industrial waste, or other waste that will settle to form sludge deposits that:
   a) Are unsightly, putrescent, or odorous, and create a nuisance, or
   b) Interfere directly or indirectly with designated uses;
2) 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:
   a) Be unsightly;
   b) Produce taste or odor;
   c) Change the existing color to produce objectionable color for aesthetic purposes;
   d) Create a nuisance; or
   e) Interfere directly or indirectly with designated uses.

The trash TMDL target has, therefore, been set to 100% removal. The water quality impairment in this waterbody is based on the determination that the standards listed above are not being met. Because there is no standard loading of trash to a waterbody that can be deemed not unsightly or not interfering with recreational use, the removal of 100% of the trash load from water body is the only assured way to meet those standards. Note that a TMDL target equal to 100% removal of the baseline load is not the same as zero trash in the waterway, but it should result in compliance with the narrative water quality standard above, as determined by the agencies responsible for interpreting the standard (Maryland Department of Environment 2014).

## 1.4 Document Organization

The Baltimore County TMDL implementation plans provide the following information to explain the necessity of the TMDL Implementation Plan and to develop a management strategy that will be followed in order to meet county TMDL reduction targets. The County will take an adaptive management approach that will include periodic assessments to determine progress and identify changes needed in the management strategy to meet the reduction targets in a timely, cost effective manner.

### *Section 1 - Introduction*

This Introduction states the pollutant that is being addressed by the TMDL IP, and the watershed for which the IP was developed. It provides a background on what a TMDL is and how the TMDL is determined. A general description of the geographic area for the specific IP is provided. The Introduction also states the overall goal of the TMDL IP and summarizes the actions that have been identified to bring Baltimore County to that goal. It also includes a brief summary of the contents of the thirteen sections of the TMDL Implementation Plan.

***Section 2 - Regulatory Policy and Planning***

This part of the document describes the administration and legal authority that mandates the development of Baltimore County's TMDL implementation plan and oversees its fulfillment. It will provide a background of how various regulating authorities and policies are related to the requirement to develop a TMDL Implementation Plan. It will also summarize the various planning guidance documents that have been produced to assist in the development of TMDL Implementation Plans and how TMDL Implementation Plans fit in the overall Baltimore County planning context.

***Section 3 - TMDL Summary***

The section summarizes the original TMDL document that was submitted by MDE and approved by the EPA. The summary includes: when the TMDL was developed, what is impaired, why the TMDL was developed, a description of the analysis process that was used to determine the total maximum daily load targets, the baseline year of data collection and analysis, the results from that analysis, and a further break down of the target loads by source sector.

***Section 4 - Literature Summary***

Each TMDL IP will address a specific pollutant. This part of the document provides an overview of the pollutant that is summarized from published literature. The literature summary includes known sources of the pollutant, the impacts associated with the pollutant, the pathways and transformations of the pollutant, and other relevant ecological processes that affect how the pollutant can be controlled and regulated.

***Section 5 - Watershed Characterization***

Characterization of the watershed will include geographical and technical information for the portion of the watershed that is specific to each TMDL IP. Each characterization will describe the watershed acreage, population size, geology and soils, topography, land use, streams, infrastructure related to watershed pollution sources, implemented restoration projects since the baseline year, and changes in pollutant load since the baseline year.

***Section 6 – Existing Data Summary***

This section will include a summary of Baltimore County's existing monitoring data that will be pertinent to the pollutant in question. It may also include some data received from sources other than Baltimore County, such as data from the Maryland Department of the Environment, or other relevant sources.

***Section 7 - Summary of Existing Restoration Plans***

Previous planning efforts will be summarized in this section. Water Quality Management Plans (WQMP) and Small Watershed Action Plans (SWAP) applicable to the IP area are identified. The process and goals for SWAP development are explained.

***Section 8 - Best Management Practice Efficiencies***

This section is an explanation of the best management practices that will be used for removing the particular pollutant and the known efficiency of those best management practices. A table will be found in this section of BMPs and the known reduction efficiency for the pollutants that can be reduced by each BMP. BMP efficiencies will also include a discussion of the uncertainty and research needs for BMPs.

***Section 9 - Implementation***

The implementation section will provide a description of programmatic, management, and restoration actions; and pollutant load reduction calculations to meet the pollutant reduction target for the specific pollutant. For each of the programmatic, management, and restoration actions there will be a list of responsible parties, actions, timeframe of actions, and performance standards.

***Section 10 - Assessment of Implementation Progress***

Assessment of implementation progress will give Baltimore County a formal method of reporting on the development of implementation and of describing the progressive success of implementation actions. The section will include a description of tracking and reporting mechanisms, and a monitoring plan that includes progress monitoring as well as BMP effectiveness monitoring.

***Section 11 - Continuing Public Outreach Plan***

This part of the document will be a continuing public outreach plan. It will encourage public involvement in the implementation process, extending beyond the finalization of this document.

***Section 12 - References***

A list of references used in the creation of this document will be provided.

The Legal Authority, Policy, and Planning Framework section will present, in brief, the background on the legal requirements that pertain to the development of Total Maximum Daily Loads (TMDLs), and the preparation of TMDL Implementation Plans. This section will also cover the planning framework for the development of the TMDL Implementation Plans (IP). Furthermore, this section is intended to provide the context for the development of this TMDL Implementation Plan and understanding of the linkage between water quality and the TMDL. Whether at the federal or state level there are a number of processes at work that result in the regulations that must be followed to remain within the law. First, legislation is passed by an elected governing body (e.g. Congress, state legislature), and once passed and signed by the executive branch, they become Acts (laws), such as the Clean Water Act. In order to provide guidelines in maintaining compliance with these laws, it is often necessary that regulations be issued to specify the law's requirements. A regulation is a rule issued by a government agency that provides details on how legislation will be implemented, and may set specific minimum requirements for the public to meet if they are to be considered in compliance with the law. These regulations may come in various forms, such as the Code of Federal Regulations (CFR), or Code of Maryland Regulations (COMAR). The information that follows is generally taken from CFR and COMAR.

Under the CFR, Title 40 encompasses the regulations enforced by the U.S. Environmental Protection Agency (EPA). These regulations include not only those related to water quality, but also air quality, noise, and a variety of land based regulations (oil operations, etc.)

## 2.1 Regulatory and Policy Framework

The ultimate regulatory authority for protecting and restoring water quality rests with the federal government through legislative passage of the Clean Water Act in 1972 and subsequent amendments. Prior to the Clean Water Act (1972), the Federal Water Pollution Control Act (1948) served as the basis for controlling water pollution. The Clean Water Act significantly amended the Federal Water Pollution Control Act and established the basic structure for regulating discharges of pollutants into the waters of the United States. Major amendments were enacted in 1977 and 1987 that further strengthened and expanded the Clean Water Act of 1972. The 1987 amendments incorporated the requirement that stormwater discharges from urban (municipal) areas be required to obtain a permit for discharge and that stormwater discharges from industrial sources also be permitted. There have been a number of minor amendments and reauthorizations over the years that have resulted in the law as it now stands.

There are several significant provisions of the Clean Water Act that pertain to TMDLs. These provisions include the requirement that states adopt Water Quality Standards by designating waterbody uses and set criteria that protect those uses. The Clean Water Act also requires states to assess their waters and provide a list (known as the 303(d) list) of waters that are impaired. The list specifies the impairing substance and requires that a TMDL be developed to address the impairment.

Through policy (memos dated November 22, 2002 and November 12, 2010) the EPA has indicated that the pollutant loads attributable to regulated stormwater discharges are to be included in the Waste Load Allocation as a point source discharge and not as part of the non-point load. The initial memo also affirmed that the Water Quality-Based Effluent Limitations (WQBELs) in Municipal Separate Storm Sewer System (MS4) permits may be expressed in the

form of Best Management Practices (BMPs) and not as numeric limits for stormwater discharges. The second memo clarified that when the MS4 permits are expressed in the form of BMPs, the permit should contain objectives and measurable elements (e.g., schedule for BMP installation or level of BMP performance). By providing both an expected level of BMP performance and a schedule of implementation of the various practices, Baltimore County will have addressed this requirement. This plan once approved by Maryland Department of the Environment (MDE) will be enforceable under the terms of the permit.

## 2.2 Maryland Use Designations and Water Quality Standards

In conformance with the Clean Water Act, the State of Maryland has developed use designations for all of the waters in Maryland, along with water quality standards to maintain the use designations.

Designated uses define an intended human and aquatic life goal for a waterbody. It takes into account what is considered the attainable use for the waterbody, for protection of aquatic communities and wildlife, use as a public water supply, and human uses, such as recreation, agriculture, industry, and navigation. Water quality standards include both the Use Designation and Water Quality Criteria (numeric standards). Water Quality Criteria are developed to protect the uses of a waterbody.

### *2.2.1 Use Class Designations*

Every stream, lake, reservoir, and tidal waterbody in Maryland has been assigned a Use Designation. The Use Designation is linked to specific water quality standards that will enable the Designated Use of the waterbody to be met. A listing of the Use Designations follows:

- Use I: Water contact recreation, and protection of nontidal warm water aquatic life.
- Use II: Support of estuarine and marine aquatic life and shellfish harvesting (not all subcategories apply to each tidal water segment)
    - Shellfish harvesting subcategory
    - Seasonal migratory fish spawning and nursery subcategory (Chesapeake Bay only)
    - Seasonal shallow-water submerged aquatic vegetation subcategory (Chesapeake Bay only)
    - Open-water fish and shellfish subcategory (Chesapeake Bay only)
    - Seasonal deep-water fish and shellfish subcategory (Chesapeake Bay only)
    - Seasonal deep-channel refuge use (Chesapeake Bay only)
- Use III: Nontidal cold water – usually considered natural trout waters
- Use IV: Recreational trout waters – waters stocked with trout

The letter "P" may follow any of the Use Designations, if the surface waters are used for public water supply. There may be a mix of Use Classes within a single 8-digit watershed; for example, Gwynns Falls has Use I, Use III, and Use IV Designations depending on the subwatershed.

**Table 2-1: Designated Uses and Applicable Use Classes**

| Designated Uses | Use Classes | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | I | I-P | II | II-P | III | III-P | IV | IV-P |
| Growth and propagation of fish (not trout), other aquatic life and wildlife | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Water contact sports | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Leisure activities involving direct contact with surface water | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Fishing | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Agricultural water supply | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial water supply | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Propagation and harvesting of shellfish | | | ✓ | ✓ | | | | |
| Seasonal migratory fish spawning and nursery use | | | ✓ | ✓ | | | | |
| Seasonal shallow-water submerged aquatic vegetation use | | | ✓ | ✓ | | | | |
| Seasonal deep-water fish and shellfish use | | | ✓ | ✓ | | | | |
| Seasonal deep-channel refuge use | | | ✓ | ✓ | | | | |
| Growth and propagation of trout | | | | | ✓ | ✓ | | |
| Capable of supporting adult trout for a put and take fishery | | | | | | | ✓ | ✓ |
| Public water supply | | ✓ | | ✓ | | ✓ | | ✓ |

### *2.2.2 Water Quality Criteria*

Water quality criteria are developed to protect the uses designated for each waterbody. Certain standards apply over all uses, while some standards are specific to a particular use. The criteria are based on scientific data that indicate threats to aquatic life or human health. For the protection of aquatic communities, the criteria have been developed for fresh water, estuarine water, and salt water. The criteria have been further based on acute levels (have an immediate negative effect) and chronic levels (have longer term effects). The human health criteria are based on drinking water levels, organism consumption levels, or a combination of drinking water and organism consumption levels, or recreational contact levels.

Water contact sports and leisure activities result in direct contact with surface water. In the case of trash pollution, direct contact with surface water may be hazardous to human health because humans could be injured by floating debris or by submerged trash. Therefore, the protection of this designated use, as granted by the water quality standards discussed above, includes the protection against potentially hazardous trash and debris.

Dissolved oxygen criteria for all Use Designations is 5 mg/L, except for Use II Designations and special criteria for drinking water reservoir hypolimnion waters (bottom waters of the reservoir).

Bacteria criteria are based on human health concerns, and apply to all Uses, with additional bacteria criteria applicable in shellfish waters. Since none of the local TMDLs are related to the shellfish criteria, they are not discussed here. The human health criteria are based on either the geometric mean of 5 samples or single sample criteria based on the frequency of full body

contact, these criteria are displayed in Table 2-2. For the freshwater bacteria TMDLs the indicator bacteria *E. coli* has been used in the development of the TMDL, therefore serves as the water quality end point. The human health recreational contact bacteria criteria are displayed in Table 2-2. The table displays both the geometric mean for bacteria and single sample maximum allow bacteria concentrations based on the frequency of full body contact.

**Table 2-2: Bacteria Criteria for Human Health (MPN/100 ml)**

| Indicator | Steady State Geometric Mean Density | Single Sample Maximum Allowable Density | | | |
|---|---|---|---|---|---|
| | | Frequent Full Body Contact Recreation | Moderately Frequent Full Body Contact Recreation | Occasional Full Body Contact Recreation | Infrequent Full Body Contact Recreation |
| **Freshwater (Either Apply)** | | | | | |
| *Enterococci* | 33 | 61 | 78 | 107 | 151 |
| *E. coli* | 126 | 235 | 298 | 410 | 576 |
| **Marine** | | | | | |
| *Enterococci* | 35 | 104 | 158 | 275 | 500 |

## 2.3 Planning Guidance

In March of 2008 the EPA released a guidance document on the development of watershed plans entitled *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. The handbook laid out nine minimum elements to be included in watershed plans, commonly called the "a through i" criteria. The criteria include:

a) An identification of the causes and sources or groups of sources that will need to be controlled to achieve the load reductions estimated in the watershed plan.
b) Estimates of pollutant load reductions expected through implementation of proposed Nonpoint Source (NPS) management measures.
c) A description of the NPS management measures that will need to be implemented.
d) An estimate of the amounts of technical and financial assistance needed to implement the plan.
e) An information/education component that will be used to enhance public understanding and encourage participation.
f) A schedule for implementing the NPS management measures.
g) A description of interim, measurable milestones for the NPS management measures.
h) A set of criteria to determine load reductions and track substantial progress towards attaining water quality standards.
i) A monitoring component to evaluate effectiveness of the implementation efforts over time.

EPA now evaluates watershed plans on the basis of the above criteria in consideration of its grant funding. The State of Maryland is also increasingly using the above criteria for funding consideration. Baltimore County has used these criteria since the publication of the handbook in the development of its Small Watershed Action Plans; and will use the criteria in the development of this TMDL Implementation Plan.

MDE developed a guidance document in conjunction with local government representatives entitled *Maryland's 2006 TMDL Implementation Guidance for Local Governments*, which provides a framework for the development of TMDL Implementation Plans. MDE has also provided guidance on the development of TMDL Implementation Plans related to specific pollutants. Guidance for specific pollutants includes:

- PCBs
- Bacteria
- Mercury
- Trash

These guidance documents have been taken into consideration in the development of the Baltimore County TMDL Implementation Plans.

### 2.4 Water Quality Standards Related to This Implementation Plan

The Jones Falls and Gwynns Falls watersheds flow into the Middle Branch and Northwest Branch Portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment. Baltimore County portion of the Jones Falls (02-13-09-04) watershed contains Use I and Use III waterbodies. Use I includes water contact recreation and protection of warm water fisheries, while Use III includes water contact recreation and cold water fisheries. The Baltimore County potion of the Gwynns Falls (02-13-09-05) watershed contains Use I, III and IV waterbodies. Use IV include recreational trout waters.

The water quality criteria applicable to the Trash and Debris TMDL is a narrative water quality standard based on the interpretation of COMAR Title 26 Subtitle 08, Chapter 2. This section of the COMAR Regulation states the following:

COMAR 26.08.02.07:

> A. All surface waters of this State shall be protected for water contact recreation, fishing, and protection of aquatic life and wildlife.

COMAR 26.08.02.01:

> (3) Waters of this State shall be protected for the basic designated uses in Regulation .02A.

COMAR 26.08.02.03:

> B. General Water Quality Criteria. The waters of this State may not be polluted by:
>
> (1) Substances attributable to sewage, industrial waste, or other waste that will settle to form sludge deposits that:
>
> (a) Are unsightly, putrescent, or odorous, and create a nuisance, or
>
> (b) Interfere directly or indirectly with designated uses
>
> (2) 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:
>
> (a) Be unsightly;
>
> (b) Produce taste or odor;
>
> (c) Change the existing color to produce objectionable color for aesthetic purposes;
>
> (d) Create a nuisance; or
>
> (e) Interfere directly or indirectly with designated uses;

While there is currently no quantitative limit on the amount of trash that can enter a waterbody in the state of Maryland, the Trash TMDL has been set to 100% removal of the baseline to ensure that all of the above narrative criteria are met. The TMDL requirement of 100% removal is not the same as a limit of zero trash in the waterway. As stated in the TMDL, success in meeting the

TMDL should result in compliance with each of the narrative criteria prescribed above, as determined by the agencies responsible for interpreting the standard (Maryland Department of Environment 2014)**.**

The TMDL summary provides context for the TMDL implementation plan. It is necessary to understand some basic information from the original TMDL document that preceded this particular implementation plan. The TMDL document describes the condition of the watershed at the time that the baseline load of the pollutant was calculated. The baseline load is simply a measurement of the amount of the pollutant that was in the waterbody during a specific time. The baseline load provides a starting pollutant measurement for the county to reduce from, in order to meet the TMDL target. The term TMDL is also used to describe the specific numeric load target, which is explained in detail within the TMDL document. The original TMDL document provides a detailed justification for choosing the TMDL target number. This justification is a description of the entire technical process including monitoring methods and calculations. The following section is a simplification of that section of the TMDL document and a brief explanation of why the TMDL was developed for the specific pollutant in this watershed.

## 3.1 TMDL Background

> The Problem: The TMDL was developed because there is sufficient data to conclude that the levels of trash in the watershed exceed that which is supportive of the water's use class designations, and/or could be considered unsightly, and/or create a nuisance, and/or produce taste or odor, and/or change the color of the water to one that is not aesthetically pleasing (Maryland Department of Environment 2014) (COMAR 2012).

The Middle Branch and Northwest Branch portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment was listed as being impaired by trash in 2008. MDE developed the TMDL and submitted it to EPA in 2014. It was approved by EPA in 2015.

The trash TMDL is unlike other TMDLs because the TMDL is calculated in terms of removal, rather than a maximum input. The removal required by the TMDL is 100% from the baseline load, measured in 2010.

## 3.2 TMDL Development

The Baltimore County Department of Environmental Protection and Sustainability and Baltimore City Department of Public Works Water Quality Monitoring and Inspections each conducted a separate study to provide data for the TMDL.

The study conducted by Baltimore City occurred between January and September 2011. It consisted of sampling at five stormwater outfalls, two within the Jones Falls and three within the Gwynns Falls. Sampling sites were selected based on a number of different factors including socioeconomic factors, land use and accessibility. Once sampling sites were selected, collection devices were installed at each selected outfall. Sampling took place approximately every 2-4 weeks, based on the amount of trash and debris in the collection device. Samples were manually collected and organic debris was removed from the sample. Containers that held liquid were emptied before weighing the sample.

The Baltimore County TMDL study occurred between October 2010 and October 2011. Twenty instream sites and seventeen stormwater management facilities (SWM Facility) were randomly selected in the Jones and Gwynns Falls watersheds. The stream sites were then selected based on a stratified selection criteria with at least one site in each of the subwatersheds in the Jones and Gwynns Falls. Ultimately ten sites were selected in the Jones Falls and ten sites were selected in the Gwynns Falls. At each site, a 500 ft reach of the stream was measured off for the survey. All trash was collected within the bankfull of the reach. Field assessment of the stormwater

management facilities was conducted to determine if the facility conditions were conductive to trash. Facilities were measured within each land use category to gather a representative sample of that land use. Trash was collected within the fenced boundary of stormwater facility sites.

Trash was removed at each site prior to initial sampling in order to get an accurate estimate of seasonal loading. Collected trash was brought back to the laboratory and spread out on tarps to dewater. Items were emptied of liquids, sediments and other contents that would affect the normal weight of the items. The trash was sorted into 5 categories: plastic bottles; glass bottles; aluminum cans; other; and dumping. Categories were weighed individually and bottles and cans were counted. Table 3-1 below shows a summary of the Baltimore County SWM Facility data. The SWM Facility data was ultimately used for the TMDL baseline because this data was determined to be more reliable for producing loading rates than the stream data.

**Table 3-1: Baltimore County Trash Monitoring – SWMF Site Data**

| SWM Facility # | DA Acres | Winter (lbs) | Spring (lbs) | Summer (lbs) | Fall (lbs) | Baseline (lbs) | Lbs./ Acre | Land Use |
|---|---|---|---|---|---|---|---|---|
| 564 | 17.6 | 8.9 | 15.8 | 8.4 | 5.2 | 38.3 | 2.2 | LDR |
| 3953 | 3.7 | 0.5 | 0.6 | 0.1 | 0.1 | 1.3 | 0.4 | LDR |
| 4172 | 9.0 | 1.0 | 1.0 | 0.9 | 0.5 | 3.4 | 0.4 | LDR |
| 4171 | 5.0 | 0.6 | 0.8 | 0.5 | 0.6 | 2.5 | 0.5 | LDR |
| | | | | | | | | |
| 1112 | 17.4 | 14.6 | 34.5 | 24.5 | 16.9 | 90.5 | 5.2 | MDR |
| 1580 | 9.5 | 8.4 | 2.8 | 10.2 | 1.8 | 23.2 | 2.4 | MDR |
| 3307 | 11.5 | 4.5 | 9.8 | 1.0 | 1.5 | 16.8 | 1.5 | MDR |
| 3552 | 18.3 | 9.2 | 6.0 | 1.7 | 2.5 | 19.4 | 1.1 | MDR |
| | | | | | | | | |
| 270 | 7.3 | 31.1 | 56.4 | 20.9 | 33.0 | 141.4 | 19.4 | HDR |
| 1656 | 12.8 | 4.0 | 22.5 | 10.2 | 1.8 | 38.5 | 3.0 | HDR |
| 1340 | 23.8 | 45.0 | 46.9 | 22.4 | 21.3 | 135.6 | 5.7 | HDR |
| | | | | | | | | |
| 1709 | 13.8 | 23.0 | 19.5 | 16.2 | 20.7 | 79.4 | 5.8 | Comm |
| | | | | | | | | |
| 1731 | 3.8 | 1.8 | 9.0 | 1.6 | 2.7 | 15.1 | 4.0 | Roadway |
| 3264 | 12.3 | 1.1 | 1.1 | 0.7 | 1.9 | 4.8 | 0.4 | Roadway |
| | | | | | | | | |
| 3641 | 13.6 | 13.6 | 16.3 | 4.5 | 4.8 | 39.2 | 2.9 | Institutional |
| 2207 | 3.9 | 0.5 | 1.5 | 1.0 | 0.6 | 3.6 | 0.9 | Institutional |
| | | | | | | | | |
| 2949 | 7.7 | 8.5 | 3.7 | 2.6 | 1.5 | 16.3 | 2.1 | Open Urban |
| **Total (lbs)** | | **176.3** | **248.2** | **127.4** | **117.4** | **669.3** | **3.5** | |

The data collected by the city and county monitoring programs was used to establish a baseline load for both point and non-point sources. Items that are too large to move through the storm drain were considered non-point source load and items that are small enough to be carried through the storm drain system were considered point source load. Baseline loads do not include natural debris.

### *3.2.1 Point Source Load Calculation*

The Baltimore County point source baseline load was determined using only the stormwater management facility data. Stormwater management facility site number 270 was removed from the data set because it was determined that it was an outlier in the data.

Trash sampling data for both county and city was normalized by inches of precipitation, due to a strong correlation between trash and rainfall. Rainfall is the primary mode by which trash enters the storm drains and streams. Precipitation for each sample was determined using data from the National Climatic Data Center (NCDC).

Total weight of the trash (lbs) was divided by the total drainage acres and by precipitation to get a normalized loading rate (lbs/ac/in). The normalized loading rate was then annualized by multiplying the 30 year normal rainfall.

$$\text{Annualized trash loading rate} = \frac{W_S}{A*R} * R_A \qquad \text{(Eq. 1)}$$

Where:

S= Sample event

W= Trash weight, in lbs

A= drainage area of sample site, in acres

R= rainfall during sample period, in inches

$R_A$= 30 year normal annual rainfall, in inches

Given that there were only five stations monitored in the city, and that the majority of the land use for those stations is urban, MDE decided to average annualized trash loading rates from all of the city sampling sites to determine a single land use loading rate for Baltimore City urban land use. The Baltimore City urban land use loading rate is 7.88 lbs/ac/yr.

There are some areas of the Gwynns Falls and Jones Falls in Baltimore City that are forested, these areas were given the Baltimore County forested land use loading rate.

Baltimore County's data was collected seasonally, so an annualized trash loading rate was first calculated for each season, then the four seasonal values was averaged to determine an annualized trash loading rate for the whole year. Finally, sites were grouped according to land use and the average for each land use was calculated. Table 3-2 shows the loading rates by land use calculated for Baltimore County.

**Table 3-2: Baltimore County Land Use Baseline Loading Rates**

| Land Use | Annualized Unit Loading Rate (lbs/ac/yr) | Number of Sites |
|---|---|---|
| **Low Density Residential** | 0.90 | 4 |
| **Medium Density Residential** | 2.45 | 4 |
| **High Density Residential** | 4.01 | 2 |
| **Commercial** | 7.91 | 1 |
| **Institutional** | 1.99 | 2 |
| **Open Urban** | 2.15 | 1 |
| **Roadway** | 2.06 | 2 |
| **Forest** | 0.02 | 2 |

### *3.2.2 Non-point Source Load Calculation*

Baltimore County collected data on Non-point source items when they were found. Non-point source data was found only at 8 individual sites with a total of 11 individual non-point source data events. Baltimore City did not collect any non-point source trash data and was therefore assigned the loading rate as Baltimore County. The total weight, in pounds, of the non-point

source trash was divided by total drainage acres and by total number of days between the start and end dates of the sample period. A normalized unit loading rate was determined, expressed in lbs/ac/day. The average of the 11 samples was taken to represent the non-point source loading rate. Table 3-3 shows the average of the annualized unit loading rate for the 11 samples.

$$\text{Annualized Trash Loading Rate} = \frac{W_s}{A*D} * 365 \frac{\text{days}}{\text{year}} \quad \text{(Eq.2)}$$

Where:

s= Sample event

W= trash weight, in lbs

A= drainage area of sample site, in acreas

D= number of days in sample period

**Table 3-3: Baltimore County Non-point Source Data**

| Site | Watershed | Dump (lbs) | lbs/ac/day | lbs/ac/year |
|---|---|---|---|---|
| **3641** | Gwynns Falls | 2.67 | 0.0038 | 1.40 |
| **G-DR-1** | Gwynns Falls | 25.00 | 0.0016 | 0.57 |
| **G-DR-3** | Gwynns Falls | 15.00 | 0.0005 | 0.20 |
| **G-GF-2** | Gwynns Falls | 4.00 | 0.0003 | 0.11 |
| **G-PM-1** | Gwynns Falls | 20.20 | 0.0001 | 0.04 |
| **G-SL-1** | Gwynns Falls | 9.20 | 0.0001 | 0.04 |
| **3307** | Jones Falls | 6.74 | 0.0049 | 1.79 |
| **J-LJF-1** | Jones Falls | 10.00 | 0.0027 | 0.98 |
| **G-DR-3** | Gwynns Falls | 13.23 | 0.0003 | 0.11 |
| **G-DR-3** | Gwynns Falls | 15.00 | 0.0003 | 0.12 |
| **G-GF-2** | Gwynns Falls | 10.00 | 0.0006 | 0.22 |
| **Average** | | | | 0.51 |

## 3.3 TMDL Results and Allocations by Source Sector

The TMDL is the sum of the wasteload allocations (WLAs) for point sources and load allocations (LA) for non-point sources plus a margin of safety (MOS). The TMDL endpoint is the water quality target. In this case, the TMDL endpoint is 100% removal of the baseline load. The TMDL value to be removed must be in addition to any trash removal processes that were already in place at the time that the baseline was measured. Due to Baltimore County's sampling method, the County will be allowed to count all structural trash removal BMPs toward the reduction rate.

Note that a TMDL target equal to 100% removal of the baseline load is not the same as zero trash in the waterway, but it should result in compliance with the narrative water quality standard (as stated in section 1.3) as determined by the agencies responsible for interpreting the standard (Maryland Department of Environment 2014).

### *3.3.1 Load Allocations: LA*

Table 3-4 shows the Annual non-point source load that must be removed for each watershed. Notice that the LA to be removed is 100% of the annual baseline plus the margin of safety.

Table 3-4: Annual and Daily LA Removal Requirements by Watershed

| Jurisdiction | Annual Baseline Non-point Source Load (lbs/yr) | MOS (5%) | Annual LA to be Removed (lbs/yr) | Daily LA to be removed (lbs/day) |
|---|---|---|---|---|
| **Baltimore Harbor** | 2,912.6 | 145.6 | 3,058.2 | 8.4 |
| **Gwynns Falls** | 21,271.1 | 1063.6 | 22,334.7 | 61.2 |
| **Jones Falls** | 19,013.8 | 950.7 | 19,964.5 | 54.7 |

### *3.3.2 Waste Load Allocation: WLA*

The WLA includes NPDES regulated MS4 discharges. Other point sources include areas of Baltimore City and Baltimore County that are not covered under the City, County or State Highway MS4 permits. These include industrial permitted facilities and other private property. Table 3-5 shows the Annual point source load to be removed for each watershed. The WLA to be removed is 100% of the annual baseline plus the margin of safety.

Table 3-5: Annual and Daily WLA Removal Requirements by Watershed

| Jurisdiction | Annual Baseline Non-point Source Load (lbs/yr) | MOS (5%) | Annual WLA to be Removed (lbs/yr) | Daily WLA to be removed (lbs/day) |
|---|---|---|---|---|
| **Baltimore Harbor** | 44,655.6 | 2,232.8 | 46,888.4 | 128.4 |
| **Gwynns Falls** | 173,076.5 | 8,653.8 | 181,730.3 | 497.8 |
| **Jones Falls** | 130,053.2 | 6,502.7 | 136,555.9 | 374.1 |

### *3.3.3 Annual TMDL Summary by Watershed*

Table 3-6, Table 3-7, and Table 3-8 show the annual trash TMDL for each of the three impaired watersheds. The TMDL is lbs/yr removed from the waterbody, unlike TMDLs for other pollutants where the TMDL is an input limit.

Table 3-6: Annual Trash TMDL for Baltimore Harbor Watershed

| WLA (lbs/yr removed) | | LA (lbs/yr removed) | MOS (5%) | TMDL (lbs/yr removed) |
|---|---|---|---|---|
| **Baltimore City Phase I MS4** | 42,869.4 | 2,912.6 | 2,378.4 | 49,946.6 |
| **Baltimore City Other Point Sources** | 1,786.2 | | | |
| **Total WLA** | 44,655.6 | | | |

Table 3-7: Annual Trash TMDL for Gwynns Falls Watershed

| WLA (lbs/yr removed) | | LA (lbs/yr removed) | MOS (5%) | TMDL (lbs/yr removed) |
|---|---|---|---|---|
| **Baltimore City: Phase I MS4** | 93,519.3 | 21,271.1 | 9,717.4 | 204,065.0 |
| **Baltimore City: Other Point Sources** | 2,892.3 | | | |
| **Baltimore County: Phase I MS4** | 72,831.6 | | | |
| **Baltimore County: Other Point Sources** | 1,533.3 | | | |
| **State Highway Administration** | 2,300.0 | | | |
| **Total WLA** | 173,076.5 | | | |

Table 3-8: Annual Trash TMDL for Jones Falls Watershed

| WLA (lbs/yr removed) | | LA (lbs/yr removed) | MOS (5%) | TMDL (lbs/yr removed) |
|---|---|---|---|---|
| **Baltimore City: Phase I MS4** | 81,107.0 | 19,013.8 | 7,453.4 | 156,520.4 |
| **Baltimore City: Other Point Sources** | 1,655.2 | | | |
| **Baltimore County: Phase I MS4** | 45,399.4 | | | |
| **Baltimore County: Other Point Sources** | 472.9 | | | |
| **State Highway Administration** | 1,418.7 | | | |
| **Total WLA** | 130,053.2 | | | |

This review pertains to direct and indirect effects of trash and littered debris on fresh water rivers and streams, specifically those effects that are relevant to the MB/NWB Patapsco. Available literature on litter pollution management for waters bodies is limited, but studies from other existing trash TMDL Implementation Plans are identified here. This is not intended to be an exhaustive review of primary literature, but rather a summary of the sources, pathways and biological effects of litter in non-tidal watersheds from literature available to Baltimore County Department of Environmental Protection and Sustainability.

## 4.1 Sources

Litter is a unique pollutant because there are no natural sources of litter. Human action is the sole source of this pollutant, whether the origin of the litter is a direct deposit into waterways, carried there by wind, or transported by stormdrain. Littering can be a deliberate action or a non-deliberate action, such as a spilled trash can or paper blowing out of a car window. Litter can be transported to waterways via wind, water (i.e. runoff), and direct disposal. Evidence of trash build up near storm drains that empty into local waterways suggest storm drains are a major conduit of trash into water (Keep America Beautiful Inc. 2009). Against common belief, trash is *not* filtered out of storm drains before emptying into a waterway in most areas in Baltimore County. Baltimore County currently uses a separate storm sewer system, meaning that storm drains are separate from the sewer system and do not lead to a waste water treatment facility. Instead, storm drains usually lead to a pipe that empties into a stream. Some pipes empty to stormwater ponds where trash is trapped in the pond instead of going to the stream.

## 4.2 Environmental Impact

Once litter accumulates, buffer zones and water quality are negatively impacted. Buffer zones of vegetation catch large amounts of trash, which prevents litter from reaching surrounding bodies of water. However, the aesthetics and health of the buffer zone are disturbed by the buildup of trash; its original function as habitat for wildlife is destroyed in the face of such pollution. Water quality and aesthetics of the waterbody itself are also impaired due to trash. Some litter such as cigarette butts, paints, and other materials release toxic chemicals into the water and sediment (Ocean Conservancy 2002). Pet waste bags, diapers, and other litter contribute to increased amounts of bacteria (California Regional Water Quality Control Board 2007).

Litter increases the risks to the safety and health of organisms that reside in and near the water. Trash can inhibit plant growth at the bottom of rivers and streams, which results in destroyed habitat and diminished food sources for wildlife. Some kinds of litter, such as plastic soda can rings, can physically constrict animals through entanglement. This may inhibit an animal's ability to digest, breathe, or move, jeopardizing its survival, and sometimes causing death. Sharp objects may also cut animals or humans and these wounds may become infected. Floating plastic exposed to UV from sunlight break into small pieces, which inhibit filter feeding organisms (California Regional Water Quality Control Board 2007). Some materials consumed by organisms will block the intestinal tract. Organisms replace their natural food source(s) with litter, which causes malnutrition and death. Overall, 100,000 mammals and 2 million birds die due to litter every year in the U.S (Ocean Conservancy 2002).

## 4.3 Existing Trash TMDL Implementation Plans

Another Trash TMDL was approved in 2010 for the Anacostia River Watershed for Montgomery and Prince George's Counties, Maryland and Washington DC. In response to the 2010 TMDL, individual trash TMDL implementation plans have been developed by the District of Columbia and by the two Maryland counties. These plans can serve as a valuable resource, showing how other governments have committed to tackle the trash and litter problem and meet their pollution reduction requirements.

Montgomery County developed an Anacostia Watershed Implementation Plan in 2012. In their plan, they aim to reach 68% reduction with structural and environmental site design (ESD) best management practices (BMPs). The remaining 32% is to be reached with non-structural BMPs such as education and outreach, and enforcement. In their plan, structural stormwater BMPs were assigned a 95% removal credit and trash nets and trash traps were given a 90% reduction.

Prince George's County looked at current programs and opportunities for program enhancements to meet trash reduction loads. They identified trash hotspots as part of a gap analysis to find areas where there is room for improvement among their existing programs. In estimating trash reduction from existing programs, they looked at source control, trash cleanups, street sweeping and existing structural BMPs. They offered suggested enhancements based on their gap analysis including increased street sweeping, and increased enforcement and estimated percent reductions for each of these enhancements.

Washington DC will utilize In –stream and end-of-pipe best management practices, skimmer boat activities, stream and river cleanup activities, roadway and block cleanup activities, street sweeping of environmental hotspots, education and outreach and regulatory approaches to meet their trash TMDL. The district will report implementation annually including new practices and their respective load reduction calculation methodologies as they are implemented.

## 4.4 Other Litter Reduction Strategies

Keep America Beautiful performed a national littering study. 17% of disposals were improper and 81% of those littering events were intentional (Keep America Beautiful Inc. 2009). Most commonly littered materials included cigarette butts, paper, and plastic. Despite a 61% decrease in roadside litter between 1968 and 2008, there are still combinations of variables that influence individuals to litter. Some variables related to physical surroundings such as presence of waste receptacles and amount of existing litter, while personal variables included age, awareness, and attitudes of the litterer.

The Keep America Beautiful study showed that littering is more likely to occur in an environment where trash, recycling, and cigarette butt receptacles are sparse or inconveniently far away. Of the sites observed in the study, 91% had at least one trash container compared to 47% with at least one cigarette butt receptacle and a mere 12% of sites had at least one recycling container (Keep America Beautiful Inc. 2009). Multiple localities are solving these issues by mandating the addition of waste containers. For instance, the Vermont Act 148 of 2012 mandated that a recycling container be placed next to any State or municipally-owned trash container. In Maryland, Montgomery County also requires this, and Baltimore County is working towards implementation of a similar mandate by 2017 (Montgomery County Department of Public Works and Transportation 2005) (Maryland Department of the Environment 2014). Increasing the number of waste bins, especially cigarette butt and recycling receptacles, is one measure being implemented to prevent litter.

Younger individuals are more likely to litter than older individuals, which means youth are a unique target for litter reduction outreach and education (Keep America Beautiful Inc. 2009). Public outreach through national ad campaigns, websites, billboards, decals, flyers, posters, and education events are ways to publicize trash and litter reduction to the general public, especially youth. This campaign appears geared towards youth due to its inclusion of an interactive, online game. T-shirts and radio campaigns like "Go Recycle" are local outreach options that are already in place in Montgomery County, MD (Maryland Department of Environment & District of Columbia Department of the Environment 2010) (Murtagh and Veliz n.d.). Education at school assemblies and during extracurricular activities like Boy and Girl Scouts could decrease the littering rate among younger people (U.S. EPA 2003). Keep America Beautiful came out with an ad campaign called "I Want to be Recycled" (Keep America Beautiful 2013). Because younger individuals were found to be more likely to litter, targeting youth in anti-litter advertisements and education would be most effective.

National, state, and local entities emphasize the need for better source reduction and recycling participation from businesses as part of litter reduction strategies. The U.S. Zero Waste Business Council began a business certification program in 2013. Maryland's Green Registry highlights sustainable actions performed by businesses. Maryland also plans to have a Zero Waste recognition program (Maryland Department of the Environment 2014). On a local level, Montgomery County Smart Organizations Reduce and Recycle Tons (SORRT) Program has a green business application program, which tracks improvements in areas related to litter reduction (Green Business Certification Program 2009). Carroll County Government has adopted a policy to recycle, reuse, and reduce in the workplace (Carroll County Government 2008). Tracking and recognizing the efforts of businesses encourages waste reduction and recycling. More studies need to be performed to confirm that source reduction and recycling actually result in lower rates of littering.

Another major finding of the Keep America Beautiful behavioral study was that individuals were more likely to litter in areas that already had a higher volume of litter (Keep America Beautiful Inc. 2009). The value of a space with litter is lower, so littered places are abandoned by humans and left to accumulate additional trash. This finding highlights the importance of tracking where litter accumulates and holding regular clean-ups of streams and rivers and upland areas. Creating an accessible system for reporting illegal dumping or litter buildup will require updating GIS information and transmitting this information to the public through a variety of media (Anacostia Watershed Restoration Partnership & Metropolitan Washington Council of Governments 2007). Clean-ups treat litter and prevent it by opening up more usable space that individuals enjoy and want to keep clean.

Litter treatment involves removing litter that has already made its way into the environment. Aside from clean-up efforts, equipment such as catch basin screen inserts, nets, grates, vortex separation systems, and trash booms assist in collecting litter from waterways. Expensive hydrodynamic vortex separation systems prevent litter from reaching water ways and avoid the issue of litter buildup. Finally, industrial trash booms deflect and collect litter on water surfaces. There are also cheaper trash boom options such as those made of milk jugs and construction fencing as utilized by Friends of Sligo Creek and in Knoxville, Tennessee (Murtagh and Veliz n.d.). These structural devices can remove litter that has already entered the environment, but will not help to prevent littering in the first place and may lead litterers to feel even less inclined to dispose of trash correctly.

## 5.1 Introduction

This section summarizes the characterization of the Middle Branch and Northwest Branch of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment (PATMH) watershed. Section 5.2 describes the natural landscape and Section 5.3 describes the human modified landscape. Note that all references to the PATMH watershed in this IP are referring to the Baltimore County portion of the watershed only.

The TMDL document produced by MDE used 2010 as the baseline year for data in determining the trash reduction required (Maryland Department of the Environment 2014). Figure 5-1 shows the PATMH watershed impairment area and Figure 5-2 shows the upland watersheds located within Baltimore County.

## 5.2 The Natural Landscape

### *5.2.1 Location*

The trash impairment is limited to the shoreline of the Middle Branch from the mouth (Ferry Bar Park to Harbor Hospital Center) extending westward and the Northwest Branch from the Hull Street Pier to Canton Waterfront Park (Figure 5-1). For the purposes of the TMDL it was assumed the source of trash causing the impairment is generated in the upland watershed draining to the tidal shoreline. This impairment receives drainage from three distinct Maryland 8-digit watersheds: Baltimore Harbor, Gwynns Falls, and Jones Falls. In Baltimore County, the PATMH is comprised of the Jones Falls and Gwynns Falls watersheds. The entire Jones Falls watershed drains into the Northwest Branch impairment and the entire Gwynns Falls watershed drains into the Middle Branch impairment.

The Jones Falls watershed is located in the Patapsco River basin of the Chesapeake Bay watershed, and contains portions of Baltimore County and Baltimore City, Maryland. The Jones Falls watershed comprises 25,933 acres within Baltimore County. The Jones Falls mainstem flows east and south from its headwaters in Garrison, Maryland to its discharge into the Inner Harbor in downtown Baltimore.

The Gwynns Falls watershed is located in the Patapsco River basin of the Chesapeake Bay watershed, and contains portions of Baltimore County and Baltimore City, Maryland. The Gwynns Falls watershed comprises 28,654 acres within Baltimore County and is located in the western portion of the County. The watershed includes the towns of Glyndon, Owings Mills, Lochearn, and Woodlawn and a portion of Pikesville. Figure 5-2 shows the location of the Jones Falls and Gwynns Falls watersheds within the PATMH. This IP only discusses the characteristics of the portions of the watershed located within Baltimore County.

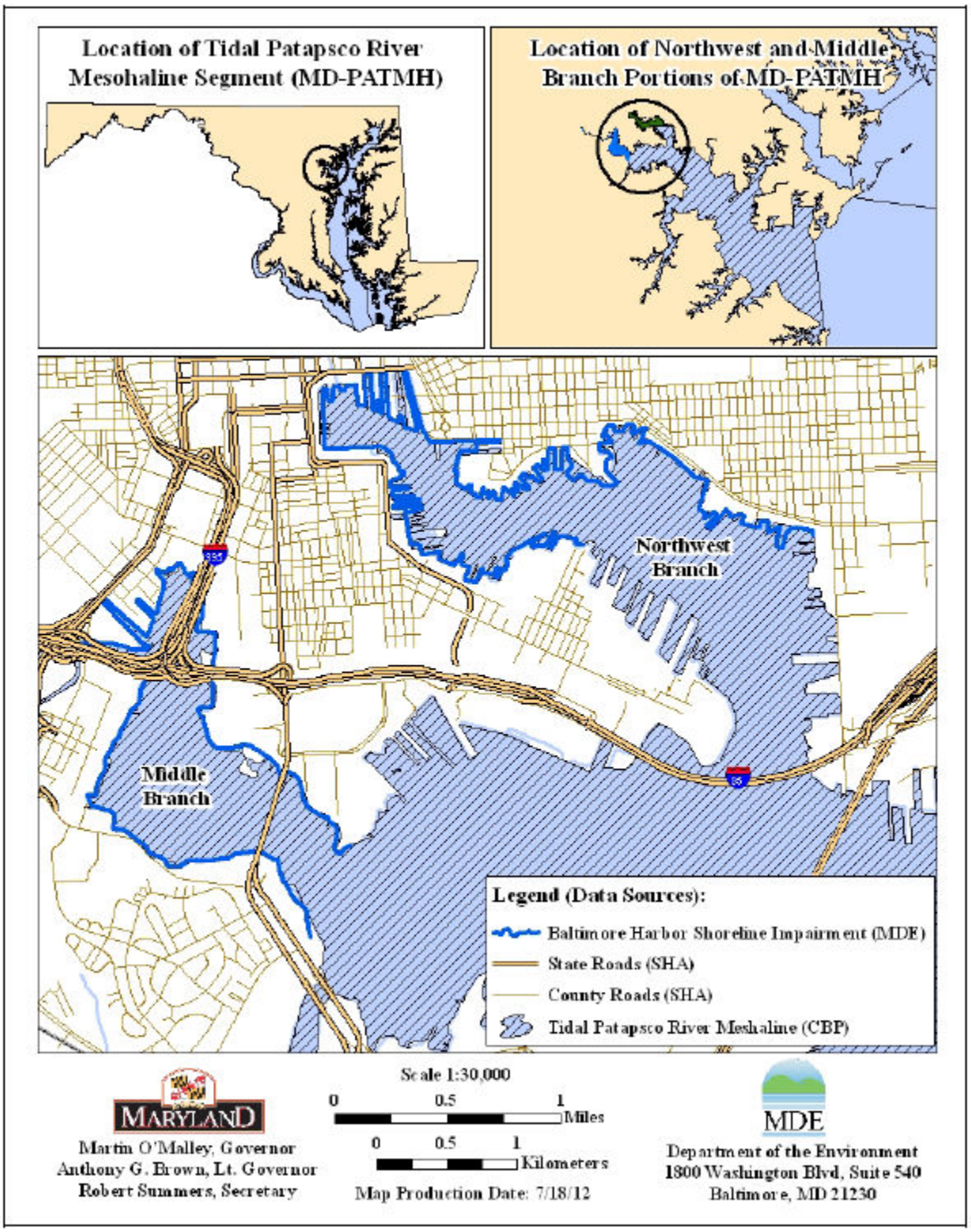


**Figure 5-1: General Location Map of the Middle Branch and Northwest Branch of the Patapsco River Mesohaline Tidal Chesapeake Bay Showing Impairment (Maryland Department of the Environment, 2014)**

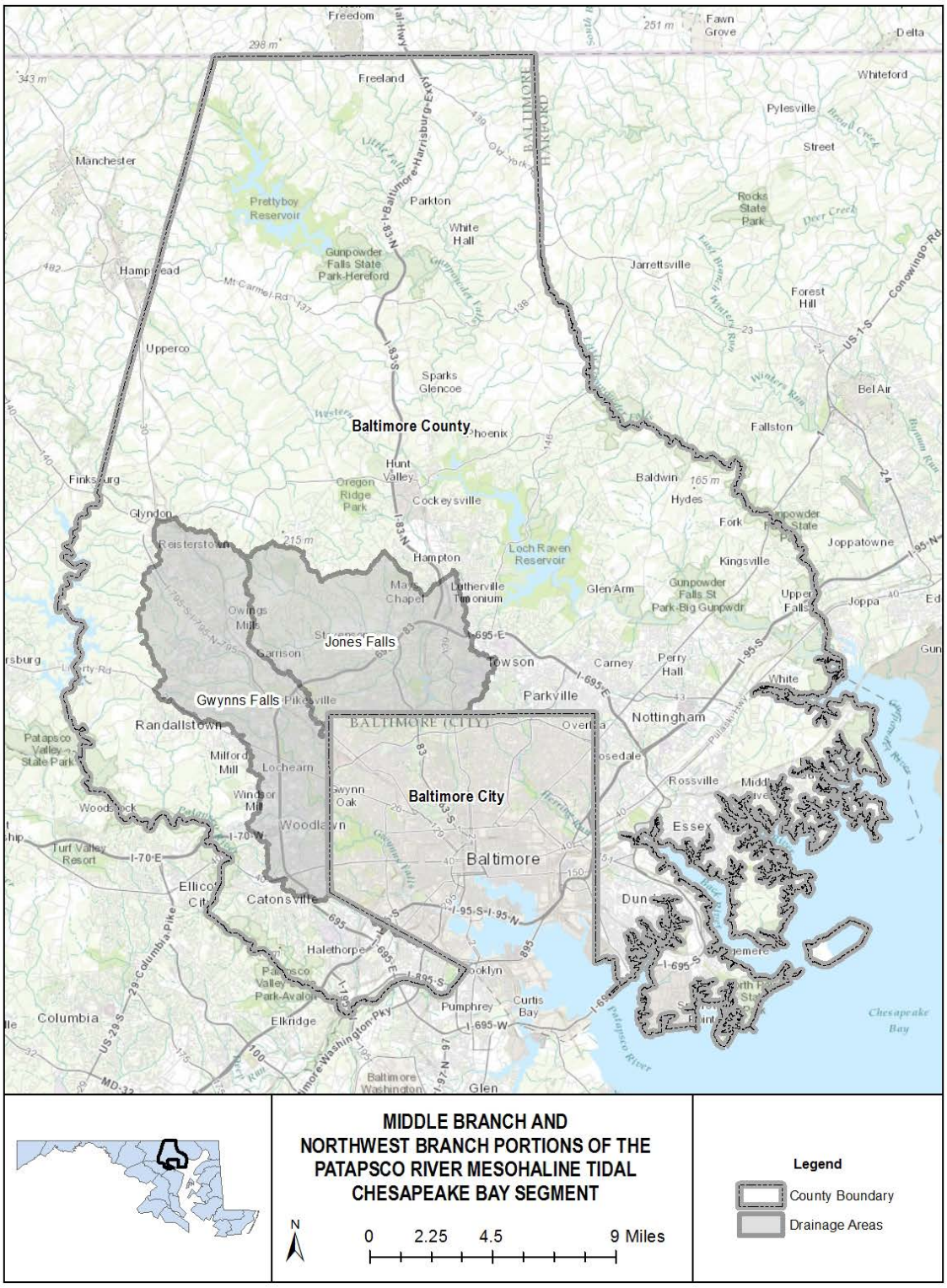


**Figure 5-2: Location Map of the Jones Falls and Gwynns Falls Watersheds within Baltimore County**

### *5.2.2 Geology*

A majority (97%) of the Jones Falls watershed is located within the Piedmont physiographic province while 3% lies within the Coastal Plain physiographic province. The Baltimore County portion of the Gwynns Falls watershed lies primarily within the Piedmont physiographic province (97%) while 3% lies within the Coastal Plain physiographic province. (Maryland Geological Survey, 2008).

The natural Piedmont landscape is characterized by rolling hills, thick soils on deeply weathered crystalline bedrock, and abundant forest litter that minimizes overland flow. The natural Coastal Plain is relatively flatter with soils formed from sedimentary deposits. Areas with steeper slopes may transport trash more efficiently to streams and storm drains.

### *5.2.3 Stream Systems*

Stream systems are a watershed's circulatory system, and the most visible attribute of the hydrological cycle. The stream system is an intrinsic part of the landscape, and closely reflects conditions on the land. The streams are a fundamental natural resource, with myriad benefits for plants, animals, and humans. Maintaining a healthy stream system is a priority for many individuals and organizations, and requires insuring that stream flows and water quality closely mimic the conditions found in un-impacted watersheds. Streams are the flowing surface waters, and are distinct from both groundwater and standing surface water (such as lakes), though they are connected with both of them.

The Jones Falls watershed contains approximately 154 miles of streams, all of which drain to the Baltimore Harbor, which is a part of the larger Chesapeake Bay watershed. A number of tributaries drain to the Jones Fall mainstem, including North Branch Jones Falls, Dipping Pond Run, Deep Run, Slaughterhouse Run, Moores Branch, Roland Run, Towson Run, Western Run, and Stony Run. An impoundment is located at Lake Roland, just north of the Baltimore County/City boundary. Figure 5-3 shows these tributaries.

The Gwynns Falls watershed contains approximately 148 miles of streams in Baltimore County, all of which drain eventually into the Chesapeake Bay. The headwaters of the Gwynns Falls begin in Glyndon, Maryland and flows southeast until its confluence with the Middle Branch of the Patapsco River near downtown Baltimore. Five major tributaries of the Gwynns Falls, listed north to south, include: Red Run, Horsehead Branch, Scotts Level Branch, Dead Run, and Maidens Choice Creek. Figure 5-3 shows the major tributaries in the Gwynns Falls and Jones Falls watersheds in Baltimore County.

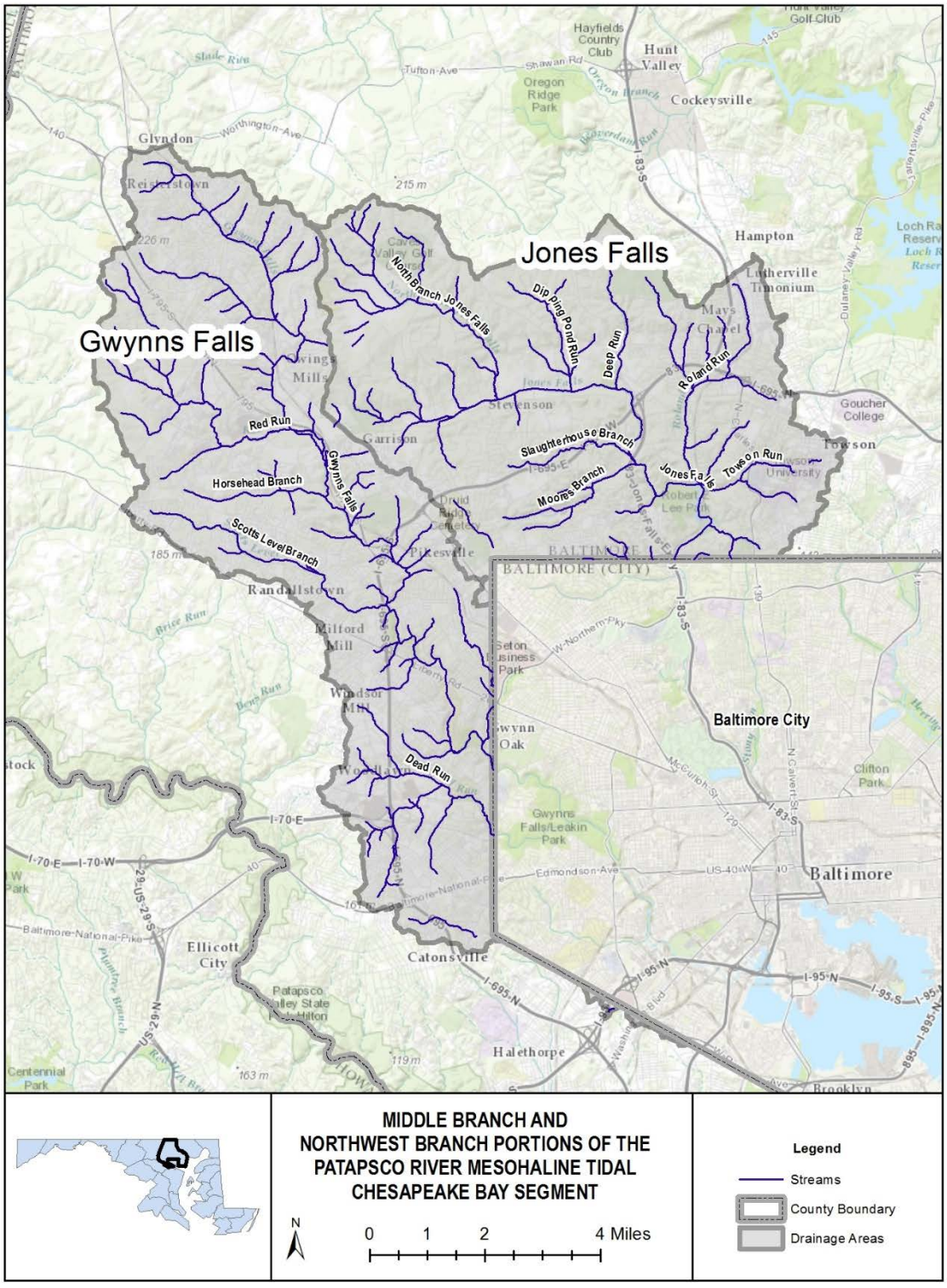


**Figure 5-3: Major Tributaries within the Gwynns Falls and Jones Falls Watersheds**

## 5.3 The Human Modified Landscape

The natural landscape has been modified for human use over time. The intensity of this modification has increased, starting with the colonization of Maryland in the 1600s. This modification has resulted in environmental impacts to both the terrestrial and aquatic ecosystems. This section will provide a characterization of the human modified landscape and how that modification is associated with impacts to the natural ecosystem. The characterization will progress from the general characteristics of land use and land cover to specific issues including population, transportation, and storm water systems, , all of which contribute to trash in the watershed.

### *5.3.1 Land Use*

The Urban Rural Demarcation Line (URDL) is a growth limit line established in 1967 which prohibits public water and sewer outside the line to concentrate growth in the inner suburbs. Approximately 54% of the Baltimore County portion of the Jones Falls lies within the URDL and 46% lies outside the URDL. Approximately 93.5% of the Gwynns Falls watershed in Baltimore County is located inside the URDL while 6.5% is located outside the URDL.

The land use of an area has an influence on the amount of trash in a watershed. As described in Section 3, Table 3-2, commercial and high density residential areas have a much higher loading rate than low density residential areas and forest. Urban areas contain higher amounts of impervious surfaces such as roads, parking areas, roofs and other human constructions. Impervious surfaces block the natural seepage of rain into the ground. Unlike many natural surfaces, impervious surfaces typically concentrate stormwater runoff, accelerate flow rates and direct stormwater to the nearest stream. Stormwater discharges are generated by runoff from urban land and impervious areas (Maryland Department of the Environment, 2014). These discharges often contain point source trash that can enter nearby waterbodies (materials small enough to enter the storm drain system through a street level storm drain such as glass bottles or aluminum cans).

The Maryland Department of Planning Land Use/Land Cover (Maryland Department of Planning, 2010) land use data was used to determine land use in Baltimore County. The land use distribution for the Jones Falls watershed, Gwynns Falls watershed, and the total for the PATMH watershed in Baltimore County is shown in Table 5-1 and Figure 5-4.

**Table 5-1: Land Use in PATMH Watershed in Baltimore County**

| Land Use Category | | Gwynns Falls | | Jones Falls | | Total (in Baltimore County) | |
|---|---|---|---|---|---|---|---|
| | | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | Commercial | 2,317 | 8.1 | 1,076 | 4.1 | 3,393 | 6.2 |
| | Extractive Mining | 77 | 0.3 | 173 | 0.7 | 250 | 0.5 |
| | High Density Residential | 4,181 | 14.6 | 1,397 | 5.4 | 5,578 | 10.2 |
| | Medium Density Residential | 9,264 | 32.3 | 3,569 | 13.8 | 12,833 | 23.5 |
| | Low Density Residential | 1,922 | 6.7 | 8,078 | 31.2 | 10,000 | 18.3 |
| | Industrial | 1,215 | 4.2 | 225 | 0.9 | 1,440 | 2.6 |
| | Institutional | 1,646 | 5.7 | 1,304 | 5.0 | 2,950 | 5.4 |
| | Open Urban Land | 1,028 | 3.6 | 1,788 | 6.9 | 2,816 | 5.2 |
| | Large Lot Subdivision | 246 | 0.9 | 1,786 | 6.9 | 2,032 | 3.7 |
| Agriculture | Ag Storage Facilities | 5 | 0 | 14 | 0.1 | 19 | 0 |
| | Cropland | 642 | 2.2 | 1,786 | 6.9 | 2,428 | 4.4 |
| | Orchard | 0 | 0 | 28 | 0.1 | 28 | 0.1 |
| | Pasture | 302 | 1.1 | 352 | 1.4 | 654 | 1.2 |
| Forest | Deciduous | 4,188 | 14.6 | 3,778 | 14.6 | 7,966 | 14.6 |
| | Evergreen | 505 | 1.8 | 112 | 0.4 | 617 | 1.1 |
| | Mixed | 70 | 0.2 | 12 | 0 | 82 | 0.2 |
| | Shrub | 254 | 0.9 | 23 | 0.1 | 277 | 0.5 |
| Water | Water | 17 | 0.1 | 60 | 0.2 | 77 | 0.1 |
| Wetland | Wetlands | 32 | 0.1 | 41 | 0.2 | 73 | 0.1 |
| Barren Land | Bare Ground | 25 | 0.1 | 26 | 0.1 | 51 | 0.1 |
| Transportation | Transportation | 716 | 2.5 | 304 | 1.2 | 1,020 | 1.9 |
| | **Total** | 28,652 | 100 | 25,932 | 100 | 54,584 | 100 |

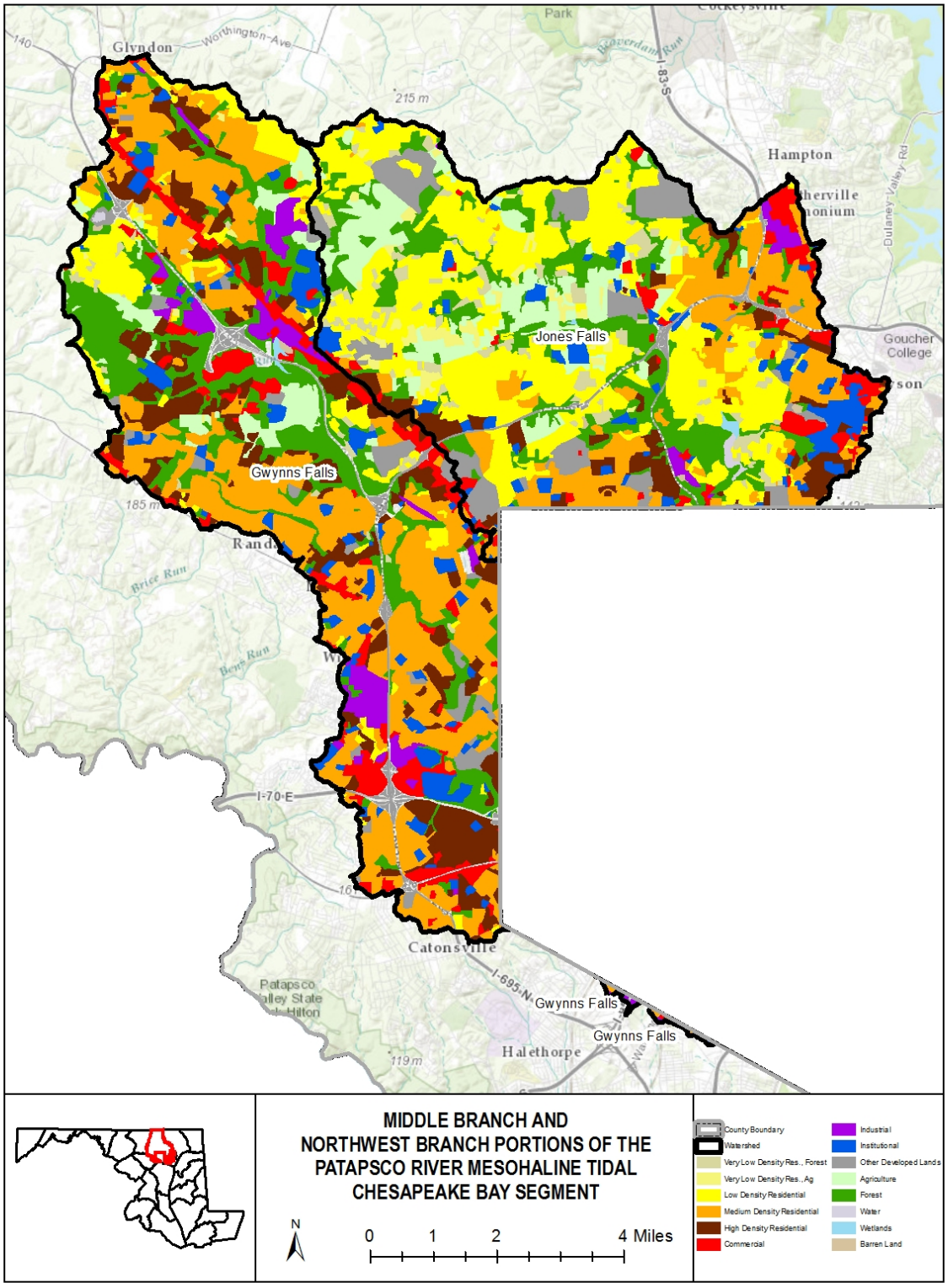


**Figure 5-4: Land Use Map of the Middle Branch and Northwest Branch of the Patapsco River Mesohaline**

### *5.3.2 Population*

Census block data from the 2010 US Census was used to determine the population in the watershed. Population in the Jones Falls and Gwynns Falls watersheds are shown in Table 5-2.

**Table 5-2: Population of Jones Falls and Gwynns Falls Watersheds in Baltimore County**

| Watershed | Population (2010 data) |
|---|---|
| Jones Falls | 64,881 |
| Gwynns Falls | 174,591 |
| Total | 239,472 |

Source: U.S. Census Bureau 2010

### *5.3.3 Roads*

Baltimore County's street sweeping program, managed by the Department of Public Works Bureau of Highways removes materials such as trash, sediment, and debris, from public streets also results in a reduction of the pollutant load (toxins and nutrients) that could have entered waterways. A study of debris removed from inlets (Law, DiBlasi, & Ghosh, 2008) showed trash accounted for 8.9% of the debris collected.

Street sweeping data is reported as tons collected per highway shop. There are 11 highway shops in Baltimore County. Street sweeping is generally conducted only on roads with curb and gutters: however, some alleys, county parking lots, and open roadways (without curb and gutter) are swept when requested. State Routes such as S.R. 45 (York Road) are not swept by the County, as State Highway Administration is responsible those roads. Curb and gutter miles per watershed are calculated based on sweeping both sides of the street plus both sides of any median.

In Jones Falls, there are 436 miles of roads; in Gwynns Falls there are 695 miles for a total of 1,131 miles of roads within Baltimore County. In Jones Falls, 360 miles of curb and gutter are eligible for sweeping and 725 miles of curb and gutter are eligible for sweeping in Gwynns Falls.

### *5.3.4 Inlets and Outfalls*

Stormwater is conveyed into storm drain systems through inlets and outfalls. Inlets are features that convey stormwater from the surface into the storm drain system where it's flushed through a drain pipe and out into a waterway through an outfall or other discharge point. As mentioned in Chapter 1, WLAs have been designated as trash items that can typically enter the storm sewer system through storm drains. There are 4,829 inlets in the Jones Falls and 11,584 inlets in the Gwynns Falls for a total of 16,413 inlets. Baltimore County quantifies it's outfalls by size: major outfalls are outfalls that are greater than 36 inches in diameter whereas minor outfalls are less than 36 inches in diameter. Table 5-3 shows the major and minor outfalls by watershed.

**Table 5-3: Major and Minor Outfalls by Watershed within Baltimore County**

| Watershed | Minor | Major | Total |
|---|---|---|---|
| Jones Falls | 327 | 65 | 392 |
| Gwynns Falls | 544 | 175 | 719 |
| **Total** | **871** | **240** | **1,111** |

### *5.3.5 Existing Stormwater Management Facilities*

The Storm Water Management Act of 2007 and Article 33 Title 4 of the Baltimore County Code aim to improve the effects of stormwater runoff. Some stormwater management facilities by

nature allow for the collection of trash. For example, because of their concave nature, wet ponds and detention ponds inherently collect trash whereas green roofs and dry wells do not have the capability to collect trash. Additionally, some stormwater facilities are required to have one or both of the following BMPs: trash rack and hydrodynamic separators which are described in Section 8. Table 5-4 shows the drainage area and count of total stormwater management facilities located in the Jones Falls and Gwynns Falls in Baltimore County and Table 5-5 shows the drainage area and count of stormwater management facilities that have the potential to collect trash. Regular maintenance is performed on stormwater management facilities and trash collection is part of that maintenance. This maintenance prevents trash from entering the stream system.

**Table 5-4: Total Stormwater Facilities in Jones Falls and Gwynns Falls Watersheds in Baltimore County**

| Watershed | Acres of Drainage Area | Count |
|---|---|---|
| Jones Falls | 4,132 | 451 |
| Gwynns Falls | 8,310 | 1,015 |
| **Total** | **12,442** | **1,466** |

**Table 5-5: Stormwater Facilities in Jones Falls and Gwynns Falls Watersheds in Baltimore County with Trash Collecting Potential**

| Watershed | Acres of Drainage Area | Count |
|---|---|---|
| Jones Falls | 3,553 | 363 |
| Gwynns Falls | 7,195 | 885 |
| **Total** | **10,747** | **1,248** |

## 6.1 Overview

Baltimore County performed a monitoring program to collect data for TMDL development by MDE between October 2010 and November 2011 (Section 6.2). Following this yearlong study, a long-term trash trend monitoring program was initiated in March 2012 with a fixed and random site study design (6.3). To target areas of high trash accumulation, an upland trash assessment monitoring plan is in development to determine the sources of trash within the Gwynns Falls and Jones Falls (See Section 10).

## 6.2 TMDL Development Study

Twenty stream sites were randomly selected using a stratified selection process whereby at least one site was within each subwatershed in the Jones Falls and Gwynns Falls, with ten sites in each watershed. The drainage areas were calculated and categorized by land use. Within the stream, a 500 ft. reach was measured for the survey. All trash was collected within the bankfull of the reach. Seventeen stormwater management ponds were also selected for this study, and were representative of the overall acreage of land use type in each watershed. Trash was collected within the boundary of the pond. Stormwater management ponds and stream reaches were initially cleared of trash to set a baseline of zero trash. The data from the stormwater management ponds was used to develop land use specific trash loading rates per acre. The data for the individual sites, both stormwater facilities and in-stream monitoring sites are presented in Table 6-1. The results of this analysis of land use using, the stormwater facility data, are displayed in Table 6-2.

**Table 6-1: Site Specific Trash Monitoring Results for the Initial TMDL Trash Monitoring Study**

| Station | Stream/ SWM | Subshed | Major Land Use | Drainage Area (acres) | Trash (lbs) | Trash (lbs/acre) |
|---|---|---|---|---|---|---|
| **Gwynns Falls - Streams** | | | | | | |
| G-GF-2 | Stream | Unnamed Trib to Gwynns Falls | MDR | 150.26 | 130.2 | 0.8665 |
| G-HH-1 | Stream | Horsehead Branch | MDR | 508.47 | 9.4 | 0.0185 |
| G-MC-1 | Stream | Maiden's Choice Run | MDR | 414.40 | 94.5 | 0.2280 |
| G-RR-2 | Stream | Red Run | Forest | 112.82 | 3.9 | 0.0346 |
| G-RR-4 | Stream | Red Run | Forest | 522.83 | 8.2 | 0.0157 |
| G-DR-1 | Stream | Dead Run | HDR | 238.41 | 306.5 | 1.2856 |
| G-DR-3 | Stream | Dead Run | MDR | 408.97 | 240.1 | 0.5871 |
| G-GF-1 | Stream | Gwynns Falls | LDR | 83.74 | 10.2 | 0.1218 |
| G-PM-1 | Stream | Powder Mill | MDR | 2,435.80 | 312.4 | 0.1283 |
| G-SL-1 | Stream | Scotts Level Branch | MDR | 738.66 | 50.8 | 0.0688 |
| | | Total Gwynns Falls Streams | | 5,614.36 | 1,166.2 | 0.2077 |
| **Gwynns Falls – Stormwater Management Facilities** | | | | | | |
| 270 | SWM | | HDR | 7.30 | 141.4 | 19.3699 |
| 564 | SWM | | LDR | 17.61 | 38.3 | 2.1749 |
| 1112 | SWM | | MDR | 17.44 | 90.5 | 5.1892 |
| 1580 | SWM | | MDR | 9.50 | 135.6 | 14.2737 |
| 1656 | SWM | | HDR | 12.78 | 17.7 | 1.3850 |
| 1709 | SWM | | Comm. | 13.84 | 38.4 | 2.7746 |
| 1731 | SWM | | Roadway | 3.75 | 79.4 | 21.1733 |
| 3264 | SWM | | Roadway | 12.34 | 15.0 | 1.2156 |
| 3641 | SWM | | Institutional | 13.64 | 3.6 | 0.2639 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4171 | SWM | | LDR | 5.03 | 16.3 | 3.2406 |
| | | Total Gwynns Falls SWM | | 113.23 | 576.2 | 5.0888 |
| **Jones Falls – Streams** | | | | | | |
| J-DR-1 | Fixed | Deep Run | LDR | 1,149.03 | 37.3 | 0.0325 |
| J-LJF-1 | Fixed | Lower Jones Falls | HDR | 48.77 | 67.4 | 1.3820 |
| J-LRR-1 | Fixed | Roland Run | Institutional | 180.29 | 6.2 | 0.0344 |
| J-MB-1 | Fixed | Moores Branch | LDR | 1,315.70 | 9.4 | 0.0071 |
| J-RR-1 | Fixed | Roland Run | OU | 221.48 | 3.4 | 0.0154 |
| J-NB-1 | Fixed | North Branch | LDR | 642.02 | 0.3 | 0.0005 |
| J-RR-2 | Fixed | Roland Run | MDR | 3,009.80 | 31.4 | 0.0104 |
| J-SHB | Fixed | Slaughterhouse Branch | LDR | 265.80 | 15.7 | 0.0591 |
| J-TR-1 | Fixed | Towson Run | HDR | 320.41 | 14.9 | 0.0465 |
| J-WR-1 | Fixed | Western Run | OU | 583.80 | 19.0 | 0.0325 |
| | | Total Jones Falls Streams | | 7,737.1 | 205.0 | 0.0265 |
| **Jones Falls – Stormwater Management Facilities** | | | | | | |
| 1340 | SWM | | HDR | 23.75 | 4.8 | 0.2021 |
| 2207 | SWM | | Institutional | 3.92 | 16.8 | 0.9168 |
| 2949 | SWM | | OU | 7.74 | 19.4 | 2.5065 |
| 3307 | SWM | | MDR | 11.45 | 39.1 | 3.4148 |
| 3552 | SWM | | MDR | 18.25 | 1.1 | 0.0603 |
| 3953 | SWM | | LDR | 3.74 | 2.6 | 0.6952 |
| 4172 | SWM | | LDR | 8.99 | 3.4 | 0.3782 |
| | | Total Jones Falls SWM | | 77.84 | 87.2 | 1.1202 |
| | | Grand Total – Streams | | 13,351.46 | 1,371.2 | 0.1027 |
| | | Grand Total - SWM | | 191.07 | 663.4 | 3.4720 |

**Table 6-2: Trash Loading Rates (Lbs/acre/year) By Land Use**

| Land Use | Land Use Codes | Trash Loading Rate |
|---|---|---|
| Low Density Residential | 11, 191, 192 | 0.90 |
| Medium Density Residential | 12 | 2.45 |
| High Density Residential | 13 | 4.01 |
| Commercial | 14 | 7.91 |
| Industrial | 15 | 7.91 |
| Extractive | 17 | 7.91 |
| Institutional | 16 | 1.99 |
| Open Urban | 18 | 2.15 |
| Roadways | 80 | 2.06 |
| Agriculture | 21, 22, 23, 241, 242 | 2.15 |
| Forest | 41, 42, 43, 44 | 0.02 |
| Construction | 73 | 7.91 |

Collected trash was sorted into five categories: plastic bottles; glass bottles, aluminum cans; other; and dumping. Dumping refers to bulk materials illegally dumped into the environment and other includes any items that do not fit into one of the other four categories. Each category was weighted. For the TMDL study, the information was collected quarterly. The results are displayed in Table 6-3.

Table 6-3: Pounds of Trash Collected by Sorting Category 2010-2011

| Sorting Category | Winter | Spring | Summer | Fall | Total | % |
|---|---|---|---|---|---|---|
| Plastic Bottles | 24.84 | 44.93 | 73.91 | 36.92 | 150.64 | 7.4 |
| Glass Bottles | 23.28 | 30.60 | 21.20 | 17.30 | 92.39 | 4.5 |
| Aluminum Cans | 10.54 | 19.16 | 30.41 | 18.73 | 78.83 | 3.9 |
| Other | 228.84 | 513.36 | 458.51 | 364.48 | 1,565.19 | 77.0 |
| Dumping | 17.66 | 90.05 | 13.22 | 24.98 | 145.90 | 7.2 |
| Total | 305.18 | 698.10 | 567.25 | 462.42 | 2,032.95 | |

As can be seen from Table 6-3, plastic bottles, glass bottles and aluminum cans represent only around 15% of the trash by weight. The data in Table 6-3 also show that the highest levels of trash were collected during the spring and the lowest levels were collected during the winter season. 7.2% of the trash was a result of illegal dumping. Dumping is differentiated from littering as intentional and illegal disposal of trash (usually bulk trash) directly into the environment, while littered material is often dropped at a different location and then transported to the site by means of wind or water flow.

Using the Maryland Department of Planning 2010 land use and the loading rates derived from the trash study stormwater facility results (Table 6-3) the annual trash load for each watershed was calculated, along with the average per acre loading rates. The results are displayed in Table 6-4 with Gwynns Fall and Jones Falls results bolded.

Table 6-4: Baltimore County Watersheds - Annual Trash Loading Rates

| Watershed | Acres | Pounds of Trash per Year | Average Lbs of Trash/Acre/Year |
|---|---|---|---|
| Deer Creek | 7,173 | 14,084 | 2.0 |
| Prettyboy Reservoir | 25,626 | 38,761 | 1.5 |
| Loch Raven Reservoir | 139,980 | 266,591 | 1.9 |
| Lower Gunpowder Falls | 29,555 | 62,516 | 2.1 |
| Little Gunpowder Falls | 17,327 | 30,801 | 1.8 |
| Bird River | 16,456 | 50,460 | 3.1 |
| Gunpowder River | 5,876 | 11,669 | 2.0 |
| Middle River | 6,485 | 23,468 | 3.6 |
| Liberty Reservoir | 17,649 | 27,366 | 1.6 |
| LNB Patapsco River | 33,678 | 82,411 | 2.5 |
| **Gwynns Falls** | **28,739** | **99,563** | **3.5** |
| **Jones Falls** | **26,010** | **64,051** | **2.5** |
| Back River | 23,183 | 84,816 | 3.7 |
| Baltimore Harbor | 11,440 | 57,236 | 5.0 |
| Total | 389,177 | 913,793 | 2.4 |

Based on this analysis, Baltimore Harbor has the highest average pounds of trash per acre per year at 5.0 lbs/acre/yr. While Gwynns Falls and Jones Falls, do not have the highest loadings per acre of all the watersheds, they drain to the trash and debris impaired shoreline in Baltimore Harbor.

## 6.3 Trash Trend Monitoring Program

Following the TMDL development study, the trash trend monitoring program has developed into a long-term trend monitoring program for stream sites only. Trash from both fixed and random sampling sites are collected on an annual basis to document trends and identify problem areas. Results of this program will help to target litter reduction efforts and determine the effectiveness of trash reduction efforts. The twenty stream sites from the previous trash survey were defined as fixed sites, and were randomly selected to be alternately sampled in groups of ten during odd

and even years. Each year, twenty additional randomly selected sites (ten in Gwynns Falls, ten in Jones Falls) are added to the survey along with the ten fixed sites. The random site locations are not resampled in the survey during the following years. The drainage area to the bottom of each trash monitoring reach is determined and the pounds of trash per acre is calculated for each site. This provides a normalization that accounts for the differing drainage areas. The major land use type for each monitoring site is also determined. The individual site results for 2012, 2013, and 2014 are presented in Table 6-6, Table 6-7, Table 6-8, respectively. The results are normalized by calculating a trash pounds/acre metric.

Trash Trend sampling is done in the spring of each year. Our seasonal sampling results from the in-stream baseline development study show that the greatest amount of trash was found in the springtime. See Table 6-5 and Figure 6-1. Implementing trend sampling in the spring ensures that we are estimating trash loadings on the high end of the regular seasonal variation. Consistently recording annual trash loadings at their peak input season will minimize the risk of overestimating the success of our trash reduction efforts during implementation. Sampling in the spring gives us confidence that our future trash reduction measurements will be conservative estimates.

**Table 6-5: Baseline Development Study Seasonal Results**

| Season | Winter | Spring | Summer | Fall |
|---|---|---|---|---|
| average (lbs/acre/day) | 0.00537 | 0.00703 | 0.00313 | 0.00357 |


**Figure 6-1: Baseline Development Study Seasonal Results**

**Table 6-6: Trash Monitoring Results for 2012 by Site**

| Station | Fixed/ Random | Subshed | Major Land Use | Drainage Area (acres) | Trash (lbs) | Trash (lbs/acre) |
|---|---|---|---|---|---|---|
| **Gwynns Falls** | | | | | | |
| G-GF-2 | Fixed | Unnamed Trib to Gwynns Falls | MDR | 150.26 | 23.11 | 0.1538 |
| G-HH-1 | Fixed | Horsehead Branch | MDR | 508.47 | 0.07 | 0.0001 |
| G-MC-1 | Fixed | Maiden's Choice Run | MDR | 414.40 | 54.87 | 0.1324 |
| G-RR-2 | Fixed | Red Run | Forest | 112.82 | 0.00 | 0.0000 |
| G-RR-4 | Fixed | Red Run | Forest | 522.83 | 7.19 | 0.0138 |
| G-795 | Random | Scotts Level Branch | MDR | 1,226.48 | 49.57 | 0.0404 |
| G-907 | Random | Maiden Choice Run | MDR | 443.58 | 45.66 | 0.1029 |
| G-1059 | Random | Powder Mill Run | MDR | 443.21 | 81.73 | 0.1844 |
| G-1146 | Random | Gwynns Falls | MDR | 708.41 | 27.93 | 0.0394 |
| G-1397 | Random | Scotts Level Branch | MDR | 89.32 | 292.77 | 3.2778 |
| G-1573 | Random | Dead Run | MDR | 237.23 | 23.44 | 0.0988 |
| G-1579 | Random | Scotts Level Branch | MDR | 2,544.54 | 235.20 | 0.0924 |
| G-2030 | Random | Gwynns Falls | MDR | 2,146.21 | 71.03 | 0.0331 |
| G-2151 | Random | Gwynns Falls | MDR | 183.73 | 46.30 | 0.2520 |
| G-2238 | Random | Powder Mill | MDR | 525.54 | 132.03 | 0.2512 |
| | | | Gwynns Falls Total | 10,257.03 | 1,090.9 | 0.1064 |
| **Jones Falls** | | | | | | |
| J-DR-1 | Fixed | Deep Run | LDR | 1,149.03 | 13.20 | 0.0115 |
| J-LJF-1 | Fixed | Lower Jones Falls | HDR | 48.77 | 6.97 | 0.1429 |
| J-LRR-1 | Fixed | Roland Run | Institutional | 180.29 | 3.13 | 0.0174 |
| J-MB-1 | Fixed | Moores Branch | LDR | 1,315.70 | 3.13 | 0.0024 |
| J-RR-1 | Fixed | Roland Run | OU | 221.48 | 0.21 | 0.0009 |
| J-251 | Random | North Branch | LDR | 48.3 | 14.52 | 0.3006 |
| J-283 | Random | Deep Run | LDR | 159.87 | 0.00 | 0.0000 |
| J-3041 | Random | Jones Falls | MDR | 19.27 | 23.24 | 1.2060 |
| J-449 | Random | Dipping Pond Run | Pasture | 151.21 | 24.05 | 0.1591 |
| J-599 | Random | Jones Falls | LDR | 1,784.74 | 2.16 | 0.0012 |
| J-947 | Random | Moores Branch | LDR | 860.09 | 12.08 | 0.0140 |
| J-1142 | Random | North Branch | LDR | 78.53 | 2.00 | 0.0255 |
| J-1529 | Random | Jones Falls | LDR | 839.93 | 9.30 | 0.0111 |
| J-1803 | Random | Slaughterhouse Branch | LDR | 1,257.65 | 6.15 | 0.0049 |
| J-2010 | Random | Towson Run | OU | 17.75 | 56.77 | 3.1982 |
| | | | Jones Falls Total | 8,132.61 | 176.91 | 0.0218 |
| | | | Grand Total | 18,389.64 | 1,267.81 | 0.0689 |

**Table 6-7: Trash Monitoring Results for 2013 by Site**

| Station | Fixed/ Random | Subshed | Major Land Use | Drainage Area (acres) | Trash (lbs) | Trash (lbs/acre) |
|---|---|---|---|---|---|---|
| **Gwynns Falls** | | | | | | |
| G-DR-1 | Fixed | Dead Run | HDR | 238.41 | 57.71 | 0.2421 |
| G-DR-3 | Fixed | Dead Run | MDR | 408.97 | 121.36 | 0.2967 |
| G-GF-1 | Fixed | Gwynns Falls | LDR | 83.74 | 3.96 | 0.0473 |
| G-PM-1 | Fixed | Powder Mill | MDR | 2,435.80 | 309.39 | 0.1270 |
| G-SL-1 | Fixed | Scotts Level Branch | MDR | 738.66 | 35.18 | 0.0476 |
| G-358 | Random | Gwynns Falls | HDR | 216.52 | 60.34 | 0.2787 |
| G-408 | Random | Scotts Level Branch | MDR | 204.39 | 175.7 | 0.8596 |
| G-465 | Random | Horsehead Branch | MDR | 177.74 | 7.75 | 0.0436 |
| G-484 | Random | Gwynns Falls | MDR | 1,990.46 | 18.36 | 0.0092 |
| G-538 | Random | Powder Mill | MDR | 2,522.19 | 143.36 | 0.0568 |
| G-919 | Random | Scotts Level Branch | MDR | 234.11 | 65.06 | 0.2779 |
| G-943 | Random | Gwynns Falls | MDR | 3,007.17 | 16.82 | 0.0056 |
| G-2614 | Random | Scotts Level Branch | MDR | 1,440.90 | 9.12 | 0.0063 |
| G-1060 | Random | Powder Mill | MDR | 414.33 | 111.57 | 0.2693 |
| G-1255 | Random | Gwynns Falls | I | 135.04 | 13.68 | 0.1013 |
| | | | Gwynns Falls Total | 14,248.43 | 1,149.36 | 0.0807 |
| **Jones Falls** | | | | | | |
| J-NB-1 | Fixed | North Branch | LDR | 642.02 | 1.00 | 0.0016 |
| J-RR-2 | Fixed | Roland Run | MDR | 3,009.80 | 20.80 | 0.0069 |
| J-SHB | Fixed | Slaughterhouse Branch | LDR | 265.80 | 7.60 | 0.0286 |
| J-TR-1 | Fixed | Towson Run | HDR | 320.41 | 11.00 | 0.0343 |
| J-WR-1 | Fixed | Western Run | OU | 583.80 | 10.91 | 0.0187 |
| J-138 | Random | Roland Run | LDR | 3,807.20 | 16.00 | 0.0042 |
| J-349 | Random | North Branch | LDR | 53.11 | 3.65 | 0.0687 |
| J-566 | Random | Western Run | OU | 147.08 | 3.58 | 0.0243 |
| J-2203 | Random | Lower Jones Falls | MDR | 32.13 | 23.10 | 0.7190 |
| J-1066 | Random | North Branch | LDR | 465.97 | 15.00 | 0.0322 |
| J-1073 | Random | Jones Falls | LDR | 82.89 | 6.97 | 0.0841 |
| J-1122 | Random | North Branch | LDR | 87.94 | 10.65 | 0.1211 |
| J-1171 | Random | Moores Branch | LDR | 45.64 | 8.11 | 0.1777 |
| J-1243 | Random | Roland Run | MDR | 109.29 | 15.00 | 0.1373 |
| | | | Jones Falls Total | 9,653.08 | 153.37 | 0.0159 |
| | | | Grand Total | 23,901.51 | 1,302.73 | 0.0545 |

**Table 6-8: Trash Monitoring Results for 2014 by Site**

| Station | Fixed/ Random | Subshed | Major Land Use | Drainage Area (acres) | Trash (lbs) | Trash (lbs/acre) |
|---|---|---|---|---|---|---|
| **Gwynns Falls** | | | | | | |
| G-GF-2 | Fixed | Unnamed Trib to Gwynns Falls | MDR | 150.26 | 120.82 | 0.8041 |
| G-HH-1 | Fixed | Horsehead Branch | MDR | 508.47 | 0.88 | 0.0017 |
| G-MC-1 | Fixed | Maiden's Choice Run | MDR | 414.40 | 60.79 | 0.1467 |
| G-RR-2 | Fixed | Red Run | Forest | 112.82 | 0.58 | 0.0051 |
| G-RR-4 | Fixed | Red Run | Forest | 522.83 | 10.06 | 0.0192 |
| G-13 | Random | Trib to Gwynns Falls | MDR | 1,254.61 | 172.63 | 0.1376 |
| G-32 | Random | Red Run | MDR | 143.50 | 6.21 | 0.0433 |
| G-83 | Random | Gwynns Falls | MDR | 506.46 | 32.28 | 0.0637 |
| G-5 | Random | Gwynns Falls | MDR | 6,328.11 | 158.07 | 0.0250 |
| G-69 | Random | Trib to Gwynns Falls | HDR | 27.96 | 11.78 | 0.4213 |
| G-94 | Random | Trib to Gwynns Falls | MDR | 164.10 | 6.53 | 0.0398 |
| G-11 | Random | Horsehead Branch | MDR | 201.64 | 20.93 | 0.1038 |
| G-42 | Random | Trib to Gwynns Falls | MDR | 52.20 | 53.60 | 1.0268 |
| G-43 | Random | Red Run | MDR | 16.82 | 30.58 | 1.8181 |
| G-95 | Random | Trib to Gwynns Falls | MDR | 244.69 | 26.21 | 0.1071 |
| | | | Gwynns Falls Total | 10,648.87 | 711.95 | 0.0669 |
| **Jones Falls** | | | | | | |
| J-DR-1 | Fixed | Deep Run | LDR | 1,149.03 | 22.15 | 0.0193 |
| J-LJF-1 | Fixed | Lower Jones Falls | HDR | 48.77 | 29.99 | 0.6149 |
| J-RR-1 | Fixed | Roland Run | Institutional | 180.29 | 14.50 | 0.0804 |
| J-MB-1 | Fixed | Moores Branch | LDR | 1,315.70 | 4.08 | 0.0031 |
| J-RR-1 | Fixed | Roland Run | OU | 221.48 | 2.00 | 0.0090 |
| J-15 | Random | Dipping Pond Run | Forest | 269.93 | 0.50 | 0.0019 |
| J-17 | Random | Slaughterhouse Branch | LDR | 1,060.17 | 11.00 | 0.0104 |
| J-8 | Random | Moores Branch | MDR | 915.19 | 2.58 | 0.0028 |
| J-20 | Random | Jones Falls Trib | LDR | 335.28 | 52.93 | 0.1579 |
| J-1 | Random | North Branch | LDR | 95.50 | 7.00 | 0.0733 |
| J-31 | Random | Dipping Pond Run | LDR | 49.48 | 14.75 | 0.2981 |
| J-9 | Random | North Branch | LDR | 113.81 | 5.73 | 0.0503 |
| J-26 | Random | Jones Falls Trib. | Forest | 36.86 | 11.12 | 0.3017 |
| J-4 | Random | Jones Falls Trib. | Forest | 99.96 | 21.00 | 0.2101 |
| J-39 | Random | North Branch | LDR | 39.59 | 0.25 | 0.0063 |
| | | | Jones Falls Total | 5,931.04 | 199.58 | 0.0337 |
| | | | Grand Total | 16,579.91 | 911.53 | 0.0550 |

The amount of trash collected varied from a high of 1,302 pounds (2013) and a low of 911 pounds (2014). A further comparison between years and watersheds is presented in Table 6-9, which shows by year the total pounds collected from the stream sites for both Gwynns Falls and Jones Falls, as well as, combined data. Normalized data (#s/acre) is also displayed as is the mean pounds/stream site.

**Table 6-9: Between Year and Between Watershed Comparison of Pounds of Trash Collected From Stream Sites**

| Year | Number of Streams | Gwynns Falls | | Jones Falls | | Both | | |
|---|---|---|---|---|---|---|---|---|
| | | Total #s | #s/Acre | Total #s | #s/Acre | Total #s | #s/Acre | Mean #s/Stream |
| 2011 | 20 | 1,166 | 0.2077 | 205 | 0.0265 | 1,371 | 0.1027 | 69 |
| 2012 | 30 | 1,091 | 0.1064 | 177 | 0.0218 | 1,268 | 0.0689 | 42 |
| 2013 | 30 | 1,149 | 0.0807 | 153 | 0.0159 | 1,303 | 0.0545 | 43 |
| 2014 | 30 | 712 | 0.0669 | 200 | 0.0337 | 912 | 0.0550 | 30 |

It is evident from Table 6-9 that there has been a general decrease in the total amount of trash collected per 500 foot of stream reach, and that Jones Falls has less trash per 500 foot section than Gwynns Falls. The greater amount of trash collected during the TMDL study period (year 2011) may reflect the fact that the trash was collected on a quarterly basis and summed to provide the annual load, while the Trash Trend Program collects data on an annual basis. Quarterly sampling may collect trash prior to transport downstream resulting in higher total weight of trash. For the years 2012-2014, there is a smaller, non-significant decrease. Monitoring in future years will determine if the decrease is actual, or a result of differing weather conditions (more storms for transporting trash).

The Trash Trend Monitoring Program includes both fixed stream monitoring sites and randomly selected stream monitoring sites. The fixed stream monitoring sites are derived from the initial Trash TMDL Monitoring Study. In the initial study there were 20 stream sites randomly selected (10 from Gwynns Falls and 10 from Jones Falls). Each year five of the steam sites from Gwynns Falls and five from Jones Falls are re-sampled. Thus, every other year the same site is monitored. Ten of the stream sites have been monitored three times. The results for these 10 sites in pounds of trash/acre are presented in Table 6-10.

**Table 6-10: Three Years of Trash Monitoring Results for 10 Fixed Sites**

| Station | Land Use | 2010/2011 (#s/acre) | 2012 (#s/acre) | 2014 (#s/acre) |
|---|---|---|---|---|
| **Gwynns Falls** | | | | |
| G-GF-2 | MDR | 0.8665 | 0.1538 | 0.8041 |
| G-HH-1 | MDR | 0.0185 | 0.0001 | 0.0017 |
| G-MC-1 | MDR | 0.2280 | 0.1324 | 0.1467 |
| G-RR-2 | Forest | 0.0346 | 0.0000 | 0.0051 |
| G-RR-4 | Forest | 0.0157 | 0.0138 | 0.0192 |
| Mean | | 0.2327 | 0.0600 | 0.1953 |
| **Jones Falls** | | | | |
| J-DR-1 | LDR | 0.0325 | 0.0115 | 0.0193 |
| J-LJF-1 | HDR | 1.3820 | 0.1429 | 0.6149 |
| J-LRR-1 | Institutional | 0.0344 | 0.0174 | 0.0804 |
| J-MB-1 | LDR | 0.0071 | 0.0024 | 0.0031 |
| J-RR-1 | OU | 0.0154 | 0.0009 | 0.0090 |
| Mean | | 0.2943 | 0.0350 | 0.1453 |
| Grand Mean | | 0.2635 | 0.0475 | 0.1704 |

The 2010/2011 monitoring results show the highest mean pounds of trash/acre. The 2012 results are much lower than the 2010/2011 results in both the Gwynns and Jones Falls. The mean 2014 results are higher in both the Gwynns and Jones Falls than the mean 2012 results. This difference may be due to the fact that 2010/2011 data was collected on a quarterly basis, which may have led to the collection of some trash prior to transport downstream. Additionally, due to the nature of sampling in 2010/2011, the amount of time between the last date of collection in the 2010/2011 quarterly sampling period to the 2012 sampling was shorter than the time between the 2012 sampling and the 2014 sampling. This difference in time may have allowed for greater trash accumulation from 2012 to 2014. Variation in amount of dumping from year to year can also affect results. Table 6-11 shows the trash by sorting category for these ten fixed sites.

Table 6-11: Total lbs by sorting category for 10 Fixed Sites

| Sorting Category | 2010-2011 (odd year sites) | | 2010-2011 (even year sites) | | 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lbs | % | Lbs | % | Lbs | % | Lbs | % | Lbs | % |
| Plastic Bottles | 58.97 | 5.9 | 19.71 | 5.3 | 18.92 | 1.9 | 35.19 | 2.7 | 19.02 | 2.1 |
| Glass Bottles | 38.12 | 3.8 | 11.03 | 3.0 | 16.72 | 1.7 | 14.70 | 1.1 | 10.36 | 1.1 |
| Aluminum Cans | 18.71 | 1.9 | 11.31 | 3.1 | 18.11 | 1.8 | 43.58 | 3.3 | 6.14 | 0.7 |
| Other | 787.75 | 78.7 | 303.87 | 82.1 | 529.06 | 53.8 | 1,035.02 | 78.7 | 481.50 | 53.1 |
| Dumping | 97.63 | 9.8 | 24.00 | 6.5 | 400.00 | 40.7 | 186.25 | 14.2 | 389.50 | 43.0 |
| Total | 1001.18 | | 369.91 | | 982.81 | | 1,314.74 | | 906.52 | |

“Other” accounts for the highest percentage of trash in each year. “Dumping” is the next highest category and seems to account for a greater percentage of the total in 2012 and 2014 than in 2010 and 2014. Dumped items also tend to be heavy things such as furniture.

Baltimore County recognizes that utilizing a variety of monitoring techniques could improve the accuracy of data results. The County is currently implementing annual upland trash monitoring studies in the Gwynns and Jones Falls watersheds. As we continue to gather data from the upland trash monitoring program, we will be able to identify trash hotspots and potential trash hotspots throughout those watersheds. Once a comprehensive list of these hotspot and potential hotspot areas is developed, we will evaluate the need for outfall trash monitoring near those sites.

Baltimore County has already developed management plans that aim to remove certain pollutants in parts of the Jones Falls and Gwynns Falls watersheds. Sections 7.1 through 7.3 provide a description watershed plans for portions of the Jones Falls watershed. Sections 7.4 through 7.6 provide summaries of plans within the Gwynns Falls watershed. Section 7.7 is a brief summary and of the county wide Trash and Litter Reduction Strategy, which is a plan that was developed to provide a comprehensive strategy for reducing litter throughout the county. Full text of the Trash and Litter Reduction Strategy will be available on the Baltimore County Environmental Protection and Sustainability website. SWAPs include local based goals and objectives that are beyond the scope of the TMDL IP. All completed SWAP documents and their appendices are available online. Past studies, SWAPs, Management Plans, and the Trash and Litter Reduction Strategy were used to inform the Implementation Plan. The following subsections provide more specific information for each plan within the Jones Falls and Gwynns Falls watersheds.

## 7.1 Northeastern Jones Falls Small Watershed Action Plan, 2012

The *Northeastern Jones Falls SWAP* addresses a 10.9 square mile portion of the Jones Falls watershed, making up the north eastern part of the Jones Falls watershed that is within Baltimore County. Northeastern Jones Falls includes the four sub-watersheds: Roland Run, Ruxton Run, Towson Run, and the Lake Roland Direct Drainage. The Northeastern Jones falls represents 19% of the entire Jones Falls watershed.

The SWAP is a strategy for restoring the Northeastern Jones Falls. It was developed, in 2012, by Baltimore County Department of Environmental Protection and Sustainability with extensive input from county citizens, county agencies, members of watershed associations, and various institutions. The action plan outlines recommendations for watershed restoration, describes management strategies for each of the four sub watersheds, and identifies priority projects for implementation. The plan also includes cost estimates for certain potential actions and a schedule for implementation over a 13 year timeline. Financial and technical partners are suggested for implementation of various potential actions.

### *7.1.1 SWAP Vision and Goals*

Northeastern Jones Falls SWAP Vision:

The Northeastern Jones Falls Steering Committee adopted the following vision statement that served as a guide in the development of the SWAP:

> *We envision a healthy, vibrant Northeastern Jones Falls watershed, which protects high quality streams and is supportive of diverse aquatic life. Our watershed conserves treasured natural resources and maintains and celebrates our residential character and landscape for today and for future generations.*

Northeastern Jones Falls SWAP Goals:

- Goal 1: Improve and Maintain Clean Water
- Goal 2: Reduce Stream Stability Problems that Create Flooding and Erosion
- Goal 3: Enhance Stream Riparian Corridors for Water Quality and Habitat Value
- Goal 4: Increase Citizen Participation with Restoration Projects
- Goal 5: Encourage Collaboration with the Institutional Landowners and Baltimore County EPS on Restoration Projects
- Goal 6: Enhance Natural Resources on Public Property
- Goal 7: Maintain the Residential Character of the Watershed

### *7.1.2 Trash and Litter Related Goals and Objectives*

There are not goals or objectives in the Northeastern Jones Falls SWAP that specifically address trash, however, Goal 1 of the SWAP is to Improve and Maintain Clean Water. Litter reduction is an important part of maintaining clean water.

## *7.2* Lower Jones Falls Watershed Small Watershed Action Plan, 2008

The *Lower Jones Falls SWAP* addresses the southern portion of the Jones Falls watershed, including the area that crosses over into Baltimore City. The area includes six sub-watersheds and makes up 45% of the Jones Falls watershed. The Lower Jones falls is 25.9 square miles of the entire 58 square miles of the Jones Falls watershed.

This small watershed action plan was developed by a partnership between Baltimore County, Baltimore City, the Herring Run and Jones Falls Watershed Associations, and the Center for Watershed Protection Inc. The plan presents results of a thorough watershed assessment by sub-watershed, conceptual storm water retrofit project plans, overall watershed recommendations, and a draft schedule for implementation with anticipated benefits of implementation.

### *7.2.1 SWAP Goals*

The stakeholder meetings resulted in the following set of goals to guide recommendations for the lower Jones Falls SWAP:

- Goal 1: Improve conditions in stream to achieve standards of swimmable, fishable, and water contact recreation in streams by 2022. Ensure that the streams are safe for our children to play in
- Goal 2: Improve the condition of the biology in the stream
- Goal 3: Implement effective watershed education
- Goal 4: Increase the involvement of the population
- Goal 5: Disconnect impervious surfaces from the storm drain system
- Goal 6: Integrate stormwater and watershed planning goals in new and redevelopment
- Goal 7: Continue collaboration between Baltimore City/County, watershed groups and citizens
- Goal 8: Engage the business community in restoration
- Goal 9: Improve management of natural and turf areas including parks, trails, trees and streams
- Goal 10: Improve government management of roadways, streetscapes and public works yards to reduce their impact on stream quality

### *7.2.2 Trash and Litter Related Goals and Objectives*

The Lower Jones Falls SWAP contains an objective to Implement Effective Watershed Education, which specifically includes a mention to improve education of proper trash disposal. This objective states that watershed education efforts should focus on a wide audience ranging from city and state employees, local residents and students. Education topics include the reduction of fertilizers, pesticide and salt application, use of native landscaping, pet waste and

proper disposal of trash. A mass media education campaign, effective brochures and websites can help achieve this goal.

### 7.3 Jones Falls Watershed Management Plan (1998)

The WQMP for Jones Falls is a document that details Capital Improvement Projects (CIPs) that the County could consider to improve water quality. These Management Plans focused on County-specific actions, and not citizen-based initiatives. The plans outlined in the WQMP may be useful for determining CIPs that the County may still implement through this plan and in the future. This plan does not specifically address trash, but mainly focuses on CIPs. These potential CIPs could result in some trash pollution reductions depending on the type of CIP and the details of the project. The SWAPs include some additional CIPs along with various citizen-based plans that can reinforce the efforts of the County. The full plan is available for review at the EPS offices at 111 W. Chesapeake Ave. Towson, MD 21204.

### 7.4 Gwynns Falls Water Quality Management Plan, 2004

The WQMP for Gwynns Falls is a document that details Capital Improvement Projects (CIPs) that the County could consider to improve water quality. These Management Plans focused on County-specific actions, and not citizen-based initiatives. The plans outlined in the WQMP may be useful for determining CIPs that the County may still implement through this plan and in the future. This plan does not specifically address trash, but mainly focuses on CIPs. These potential CIPs could result in some trash pollution reductions depending on the type of CIP and the details of the project. The SWAPs include some additional CIPs along with various citizen-based plans that can reinforce the efforts of the County. The full plan is available for review at the EPS offices at 111 W. Chesapeake Ave. Towson, MD 21204.

### 7.5 Middle Gwynns Falls Small Watershed Action Plan, 2013

The *Middle Gwynns Falls Small Watershed Action Plan* addresses the southern half of the portion of the Gwynns Falls watershed that is located within Baltimore County. The Middle Gwynns Falls borders the Baltimore City line and the boundary of the Jones Falls watershed to the east, the boundary of the Patapsco river watershed to the south and west, and the boundary of the Liberty Reservoir and the Upper Gwynns Falls watershed to the north. The Middle Gwynns Falls is made up of five sub-watersheds and is 23.25 square miles of the entire 65 square mile Gwynns Falls watershed.

The SWAP is a strategy for restoring the Middle Gwynns Falls watershed. It was developed, in 2013, by Baltimore County Environmental Protection and Sustainability with extensive input from county citizens, county agencies, members of watershed associations, various local institutions and businesses. The report presents recommendations for watershed restoration, describes management strategies for each of the five sub-watersheds that make up the Middle Gwynns Falls, and identifies priority projects for implementation. The action plan provides cost estimates for many potential restoration projects throughout the watershed and an implementation schedule through the year 2025. Financial and technical partners for plan implementation are suggested for various potential actions.

### *7.5.1 SWAP Vision and Goals*

Middle Gwynns Falls SWAP Vision:

The Middle Gwynns Falls Steering Committee adopted the following vision statement that served as a guide in the development of the SWAP:

> *We envision that through responsible environmental stewardship, our neighborhoods, schools and businesses within the Middle Gwynns Falls watershed will be part of a healthy, stable, sustainable and vibrant environment that supports diverse aquatic and terrestrial life; maintains physical, chemical and hydrologic standards; and flows free of trash throughout the watershed on its way to the Baltimore Harbor and Chesapeake Bay.*

Middle Gwynns Falls SWAP Goals:

- Goal 1: Restore and maintain clean water to applicable water quality standards
- Goal 2: Restore and improve stream hydrology
- Goal 3: Reduce trash dumping
- Goal 4: Use education to promote the basic understanding of watershed science and responsible stewardship and restoration of our neighborhoods, schools and business communities
- Goal 5: Improve the biological health of local streams
- Goal 6: Improve tree and forest coverage in the watershed
- Goal 7: Address environmental problems that disproportionately affect low-income and minority communities

### *7.5.2 Trash and Litter Related Goals and Objectives*

Goal three of this SWAP is to reduce trash and dumping. The description of this goal is as follows, trash and debris is generated throughout the watershed and readily moves through storm drains and tributaries and is carried by wind into surface waters. Trash and other bulk materials are also thrown directly into the streams. Besides the glaring visual detriment to natural beauty, trash contributes toxins and presents hazards to water fowl, other wildlife, and people. By educating citizens of the consequences of littering and dumping on the health of their watershed, community, and families, the stage will be set to change behaviors, and will lead to a healthier Middle Gwynns Falls.

The objectives that relate to this goal are:

1. Reduce trash in upland areas
2. Reduce dumping of trash and other materials
3. Increase and support community clean-ups
4. Increase recycling of bottles, cans, plastic bags and paper
5. Support recycling in commercial establishments

## 7.6 Upper Gwynns Falls Small Watershed Action Plan, 2011

The *Upper Gwynns Falls Small Watershed Action Plan* addresses the northern portion of the Gwynns Falls watershed that is located within Baltimore County. It encompasses 13, 615 acres (21.3 square miles). There are five subwatersheds within the Upper Gwynns Falls Watershed with the majority of the watershed located in the Owings Mills growth area.

The SWAP is a strategy for restoring the Upper Gwynns Falls watershed. It was developed, in 2011, by Baltimore County Environmental Protection and Sustainability with extensive input from county citizens, county agencies, members of watershed associations, various local institutions and businesses. The report presents recommendations for watershed restoration, describes management strategies for each of the five sub-watersheds that make up the Upper

Gwynns Falls, and identifies priority projects for implementation. The action plan provides cost estimates for many potential restoration projects throughout the watershed and an implementation schedule for 10 years. Financial and technical partners for plan implementation are suggested for various potential actions.

### *7.6.1 SWAP Vision and Goals*

The Upper Gwynns Falls Vision: The Upper Gwynns Falls Steering Committee adopted the following vision statement that served as a guide in the development of the SWAP:

> *We envision the Upper Gwynns Falls watershed with a healthy, stable and vibrant stream network that supports diverse aquatic life. Our watershed includes high quality streams and forests, which will be protected to maintain physical, chemical and hydrologic standards. Forest cover will be measured throughout the watershed. Development and redevelopment will be managed to minimize impacts from stormwater and increase infiltration. Improved public access to streams will increase enjoyment and responsible stewardship of the streamside habitat. Our streams will flow free of trash throughout the watershed and on the way to the harbor and Chesapeake Bay.*

Upper Gwynns Falls SWAP Goals:

- Goal 1: Improve and Maintain Physical and Chemical Stream Conditions
- Goal 2: Preserve High Quality Streams
- Goal 3: Restore and Maintain Aquatic Biodiversity
- Goal 4: Increase Tree and Forest Coverage
- Goal 5: Promote Environmentally Sensitive Development and Redevelopment
- Goal 6: Restore Stream Hydrology
- Goal 7: Reduce Trash and Promote Recycling
- Goal 8: Improve Access to Streams

### *7.6.2 Trash and Litter Related Goals and Objectives*

Goal seven is reduce trash and promote recycling. The following objectives are related to this goal:

1. Develop a baseline trash load through 1-year monitoring period
2. Implement an effective monitoring program to identify hotspots and document long-term conditions and assess trends
3. Reduce trash through cleanups and educational activities on proper trash handling
4. Increase stewardship by students, religious institutions, boy/girl scouts and other community groups through activities such as clean-ups, storm drain marking and recycling awareness
5. Increase the quantity of material recycled and compost
6. Utilize code enforcement policies and implement actions for improper handling of trash and improper vehicle storage and maintenance
7. Increase trash removal maintenance in SWM facilities

## 7.7 Trash and Litter Reduction Strategy, 2014

Baltimore County Trash and Litter Reduction Strategy was developed by the Baltimore County Department of Environmental Protection & Sustainability (EPS) in close partnership with various County agencies, public stake holders, local watershed associations, and with input from Trash Free Maryland. Suggestions from the public, via community input events held throughout the county, are the main driver of the actions within this plan. Suggestions for litter reduction actions, made by individual citizens, were compiled into a report in the initial phase of strategy development. Those suggestions were then evaluated for their feasibility and potential effectiveness. This plan is the result of that evaluation.

The ultimate vision for this strategy is a collaborative government effort to put citizen requests into a feasible plan of action. This Trash and Litter Reduction Strategy is, therefore, a direct reflection of Baltimore County citizen ideas to improve the health and aesthetic integrity of their communities.

### *7.7.1 What is a Trash and Litter Reduction Strategy?*

A Trash and Litter Reduction Strategy is a plan to reduce the amount of litter entering Baltimore County streams, rivers, and waterways. Litter on the roads, highways, and in our neighborhoods is visible every day, but most do not realize that all of that trash is carried away by wind and stormwater runoff into the natural environment. It is easy to forget that everything moves in the direction of drainage and eventually ends up in our waterways. Many of our streams and rivers are already degraded by litter and by deliberate trash dumping. We must all make the connection that trash in our streets becomes trash in our streams and rivers and eventually pollutes our drinking water reservoirs, and the Chesapeake Bay. That is why Baltimore County sought to develop a comprehensive and highly effective Trash and Litter Reduction Strategy.

### *7.7.2 Strategy Objective*

*The overall goal of the Trash and Litter Reduction Strategy is for Baltimore County to make steady progress toward elimination and prevention of trash impairment in our streams, lakes, rivers, and tidal waters with a measurable downward trend in quantity of trash from year to year.*

### *7.7.3 Legal Authority*

Baltimore County is required to have a Trash and Litter Reduction Strategy under its Municipal Separate Storm Sewer Systems (MS4) permit. The County is issued a new MS4 permit every five years, which it must adhere to. Within the permit that was renewed on December 23, 2013, Baltimore County was given specific requirements to develop a trash reduction strategy, including a public education and outreach campaign.

### *7.7.4 The Three Phases of the Trash and Litter Reduction Strategy*

Actions in the strategy are divided into three separate phases.

- **Phase I**: Education and Source Reduction Phase
- **Phase II**: Evaluation of Success Phase
- **Phase III**: Contingent Structural Trapping Device Phase

Phase I Actions:

- Existing Programs
- Coordination
- Education and Outreach
- Incentive Programs
- Enforcement

Phase I is the preferred method for reducing litter and trash and are the focus of the Trash and Litter Reduction Strategy. The actions in this phase are less costly than Phase III and aim to stop litter before it reaches the environment. Phase II is an evaluation on the effectiveness of Phase I, which will determine if there is a need for the contingent Phase III. Phase II will use monitoring data collected during Phase I to construct the assessment of effectiveness. Phase III involves the use of mechanical and structural devices and actions that remove litter from the environment.

These actions are usually costly and require regular maintenance. Ideally, the County can accomplish its litter reduction goals without the contingent phase III actions.

The trash TMDL is unique in that, unlike most TMDLs, the Trash TMDL is expressed in terms of quantity to be removed from the water, while normally a TMDL is the maximum pollutant level that can be added to a waterbody each year. The trash TMDL is expressed in terms of removal from the waterbody because the TMDL has been set equal to 100 percent removal or capture of the baseline trash load. The trash removal TMDL must be achieved in addition to existing removal rates, with the exception of structural trash removal BMPs. The distinction between different trash removal BMPs will be discussed in detail this section.

This best management practice (BMP) efficiencies section will provide basic information on each BMP capable of reducing trash in the PATMH watershed.

## 8.1 BMP Descriptions

This section provides an overview of trash reduction measures and their predicted effectiveness. This overview is meant to serve as a guide to aid in selecting the most efficient possible BMPs that may be implemented to meet the pollutant reduction goals required by the TMDL and to provide the information necessary to calculate the amount of each action necessary to meet the TMDL trash load reduction. This review utilizes conservative estimates of BMP efficiency for planning purposes, as exact types of BMPs (e.g. structural BMPs) will not be chosen until appropriate on-site analysis is complete. It is possible that only some of the listed actions in this section will be selected for inclusion in Section 9 of this Implementation Plan.

End-of-pipe and in-stream controls may be necessary to meet trash and debris TMDL, but MDE encourages upland source reduction measures first, as these get at the root of the trash problem and in the long-term will cost less to implement.

### *8.1.1 Source Elimination/Reduction BMPs*

Recycling programs - Create new programs, expanding existing programs and/or the continuation of the programs that are in place.

Regulations and Ordinance - Enforcement of existing Illicit Dumping Laws and creation of new regulations and ordinances if not currently in place, such as plastic bag bans, litter fines, fines for illegal dumping, etc.

Trash Disposal Access - Installation of new trash receptacles and maintenance of existing trash receptacles. Focus efforts at trash/litter hotspots such as transit stops.

Public Education - As part of Baltimore County's NPDES permit, a public education and outreach program is being developed and implemented for litter control, recycling and composting with a focus on the following: anti-litter campaigns, recycling education, storm drain marking, etc.

### *8.1.2 Cleanups/ Removal BMPs*

Street Sweeping and Inlet Cleaning – Street sweeping is measured by the weight of street residue collected. Street sweeping and storm drain cleanout practices rank among the oldest practices used by communities for a variety of purposes to provide a clean and healthy environment, and more recently to comply with their National Pollutant Discharge Elimination System stormwater permits.

Organized Trash Cleanups

- Clean Green 15 Program – The Clean Green 15 Challenge for Baltimore County public schools is a challenge to see whose "school community" can hold the most fifteen minute litter clean-ups. Anyone can participate in a Clean Green 15 clean-up and dedicate the clean-up to a Baltimore County public school of their choice. Clean-ups are reported in bags of trash collected or by pounds of trash through an online form.
- Household Hazardous Waste Recycling Program – Baltimore County citizens can drop off household hazardous waste materials for recycling or proper disposal at three permanent collection facilities: Eastern Sanitary Landfill Solid Waste Management Facility, Central Acceptance Facility (Cockeysville), and Western Acceptance Facility (Halethorpe). The facilities are operated by EPS, in cooperation with the Department of Public Works (DPW), and are open Monday through Saturday. In addition, EPS holds two one-day collection events annually, in the spring and fall, at different locations around Baltimore County.
- Upland Assessments – The Upland Assessment identifies areas in need of improved trash management and provides the data needed to target citizen awareness efforts, organize trash cleanups, and other litter reduction BMPs.
- Maryland Green Schools Program – This program is overseen by the Maryland Association of Environmental and Outdoor Educators. The program helps schools in the County achieve Green School status or to be re-certified. As part of this program, schools emphasize reducing the amount of trash generated.

### *8.1.3 Structural BMPs*

Trash and debris can be washed through storm drain networks. Some stormwater management facilities by nature allow for the collection of trash. For example, because of their concave nature, wet ponds and detention ponds inherently collect trash. Additionally, most stormwater facilities are required to have one or both of the following BMPs:

Trash Rack – Trash racks are used to prevent trash and debris from clogging stormwater outlet control structures. They are grills, grates, or other devices installed at the intake of a channel, pipe, drain, or spillway for the purpose of preventing oversized debris from entering the structure (MDE, 2000 Maryland Stormwater Design Manual 2000).

Hydrodynamic Separators - Hydrodynamic separators are engineered to separate out sediment and oil and floating trash and come in a variety of sizes. They use the energy of the flowing water to separate the sediment and trash from the flowing water as it moves through a separation screen, no outside power source is needed.

Table 8-1 displays different types of BMPs and which pollutants they address. Some BMPs are able to address many different pollutants, while some BMPs may be specifically targeted at reducing only a few pollutants. Table 8-2 shows the trash reduction efficiencies of structural and nonstructural BMPs.

**Table 8-1: Pollutant Reductions of BMPs**

| Practice | Nitrogen | Nutrients | Sediment | Bacteria | Trash |
|---|---|---|---|---|---|
| Dry Detention Ponds and Hydrodynamic Structures | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dry Extended Detention Ponds | ✓ | ✓ | ✓ | ✓ | ✓ |
| Wet Ponds & Wetlands | ✓ | ✓ | ✓ | ✓ | ✓ |
| Infiltration Practices | ✓ | ✓ | ✓ | ✓ | |
| Filtering Practices | ✓ | ✓ | ✓ | ✓ | ✓ |
| Environmental Site Design | ✓ | ✓ | ✓ | | ✓ |
| Street Sweeping and Inlet Cleaning | ✓ | ✓ | ✓ | ✓ | ✓ |
| Tree Planting | ✓ | ✓ | ✓ | | |
| Urban Forest Buffers | ✓ | ✓ | ✓ | ✓ | |
| Impervious Surface Removal | ✓ | ✓ | ✓ | | |
| Stream Restoration | ✓ | ✓ | ✓ | ✓ | |
| MD Fertilizer Use Act of 2011 | ✓ | ✓ | | | |
| Organized Trash Cleanups | | | | | ✓ |
| Trash Rack | | | | | ✓ |
| Hydrodynamic Separators | | | | | ✓ |
| Public Education | | | | ✓ | ✓ |

**Table 8-2: Trash Reduction Efficiencies of BMPs**

| Practice | How Credited | Category | Trash Efficiency |
|---|---|---|---|
| SWM facilities | Reduction Efficiency | Structural | 95%[1] |
| Street Sweeping and Inlet Cleaning | Load reduction (lbs) / ton of dry material | Management Program | Based on weight of material removed |
| Anti-litter Campaign; School-Based Programs, Clean Green 15 | | Educational | 50-60% [2] |
| Littering and Illegal Dumping Enforcement; Dumpster Management | | Enforcement | 5% of Industrial and Commercial "Hot" Land Use[3] |

[1] Source: Anacostia Watershed Implementation Plan (Montgomery County Department of Environmental Protection 2012)

[2] Based on maximum practicable reduction targets in the bacteria TMDLs for Baltimore County and adjustment for uncertainty in the relatedness of anti-litter campaign BMP efficiency to pet-waste campaign BMP efficiency (Maryland Department of the Environment 2006)

[3] Based on assumptions in Anacostia Watershed Implementation Plan (Montgomery County Department of Environmental Protection 2012) associated with other outreach and education programs. Assumes 100% of industrial and commercial hot areas are targeted and 8% awareness and 60% effectiveness, or 1.0 x 0.08 x 0. = 0.05

## 8.2 BMP Calculations

Pollutant reductions for practices with approved reduction efficiencies are calculated based on the approximate pollutant load received from the drainage area (DA) and removal efficiencies (RE) recommended by CBP for the various types of SWM faculties. The equation used to estimate trash reductions for a particular type of BMP is expressed as:

$$[LR((lbs/acre)/yr) * DA(acres)] * 95(\%)$$

The pollutant load received from the drainage area contributing to the SWM facility is denoted by the first expression in brackets in the above equations. The load must be calculated for each

type of land use draining to the facility using the appropriate loading rate (LR). The percent pollutant removal efficiency is based on the values shown in Table 8-2.

## 8.3 Uncertainty and Research Needs

### *8.3.1 BMP Efficiency Uncertainty*

There is uncertainty on how trash in transported in a watershed. Best management practices approved by the Chesapeake Bay Program are assigned estimated pollutant reducing capabilities for nutrients and sediment, but not for trash, based on the best available science at the time. Although every effort is made to be as accurate as possible with these estimates, uncertainties do exist surrounding the pollutant reducing capabilities of all BMPs. More research is needed to determine the effect of BMPs on trash, especially for nonstructural BMPs such as the proposed anti-litter campaign. BMP effectiveness and performance depends on periodic maintenance.

The estimated BMP reduction for Stormwater Management Facilities is based on the best available data. We were unable to find any more recent documentation of such removal efficiencies than the Montgomery County Department of Environment's 2012 Anacostia Watershed Implementation Plan. As we move into implementation, we will continue to gather the best available research and reporting on the efficiency of SWM ponds in collecting trash. We will also develop a monitoring program to better estimate SWM pond trash trapping efficiency. This monitoring program with monitor various types of SWM facilities and their trash reduction efficiencies.

Efficiencies for the anti-litter campaign are also based on best available data. As part of the anti-litter campaign, the county will be developing a methodology for tracking the success of the campaign. Ultimately, the data will be used to estimate a more accurate reduction efficiency for the anti-litter campaign.

## 8.4 Alternative BMPs

If the County determines that it cannot achieve the reduction needed with the BMPs listed above, the following alternative BMPs will be considered:

Inlet Insert - Inlet inserts come in a variety of forms and devices vary by manufacturer, but generally they are a separator or screen that sits inside the storm drain and is meant to separate trash from the water as it flows through the insert.

End of Pipe Screening - This device is a basket or net attached to the end of a storm drain pipe that catches the trash as the water flows out of the pipe.

Trash Boom - Trash booms can be thought of as large floating fences that stop anything floating on the surface of the water. Floating debris is allowed to gather at the trash boom until it can be removed from the water or, in some instances, there may be a catchment device that trash is directed into as it accumulates in the boom. These are most effective when they can be placed in a spot that accumulates a lot of trash and is downstream of some high litter sources.

Debris Cage - Debris cages are meant for use in stormwater management basins and ponds. The debris cage covers the outflow point of the stormwater pond so that debris that has found its way into the pond cannot escape into the river or stream with the exiting water. These are part of the regular design of most stormwater management facilities.

Storm Drain Grates - Storm drain grates are simply grates that cover the storm drain inlet. They catch debris before it enters the storm drain. They must be cleaned regularly through street

sweeping to remove debris and prevent flooding. They are sometimes hinged to fold down during high water flow to prevent flooding due to clogged gates.

In this section you will find a list of actions that together become one scenario for how the county could reach the trash pollutant load reduction target. Progress will be assessed on an annual basis through results of implementation actions and monitoring data. Progress will be reported in the county's Annual NPDES report, which is posted to the county EPS website every year. It is intended that the Implementation Plan will be reviewed on a five-year cycle for potential revisions. The County takes an adaptive management approach to all watershed planning efforts.

Adaptive management is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood (U.S Department of the Interior 2009). The tools that Baltimore County will use in adaptive management are the tracking of implementation progress through the various actions proposed in the strategy in this section, identification of barriers that prevent targeted actions from occurring, and an enhanced monitoring program to measure progress in both reductions and meeting water quality standards.

Due to the nature of litter pollution, there are many uncertainties in the available data. The implementation approach in this plan is based on available data. As uncertainties are resolved, adjustments may need to be made to the plan. The baseline year for this TMDL Implementation Plan is 2010. This baseline year was determined because the baseline study was done in 2010 and 2011 and because the TMDL loading rates were determined use 2010 land use data.

## 9.1 Uncertainties

The following list of uncertainties are some of the trash pollution questions that are not answered by the available literature. These uncertainties may cause the measurable outcome of implementation actions to differ from the calculated reductions in this section. Further study will need to be done to determine the measureable effect of these issues on load reductions.

***Trash Transport Pathways to Waterbodies:***

We do not know what percentage of debris, from various drop points on land (i.e. from storm drains, from roads, by distance from stream, by type of land use etc.) actually make it into the waterbody. This is necessary to determine how the weight of trash removed from the upland area translates to weight (in lbs/yr) diverted from the stream. Due to this uncertainty, any reduction estimates from actions conducted in upland areas may be inaccurate.

***Percentage of Trash Collected that is Lingering Pollution and Not part of the Annual Load:***

Trash has a tendency to get stuck on limbs and roots, embedded in sediment, etc. as it passes down a stream channel. Trash can linger at these points of attachment until it is washed away. When we remove trash from a stream channel, we count the entire weight removed. It should be noted, however, that the entire weight may not be attributable to the annual trash loading due to this lingering tendency. There is currently no available data in the literature, which would allow us to estimate the amount of trash collected that is actually legacy trash.

***Percentage of Trash that is likely to be Transported to the Impaired Shoreline:***

The impairment that triggered the TMDL is specific to the shoreline of the *"Middle Branch from the mouth (Ferry Bar Park to Harbor Hospital Center) extending westward and the Northwest Branch from the Hull Street Pier to Canton Waterfront Park.*" It is assumed that the upland

watersheds, which drain to the shoreline are the source of the impairing shoreline trash. The goal of the TMDL is to reduce trash and debris throughout the watersheds to the extent that the shoreline is no longer impaired. As mentioned above, trash has a tendency to get stuck as it passes through a stream channel. We do not know to what extent trash lingers in the stream channel or the factors that affect the likelihood of the trash to linger in the channel. Therefore, we do not know if there are specific sources or kinds of trash or points of release that are more likely to result in trash reaching the shoreline than others.

## 9.2 A Two Phase Plan

Actions are divided into two phases. Phase 1 is the source reduction phase. This phase includes education, incentive and enforcement actions that are meant to stop littering before it gets into the environment. Any new actions developed for this phase will be considered part of the Clean Green County Initiative, which is a conglomeration of various environmental programs initiated throughout the county. Phase 1 will also include the continuation of any existing municipal programs and a means of measuring the effectiveness of Phase 1 actions. Throughout Phase 1, effectiveness of the first phase programs will be evaluated. The evaluation will be incorporated into the Annual NPDES report. Phase I implementation will be conducted for a ten year period, at which point the report will include a recommendation for or against moving into Phase 2, and a rationale for that recommendation.

Phase 2 is the contingent treatment actions phase, which includes the installment of trapping devices, such as inlet inserts, trash booms, end of pipe trash traps, etc. to capture the trash after it has been littered. Phase 2 will be far more costly than Phase 1, making it preferable to avoid this phase if possible. Additionally, source reduction actions are preferable over trapping devices because trash trapping does not stop the act of littering from occurring. Litter will still enter the environment, but be captured where trapping devices exist.

The initiation of Phase 2 is contingent upon the determination that Phase 1 actions are not sufficient to meet the TMDL reduction requirements within a 20 year timeline. This determination to initiate Phase 2 will be made ten years into implementation. Figure 9-1 shows how implementation phases will be applied to reach the goal.

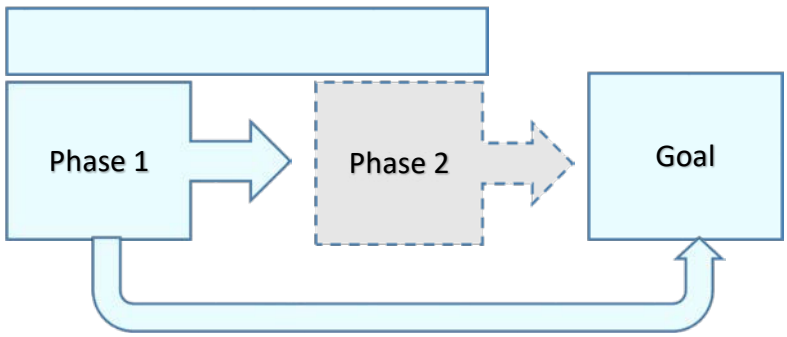


**Figure 9-1: Implementation Phases**

## 9.3 Existing Trash Reduction Efforts

Existing efforts include all efforts that the county is currently making to address trash and litter in the Jones and Gwynns Falls Watersheds.

### *9.3.1 Street Sweeping*

Street Sweeping is a program of the Baltimore County Department of Public Works, Bureau of Highways. Street sweeping is conducted every year to keep debris out of the storm drains and out of the Chesapeake Bay. Over 1,000 tons of debris are removed each year across the county. Ten county street sweepers and one contract street sweeper maintain over 2,600 miles of roadway. Table 9-1 shows curb miles in Baltimore County by sector and percent of curb miles swept.

**Table 9-1: Street Sweeping Curb Miles**

| Watershed | Category | Non-Curb Road Edge Length (mi) | % of Non-Curb Road Edge Length | Curb Road Edge Length (mi) | Total Road Edge Length (mi) | Percent of Road Edges with Curbs (swept) |
|---|---|---|---|---|---|---|
| **Gwynns Falls** | | | | | | |
| Gwynns Falls | County | 294.75 | 74.4 | 725 | 1,019 | 71.1% |
| Gwynns Falls | Non-County Total | 101.07 | 25.5 | 101 | 202 | Unknown |
| Gwynns Falls | City | 0.47 | 0.1 | | | |
| Gwynns Falls | State | 99.57 | 25.1 | | | |
| **Gwynns Falls** | **Total** | **396** | **100.0** | **826** | **1,222** | **Unknown** |
| **Jones Falls** | | | | | | |
| Jones Falls | County | 273.75 | 73.1 | 360 | 633 | 56.8% |
| Jones Falls | Non-County Total | 100.53 | 26.9 | 55 | 156 | Unknown |
| Jones Falls | City | 1.20 | 0.3 | | | |
| Jones Falls | State | 99.33 | 26.5 | | | |
| **Jones Falls** | **Total** | **374** | **100.0** | **415** | **789** | **Unknown** |

The calculation used to determine trash load reductions from street sweeping is based on total annual street sweeping debris by highway shop. A GIS analysis of the watershed was used to determine how much of that debris was likely collected from streets in the Jones and Gwynns Falls watersheds. With little data available on the percentage of street sweeping debris that is trash, the 2006 study described in the storm drain cleaning section below was determined to be the best available data for calculating trash load reductions. This is based on the assumption that the debris found in stormdrain inlets is similar in composition to the debris along curb and gutter that is collected by the street sweepers.

Baltimore County plans to conduct a future study to establish a more accurate trash reduction estimate for street sweeping. The TMDL actions will be adjusted as improved data becomes available. Any updates to the calculated reductions needed to meet the TMDL will be recorded in the county's Annual NPDES report.

The debris collected has varied over the years due to various reasons, including the age of the sweepers causing them to be out of service for repair. In 2014, using Stormwater Remediation Fee funds, the county increased its fleet of street sweepers to nine. This led to a significant increase in street sweeping in FY 2014 that continued into FY 2015. In addition, in FY 2014, the Bureau of Highways purchased three Elgin Megawind Sewer Catch Basin trucks. These complement the vehicles already in service with the Bureau of Utilities. The material collected

from the inlets is dumped in the street sweeping debris dumpster and weighed at the landfill. That data is included with the Street Sweeping Program and not with the inlet cleaning. Table 9-2 and Table 9-3 show the amount of debris removed (**not adjusted for trash loading estimates**) by street sweeping in Gwynns and Jones Falls respectively.

**Table 9-2: Debris removed by Street Sweeping in Gwynns Falls**

| Year | Debris (Tons) |
|---|---|
| CY2010 | 307.1 |
| CY2011 | 242.3 |
| FY2012* | 283.8 |
| FY2013 | 200.4 |
| FY2014 | 529.5 |
| FY2015 | 257.5 |

* The analysis for 2012 was projected in terms of the 2012 fiscal year using data from January-June 2012, which was added to the ½ the value of the 2011 data.

**Table 9-3: Debris removed by Street Sweeping in Jones Falls**

| Year | Debris (Tons) |
|---|---|
| CY2010 | 65.0 |
| CY2011 | 51.3 |
| FY2012* | 60.0 |
| FY2013 | 42.4 |
| FY2014 | 529.5 |
| FY2015 | 133.22 |

* The analysis for 2012 was projected in terms of the 2012 fiscal year using data from January-June 2012, which was added to the ½ the value of the 2011 data.

Tonnage of debris collected is reported as tons per highway shop (debris weighed at landfill). Street sweeping is conducted only on roads with curb and gutters. Some alleys, County parking lots, and open roadways (without curb and gutter) are swept when requested. State Routes such as MD 45 (York Road) are not handled by the County; State Highway Administration is responsible for those roads.

### *9.3.2 Storm Drain Cleaning*

Storm drain cleaning is an ongoing programmatic action of the county. Data from storm drain cleaning is collected on an annual basis and published in the annual NPDES report. A study in 2006 of the composition of inlet debris found that trash accounted for 8.9% of the weight of the debris. Based on this study, the FY 2015 weights were multiplied by 0.089 to get the estimated annual load reductions for storm drain cleaning.

The 2006 study utilized a limited sample of storm drains to determine average percentage of trash per inlet. Baltimore County will conduct a study to establish a more accurate trash reduction estimate for storm drain cleaning. The TMDL actions will be adjusted as improved data becomes available. Any updates to the calculated reductions needed to meet the TMDL will be recorded in the county's Annual NPDES report. Table 9-4 and Table 9-5 show the total amount of material removed (**not adjusted for trash loading estimates**) by reporting year in Gwynns and Jones Falls respectively.

Table 9-4: Material Removed in Gwynns Falls

| Year | Inlets Cleaned | Inlet Volume Cleaned (Cu. yd.) | Length of Pipe Cleaned (Ft.) | Pipe Volume Cleaned (Cu. yd.) | Total Volume (Cu. yd.) |
|---|---|---|---|---|---|
| CY2010 | 60 | 91.4 | 2,325 | 46.7 | 138.1 |
| CY2011 | 107 | 111.0 | 4,205 | 69.0 | 179.9 |
| FY2012* | 101 | 89.9 | 3,586 | 67 | 156.8 |
| FY2013 | 56 | 86.3 | 3,057 | 62.5 | 148.8 |
| FY2014 | 44 | 71.9 | 2,207 | 37.6 | 109.5 |
| FY2015 | 181 | 102.3 | 7,010 | 102.5 | 204.8 |

* The analysis for 2012 was projected in terms of the 2012 fiscal year using data from January-June 2012, which was added to the ½ the value of the 2011 data.

Table 9-5: Material Removed in Jones Falls

| Year | Inlets Cleaned | Inlet Volume Cleaned (Cu. yd.) | Length of Pipe Cleaned (Ft.) | Pipe Volume Cleaned (Cu. yd.) | Total Volume (Cu. yd.) |
|---|---|---|---|---|---|
| CY2010 | 26 | 21.5 | 1,017 | 9.8 | 31.3 |
| CY2011 | 38 | 42.9 | 1,312 | 16.3 | 59.1 |
| FY2012* | 22 | 21.5 | 831 | 10.1 | 31.5 |
| FY2013 | 37 | 20.9 | 2,280 | 30.8 | 51.6 |
| FY2014 | 31 | 34.9 | 1,283 | 20.9 | 55.9 |
| FY2015 | 125 | 45.6 | 8,311 | 70.3 | 115.9 |

* The analysis for 2012 was projected in terms of the 2012 fiscal year using data from January-June 2012, which was added to the ½ the value of the 2011 data.

The number of inlets clean has varied over the years but has increased overall. The inlet volume cleaned has also varied. However, in FY 2015 it was assumed the pipe was 50% full before cleaning and then the volume of debris was determined. In previous years, 100% and 75% assumptions have been used.

The length of pipe cleaned and volume of pipe cleaned as well as the volume has increased substantially between 2010 and 2015.

### *9.3.3 Stormwater Management Facilities*

Due to the methodology that was used to determine the baseline trash loads for Baltimore County, the county is able to take credit for reductions from stormwater management facilities and apply it toward the TMDL reduction. Reductions estimates for storm water management facilities are based on a 95% removal efficiency, as described in Section 8 of this plan. The estimated reductions were calculated using the drainage acres by land use within drainage areas for stormwater management facilities in the Jones and Gwynns Falls. Trash loading rates were applied to the land use categories. The 95% efficiency was then applied to the calculated loadings to get the estimated reductions. The LA reductions are calculated using the average LA trash loading rate as presented in the trash TMDL (0.51).

### *9.3.4 Clean Green County*

The Clean Green County Initiative encompasses many programs in various departments of the county that aim to make Baltimore County cleaner and greener. Some of these programs are temporary and some are on-going. Recently, the Team BCPS Clean Green 15 Litter Challenge was developed as a primary branch of the Clean Green County Initiative. All new anti-litter

education and outreach programs developed as part of this implementation plan will be Clean Green County programs and will be an integral part of the county's continued efforts to make Baltimore County cleaner and greener.

The Clean Green 15 program is a Clean Green County Initiative to encourage citizens to do short 15 minute trash clean –ups around the county and to report the amount of litter that they picked up. The following website has a description of Clean Green 15 and the reporting form for clean-ups http://www.baltimorecountymd.gov/Agencies/environment/cleangreen/cleangreen15.html. An expansion of Clean Green 15 through Baltimore County Public Schools, Team BCBS Clean Green 15 Litter Challenge, began in 2014. Baltimore County public schools compete to see whose "school community" can hold the most Clean Green 15 litter clean-ups. "School community" means school-based groups as well as any civic or community group, scout troop, sports team, place of worship, youth group, environmental organization, etc. who wants to do a clean-up and designate a school to receive credit.

Participating groups conducted Clean Green 15-minute litter clean-ups, and recorded their clean-ups on a program web site, designating one BCPS school to receive credit. Winning schools were selected based on clean-up activity credited to their school as well as other anti-litter education and outreach efforts.

Purpose:

- to prompt young people to internalize an anti-litter ethic
- to directly remove tons of litter from communities, preventing it from polluting waterways
- to generate "buzz" and positive peer pressure about litter and its damaging effects

Calculated trash reductions for this TMDL implementation plan were based on an average of 2014 and 2015 Clean Green 15 reports. GIS analysis was used to query out those cleanups located within the Jones and Gwynns Falls watershed boundaries. The averages for each watershed were then separated into estimated WLA and LA.

### *9.3.5 Project Clean Stream*

Project Clean Stream is a program of the Alliance for the Chesapeake Bay. The project has been in existence for about 12 years and gathers volunteers to come together and do a few hours of trash clean-up on a unified day of service. Even though the project is aimed at getting volunteers for this single day event, they support clean-up projects throughout the spring. There are a number of organizations in Baltimore County that have participated in project clean stream.

The Alliance for the Chesapeake Bay provided Baltimore County with project clean stream data for projects in Baltimore County over the years 2013-2015. An average was calculated for each watershed and separated into estimated waste load allocations and load allocations.

Baltimore County will continue to seek the best available data for all trash reduction calculations. As better data becomes available, adjustments to load reduction calculations will be found in the annual NPDES report.

Project Clean Stream has been in existence prior to the baseline year. Baltimore County is not subtracting the difference between the number of clean ups prior to the baseline and cleanups after the baseline. The decision to not subtract the baseline is because stream cleanups occur in stream. The baseline study was done in stormwater management ponds. The loading rate for the TMDL was calculated based on litter in stormwater management ponds in 2010 would not have been altered by instream cleanups.

### *9.3.6 NGO and Community Stream Clean Ups*

Baltimore County partners with Blue Water Baltimore, the primary watershed association non-profit working in the Jones and Gwynns Falls watersheds. Blue Water Baltimore supplies the weight of their total trash collected from stream clean-ups in the county each year. They have supplied this data since their formation to present. Because this report was written in 2015, the full stream clean-up data for 2015 was not yet available. In order to avoid double counting, Baltimore County must separate out the Project Clean Stream clean-ups from the other NGO clean-ups. Full data was available for Project Clean Stream events from 2013-2015. Considering the available data, an average of Blue Water Baltimore clean-ups for the years 2013 and 2014, minus their Project Clean Stream clean-ups, was used to develop a reduction estimate for NGO stream cleanups. The average was then separated by estimated waste load allocation and load allocation.

NGO and Community Stream Clean Ups have been occurring for many years. Baltimore County is not subtracting the difference between the number of clean ups prior to the baseline and cleanups after the baseline. The decision to not subtract the baseline is because stream cleanups occur in stream. The baseline study was done in stormwater management ponds. The loading rate for the TMDL was calculated based on litter in stormwater management ponds in 2010 would not have been altered by instream cleanups.

### *9.3.7 Enforcement*

Existing enforcement against littering in Baltimore County is tasked to both the Baltimore County Police Department and Baltimore County Department of Permits Approvals and Inspections. The Police Department can issue tickets for littering. Permits Approvals and Inspections handles open dump conditions, junk yard conditions, and other issues related to dumping. The enforcement reductions are calculated, assuming an 8% awareness from the public that enforcement actions will be taken against them if they are in violation of litter and dumping related regulations, and 60% effectiveness that enforcement will prevent future problems. These awareness and effectiveness factors come from Montgomery County's Anacostia Watershed Implementation Plan and their interpretation of how the Center for Watershed Protection Watershed Treatment Model data could be applied to littering and illegal dumping enforcement and litter management. Our enforcement programs target all land uses across the county and so we applied the efficiency to not just one land use, but the litter load for all land uses.

### *9.3.8 Programmatic Actions*

Programmatic actions are actions that do not directly result in load reductions, but create the necessary conditions for load reduction. These actions will move Baltimore County closer to achieving TMDL targets; however, there is currently no way to attribute a predictable pollutant load reduction to programmatic actions. Some programmatic actions, such as investigation and monitoring, are necessary to implement management and restoration actions or make those actions more efficient. Other programmatic actions are predicted to increase the load reduction over time through behavioral change and/or BMP implementation by individual citizens. Programmatic actions are listed in Table 9-6. Each of these actions are ongoing actions. Although some of the programmatic actions have a performance measure in tons of debris, a loading reduction of litter to the watershed cannot be calculated due to a lack of data on change since the baseline year or due to a lack of data on how much of the debris may have been littered if not for the program. These actions are described in detail in the Baltimore County Trash and Litter Reduction Strategy.

Table 9-6: Programmatic Litter Reduction Actions

| Action | Responsible Department/Bureau | Performance Measure |
|---|---|---|
| Solid Waste Education Programs | Public Works Bureau of Solid Waste | Number of students reached |
| Community Clean Up Program | Public Works Bureau of Solid Waste | N/A |
| Recycle Bin Loan Program | Public Works Bureau of Solid Waste | N/A |
| Adopt-A-Road | Public Works Bureau of Highways | # of Bags Collected |
| Inmate Litter Crew Highway Cleanup | Public Works Bureau of Highways | Tons of debris collected and number of bags collected |
| District Litter Removal | Public Works Bureau of Highways | Tons of debris from dumpster |
| Neighborhood Dumpster Clean-Ups | Public Works Bureau of Highways | Tons of debris from dumpster |

### *9.3.9 Monitoring and Reporting Actions*

The monitoring and reporting actions listed in Table 9-7 below are ongoing and will provide the means for determining progress made in meeting the load reductions. Some of the monitoring actions will be used to better target programs for remediation. Reporting actions are actions that have been outlined in previous TMDL Implementation Plans that apply to this Implementation Plan as well.

Table 9-7: Monitoring and Reporting Actions

| Action | Time Frame | Performance Standard | Responsible Party |
|---|---|---|---|
| **Monitoring Actions** | | | |
| Trash Trend Monitoring | Ongoing | Annual Monitoring in Gwynns and Jones Falls | EPS |
| Upland Trash Assessments | Ongoing | Annual Monitoring in Gwynns and Jones Falls | EPS |
| **Reporting Actions** | | | |
| Develop a unified restoration tracking system to track progress toward meeting TMDL reduction requirements | 1 year | Tracking system implemented after 1 year | EPS |
| SWAP Implementation Committees to meet on a semi-annual basis to discuss implementation progress and assess any changes needed to meet the goals | 20 years | 2 meetings per year | EPS and Implementation Committee partners |
| Continue to update status of restoration projects and BMPs in the Annual MS4 Report | Annually | MS4 Report submitted to MDE and posted on county website | EPS |
| Implement the Continuing Public Outreach Plan | On-going | Number of actions per year | EPS |

| | | | |
|---|---|---|---|
| Hold Biennial State of Our Watersheds Conference in even years | Biennially | Conference Held | EPS |
| Adaptive management assessment of the Implementation Plan | 5 year intervals | Assessment complete | EPS |

## 9.4 Implementation Actions Calculations and Adaptive Management Approach to Reductions

All estimated reductions are based on the available data. Due to the uncertainties in the data currently available, these reduction estimates have been calculated only for the purpose of guiding actions and interim goals in this implementation plan.

Reductions, in Table 9-8 below, have been broken out by WLA and LA using the percentages of each of these loads, by watershed, found in the baseline study. The percentages have been applied only to reduction actions that may represent both WLA and LA removals. Baltimore County EPS will investigate future data collection methodologies that may lead to more accurate measures of WLA and LA distribution for the applicable actions.

The reductions will be revaluated as more data becomes available and as more studies are conducted. The implementation actions and interim goals may be altered as more reliable reductions are revealed. Data collected on these actions can be found annually in the NPDES annual report http://www.baltimorecountymd.gov/Agencies/environment/npdes/. As improved data leads to revisions in the plan, those revisions will become publicly available as well.

**Table 9-8: Trash TMDL Implementation Actions and Load Reductions for Existing Programs**

| Action | Calculation | Calculated Reduction Jones (WLA) | Calculated Reduction Result Jones (LA) | Calculated Reduction Result Gwynns (WLA) | Calculated Reduction Result Gwynns (LA) |
|---|---|---|---|---|---|
| | | Lbs/yr | Lbs/yr | Lbs/yr | Lbs/yr |
| Category Percentage of Watershed Load | | 78% | 22% | 84% | 16% |
| Ongoing Management Actions | | | | | |
| Street Sweeping | (Lbs street sweeping debris per watershed area 2015- lbs street sweeping debris per watershed area 2010) *8.9% trash = total reduction from street sweeping | 3,932 | N/A | 4,746 | N/A |
| Storm Drain Cleaning | (Debris FY 2015 (NPDES 2015 Table 7-4) - 2010 debris from storm drains) (refer to SOP for calculations) Multiplied by 0.089 as 8.9% of weight is assumed to be trash from historical data. | 2,140 | N/A | 1,438 | N/A |

| Action | Calculation | Calculated Reduction Jones (WLA) Lbs/yr | Calculated Reduction Result Jones (LA) Lbs/yr | Calculated Reduction Result Gwynns (WLA) Lbs/yr | Calculated Reduction Result Gwynns (LA) Lbs/yr |
|---|---|---|---|---|---|
| Category Percentage of Watershed Load | | 78% | 22% | 84% | 16% |
| SWM facilities | ∑ (Drainage Acres 2015 by land use * loading rate for land use) * 95% efficiency | 9,048 | N/A | 25,558 | N/A |
| SWM facility Conversions | ∑ (Drainage Acres 2015 by land use * loading rate for land use) * 95% efficiency | N/A | N/A | 732 | 105 |
| SWM facility retrofits | ∑ (Drainage Acres 2015 by land use * loading rate for land use) * 95% efficiency | 791 | 101 | 292 | 23 |
| Ongoing Clean Ups | | | | | |
| Clean Green 15 | Average 2014 and 2015 lbs removed * WLA or LA percentage | 135 | 38 | 4758 | 906 |
| Community Clean Ups (BWB) | Average Clean Ups 2014 and 2013 (excluding project clean stream)* WLA or LA percentage | 5,417 | 1,528 | 2,079 | 396 |
| Project Clean Stream | Average lbs of trash collected 2013-2015* WLA or LA percentage | 3419 | 964 | 2187 | 417 |
| Enforcement | | | | | |
| Anti-litter and Dumping Enforcement | 8% awareness and 60% effectiveness for all land uses = 5% efficiency for all land uses. | 2322 | 661 | 3887 | 731 |
| Monitoring Removals | | | | | |
| In-stream trash monitoring program removals | Average Trash collected 2012-2014 | 65 | 26 | 307 | 185 |
| **Total Calculable Reductions** | | **27,269** | **3,318** | **45,994** | **2,763** |
| **Total Reduction Goal (Based on Baltimore County Delineation of the Jones and Gwynns Falls plus 5% MOS)** | | **48,773** | **13,887** | **81,621** | **15,345** |

## 9.5 Gap Analysis

The gap analysis serves as the comparison between actual reductions from existing actions and the desired reductions to meet the TMDL goal. The remaining reductions are displayed in Table 9-9. Subsections describe the process of analysis used to select opportunities for program

enhancements. Those program enhancements will be administered to meet the remaining reductions.

**Table 9-9: Remaining Reductions**

| | Jones Falls WLA | Jones Falls LA | Gwynns Falls WLA | Gwynns Falls LA | Total |
|---|---|---|---|---|---|
| TMDL Goal | 48,773 | 13,887 | 81,621 | 15,345 | 159,626 |
| Reductions from Existing Actions | 27,269 | 3,318 | 45,994 | 2,763 | 79,344 |
| Remaining Reductions | 21,504 | 10,569 | 35,627 | 12,582 | 80,282 |
| Existing Actions Progress to Goal | 55.9% | 23.9% | 56.4% | 18.0% | 49.7% |

### *9.5.1 Information Gathered from County Wide Listening Sessions*

Baltimore County EPS held three open community meetings to engage with the public in a discussion about trash and litter in Baltimore County. The meetings were held at three different locations in an attempt to receive input from as many participants from various neighborhoods. One on the west side of the county at the Randallstown Community Center, one in the north/central area at the University of Maryland extension near Cockeysville, and one on the east side of the county in the Dundalk area at Patapsco High School. These weeknight meetings ran about 90 minutes and included short presentations from Baltimore County staff regarding the litter problem, known data, and the need to develop a Trash and Litter Reduction Strategy. Information was collected during two forums of open discussion within each meeting, each included a way of recording survey results, and a note taker was designated to record meeting comments and events. Comments and reports were also accepted via email before and after the meetings.

In all three meetings, Litter Thrown from Cars was a top-three source as perceived by survey respondents with Fast Food being included in at least the top four of each listening session. According to discussions in both Eastern and Western community meetings, overflowing public trash bins and bus stop maintenance were brought up as specific issues. The desire for enhanced enforcement actions by the county was expressed at all three meetings. Incentive programs were repeatedly suggested as well.

Barriers to these actions include the difficulty of changing public attitudes about littering, collecting sufficient record of the areas where these littering issues are occurring and the challenge to enforcement agencies to catch litterers in the act and to devote sufficient time to do so. When enforcement agencies devote time to littering, their time is reduced for addressing other enforcement needs. Creative strategies are needed to address these problems and the feasibility of programs related to the issues identified in the public meetings will needs to be assessed.

More information about the listening sessions is available in the county wide Trash and Litter Reduction Strategy.

### *9.5.2 Upland Trash Assessment*

The available research on trash transport to waterbodies and education and outreach efficiencies for litter reduction is limited. Baltimore County has developed an Upland Trash Assessment in

order to better target education and outreach efforts, as well as other trash reduction actions, and to potentially establish a baseline of upland littering for future outreach efficiency measurements. This assessment will help the county to determine areas of high littering, identify reportable littered areas for clean-up and/or enforcement actions, better track and follow up on litter removal in the upland areas, identify any correlation between area characteristics and levels of litter, focus litter reduction efforts in the areas that are most affected by litter, and establish baseline levels of upland litter for areas assessed.

Results collected from the Upland Trash Assessment will be reported annually in the NPDES report. This data will help to focus any program enhancements.

### *9.5.3 Trash and Litter Reduction Strategy and SWAP*

The trash reduction strategy is a county wide litter reduction plan, which includes a list of actions to be considered for reducing litter across Baltimore County. The trash and litter reduction strategy development involved meeting with several Baltimore County agencies to improve collaboration in determining feasibility of future actions. EPS will continue to maintain close collaboration with other county agencies throughout the implementation of the trash TMDL. Potential actions identified in the Trash and Litter Reduction Strategy acted as a guide to the opportunities for program enhancements identified within this plan.

The Small Watershed Action Plans (SWAPs) involve a careful study and characterization of the watershed and a list of goals, objectives and actions based on the results of that study and input from the steering committee. Nine of the SWAPs have specific goals relating to litter reduction. Actions such as investigating hotspots and institutions identified as having trash management problems and developing a trash and litter management work plan align with the development of the trash and litter reduction strategy and the upland trash assessment.

### *9.5.4 Opportunities for Program Enhancements in the Jones Falls and Gwynns Falls Watersheds*

Potential opportunities for program enhancements would expand Phase I of the Trash TMDL implementation in Baltimore County. Reductions and efficiencies are not available for most of these potential programs. Once feasibility of these enhancement programs is explored, and if a plan of implementation is developed, methodologies for determining reductions will be developed as part of program implementation. These suggested program enhancements are one scenario of options that the county will consider based on the gap analysis data. This list does not exclude other program enhancements from inclusion in Phase I implementation.

#### 9.5.4.1 Anti-Litter Campaign

Development of the campaign will include a pilot term in which the effectiveness will be evaluated. A scientific method for evaluating the impact of the public outreach campaign on county citizens will be developed for the purposes of this evaluation. Changes may be made to the campaign due to findings in the pilot term, prior to full implementation. Data on campaign impacts will continue to be collected throughout the lifespan of the campaign. A request for proposal has been developed to contract outside help to develop the anti-litter campaign and measurement of campaign efficiency.

MDE describes maximum practicable reductions for domestic bacteria in the Bacteria TMDLs for Baltimore County, estimating a possible 75% reduction. Domestic pet waste pollution is primarily a public awareness issue, meaning that the majority of this reduction will likely be from improved public awareness through various messaging techniques. Accounting for other

BMPs that might address pet waste pollution and for uncertainty in the effectiveness of anti-litter messaging, Baltimore County estimates that an anti-litter campaign could practicably reduce litter pollution by 50-60%.

As part of the anti-litter campaign, the county will be developing a methodology for tracking the success of the campaign to be implemented along with the outreach strategies. Ultimately, the data will be used to estimate a more precise reduction efficiency. Using an adaptive management approach, the county will assess the need to revise the implementation strategy on a regular basis. If the new reduction efficiency is outside the range of 50-60% reduction, the path to meeting reduction goals will be reevaluated based on the new efficiency.

9.5.4.2 Expanding Police Enforcement of Littering

Twelve jurisdictions of the Potomac River watershed claim April as their litter enforcement month due to a program initiated by the Alice Ferguson Foundation. In these jurisdictions it is always illegal to litter but in April, officers increase their focus on littering and sometimes issue a press release warning citizens that they will be looking out for litter bugs. Baltimore County EPS will coordinate with the Police Department to explore the feasibility of a litter enforcement day. Resource limitations may be a barrier to this type of program. An effective enforcement program, such as the one described should include some associated outreach. The program would also need to include a component for determining a load reduction efficiency.

9.5.4.3 Increase Litter Reporting to Permits Approvals and Inspections

As part of the Upland Trash Assessment, field crews complete a standard assessment form for each site assessed. At the end of the assessment form, there is an option to report an issue to PAI. Sites will be investigated at random by field crews and any issue can be immediately reported to PAI through this option on the form. This will provide a system of identifying and resolving a higher number of littering issues throughout the county.

9.5.4.4 Residential Incentive Program

A residential incentive program will be explored. Neighborhoods that have the least litter or that participate in trash clean ups may be recognized as part of a Clean Neighborhood Incentive Program. This incentive program would reward neighborhood associations that recognize the importance of litter reduction and prevention. It would also demonstrate Baltimore County's recognition that the efforts of individual citizens are crucial to a successful county wide litter reduction campaign. Because there is no data available on the litter reduction efficiency of such a program, a monitoring component would need to be incorporated into the program as well.

9.5.4.5 Business Incentive Program

Corporate Environmental Responsibility is becoming an increasingly important concept in the business sector. It is a sub-set of Corporate Social Responsibility, which has become a staple in many modern business models. This action would create a program to recognize those local businesses that make Environmental Responsibility a priority and subsequently contribute to the efforts of making a healthier and cleaner Baltimore County. The first step in this action would be to develop criteria for Corporate Environmental Responsibility recognition in the county. Eventually, a system of determining the efficiency of the program would need to be developed.

9.5.4.6 Enhanced Monitoring

Baltimore County will assess the potential for refinement of our monitoring programs. Where possible, programs will be expanded. Enhancement of these programs will not have calculable

load reductions, but may lead to improved efficiency of other trash reducing BMPs, which could indirectly increase load reductions.

9.5.4.7 Planned SWM Facility Retrofits

The planned SWM facility retrofits are the drainage acres planned for retrofits to meet existing nutrient and sediment TMDLs. The trash loading rate used to calculate WLA reductions from these planned facilities is the area weighted average point-source trash load for urban lands in each watershed: 3.41 lbs/ac/yr in Gwynns Falls, and 2.14 lbs/ac/yr in Jones Falls. The LA reductions are calculated using the average LA trash loading rate as presented in the trash TMDL (0.51).

9.5.4.8 Redevelopment

Redevelopment refers to new construction on sites that were developed in the past, typically before stormwater management requirements existed. Current State of Maryland regulations require the installation of stormwater management BMPs at redevelopment sites. These new stormwater management BMPs are similar to stormwater retrofits: they take trash loads that were previously unmanaged and manage them with a stormwater BMP. To encourage redevelopment, the regulations allow a set portion of each redevelopment site to remain untreated by stormwater BMPs. Baltimore County staff have tracked redevelopment projects built from 2011 through 2015. Most of those projects were on commercial or industrial sites. For the redevelopment projects during that period, 65% of the total redevelopment site area transitioned from untreated to treated, while 5% was treated before the projects, and 30% remained untreated after the projects. Applying the 95% efficiency for trash removal for SWM facilities, 61.75% of the trash load from redevelopment sites are captured by SWM facilities. The point-source loading rate for commercial and industrial land is 7.91 lbs/ac/year, and the non-point source loading rate is 0.51 lbs/ac/year. Thus, redevelopment provides 4.88 lbs/ac/yr point-source load reductions, and 0.315 lbs/ac/yr non-point source load reductions.

### *9.5.5 Calculating Potential Trash Reductions from Program Enhancements*

At this time it is possible to calculate some, but not all projected reductions from program enhancements. Table 9-10 displays a list of all potential program enhancements. Table 9-11 expands upon Table 9-9 to show potential progress toward the TMDL goal with program enhancements. It is important to note that the progress to the goal shown in Table 9-8 will not include program enhancements that have unknown reductions and will likely be greater once those efficiencies are known.

**Table 9-10: Opportunities for Program Enhancements to Meet Load Reductions**

| Actions | Reductions Calculations | Reductions |
|---|---|---|
| **Enhancement of Programmatic Actions** | | |
| Implement Anti-litter campaign | 50-60% * Total trash land use loading | 50-60% for Gwynns and Jones WLA and LA |
| Explore the Feasibility of Expanding Police Enforcement | efficiency * land use | Unknown |
| Increase Litter Reporting to PAI Through Upland Trash Assessments | # of citations * average weight per citation * efficiency of citation | Unknown |
| Explore the Feasibility of a Residential Incentive Program | efficiency * land use | Unknown |
| Explore the Feasibility of a Business Incentive Program | efficiency * land use | Unknown |
| **Enhancement of Monitoring Actions** | | |
| Existing Trash Trend Assessment for Refinements | N/A | N/A |
| Increased Effort of Upland Assessments | N/A | N/A |
| Develop Trash Reduction Effectiveness Monitoring | N/A | N/A |
| Develop Trash Transport Monitoring | N/A | N/A |

**Table 9-11: Remaining Reductions**

| | Jones Falls WLA | Jones Falls LA | Gwynns Falls WLA | Gwynns Falls LA | Total |
|---|---|---|---|---|---|
| TMDL Goal | 48,773 | 13,887 | 81,621 | 15,345 | 159,626 |
| Reductions from Existing Actions | 27,269 | 3,318 | 45,994 | 2,763 | 79,344 |
| Remaining Reductions | 21,504 | 10,569 | 35,627 | 12,582 | 80,282 |
| Existing Actions | 55.9% | 23.9% | 56.4% | 18.0% | 49.7% |
| Planned SWM facility retrofit Reductions | 0 | 146 | 0 | 2,137 | 2,283 |
| Redevelopment SWM Reductions | 269 | 17 | 1,221 | 79 | 1,586 |
| Anti-Litter Campaign | 21,235 | 8,332 | 34,406 | 9,207 | 73,180 |
| Anti-Litter Campaign Percent Reduction* | 44% | 60% | 42% | 60% | 46% |
| Calculable reductions with Program enhancement | 48, 773 (100%) | 11,813 (85.1%) | 81,621 (100%) | 14,186 (92.4%) | 156,393 (98.0%) |

*Estimated Anti-litter campaign reduction efficiency is 50-60% (see section 9.5.4.1). Reductions are estimated at a maximum of 60%. If the remaining reduction after existing actions is less than 60%, then reductions are the total of the remaining amount.

## 9.6 Reductions Discussed

The timeline to implement all of the future actions with measurable reduction extends over the next 20 years. That means that all actions will be implemented by 2036. However, it is important to understand the role of lag times in watershed management and planning. Lag time is the delay from when a pollution control action is taken to when it actually results in water quality improvements. It is the sum of time required for practices to take desired effect, time required for effect to be delivered to the water source, and time required for the waterbody to respond to the effect (Meals, Dressing and Davenport 2010). The term lag time is typically applied to pollutants like sediment, nitrogen and phosphorus. The effect of lag time on litter reduction has little or no study, but it is assumed that there is a lag between when anti-litter education is provided to the public and when the public incorporates it into their daily actions and a reduction of upland litter results, which should eventually lead to a measurable reduction in waterbodies. Expectations in water quality results should take lag time into account.

Because of the uncertainties surrounding litter reduction practices and their direct effects on watershed loadings, adaptive management will be a significant component to this plan. As previously mentioned, the plan will be revaluated every 5 years and any changes will be made publicly available. Many of the actions in this plan incorporate some type of evaluation for more accurate reductions estimates. Monitoring and data collection will parallel the implementation actions. Monitoring procedures will be detailed in the NPDES Annual Report as they are developed. See Section 10 for a more detailed explanation of how implementation progress will be assessed.

## 9.7 Milestones

Milestones for implementation will be set at five year intervals. Progress in meeting milestones will be carefully tracked and will be reported in the annual NPDES Report. The adaptive management approach of this implementation plan means that the implementation strategy will be adjusted if milestones are not being met. The table below, Table 9-12, shows the five year milestone goals and the steps of implementation that will take place at each of the five year intervals.

**Table 9-12: Milestones**

| Year | 2016 | 2021 | 2026 | 2031 | 2036 |
|---|---|---|---|---|---|
| Percent Progress to Goal | 62.9%[1] | 70% | 80% | 90% | 100% |
| Implementation Step | Begin Development of Program Enhancements | Program Enhancements are In Beginning Stages of Implementation | Evaluation of Necessity of Phase II Based on Progress; Design of Phase II Begins | Continue Phase I and/or Begin Implementing Phase II | Meet TMDL Goal |

1. Percentage of total existing reductions to TMDL goal from Table 9-8

## 9.8 Phase II: Trapping Devices

At 10 years, Baltimore County will evaluate the plan for the necessity of implementing Phase II actions, outlined in Table 9-13. Phase II is the use of trash trapping and filtering devices to meet the reduction goal. It is contingent on a determination by Baltimore County that the TMDL reduction requirement cannot be met with only the outreach, incentives and enforcement outlined in this initial plan. The monitoring data collected from the first 10 years will be used to determine if Phase II is necessary and if there are any priority locations to install trapping

devices. The Phase II plan will be developed when and if it is deemed necessary. Phase II actions may include:

**Table 9-13: Possible Phase II Treatment Devices**

| Device | Description |
|---|---|
| Inlet insert | Inlet inserts come in a variety of forms and devices vary by manufacturer, but generally they are a separator or screen that sits inside the storm drain and is meant to separate trash from the water as it flows through the insert |
| End of pipe screening | This device is a basket or net attached to the end of a storm drain pipe that catches the trash as the water flows out of the pipe. This action presents several issues including access to pipes, frequent maintenance and netting detaching during high flows |
| Trash boom | Trash booms can be thought of as large floating fences that stop anything floating on the surface of the water. Floating debris is allowed to gather at the trash boom until it can be removed from the water or, in some instances, there may be a catchment device that trash is directed into as it accumulates in the boom. These are most effective when they can be placed in a spot that accumulates a lot of trash and is downstream of some high litter sources. |
| Storm drain gates | Storm drain gates are simply grates that cover the storm drain inlet. They catch debris before it enters the storm drain. They must be cleaned regularly to remove debris and prevent flooding. They are sometimes designed to open during high water flow to prevent flooding due to clogged gates. |

It is not yet possible to calculate reductions for many of these actions because these devices often require on site assessments and considerable planning. Until these assessments can be made, we do not yet know the potential size and scope of these projects.

We can however, calculate a potential reduction if all inlets in Baltimore County, not draining to a trash-treating SWM facility, had inlet inserts installed. This reduction will only be to the WLA because the trash WLA is defined as debris that could potentially be transported by the storm drain system.

This calculation can be done by first identifying and tallying all the inlets that do not drain to trash-treating SWM facilities ("untreated inlets"). Next, an average land area per inlet is calculated by finding the acreage of stormdrain outfall drainage areas, and dividing that acreage by the number of stormdrain inflows located inside said outfall drainage areas. Next, the average per-acre trash loading rate for outfall drainage areas is calculated by overlaying with the MDP 2010 land use data, multiplying by the land use loading rates specified in the Trash TMDL, and dividing by the acreage. The trash load received by untreated inlets is calculated by multiplying the number of untreated inlets with the average land area per inlet and multiplying that with the average per-acre trash loading rate. A 95% efficiency was then applied to the trash load received by the untreated inlets. Table 9-15 shows the WLA load reductions for Jones and Gwynns falls from this calculated scenario and the percent progress to goal including existing actions. Table 9-14 shows the data used in calculating the inlet insert scenario reductions.

Table 9-14: Jones and Gwynns Falls Inlet Insert Scenario Calculations

| | Inlets outside drainage are to SWM facilities that treat trash |
|---|---|
| **Gwynns Falls** | 7,156 |
| **Jones Falls** | 3,390 |
| | **Average acres per inlet** |
| **Gwynns Falls** | 1.67 |
| **Jones Falls** | 1.53 |
| | **Land area draining to untreated inlets (acres)** |
| **Gwynns Falls** | 11,951.57 |
| **Jones Falls** | 5,200.15 |
| | **Reductions from Inlet Inserts (lbs/yr)** |
| **Gwynns Falls** | 39,126 |
| **Jones Falls** | 15,804 |

Table 9-15: Jones and Gwynns Falls Inlet Insert Scenario Reductions

| | Jones Falls WLA | Gwynns Falls WLA |
|---|---|---|
| **TMDL Goal** | **48,773 lbs/yr** | **81,621 lbs/yr** |
| **Inlet Insert Scenario Projected Reductions** | 15,804 lbs/yr | 39,126 lbs/yr |
| **Reductions from Existing Actions** | 27,278 lbs/yr | 64,935 lbs/yr |
| **Total Inlet Insert Scenario + Existing Actions** | **43,082 lbs/yr** | **104,061 lbs/yr** |
| **% to goal** | **88.3%** | **100%** |

The inlet insert scenario in Table 9-15 for the Gwynns Falls led to a reduction that far exceeds the TMDL WLA goal. The inlet insert scenario for the Jones Falls would allow us to reach 88.3% of the TMDL WLA goal. This means that this remaining reduction could come from the anti-litter campaign and/or from Phase I or Phase II actions that do not yet have calculable reduction. In order to reach the remaining 11.7% reduction in the Jones Falls with the anti-litter campaign alone, the anti-litter campaign would need to have a minimum reduction efficiency of 11.7%. The potential use of other phase II trapping mechanisms and their associated trash reductions will be investigated.

The assessment of implementation progress is based on two aspects; progress in meeting programmatic, management, and restoration actions; and progress in meeting water quality standards and any interim water quality benchmarks. The assessment of progress in meeting the restoration actions; includes setting up methods of data tracking, validation of projects, and pollutant load reductions associated with the actions (10.1) and will be consistent across all TMDL Implementation Plans. The assessment of progress in meeting water quality standards and interim milestones (10.2) is the data analysis associated with the monitoring plan specific to each TMDL Implementation Plan.

## 10.1 Implementation Progress: Data Tracking, Validation, Load Reduction Calculation and Reporting

MDE provides guidance through its web site, with a webpage entitled *Maryland TMDL Data Center*. This site provides guidance on the development of the TMDL Implementation Plans and is updated on a regular basis. MDE has provided specific guidance for developing trash/debris TMDL implementation plans entitled Guidance for Developing Stormwater Wasteload Allocation Implementation Plans for Trash/Debris Total Maximum Daily Loads. MDE strongly recommends the inclusion of a monitoring program within a trash TMDL implementation plan. To assist with the development of such a program, MDE has also provided a Trash Monitoring Guidance document. These guidance documents have been used to guide the development of this plan.

Baltimore County is preparing a document entitled *Baltimore County Method for Pollutant Load Calculations, Pollutant Load Reduction Calculations, and Impervious Area Treated.* This document will detail the data sources, data analysis (including pollutant load calculations, and pollutant load reductions calculations), validation of the practices, and reporting of progress made. It will be modified on an annual basis to take into account any modifications to any guidance documents, monitoring results, and/or new literature; and future calculations will reference the edition on which the calculations were based.

### *10.1.1 Reporting*

Baltimore County will prepare two-year milestones for each local TMDL in conformance with the Chesapeake Bay TMDL two-year milestone process. Programmatic actions and monitoring data analysis will be based on the calendar year, while restoration actions will be based on the fiscal year (July 1 – June 30). The current two-year milestone period was developed in January 2014; for Programmatic actions covers January 2014 through December 2015, and for restoration actions cover July 1, 2013 through June 30, 2015. When the next two-year milestones are developed in 2016, they will be presented by watershed and will include each of the local TMDLs.

Reporting will be done through the annual NPDES – MS4 Permit Report. This is technically due on the anniversary date of the permit renewal, but will be completed for submittal to MDE in October each year, if possible. The report will detail progress made in meeting each of the local TMDLs and the Chesapeake Bay TMDL. The analysis will include progress in meeting the two-year milestone programmatic and restoration actions, along with the calculated load reduction. It will also present the results of the monitoring conducted the previous year. See below for TDML specific monitoring.

In January of each year, a progress report (mostly extracted from the MS4 report) will be prepared and posted on the web.

## 10.2 Implementation Progress: Water Quality Monitoring

The rationale for the development of the Baltimore Harbor Trash TMDL was that the narrative standard for Trash, set by COMAR Title 26 Subtitle 08, Chapter 2, was not being met for the shoreline of the Middle Branch from the mouth extending westward and the Northwest Branch from the Hull Street Pier to Canton Waterfront Park. The narrative standard prohibits pollution by wastes that are unsightly, produce taste or odor, change the existing color to one that is objectionable for aesthetic purposes, create a nuisance, or interfere directly or indirectly with designated uses. The source of trash is known to be from humans, but since little is known about trash transport pathways, variables that affect the loading of trash to waterbodies, and BMP efficiencies for trash management actions, Baltimore County will develop new monitoring programs to address these gaps in the available research.

### *10.2.1 Upland Trash Assessment*

The upland trash assessment was pilot tested in select areas of the Upper Jones Falls and the Gwynns Falls in 2015. The purpose of the upland trash assessment is to determine the areas of the Jones and Gwynns Falls with the highest levels of littering. These highly littered areas can then be targeted for education and outreach or reported to the appropriate authority for enforcement when necessary. Upland areas with high trash volume may also become prospective clean-up sites for watershed organizations. The upland trash assessment is a windshield survey, which is conducted by answering a standard set of questions about the area's trash and litter related conditions (i.e. are dumpsters overflowing, are there no dumping or anti-litter signs present, are traffic conditions in the area high, medium, or low etc.). Additionally, the windshield survey involves conducting a visual ranking of various areas of the site in terms of litter volume. Surveyed sites may be Residential, institutional, or commercial in nature (i.e. a neighborhood, a shopping center, a school etc.). The Upland Litter Assessment is discussed in further detail in section 6.

### *10.2.2 Future Monitoring*

There is limited data on the efficiencies of trash reduction practices. Baltimore County plans to conduct future monitoring on the efficiency of practices implemented in the county. Findings will be detailed in the Annual NPDES report as monitoring is conducted. Updates to projected reductions and adaptations will be detailed in the annual report as well.

One specific challenge that will require future monitoring is in measuring the effectiveness of an education and outreach campaign. In order to understand the efficiency of the anti-litter campaign, we will need to measure behavioral change and the resulting pollutant load reductions. A request for proposal has been advertised by Baltimore County for an education and outreach environmental consultant. This consultant will have the expertise to aid in the development of the anti-litter campaign and also to develop a methodology for measuring behavioral change and identifying a trash reduction efficiency for the anti-litter campaign.

More data may also be needed on the pathways of trash delivery to the stream and to the impaired shoreline in order to fully understand the efficiency of litter reduction actions. Potential future monitoring may be done on trash pathways from land and passage through the stream.

In order to engage the public in the TMDL implementation process this continuing public outreach plan will be implemented upon approval of this TMDL Implementation Plan. The continuing public outreach plan is applicable to all TMDL Implementation Plans that are currently being developed and those developed in the future, as well as the Trash and Litter Reduction Strategy. This continuing public outreach plan is meant to engage county agencies, environmental groups, the business community, and the general public.

## 11.1 County Agencies

County agencies will be engaged through two regularly scheduled NPDES Management Committee meetings per year and other agencies meetings as necessary to move implementation forward.

### *11.1.1 NPDES Management Committee*

The NPDES Management Committee is composed of representative agencies that are involved in meeting the NPDES – MS4 Permit requirements. This committee has met irregularly in the past, generally to review information on permit requirements and other upcoming regulatory requirements, such as, the General Industrial Stormwater Discharge Permit. In the future this committee will meet twice per year and will discuss not only the NPDES – MS4 Permit requirements, but also the TMDL Implementation Plans and progress being made in meeting the implementation strategy. In order to address all components of the TMDL Implementation Plans the committee membership will be expanded to include any county agency that has some responsibility for TMDL implementation. Examples being, the County Police Department and the Department of Environmental Protection and Sustainability – Groundwater Management Section. Prior to the development of the TMDL Implementation Plans and the Trash and Litter Reduction Strategy, these agencies were not specifically engaged in NPDES – MS4 Permit activities.

The first yearly meeting will be held in January of each year. The focus of this meeting will be to review the implementation plan 2-year milestones for each plan; provide a forum for discussion of the ability to meet the implementation actions; and determine any revisions necessary to meet the interim implementation milestones set in the plan. This meeting is also the forum for discussion of data tracking and reporting to ensure that the implementation actions are properly credited.

The second yearly meeting will be held in July of each year and will provide the forum for determining data submittal for the yearly progress report on the implementation actions and the resulting load reductions. The monitoring data from the previous calendar year will be presented and contrasted with the interim water quality milestones that are detailed in each implementation plan.

### *11.1.2 Other Agency Meetings*

In order to move forward with implementation, agency meetings regarding specific implementation actions are anticipated. These will be scheduled as needed, and tracked by meeting date, attendance, TMDL Implementation Plans discussed, and topic. Meeting minutes will be reported in the Annual NPDES – MS4 Report submitted to Maryland Department of the Environment. This report is also posted on the County website for public access.

## 11.2 Meetings with Baltimore City

Baltimore County EPS will meet with Baltimore City Public Works on a quarterly basis to share data and other information about Trash TMDL implementation. The primary purpose of these quarterly information sharing meetings is to collaborate on monitoring methodologies and to share trash reduction efficiency data as it is developed. This collaboration will provide consistency in determining progress toward the TMDL goal. Additional work sessions will be scheduled between quarterly meetings as needed.

## 11.3 Environmental Groups

Baltimore County is currently engaged with local watershed associations through its funding of *Watershed Association Restoration Planning and Implementation Grants*, and through inclusion of watershed association members on the Steering Committees of the Small Watershed Action Plans. Formerly, this engagement and support was coordinated through the *Baltimore Watershed Agreement*. As part of that engagement, periodic Watershed Advisory Group (WAG) meetings were held. As part of this continuing public outreach plan, WAG participation will be formalized with two meetings per year.

The first meeting will be held in March of each year and focus on the local and Chesapeake Bay TMDL implementation actions and implementation progress, including an analysis of the pollutant load reduction calculations from the previous fiscal year. The watershed associations are currently engaged in citizen-based restoration activities and report their implementation progress to the county for inclusion in the Annual NPDES – MS4 Report. This meeting will provide a forum for discussion of the progress being made, coordination between the watershed associations, and any changes to the *Watershed Association Restoration Planning and Implementation Grant* being considered for the next grant period.

The second meeting will be held in November of each year and will focus on the water quality monitoring results from the previous calendar year. The results presented will compare trends and measures against the TMDL Implementation Plans water quality benchmarks and water quality standards.

## 11.4 Business Community

The business community will be engaged through various business forums, targeted outreach and education efforts on specific topics, and hosting workshops on specific topics as necessary.

### *11.4.1 Business Forums*

Business forums, such as the Hunt Valley Business Forum with greater than 200 business members, provide opportunities to present the TMDL Implementation Plans and the Trash and Litter Reduction Strategy, and discuss the role of business in helping improve water quality. These forums will be convened as the opportunities arise. Summaries of these meetings will be reported in the annual NPDES – MS4 Report and will include the name of the forum (or other business organization), approximate number in attendance, the topic presented, and audience responses.

### *11.4.2 Targeted Business Outreach and Education*

The Small Watershed Action Plan (SWAP) process includes an upland assessment of potential pollution hotspots. Often, these potential hotspots are commercial or industrial sites. The information derived from this assessment will be used to target outreach and education to

businesses specific to the issue(s) at the location identified in each SWAP. These actions will be tracked and reported in the annual NPDES – MS4 Report.

### *11.4.3 Business Workshops*

There are certain issues that may be pervasive through a segment of the business community that can most effectively be addressed through hosting workshop education on the specific topic. These issues will be identified as SWAP implementation moves forward, but one potential topic for a business workshop is related to the recently renewed *General Discharge Permit for Stormwater Associated with Industrial Activities.* A workshop designed in conjunction with Maryland Department of the Environment would not only result in improved water quality, but it would also benefit the business community through increased understanding of the requirements of the permit.

## 11.5 General Public

The general public will be engaged through a number of mechanisms, including:

- WIP Team meetings
- Targeted outreach and education efforts on specific topics
- Steering Committee meetings and stakeholder meetings in the development of Small Watershed Action Plans
- Meetings of the Implementation Committee for completed Small Watershed Action Plans
- Displays at various events
- Annual progress reports posted on the county website and placed in our libraries
- A biennial *State of Our Watersheds* conference.

### *11.5.1 Watershed Implementation Plan (WIP) Team Meetings*

Baltimore County has assembled a Watershed Implementation Plan (WIP) team to serve as a sounding board for the development of the WIP to address the Chesapeake Bay TMDL. Members of the team include representatives from various county agencies, business community representatives (particularly the environmental engineering community), watershed associations, representatives from the agricultural community, and Baltimore County citizens.

The county will schedule at least one meeting annually to present implementation progress and to address specific topics related to the TMDL Implementation Plans and the Trash and Litter Reduction Strategy. Meetings will be scheduled as issues arise. It is anticipated that the WIP team will provide initial review of newly developed outreach and education materials, in order to provide feedback from a variety of perspectives.

### *11.5.2 Targeted Outreach and Education*

The Small Watershed Action Plan development process includes upland assessments of neighborhoods to identify pollution sources and restoration opportunities. This information will be used to prioritize and target outreach and education efforts specific to the issue(s) in neighborhoods with the intent to affect behavioral change and/or increase citizen based restoration actions. These actions will be tracked and reported in the annual NPDES – MS4 Report.

### *11.5.3 Small Watershed Action Plans (SWAPs)*

Baltimore County has been developing Small Watershed Action Plans since 2008. There are 22 planning areas in the county, with 13 completed plans, 5 plans in development, and 4 areas pending. These planning areas cover the entire county. The planning process includes the

development of a steering committee, the composition of which is determined by the issues, and land ownership within the planning area. At a minimum membership consists of agency representatives, watershed associations, and citizen representatives. The process also includes a number of stakeholder meetings, open to all planning area residents and businesses, which provide information on the plan and solicit input. Once the SWAP is complete, the steering committee becomes the implementation committee. As designed the implementation committee is to meet twice per year, however, most implementation committees have not met this goal.

The plans have addressed to varying degrees the TMDLs that are applicable within the planning area. Some of the TMDLs have been developed subsequent to the specific SWAP development or did not address the full range of TMDLs that were applicable to the planning area. The TMDL Implementation Plans are built on incorporation of the actions from each SWAP within the applicable TMDL area. In some cases, additional actions have been identified in order to meet water quality standards.

#### 11.5.3.1 Small Watershed Action Plans in Development and Future Plans

For SWAPs currently under development, and for plans developed in the future, the steering committee and stakeholder meetings will be used for outreach regarding the TMDL Implementation Plans and the progress being made in achieving water quality standards. The meeting participants will be informed on where they can access the TMDL Implementation Plans, the Trash and Litter Reduction Strategy and any Progress Reports that have been developed.

Applicable TMDL Implementation Plan actions will be incorporated into the SWAP based on the assessment of applicable restoration actions within the SWAP planning area. Since the SWAPs incorporate field assessments of streams and uplands, they provide more detailed information on applicable restoration actions, both on quantity and location. The accelerated schedule for developing TMDL Implementation Plans precluded conducting field work to build the plans.

#### 11.5.3.2 Small Watershed Action Plans Already Developed

For those SWAPs already developed, the implementation committee meetings will be scheduled twice per year. The first meeting will be held in winter and will present the implementation progress not only of the SWAP, but also any applicable TMDL Implementation Plan progress. The progress analysis will be based on fiscal year. This meeting will also provide the opportunity to discuss any changes in the SWAP or the TMDL Implementation Plan based on an analysis of what actions have been successful and what actions have been more difficult to implement.

The second implementation committee meeting will be held in fall of each year and will present the monitoring data in relation to progress being made in relation to interim milestones and water quality standards.

### *11.5.4 Educational Displays at Events*

Educational displays and handouts will continue to be used at applicable events as they occur. The particular display and handout materials will be determined by the location and focus of the event. The location and focus of the event, number of citizens engaging staff at the display, and the number of handouts taken by citizens will be tracked for annual reporting in the NPDES – MS4 Report.

### *11.5.5 TMDL Implementation Plan, Trash and Litter Reduction Strategy, and Progress Report Availability*

The TMDL Implementation Plans and the Trash and Litter Reduction Strategy will be posted on the Baltimore County website with hard copies placed in county libraries. The hard copies in the libraries will be specific to the watershed in which the library is located. Progress reports will be posted on the County website and placed in libraries. A set of hard copy plans will be kept at the Baltimore County Department of Environmental Protection and Sustainability

### *11.5.6 Biennial State of Our Watersheds Conference*

Baltimore County, in conjunction with Baltimore City, has held *State of Our Watershed* conferences in the past to present information to county and city citizens on water quality issues applicable to the watersheds in these jurisdictions. Future conferences will be held in early March of even numbered years. Information on implementation progress for local TMDLs and the Bay TMDL will be presented, along with other topics of interest. These conferences will be organized with the assistance of the Watershed Advisory Group (WAG), and the surrounding local jurisdictions (Baltimore City, Howard County, Carroll County, Harford County, and York County, PA) will be invited to participate in the organization and presentation of the conference.

The timing of even years is related to the 2-year milestone process set up by the Maryland Chesapeake Bay TMDL Watershed Implementation Plan (WIP) whereby in January of even calendar years, progress in meeting the previous 2-year milestone programmatic and restoration implementation is reported and the next 2-year programmatic and restoration implementation milestones are proposed by the local jurisdictions. The timing of the conference not only permits reporting on the progress made in meeting the previous 2-year milestones but also what is planned for the next two years.

## 11.6 Summary of Continuing Public Outreach Plan

A summary of the continuing public outreach plan, by component, element and frequency is presented in Table 11-1.

**Table 11-1: Continuing Public Outreach Plan Summary**

| Plan Component | Plan Element | Frequency |
|---|---|---|
| Agencies | NPDES Management Committee | 2x per year |
| | Other Agency meetings | As needed |
| County/City Meetings | Collaboration Work Sessions | Quarterly and as needed |
| Environmental Groups | Watershed Advisory Group (WAG) meetings | 2x per year |
| Business Community | Business Forums | As identified |
| | Targeted Business Outreach and Education | As identified |
| | Topical Workshop | As identified |
| General Public | WIP Team meetings | 1x per year |
| | Targeted Outreach and Education | As identified |
| | SWAP – Steering Committee meetings | 6x per year, each |
| | SWAP – Stakeholder meetings | 2x per year, each |
| | SWAP – Implementation Committee meetings | 2x per year, each |
| | Educational Displays at Events | As identified |
| | Document availability (various) | As needed |
| | Biennial Conference | Even # Years |

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