BIRD RIVER SMALL WATERSHED ACTION PLAN

Volume I

April 2014

Prepared for

Baltimore County Department of Environmental Protection and Sustainability

Prepared by

VERSAR

with

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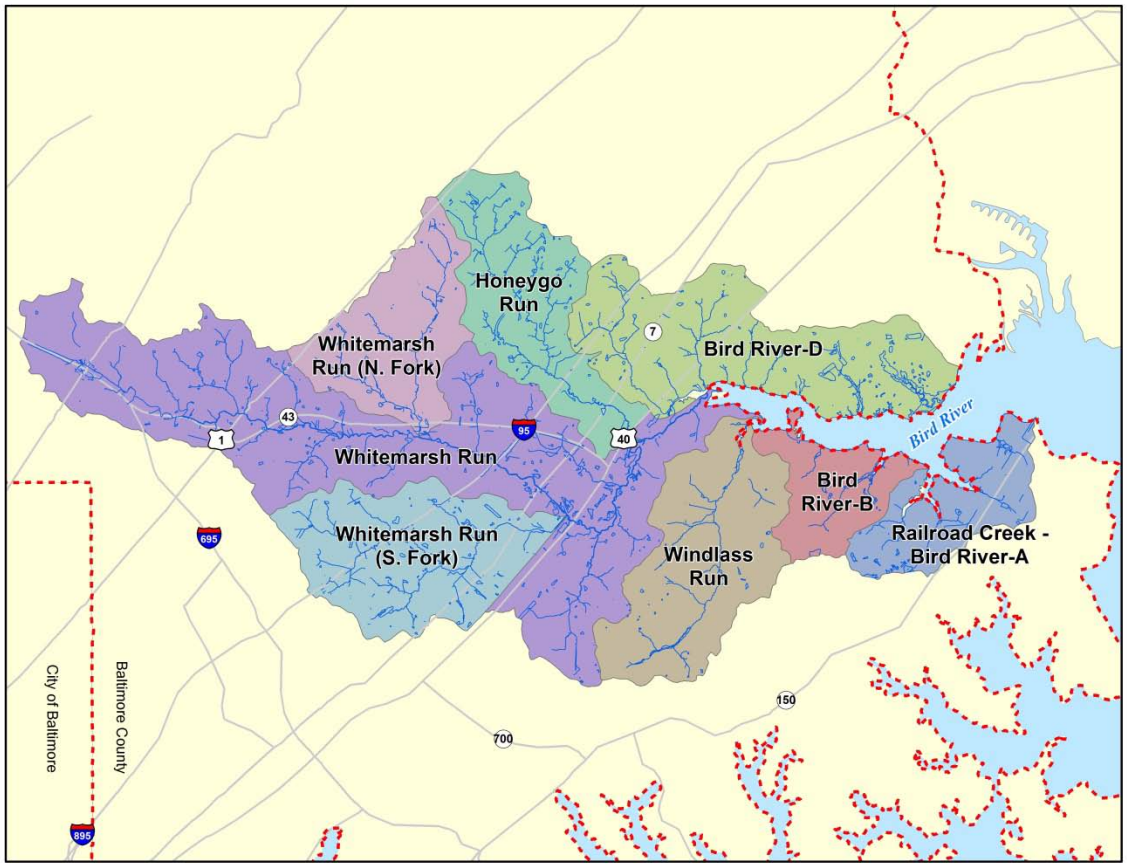
BIRD RIVER
SMALL WATERSHED ACTION PLAN



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CHAPTER 1: INTRODUCTION

1.1 Purpose

The purpose of the Bird River Small Watershed Action Plan (SWAP) is to provide guidance on the restoration of the Bird River watershed. This report outlines a series of strategies for watershed restoration, describes management strategies for each of the eight subwatersheds within the Bird River watershed, and identifies priority projects for implementation. The SWAP includes the identification of potential stormwater management conversion sites and capital projects, as well as citizen-based stream restoration opportunities, operational program implementation, and an implementation schedule. Planning-level cost estimates are provided where feasible and a preliminary schedule for implementation over a ten-year horizon is outlined. Financial and technical partners for plan implementation are suggested for various strategies and projects. The watershed plan is intended to assist Baltimore County and other organizations, such as the Gunpowder Valley Conservancy (GVC), in moving forward with restoration of the Bird River watershed.

1.2 Background

In 2005, Baltimore County initiated a new round of watershed planning, to develop Small Watershed Action Plans (SWAPs). A SWAP identifies strategies for bringing a small watershed into compliance with water quality standards and to meet other watershed management goals. Strategies include a combination of government capital projects, actions in partnership with local watershed associations, educational outreach, and volunteer activities. Effective implementation of watershed restoration strategies will require the coordination of all watershed partners and the participation of many stakeholders.

Baltimore County's SWAP planning process is intended to address the many mandates that the County is charged to meet in each individual watershed. These include the requirements of the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, watershed-specific Total Maximum Daily Loads (TMDLs), and the Chesapeake Bay TMDL. The small watershed action planning process is designed to bring all these individual mandates together at a subwatershed level that will facilitate implementation. The SWAP will inform residents about the intent of each program, examine how to most efficiently meet the goals, and define the roles of the partners.

Over the past year, Bird River watershed partners have worked together conducting assessments, identifying restoration opportunities, and engaging the community, in order to build a successful plan. A Steering Committee, consisting of various watershed partners, was formed to aid in developing the Bird River SWAP. This included Baltimore County personnel, Maryland Department of Natural Resources (DNR) personnel, members of local watershed organizations, and citizens and leaders from the local community. The Steering Committee met regularly throughout the SWAP development process. Bird River SWAP Steering Committee members are:

- Baltimore County Department of Environmental Protection and Sustainability (EPS)
  - Nathan Forand
  - Steve Stewart

- Maryland Department of Natural Resources (DNR)
  - Andrew Hangen
- Baltimore County Public Schools (BCPS)
  - Chris Blasetti
  - Steven Ruth
- University of Maryland Sea Grant Extension
  - Krisztian Varsa
- Bowerman-Loreley Beach Community Association (BLBCA)
  - Betsy Eisbart
  - Karen Schueler
- Gunpowder Valley Conservancy (GVC)
  - Charlie Conklin
  - Jack Leonard
  - Peg Perry
- Bird River Road Neighborhood Association
  - Linda Felts
- Baltimore County Commission on Environmental Quality
  - Kathy Martin
- Blue Water Baltimore
  - John Smith
- Concerned Citizens
  - Janet Terry

In addition, because the participation of the local stakeholders is an essential component for effective watershed restoration, two community meetings were held during SWAP development. These community meetings were intended to raise citizen awareness and solicit feedback from residents, local community leaders, institutions, and business associations regarding watershed restoration strategies. A description of each community meeting held, including date, approximate number of attendees, and topics covered, is provided below.

1) *Community Meeting #1* (June 24, 2013; 29 attendees): A presentation was given by Baltimore County staff to explain why a SWAP is developed and why watersheds are important to communities and the environment. Representatives of the Versar consultant

team then presented a general review of existing conditions, including photographs of watershed features and maps of subwatersheds and land use characteristics. This was followed by a presentation of work to date on the SWAP, including the status of field work, analysis, and reporting. The consultant team then led a visioning exercise for stakeholders to describe what they want the watershed to be ideally. Participants were asked to give feedback on the Draft Vision Statement and fill out a survey card with their priorities for issues the SWAP should address. The team also presented the project schedule, "next steps", and plans for future stakeholder meetings. There was a question and answer session. Following the presentation, University of Maryland Sea Grant Extension assisted the team by providing an interactive electronic map where participants could provide information on improvements in the watershed that should be addressed, either generally or at specific locations. Several community organizations set up tables to provide information on their respective missions.

2) *Community Meeting #2* (Tuesday, March 25, 2014; 25 attendees): Baltimore County staff presented updates regarding issues raised at the first Community Meeting. The consultant team summarized the SWAP process and Bird River watershed characteristics to provide context. They then explained the methods used to analyze the watershed and the results of the fieldwork and characterization report, and sought community feedback. The consultant team presented initial restoration options and solicited input and participation, particularly in regard to citizen-based restoration opportunities. A local environmental non-profit, Gunpowder Valley Conservancy, presented about their mission and role in the SWAP implementation committee. Baltimore County staff then presented about citizen actions and explained the implementation process. All presenters stressed the importance of citizen participation in conjunction with County and partner organization efforts. After a brief question and answer session, participants received information about local projects and how to get involved.

1.3 Environmental Requirements

This SWAP was developed to satisfy various regulatory drivers. They include:

- Baltimore County's NPDES municipal stormwater permit (MS4) assessment and planning requirements;
- Watershed-specific impairment listings for PCBs, nutrients, sediment, and other impairments in the Bird River watershed; and
- TMDL for the Chesapeake Bay for nutrient (nitrogen and phosphorus) and sediment reductions to meet water quality standards.

1.3.1 NPDES MS4 Permits

Baltimore County's NPDES permit (11-DP-3317, MD0068314) requires completion of detailed watershed assessments for all watersheds within the County. Assessments shall:

- Determine current water quality conditions;
- Identify and rank water quality problems;

- Include the results of visual watershed inspections;
- Prioritize all structural and nonstructural water quality improvement projects; and
- Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater wasteload allocations (WLAs).

The County's NPDES permit also requires the County to treat 20 percent of the untreated impervious area during the 5-year permit term. This SWAP meets the systematic assessment and planning requirements of the NPDES permit and provides strategies for how Baltimore County will meet the goals for addressing impervious cover.

1.3.2 Watershed-Specific Impairments

Section 303(d) of the 1972 Clean Water Act requires states to develop (and periodically update) a list of impaired waters that fail to meet applicable state water quality standards which are defined by their designated uses. States must also establish priority rankings and develop Total Maximum Daily Loads (TMDLs) for waters on the 303(d) list. According to the U.S. Environmental Protection Agency (EPA), a TMDL is a calculation of the maximum amount of a pollutant that a water body can receive in a day and still safely meet state water quality standards. TMDLs can be developed for a single pollutant or group of pollutants of concern which generally include sediment, metals, bacteria, nutrients, and pesticides.

The Bird River SWAP area (also known as Baltimore County's SWAP Area K) is one of Maryland's 8-digit watersheds. Bird River drains to the tidal Gunpowder River, just north of where the Gunpowder enters the Chesapeake Bay. The Bird River is listed as impaired in the Maryland 303(d) list of impaired waters only for polychlorinated biphenyls in fish tissue (PCBs, 2008 listing). A previous listing for total suspended solids (TSS) has been superseded by the Chesapeake Bay TMDL. There is a potential impairment of unknown cause due to insufficient data, for low fish and benthic Indices of Biotic Integrity. A previous listing for nutrients was removed following a Water Quality Analysis (WQA) in 2005. A WQA is performed by the state to determine if the pollutant of concern is actually impairing the waters. If it is determined that the pollutant of concern is not contributing to water impairment, a WQA report documenting the findings is submitted to EPA for concurrence.

The upland streams in the Bird River watershed are designated as Use IV: Recreational Trout Waters, except for the coastal plain portion in the watershed which are designated as Use I: Water Contact Recreation, and Protection of Non-tidal, Warm-water Aquatic Life. Tidal areas are designated as Use II: Support of Estuarine and Marine Aquatic Life, according to Maryland water quality standards. Impairment listings reflect the inability to meet water quality standards for these designated uses. Impairment in the tidal receiving waters is related to pollutants coming from the entire watershed; therefore, TMDLs developed for this segment will require watershed pollutant load reductions. Table 1-1 summarizes the status of the various impairment listings for the Bird River.

Table 1-1: Bird River Water Quality Impairment Listings and Status

Impairment	Applicable Segment	Regulatory Status	Approval Date
PCBs in Fish Tissue	Tidal Bird River	Impaired	
TSS	Tidal Gunpowder River, including Bird River	Impaired; the Chesapeake Bay TMDL, addressing this impairment, was finalized on 12/29/2010. This listing supersedes the Sediment/TSS listings for watersheds 02130801 and 02130803	December 2010
Unknown	Bird River 1st thru 4th order streams	Insufficient data to determine impairment, based on fish and benthic Indices of Biotic Integrity (IBIs)	
Nutrients	Tidal Bird River	WQA completed	May 2005

PCBs – Polychlorinated Biphenyls (toxic organic compounds that were widely used for applications such as transformers, capacitors, and coolants)
TSS – Total Suspended Solids

As shown in the table above, the Bird River watershed had four impairment listings. One TMDL (for TSS) and one WQA have been completed. TMDLs or WQAs may be developed at some point in the future for PCBs and biological impairment listings. The biological listing in the 2012 Integrated Report of Surface Water Quality in Maryland states there is insufficient data to determine if the Bird River is biologically impaired.

1.3.3 Chesapeake Bay TMDL

The Bird River drains to the tidal Gunpowder River and then to the Chesapeake Bay, the largest estuary in North America. In 1975, the United States Congress directed the EPA to conduct a comprehensive study of the most important problems affecting the Chesapeake Bay. The findings of this study formed the crux of the first Chesapeake Bay Agreement, signed in 1983 by Maryland, Virginia, Pennsylvania, Washington DC, the Chesapeake Bay Commission and the EPA. Additional scientific information gained from monitoring data and modeling efforts was used to amend that Agreement, resulting in the 2000 Chesapeake Bay Agreement and the interagency efforts that continue today with the development of the Chesapeake Bay TMDL and Watershed Implementation Plans (WIPs).

Scientific studies have shown that three of the biggest problems facing the health of the Chesapeake Bay and its tributaries (the rivers and streams that flow into the Bay) are excess nitrogen, phosphorus, and sediments. The nutrients nitrogen and phosphorus fuel excessive algae growth. These algae, as well as suspended sediments, cloud the water and prevent bay grasses from getting enough light. When healthy, bay grasses provide essential habitat for crabs and fish as well as food for waterfowl. When algae die, they decompose using up essential oxygen. This lack of oxygen kills bottom-dwellers such as clams and sometimes fish. In addition, excess nutrients sometimes favor the growth of harmful algae. Harmful algae can be toxic to aquatic animals and even humans.

EPA established the Chesapeake Bay TMDL, a historic and comprehensive “pollution diet” with rigorous accountability measures to initiate sweeping actions to restore clean water in the Chesapeake Bay and the region’s streams, creeks, and rivers.

Concurrent with the development of the Bay TMDL, EPA charged the Bay watershed states and the District of Columbia with developing WIPs to provide adequate “reasonable assurance” that the jurisdictions can and will achieve the nutrient and sediment reductions necessary to implement the TMDL within their respective boundaries.

Maryland’s Phase I WIP provided a series of proposed strategies that will collectively meet the 2017 target (70% of the total nutrient and sediment reductions needed to meet final 2020 goals). After more than a year of cooperative work, the Maryland Department of the Environment (MDE) and the Departments of Natural Resources, Agriculture, and Planning, submitted Maryland’s Final Phase I WIP to EPA in December 2010. Baltimore County’s Phase I plan required reductions equivalent to retrofit of 30% of pre-1985 developed land.

MDE worked with the other Maryland Bay agencies and many partners in local jurisdictions to develop Phase II WIPs with more detailed reduction targets and specific strategies to further ensure that the water quality goals of the Bay TMDL will be met (EPS 2012). Baltimore County completed its Phase II WIP in July 2012, which was incorporated into the Maryland Phase II WIP that was finalized in October 2013. Phase II WIP reduction targets for the Baltimore County watershed urban areas are: 32.2% for nitrogen and 47.0% for phosphorus. The Phase II process will continue through 2017.

1.4 U.S. EPA Watershed Planning "A-I Criteria"

This watershed plan is written to meet EPA guidance published in the October 23, 2003 Federal Register. The guidance requires watershed-based plans to restore waters impaired by nonpoint source (NPS) pollution using incremental Section 319 funds to include particular "components of a watershed based plan". Baltimore County will request EPA review and acceptance of this watershed plan based on their A-I Criteria, so that NPS implementation projects consistent with this watershed plan will be eligible for 319(h) Grant funding. The watershed plan components listed in EPA's guidance, which are commonly called the "A-I Criteria", are summarized below:

a) Identification of the causes and 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 NPS management measures;

c) A description of the NPS management measures that will need to be implemented;

d) An estimate of the amount 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;

h) A set of criteria to determine load reductions and track substantial progress towards attaining water quality standards; and

i) A monitoring component to determine whether the watershed plan is being implemented.

This watershed plan meets the A-I criteria. Table 1-2 shows where these criteria are addressed throughout this watershed plan; Appendix B summarizes the components of the plan that address each criterion.

Table 1-2: Where to Locate Information for USEPA's A-I Criteria

Report Section	USEPA Criteria								
	A	B	C	D	E	F	G	H	I
Chapter 1		✓							
Chapter 2		✓							
Chapter 3	✓	✓	✓		✓				
Chapter 4			✓		✓				
Chapter 5							✓	✓	✓
Appendix A			✓	✓	✓	✓	✓		
Appendix B									
Appendix C				✓					
Appendix D		✓						✓	
Appendix E	✓								

1.5 Partner Capabilities

In order to achieve effective watershed restoration, the capabilities of many organizations must be brought together and coordinated. Within the Baltimore region, a great deal of cooperation and coordination has been advancing in recent years as common goals in water quality improvement in local streams and rivers are sought.

1.5.1 Baltimore County

Baltimore County has a watershed restoration program to implement restoration projects, including stream restoration, stormwater conversions and retrofits, reforestation, and shoreline enhancement projects. The Bird River Water Quality Management Plan was submitted to Maryland Department of the Environment in 1995. Since then, ten stream restoration projects have been completed in the Honeygo Run, Whitemarsh Run, Whitemarsh Run (N. Fork) and Whitemarsh Run (S. Fork) subwatersheds. A total of 25,500 linear feet of stream channel have been restored. Additional funding for projects is allocated in the capital budget through FY2016 (EPS 2013). Seven retrofit projects were also completed in these subwatersheds in conjunction with the County's Department of Public Works.

Baltimore County has an extensive monitoring program that assesses the current ambient water quality, evaluates efficiency of various restoration projects in relation to pollutant removal efficiency and biological community improvement, and tracks trends over time. The County also has an Illicit Connection Program that monitors storm drain outfalls, tracks pollution sources, and coordinates remediation.

Baltimore County is under a consent decree to address Sanitary Sewer Overflows (SSOs). The consent decree has specific requirements for improvements to pumping stations, remediation of sanitary sewer lines, maintenance, and inspection. Implementation of the consent decree requirements will help reduce bacteria contamination, as well as reduce nitrogen and phosphorus in the streams.

The County operates street sweeping and inlet cleaning programs throughout the county that remove sediment, nitrogen, and phosphorus before they reach the waterways. These programs are tracked and estimates of the pollution removal are calculated (EPS 2013).

1.5.2 Gunpowder Valley Conservancy (GVC)

The Gunpowder Valley Conservancy, a non-profit organization, mobilizes people and resources to care for the lands, waters and character of the Gunpowder River watershed. Its emphasis is on land preservation, restoration, stream cleanups and education.

GVC has been working since 1989 to preserve land, improve water quality, and educate people in the Gunpowder River watershed. Their efforts include reforestation, tree maintenance, stream cleanups, trail maintenance, stormwater pollution controls, and public outreach. They partner with National Fish and Wildlife Foundation (NFWF), Baltimore County EPS, Chesapeake Bay Trust, and dozens of community partners and volunteers to perform this work. To date they have preserved 1,500 acres through conservation easements, planted 23,000 trees, cleaned 150 miles of streams, distributed 150 rain barrels, and connected with and influenced thousands of citizens through outreach efforts.

1.6 The Bird River Watershed Overview

The Bird River watershed is divided between the Eastern Piedmont and Coastal Plain regions of Maryland, located north and east of the City of Baltimore (Figure 1-1). Table 1-3 summarizes key watershed characteristics of the Bird River, which flows into the tidal Gunpowder River. The 306,136 acres of the Gunpowder River Watershed (including the tidal portions) are located within Baltimore, Carroll, and Harford Counties in Maryland and York County in Pennsylvania. The tidal portion of the Gunpowder River flows about 6.8 miles from just south of Joppa down to the Chesapeake Bay between Baltimore and Harford Counties.

The Bird River SWAP area comprises a southern portion of the Gunpowder basin, including the areas of Fullerton, Perry Hall, White Marsh, and Chase, and is approximately 16,408 acres (26 square miles) or five percent of the overall Gunpowder River watershed.

This SWAP focuses on all eight subwatersheds in the Bird River, where land use/land cover is predominantly urbanized and forested. A detailed review of the natural resources and landscape of the watershed is provided in the Bird River Watershed Characterization report (Appendix E).

The Bird River watershed contains eight smaller drainage areas called subwatersheds (Figure 1-2). In addition to characterizing the entire watershed, analyses were conducted on a subwatershed scale to provide detailed information for smaller areas and to focus restoration and preservation efforts. Also, success of restoration efforts can be more easily monitored and measured on this smaller scale.

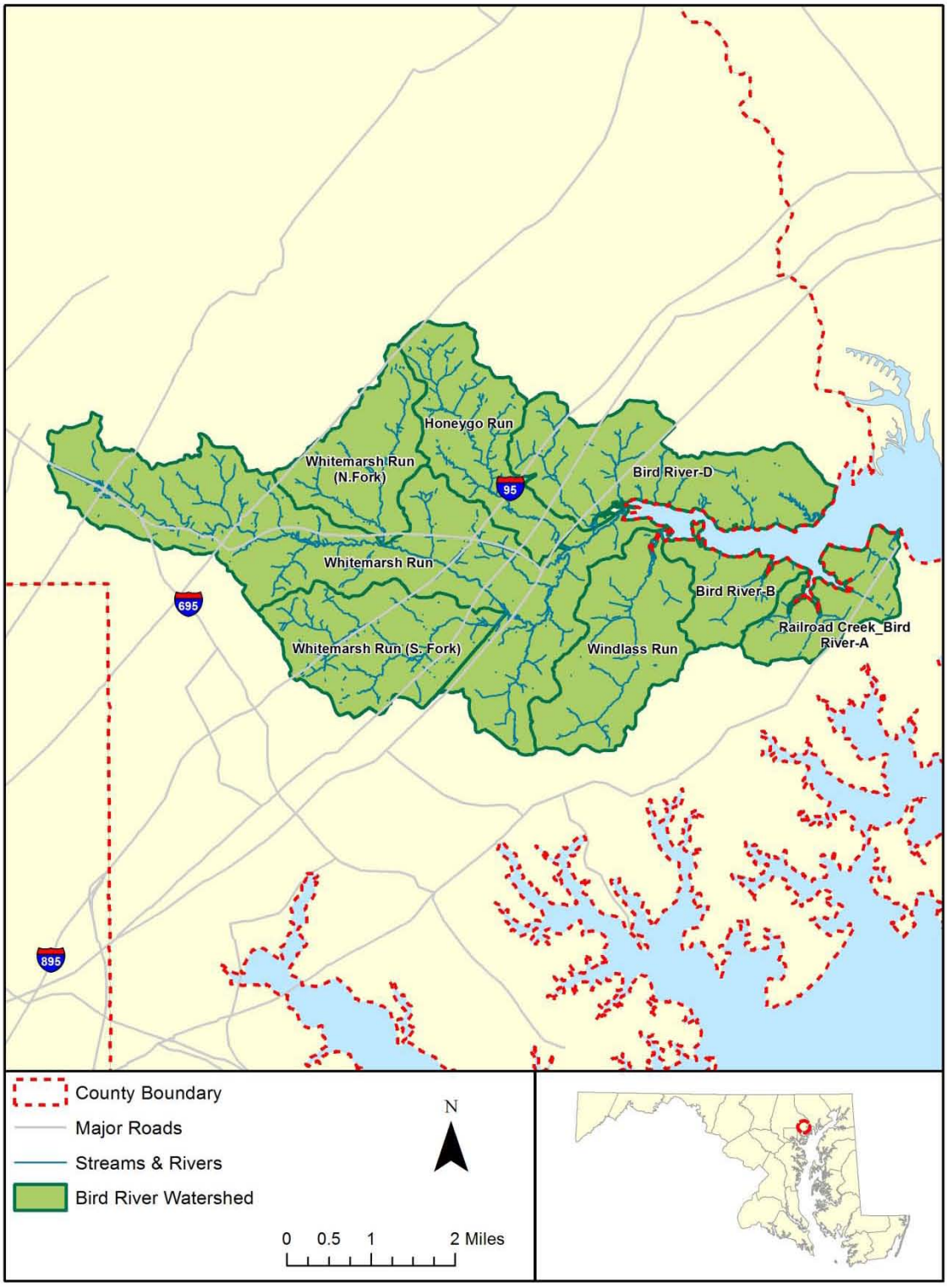

Figure 1-1: Bird River SWAP Area

Table 1-3: Key Characteristics of Bird River watershed, Baltimore County, Maryland

Drainage Area	16,408 acres (26 sq. mi.)	
Stream Length	89.84 miles	
Subwatersheds	8	
Jurisdictions	Baltimore County	
Population	60,895 (2010 census)	
Land Use/Land Cover	Very Low Density Residential:	3.7%
	Low Density Residential:	7.5%
	Medium Density Residential:	21.2%
	High Density Residential:	7.5%
	Commercial:	4.7%
	Industrial:	3.6%
	Institutional:	2.6%
	Extractive:	1.5%
	Open Urban Land:	1.6%
	Agriculture:	11.4%
	Forest:	29.3%
	Barren Land:	1.1%
	Water/Wetlands:	1.9%
	Transportation	1.2%
Impervious Cover	3,058 acres (18.6% of watershed)	
Soils	A Soils (low runoff potential):	10.9%
	B Soils:	28.6%
	C Soils:	48.5%
	D Soils (high runoff potential):	12.0%

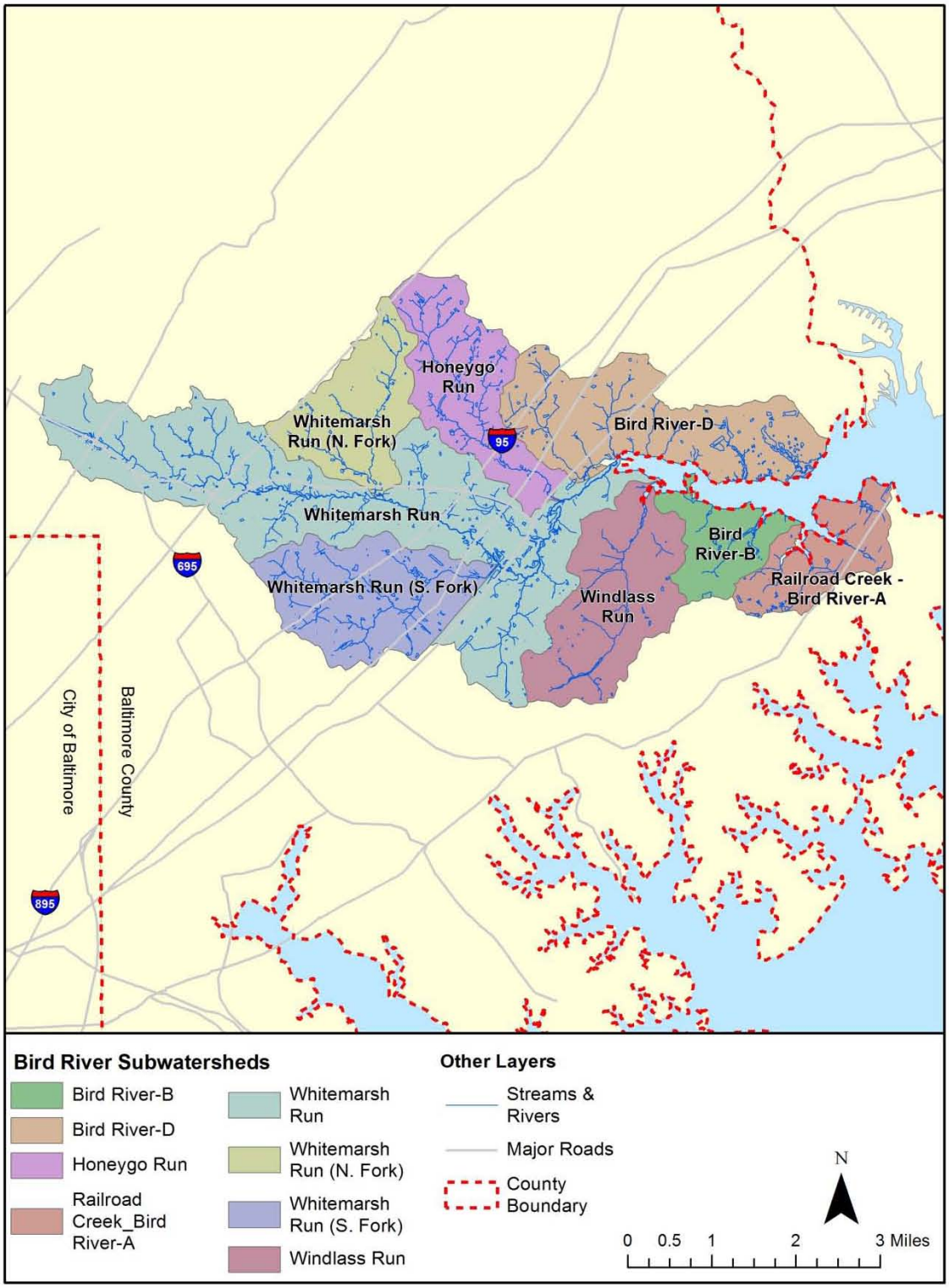

Figure 1-2: Bird River Subwatersheds

1.7 Report Organization

The SWAP consists of two volumes. Volume 1 is the Small Watershed Action Plan and is organized into 5 major chapters. Volume 2 includes supporting materials as appendices.

1.7.1 Volume 1: The SWAP

Chapter 1 is a short introduction chapter explaining the background and purpose of the SWAP, the environmental mandates, partner organizations, and an overview of the report and the planning area.

Chapter 2 covers the Vision, Goals, and Objectives for the SWAP agreed upon by the steering committee and members of the local community.

Chapter 3 describes the restoration strategies deemed as feasible by the steering committee and members of the local community. Those strategies are categorized based upon municipal actions and citizen-based actions. Computations for estimating nutrient and sediment reductions from the proposed actions across the entire watershed are included in this section. Identified stream enhancement and restoration projects are also included, along with corresponding estimated loading reductions.

Chapter 4 presents restoration strategies by subwatershed and ranks the subwatersheds based on various evaluation criteria. A map showing the location of proposed restoration strategies, photos, and supporting narrative for the recommendations is included here.

Chapter 5 details how implementation of the SWAP will be evaluated long-term via monitoring and includes a discussion of performance measures.

This volume also includes the following appendices with additional, detailed information used to develop and support this SWAP.

- Appendix A consists of a table of all actions identified for implementation towards meeting goals divided into five categories: Restoration, Outreach and Awareness, Monitoring, Funding, and Reporting. The table includes the action, the performance measure, and schedule for implementation, unit cost, and the responsible party. The goal and objective of each action are described here.

- Appendix B provides information on how the development of the SWAP addresses EPA “a through i” criteria for watershed planning and serves as a guide to the location within the document where each criterion is addressed.

- Appendix C provides an analysis of the potential cost of implementation of the plan and a list of potential funding sources.

- Appendix D includes a table showing the Maryland Assessment Scenario Tool (MAST) pollutant reduction efficiencies that were approved by the Chesapeake Bay Program.

1.7.2 Volume 2: Characterization Report

This volume includes the following appendices with supporting documentation related to the current conditions of the Bird River watershed.

- Appendix E contains the Bird River Watershed Characterization report.
- Appendix F contains the Stream Corridor Assessment (SCA) data summary.
- Appendix G contains the Upland Assessment data summary.
- Appendix H provides the supporting calculations for the supporting calculations for the Neighborhood Source Assessment Analyses.
- Appendix I provides the Water Quality Analysis (WQA) report for the tidal portion of Bird River.
- Appendix J contains photodocumentation from the Stormwater Management Facility (SWMF) Assessments.
- Appendix K contains Access databases, scanned copies of field datasheets and digital photographs from the Upland Assessment field visits, SCA, and SWMF Assessments.

CHAPTER 2: VISION, GOALS, AND OBJECTIVES

2.1 Vision Statement

The Bird River Watershed Steering Committee adopted the following vision statement that served as a guide in the development of the SWAP:

> *Our vision for the Bird River is a watershed with healthy, swimmable and navigable waters, with streams that contribute less sediment, nutrients, trash and sewage to the river and the Chesapeake Bay.*

2.2 Bird River SWAP Goals & Objectives

A total of four goals were identified for restoring the Bird River watershed based on the vision statement and input from the Steering Committee meetings and Community meeting. The goals were developed through discussions with the Bird River SWAP Steering Committee and refined based on feedback from watershed residents at the first SWAP community meeting. Community stakeholders were given the opportunity to rank the importance of goals developed by the Steering Committee, raise any additional issues that are important to the community, and indicate the type of restoration activities that are of interest to achieve watershed goals. Community participation is important to ensure the implementation and success of the plan.

The following sections present a discussion of each of the four goals for restoring the Bird River watershed. For each goal, a series of objectives was developed to ensure that the plan will meet each goal. An objective is a measurable statement such as “reduce Total Phosphorus loading in the watershed by 47.0%.” Action strategies describe the method that will be used to achieve the objective and ultimately, the water quality goal. An example of an action strategy for phosphorus reduction could be “reforestation of 25 acres of open pervious area” in a given subwatershed. The action strategies developed to achieve these objectives and goals are summarized in Appendix A and discussed further in Chapter 4.

When possible, action strategies are expressed as quantifiable measures (e.g., linear feet of forested buffer planted). However, the numeric values assigned to these actions are intended to serve as a guide, rather than an absolute measure, in achieving watershed goals and objectives. Many actions address multiple watershed goals and objectives. Appendix A provides a table that lists the action strategies proposed for the Bird River watershed and their applicable goals and objectives.

The general types of restoration strategies proposed for the Bird River watershed are discussed further in Chapter 3. An adaptive management approach will be emphasized as SWAP implementation progresses. This approach includes evaluating the success of SWAP implementation over time (see Chapter 5) and modifying action strategies based on community acceptance and availability of funding.

2.2.1 Goal 1: Improve and maintain water quality in streams and tidal area

While there are no local TMDLs for Bird River, the entire watershed is subject to the Chesapeake Bay TMDL for nutrients. Watershed implementation plans (WIPs) have been developed by the state of Maryland and Baltimore County in order to provide adequate “reasonable assurance” that the jurisdictions can and will achieve the nutrient reductions

necessary to implement the TMDL within their respective boundaries. Meeting these TMDL goals will go a long way toward improving overall water quality in the Bird River and achieving the community's vision of a healthy, swimmable river.

Objectives:

1. Reduce annual Total Nitrogen (TN) and Total Phosphorus (TP) loadings from urban land in the Bird River SWAP area by 32.2% and 47.0% respectively to meet the requirements of the Chesapeake Bay TMDL.
2. Reduce sediment flowing into Bird River.
3. Encourage enforcement of Critical Area regulations.
4. Promote implementation of conservation practices on agricultural lands.
5. Per the Consent Decree, eliminate sanitary sewer overflows (SSOs) by 2020 (*i.e.* reduce gallons of sewage discharged into Bird River and its tributaries to 0 gallons).
6. Reduce the impact of impervious surfaces on water quality in Bird River. Reduce or treat impervious surfaces to help achieve the County-wide NPDES permit goal of 20% impervious restored by the end of the permit term.

2.2.2 Goal 2: Enhance the connection between the communities and the watershed

There is no substitute for engaged and involved citizens participating in the protection of their local watersheds. However, the first step to engaging citizens is making them aware of their connections to the Bird River and the problems particular to this watershed. In a modern, urbanized landscape, it is easy to become disconnected from the natural environment, since few people have a stream running through their backyard. In addition, the thought of tackling challenges, like those faced by the Chesapeake Bay, can be overwhelming for most people. By raising awareness about the issues facing a nearby stream, citizens are given an opportunity to take action on a local, more manageable scale, where they are more likely to see the positive effects their actions produce, and thus continue their efforts.

There are many ways for people to develop a connection to Bird River. People are empowered when they can physically make a difference and improve their community in a way that benefits everyone. Clean-ups and other restoration projects are great opportunities for education. Students, families, and community groups (civic, corporate, religious, etc.) are readily available labor sources. Restoration projects should be recognized as celebrations of our natural heritage. Participation in outdoor recreation allows citizens to develop an appreciation for the beauty and value of the natural resources available to them. When people have hiked along a trail or paddled a stream or river, and seen firsthand the impact of trash and pollution, they may feel greater motivation to participate in clean-ups and become advocates for the health of Bird River. However, it is necessary to balance the benefits of outdoor recreation with the toll it can take on the environment. Proper planning and education can minimize these drawbacks and maximize the educational value and enjoyment of the outdoor experience.

Objectives:

1 Improve public access to the river.

2. Provide information to waterfront residents about programs to help replace failing bulkheads with living shorelines.

3. Outreach to commercial, farming, industrial, and residential communities throughout the watershed to encourage and support actions that reduce pollutant loads to the river.
4. Improve navigational access in Bird River.

2.2.3 Goal 3: Restore and maintain aquatic biodiversity

Healthy ecosystems have a robust and diverse community of plants and animals; aquatic biodiversity is the living proof of the health and vitality of a river system. Physical damage to aquatic habitats has resulted over time from development of land and shorelines, poor land management practices, introduction of exotic invasive species, and obstructions to upstream breeding sites, etc. The objectives for this goal relate to the improvement of degraded river conditions that result in poor conditions for aquatic life.

Objectives:

1. Restore and protect stream and tidal habitats to encourage robust aquatic communities.
2. Eradicate water chestnut.

2.2.4 Goal 4: Reduce trash in the watershed

Trash is one of the most noticeable pollutants in the Bird River. Trash is generated throughout the watershed and readily moves through storm drains, entering small streams and the river, and ultimately the Chesapeake Bay. Besides the glaring visual detriment to the River's natural beauty, trash contributes toxins and presents a hazard to water fowl, other wildlife and people. Reducing trash and increasing recycling is mainly an issue of public awareness and stewardship. By engaging citizens of all ages to help clean up the trash and to dispose of trash responsibly, the stage will be set to change behaviors, leading to other positive actions for a healthier Bird River.

Objectives:

1. Reduce the amount of trash reaching stream and the Bird River through preventative practices and awareness campaigns.
2. Reduce illegal dumping of trash.
3. Encourage community stewardship through stream adoption and cleanup programs.

CHAPTER 3: RESTORATION STRATEGIES

3.1 Introduction

This chapter presents an overview of the key restoration strategies and associated pollutant load reductions proposed for restoring the Bird River watershed. A complete list of actions proposed for the watershed including goals and objectives targeted, timelines, performance measures, cost estimates, and responsible parties is included in Appendix A. Although only key, quantifiable restoration strategies are the focus of this chapter, it is important to remember that a combination and variety of restoration practices, from capital stream restoration projects to public education and outreach, are needed to engage citizens and meet watershed-based goals and objectives.

The Bird River watershed restoration will occur as a partnership between the local government, watershed groups, and citizens. The actions of each partner are critical to the success of the overall watershed restoration strategy. Local governments are able to implement large capital projects such as stream restoration, large-scale stormwater retrofits, changes in municipal operations, and large-scale public awareness campaigns. Watershed groups and citizens are able to implement locally-based programs such as tree plantings and downspout disconnection. Therefore, key restoration strategies are divided into two broad categories: municipal strategies (Section 3.2) and citizen-based strategies (Section 3.3). It is important that restoration occurs at all levels to ensure that a wide range and variety of projects is implemented. This will encourage citizen participation and awareness, which is also critical to the success of restoration efforts.

The watershed pollutant loading analysis performed to estimate current nutrient loads generated by the various non-point sources within the Bird River watershed is discussed in Section 3.3. Section 3.4 discusses the pollutant removal calculations for proposed BMPs (i.e., key restoration strategies discussed in Sections 3.2 and 3.3) to ensure that TMDL requirements are met in Bird River.

3.2 Municipal Strategies

Baltimore County is working to improve watershed health and water quality by restoring local streams, through capital improvement projects and municipal management activities (e.g., development review, street sweeping, illicit connection programs, etc.). Key municipal strategies proposed for restoring the Bird River are discussed in the following sections.

3.2.1 Stormwater Management

Increased importance of water quality and water resource protection led to the development of the Maryland Stormwater Design Manual, which provided BMP design standards and environmental incentives (MDE 2000; revised 2009). There has been a general shift toward adopting practices that mimic natural hydrologic processes, are low impact, and achieve pre-development conditions. Building upon the approaches in the 2000 Manual, the Maryland Stormwater Act of 2007 (and 2009 revisions to the Manual) takes those principles one step further and requires that Environmental Site Design (ESD) be implemented to the maximum extent practicable (MEP) via the comprehensive use of non-structural BMPs and/or other better

site design techniques that mimic predevelopment. The intent of ESD is to distribute flow throughout a development site and reduce stormwater runoff leaving that site. This will also reduce pollutant loads and prevent stream channel erosion.

A total of 299 existing SWM facilities are located within the Bird River watershed including dry and wet ponds, wetlands, infiltration/filtration practices, extended detention, and proprietary BMPs. Existing SWM facilities treat a total drainage area of approximately 3,382 acres of urban land or 37.4 percent of the total urban land use in the watershed.

3.2.2 Stormwater Management Conversions

Detention ponds are typically designed to address water quantity only (channel protection and/or flood control) and therefore provide almost no pollutant removal. Because they have already been created for water treatment purposes, and because they have established maintenance agreements they are excellent candidates for conversion to a type of facility that provides pollution control benefits in addition to quantity control. Conversion is relatively simple and certainly cheaper than permitting and constructing a new BMP. For example, dry extended detention ponds are designed to capture and retain stormwater runoff from a storm to allow sediment and pollutants to settle out while also being able to simultaneously provide flood control. Baltimore County identified 20 existing stormwater management facilities in the Bird River watershed for evaluation of their conversion potential. Fifteen of these facilities were recommended as those potentially suitable for conversion.

3.2.3 Stormwater Retrofits

Stormwater management retrofits involve implementing BMPs in existing developed areas where SWM practices do not currently exist in order to help improve water quality. Stormwater retrofits improve water quality by capturing and treating runoff before it reaches receiving water bodies. For example, based on initial field and desktop evaluations, Neighborhood Source Assessments (NSAs) identified five sites as having sufficient open space for stormwater retrofits to treat runoff from impervious parking lots or alleys. Candidate sites for stormwater retrofits will be drawn from all four upland components surveyed: neighborhoods, hotspots, institutions, and pervious areas.

Impervious surfaces, including roads, parking lots, roofs and other paved surfaces, prevent precipitation from infiltrating into the ground as it would naturally in a forest or meadow in good condition. As a result, impervious surface runoff can result in decreased times of concentration of stormwater to receiving streams (“flashy flows”) leading to erosion, flooding, habitat destruction, and increased pollutant loads to receiving water bodies. Subwatersheds with high proportions of impervious cover are more likely to have degraded stream systems and be significant contributors to water quality problems in a watershed than those that are less developed. Removing impervious cover and converting it to pervious or forested land will help promote infiltration of runoff and reduce pollutant loads.

Unused or unmaintained (broken, crumbling) impervious surfaces with the potential for removal were identified at eight institutional locations. The areas of these impervious surfaces were used to estimate potential pollutant load reductions that would result from impervious cover removal activities.

While not included in pollutant reduction calculations, education and outreach tools could be used to inform residents of the water quality impacts associated with large impervious parking lots, driveways, or patios and options available for conversion to or incorporating more permeable surfaces.

3.2.4 Stream Restoration

Stream restoration practices are used to enhance the appearance, stability and aquatic function of urban stream corridors. Stream restoration practices can include vegetative bank stabilization, localized grade control and comprehensive repairs, such as full channel redesign and realignment. Stream corridor assessments completed in the Bird River watershed showed opportunities for stream restoration. Stream corridors noted to have significant erosion and channel instability were used to estimate pollutant load reductions for potential stream repair efforts. Stabilizing stream channels improves water quality in many ways including preventing eroded soils, and the pollutants contained in them, from entering the stream and making their way to the Bird River and Chesapeake Bay.

3.2.5 Street Sweeping and Trash Reduction

Street sweeping removes floatable trash, sediment, heavy metals and nutrients associated with sediment particles, petroleum associated with sediment, and organic matter such as leaves and twigs from the curb and gutter system, preventing them from entering storm drains and nearby streams. Decay of a disproportionate amount of organic matter in the stream can take away oxygen needed for supporting aquatic life. Additionally, excessive organic matter can clog streams and storm drains, causing flooding resulting in costly maintenance.

Neighborhoods with significant trash and/or organic matter build-up along curbs were recommended for street sweeping during NSAs. EPS will be collaborating with the County's Department of Public Works to determine the amount of increased street sweeping that would be possible for the recommended neighborhoods. Adding a targeted neighborhood to the sweeping route or increasing frequency of sweeping would address build-up of excessive curb and gutter material.

Baltimore County's approach to trash and litter reduction is a multi-faceted approach. This effort includes public service advertising, a trash treaty, celebrity encouragement, clean-ups, and enforcement.

A citizen awareness campaign is part of the overall strategy and focuses on better stewardship regarding trash issues. Advertising includes different media for different audiences. Videos using images that resonate with teens can be posted on YouTube or similar electronic distribution networks. Other elements include trash can signs, point-of-sale displays and print ads.

A trash treaty encourages citizens to vow not to litter. Volunteers lead the effort by gathering the signatures. Those that sign up receive a gift such as a reusable grocery bag or recycling & litter bags for cars. Data indicate that if someone signs a treaty they are much more likely to act upon the issue.

Clean-ups, promoted as Quick Pick-It-Ups, include all audiences. Groups may include recreation councils, scout troops, businesses and religious organizations. A model used in Howard County was very successful where specific dates and times were promoted; however it is clear that any clean-up will be counted towards the goal. Additional clean-ups are encouraged through Project Clean Stream, Stream Watch and the County's Adopt-a Road program.

Enforcement is the stick that every institution hopes is unneeded, but recognizes is necessary. Baltimore County uses local police and staff from its Code Enforcement unit. Enforcement actions usually address businesses or apartments with consistent litter problems, overflowing dumpsters, and dumping.

3.2.6 Illicit Connection Detection/Disconnection

An Illicit Discharge Detection and Elimination program has been developed by Baltimore County to find and stop discharges into streams that are harmful to aquatic life and water quality or that are causing erosion/sedimentation problems. The County will continue its Illicit Discharge Detection and Elimination program, seeking to improve techniques and methodologies for more effective reductions of these discharges. Pollutant reductions associated with this program are not included in pollutant removal analyses due to the uncertainty in the contribution of illicit connections to overall pollutant loading rates. However, this program will provide a margin of safety in the overall nutrient reduction strategy.

3.2.7 Sanitary Sewer Consent Decree

In September 2005, EPA and MDE issued a consent decree to Baltimore County with deadlines to reduce and eliminate sanitary sewer overflows (SSOs) by 2020. Implementation of work (capital projects, equipment, operations and maintenance improvements) in compliance with the consent decree will result in a reduction of nutrients and bacteria entering streams in the Bird River watershed.

3.3 Citizen-Based Strategies

The participation of citizens in watershed restoration is an essential part of the SWAP process. When large numbers of individuals become involved in citizen-based water quality improvement initiatives, changes can be made to the aesthetic and chemical aspects of waterways within the watershed that would not be possible without public participation. Citizen participation is critical to the implementation and long-term maintenance of restoration activities. Key citizen-based strategies proposed for restoring Bird River are discussed in the following sections.

3.3.1 Reforestation

Trees help improve water quality by capturing and removing pollutants in runoff including removal of excess nutrients through their roots before the pollutants enter groundwater and streams. Tree leaves and stems also intercept precipitation which helps to reduce the energy of raindrops and prevent any erosion resulting from their impact on the ground. In addition to water quality improvement, trees provide air quality, aesthetic and economic benefits. For example, trees strategically planted around a house can form windbreaks to reduce heating costs in the winter and can provide shade, reducing cooling costs in the summer. Incentive programs, such as Tree-Mendous Maryland and State Highway Administration's (SHA) Partnership Program for

public property, can help increase the success of planting efforts. Several areas throughout the watershed are targeted for reforestation opportunities and are described below.

3.3.1.1 Riparian Buffer

Stream and shoreline riparian buffers are critical to maintaining healthy streams and rivers. Forested buffer areas along streams and shorelines can improve water quality and prevent flooding since they can filter pollutants, reduce surface runoff, stabilize stream banks, trap sediment, and provide habitat for various types of terrestrial and aquatic life including fish. Buffer encroachment as a result of development was noted during upland and stream surveys conducted throughout the watershed. Areas on privately-owned land (e.g., residential properties) can be recommended for buffer awareness initiatives to encourage landowners to plant trees and/or create a no-mow area adjacent to streams and shorelines. Open pervious areas identified within the 100-foot stream and shoreline buffer areas via a GIS analysis in the Watershed Characterization Report (Appendix E) are good candidates for tree planting and are targeted for initial buffer reforestation efforts.

3.3.1.2 Upland Pervious Areas

Converting open areas in the upland portion of the watershed to forested areas through tree plantings can also reduce nutrient inputs to nearby streams and reduce erosion. Large open areas identified in the pervious area assessments (PAAs) should be further investigated for tree planting potential. Publicly-owned lands requiring minimal site preparation (low-hanging fruit) are targeted for initial reforestation efforts.

3.3.1.3 Street and Open Space Tree Plantings

Several opportunities for neighborhood street tree plantings were identified during NSAs. Opportunities for open space tree plantings were also identified at several institutional sites and in some neighborhoods with multi-family housing. Street trees and open space trees provide aesthetic value and air and water quality benefits. They provide shade thereby reducing urban heat-island effect while also providing habitat for wildlife. They also absorb nutrients through their root systems.

Canvassing residents and/or contacting homeowner associations can be effective techniques for implementing a street tree planting program within a neighborhood. Tree planting incentive programs mentioned previously can also help increase the success of planting efforts.

3.3.2 Downspout Disconnection

Downspout disconnection can help reduce runoff and pollutants introduced to local streams. This can be achieved through downspout redirection (from impervious to pervious areas), rain barrels, and/or rain gardens. A combination of outreach/awareness techniques and financial incentives can be used to implement a downspout disconnection program in neighborhoods identified as potential candidates during NSAs. Pilot disconnection programs have been conducted in Upper Back River by Blue Water Baltimore and the Center for Watershed Protection (CWP). Results from these programs can be used to determine successful techniques and strategies for Bird River.

3.3.3 Urban Nutrient Management

Raising awareness among citizens about some of the common activities around their homes and how those activities can negatively affect water quality is an excellent citizen-based strategy. Yards and lawns typically represent a significant portion of the land cover in an urban subwatershed and therefore, can be a major source of nutrients, pesticides, sediment, and runoff. Fertilization, pesticide use, watering, landscaping, and trash/yard waste disposal all impact subwatershed quality. Urban nutrient management efforts related to lawn maintenance and using natural "Bayscaping" (defined below) as opposed to manicured monocultures of lawn grass can help reduce nutrient inputs to nearby streams.

3.3.3.1 Lawn Maintenance Education

Lawn maintenance activities often involve over-fertilization, poor pest management, and over-watering resulting in excess pollutant runoff to local streams. Lawns with a dense, uniform grass cover or signs designating chemical lawn care treatment indicate high-maintenance lawn care activities. Neighborhoods identified as having high lawn maintenance issues should be targeted for awareness programs emphasizing responsible fertilizing techniques such as proper application, proper time of year for fertilization, soil testing for nutrient requirements, and keeping fertilizers away from impervious surfaces. Lawn maintenance education can be achieved through door-to-door canvassing, informational brochures/mailings, excerpts in community newsletters, or demonstrations at community meetings. Information on organic alternatives to chemical lawn treatments should also be included in these outreach efforts.

3.3.3.2 Bayscaping

Reducing the amount of mowed lawn and increasing landscaping features provides water quality benefits through interception and filtration of stormwater runoff. Bayscaping refers to the use of plants native to the Chesapeake Bay watershed for landscaping. Because they are native to the region, these plants require less irrigation, fertilizers, and pesticides to maintain as compared to non-native or exotic plants. This means less maintenance and therefore less stormwater pollution. Bayscaping is also beneficial to wildlife because it creates pockets of native habitat. Similar to lawn maintenance education, Bayscaping awareness can be raised through informational brochures/mailings, excerpts in community newsletters, or demonstrations at community meetings. A combination of outreach/ awareness techniques and financial incentives can be used to implement a Bayscaping program in neighborhoods identified as potential candidates during NSAs.

3.4 Pollutant Loading and Removal Analyses

This section presents results of the watershed pollutant loading analysis performed to estimate current nutrient loads generated by the various non-point sources within the Bird River watershed. Also discussed are the pollutant removal calculations for proposed BMPs to ensure the TMDL requirements are met in the Bird River watershed.

3.4.1 Pollutant Loading Analysis

A pollutant loading analysis was performed to estimate total nitrogen, phosphorus, and sediment loads currently generated by all non-point sources (i.e., runoff from all land uses) present within the Bird River watershed. Estimates were based on Maryland Department of

Planning's (MDP) 2010 Land Use/Land Cover (LU/LC) GIS layer and pollutant loadings rates developed by CBP for all land uses. The pollutant loading analysis is described in detail in Chapter 3.3 of the Watershed Characterization Report (Appendix E).

Table 3-1 summarizes results from the watershed pollutant loading analysis including areas, nutrient loadings rates, and annual nutrient loads for each nonpoint source/land use type.

Table 3-1: Bird River Watershed Nitrogen, Phosphorus, and Sediment Loads Estimated Using 2010 MDP Land Use/Land Cover (see Appendix E for details)

Source	Area (acres)	Nitrogen		Phosphorus		Sediment	
		Rate (lbs/ac)	Load (lbs/yr)	Rate (lbs/ac)	Load (lbs/yr)	Rate (lbs/ac)	Load (lbs/yr)
Urban Pervious	5,993	5.85	35,027	0.25	1,480	76.9	460,602
Urban Impervious	3,058	9.24	28,269	1.39	4,260	565.4	1,729,028
Crop	1,543	20.74	32,002	1.31	2,016	373.4	576,168
Pasture/Orchards/Ag Build.	149	4.06	606	0.36	54	42.3	6,304
Livestock	7	62.25	461	10.88	80	972.1	7,192
Forest	5,087	1.49	7,593	0.04	178	21.3	108,421
Water	30	10.26	304	0.60	18		
Wetlands	271	1.49	404	0.04	9		
Bare Ground	270	12.36	3,340	2.95	796	2090.3	564,789
Totals	16,408		108,006		8,892		3,452,504

As discussed in Chapter 1, a TMDL analysis showed stormwater runoff is the primary contributor to nutrient and sediment inputs to the Bird River watershed. The bulk of the nitrogen, phosphorus, and sediment reductions required to meet the Chesapeake Bay TMDL and water quality standards for the Bird River watershed will come from control of stormwater runoff. The Chesapeake Bay TMDL analysis determined that a 32% reduction in nitrogen and a 47% reduction in phosphorus loads from urban stormwater discharges are necessary to meet Bay water quality standards. The load reductions needed within the urban portion of Bird River watershed to achieve these reductions are summarized in Table 3-2**.**

Table 3-2: Bird River Watershed Nitrogen, Phosphorus, and Sediment Load Reductions

Source	Area (acres)	TN Load (lbs/yr)	TP Load (lbs/yr)	Sediment Load (lbs/yr)
Urban	9,051	63,296	5,740	2,189,630
Reduction Goal:		20,381	2,698	NA

3.4.2 Pollutant Removal Analysis

The following sections present a quantitative analysis of pollutant removal capabilities of the proposed BMPs to ensure that the required reduction in nutrient loads from urban runoff in the Bird River watershed is achieved. Note that many of the removal efficiencies used to estimate pollutant reductions are based on peer-reviewed and CBP-approved nonpoint source BMP tables developed for the Phase 5.3 CBP Watershed Model. These tables are included in Appendix D. Also note that the calculations and estimates presented in the following subsections represent maximum potential pollutant capabilities. A summary of overall pollutant

load reduction estimates is presented at the end of this section for two scenarios: a maximum implementation scenario and one based on projected participation for each BMP.

3.4.2.1 Implemented Capital Improvement Projects

Baltimore County has implemented many capital improvement projects in the county's various watersheds including stream restoration, stormwater facility retrofits and conversions, and shoreline enhancements. The County has implemented 7 pond conversions and 10 stream restoration projects (totaling 25,550 linear feet of stream) in the Bird River watershed. Pollutant loads were estimated by the County based on the contributing drainage area (DA) and the corresponding project type's land use-specific pollutant loading rates. Load reduction is calculated as the product of the pollutant load and removal efficiency. For the BMP retrofits, filtration pollutant removals are 40% for nitrogen, 60% for phosphorus, and 80% for sediment per the values shown in Appendix D under Urban and Mixed Open BMPs, Stormwater Management. For stream restoration projects, nutrient reduction credits are based on the length of stream restored. A summary of existing load reductions is shown in the Table 3-3.

Table 3-3: Load Reductions Estimated for BMP Retrofit, Pond Conversion, and Stream Restoration Projects in Bird River Watershed

Project	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)	Sediment Reduction (lbs/yr)
Retrofits and Pond Conversions			
Burnam Woods	56	12	6,446
Evergreen Pond Retrofit	39	8	4,331
Featherhill	106	19	9,815
Lawrence Hill	74	12	6,066
Perryvale Retrofit	69	14	7,213
S Fork @ Franklin Square	57	7	8,289
White Marsh Mall Retrofit	298	51	24,284
Total	699	123	66,444
Stream Restorations			
East Br. Honeygo Run	800	272	217,000
N Fork WMR @ Perryvale	160	54	43,400
N Fork WMR @ Slvr Mdw	80	27	21,700
N. Fork White Marsh Run	1,400	476	379,750
S Fork @ Franklin Sq SR	520	177	141,050
S Fork WMR SR	380	129	103,075
S Fork WMR@ Kings Ave.	500	170	135,625
White Marsh Run SR	800	272	217,000
WMR @ Orbitan	60	20	16,275
WMR @ Woodcroft	400	136	108,500
Total	5,100	1,733	1,383,375

3.4.2.2 Existing Stormwater Management (SWM)

As described in detail in Section 2.3 of the Watershed Characterization Report (Appendix E), there are 300 existing SWM facilities in the Bird River watershed including dry ponds,

infiltration/filtration practices, extended detention, proprietary BMPs and other types of SWM facilities (i.e., underground detention). One practice type noted in the Characterization Report, level spreader, is not recognized by the Maryland Assessment Scenario Tool (MAST). Therefore, the single BMP of this type was excluded from the modeling, and a total of 299 BMPs were modeled. The pollutant removal capability of the existing SWM in the watershed is not fully accounted for in the baseline loading analysis; therefore, it is included in the pollutant removal analysis.

Pollutant reductions for existing SWM 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 total nitrogen (TN) load reductions for a particular type of SWM facility is expressed as:

$$[6.99(lbs/ac/yr) * DA\ (acres)] * RE\ (\%)$$

The equation used to estimate total phosphorus (TP) load reductions for a particular type of SWM facility is expressed as:

$$[0.63(lbs/ac/yr) * DA\ (acres)] * RE\ (\%)$$

The equation used to estimate sediment load reductions for a particular type of SWM facility is expressed as:

$$[242(lbs/ac/yr) * DA\ (acres)] * RE\ (\%)$$

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 pollutant loading rates shown, 6.99 lbs TN/ac/yr, 0.63 lbs TP/ac/yr, and 242 lbs sediment/ac/yr, represent the weighted average of impervious and pervious urban rates used in the pollutant loading analysis (Table 3-2) since this represents the likely sources of runoff being treated. Note that impervious and pervious urban loading rates are based on CBP's Watershed Model Phase 5.3, as implemented in the MAST run from September 2013 for the 2010 Progress scenario. The percent pollutant removal efficiency depends on the type of facility and is based on the values shown in Appendix D under Urban and Mixed Open BMPs, Stormwater Management. The total pollutant load reduction expected from existing SWM is a sum of the removal capacities of the individual facilities. A summary of existing SWM load reduction calculations and results is shown in the Table 3-4.

For additional information on MAST, visit http://www.mastonline.org.

Table 3-4: Existing SWM Load Reductions

				Total Nitrogen			Total Phosphorus			Sediment		
SWM Facility Type	Soil Type	#	DA (acres)	Load from DA (lbs/yr)	RE (%)	Max Potential Load Reduction (lbs/yr)	Load from DA (lbs/yr)	RE (%)	Max Potential Load Reduction (lbs/yr)	Load from DA (lbs/yr)	RE (%)	Max Potential Load Reduction (lbs/yr)
Bioretention	A&B	2	5.4	38	70	26.5	3	75	2.6	1,311	80	1,049
Bioretention	C&D	2	1.8	13	25	3.2	1	45	0.5	445	55	245
Dry Pond		62	1,229.9	8,601	5	430.1	780	10	78.0	297,543	10	29,754
Dry Well	A&B	2	0.2	2	80	1.2	0	85	0.1	53	95	51
Extended Detention		102	891.7	6,236	20	1,247.2	565	20	113.1	21,5730	60	129,438
Infiltration Basin	A&B	3	19.0	133	85	113.2	12	85	10.3	4,606	95	4,376
Infiltration Basin	C&D	3	22.4	156	85	132.9	14	85	12.1	5,410	95	5,139
Infiltration Trench	A&B	9	11.3	79	80	63.3	7	85	6.1	2,736	95	2,599
Infiltration Trench	C&D	7	26.4	184	80	147.4	17	85	14.2	6,375	95	6,056
Oil/Grit Separator	A&B	3	1.2	9	5	0.4	1	10	0.1	295	10	30
Oil/Grit Separator	C&D	7	3.3	23	5	1.1	2	10	0.2	786	10	79
Permeable Pavement*	C&D	1	2.8	20	10	2.0	2	20	0.4	677	55	373
Sand Filter	A&B	13	69.6	487	40	194.6	44	60	26.5	16,833	80	13,467
Sand Filter	C&D	40	143.8	1,006	40	402.2	91	60	54.7	34,784	80	27,828
Sand Filter		2	2.6	18	40	7.3	2	60	1.0	629	80	503
Shallow Marsh	A&B	3	42.9	300	20	60.0	27	45	12.2	10,374	60	6,224
Shallow Marsh	C&D	5	113.6	795	20	158.9	72	45	32.4	27,488	60	16,493
Stormceptor				0	5	0.0	0	10	0.0	0	10	0
Swale	A&B	1	1.5	11	45	4.8	1	45	0.4	373	70	261
Swale	C&D	2	3.7	26	10	2.6	2	10	0.2	900	50	450
Underground Structure	A&B	2	5.8	40	5	2.0	4	10	0.4	1,401	10	140
Underground Structure	C&D	8	18.8	131	5	6.6	12	10	1.2	4,548	10	455
Wet Pond		20	763.9	5,342	20	1,068.4	484	45	218.0	184,799	60	110,880
Total		299	3,381.6	23,649		4,076.1	2,144		584.6	818,098		355,888

* For Permeable Pavement (PP), the removal rate of nitrogen was calculated as the average of the removal rates for PP-with sand and vegetation and PP-without sand and vegetation. Both categories of PP assumed C/D soils with underdrains.

3.4.2.3 Stormwater Management Conversions

Fifteen dry ponds could be converted to facilities with higher capacity for nutrient removal, however only ten have a high or medium probability of being converted. Pollutant reductions for SWM conversions are calculated based on the approximate pollutant load received from the drainage area (DA) and the increase in removal efficiency (RE) based on BMP efficiencies by CBP for detention and extended detention facilities (Simpson and Weammert 2009). The equation used to estimate total nitrogen (TN) load reductions for SWM conversion is expressed as:

$$[6.99(lbs/ac/yr) * DA\ (acres)] * RE\ (\%)$$

The equation used to estimate total phosphorus (TP) load reductions for SWM conversion is expressed as:

[0.63(lbs/ac/yr) DA (acres)]* RE (%)*

The equation used to estimate sediment load reductions for SWM conversion is expressed as:

[242(lbs/ac/yr) DA (acres)]* RE (%)*

The pollutant load received from the drainage area contribution to the SWM facility is denoted by the first expression in brackets in the equations above. Similar to existing SWM, the pollutant loading rates, 6.99 lbs TN/ac/yr, 0.63 lbs TP/ac/yr, and 242 lbs sediment/ac/yr, represent the weighted average of impervious and pervious urban rates in the pollutant loading analysis (Table 3-2) since this represents the likely sources of runoff being treated. The increased in pollutant removal efficiency is represented by the third expression in the equations above. This is the difference between percent pollutant removal efficiencies of the facilities, based on CBP guidance shown in Appendix D under Urban and Mixed Open BMPs, Stormwater Management. A summary of SWM conversion load reduction calculations and results are shown in Table 3-5 and Table 3-6.

Table 3-5: SWM Conversion Load Reductions

Pollutant	Total DA for SWM Conversion (acres)	Original RE (%)	New RE (%)	Increase in Efficiency (%)	Max Potential Load Reduction (lbs/yr)
Convert Dry Ponds to Urban Filtering Practice					
TN	225	5%	40%	35%	727
TP	225	10%	60%	50%	156
Sediment	225	10%	80%	70%	88,884

Table 3-6: SWM Conversion Load Reductions for Individual Ponds

Pond #	Potential for Conversion	Total DA for SWM Conversion (acres)	Total Nitrogen				Total Phosphorus				Total Sediment\			
			Original RE (%)	New RE (%)	Increase in Efficiency (%)	Max Potential Load Reduction (lbs/yr)	Original RE (%)	New RE (%)	Increase in Efficiency (%)	Max Potential Load Reduction (lbs/yr)	Original RE (%)	New RE (%)	Increase in Efficiency (%)	Max Potential Load Reduction (lbs/yr)
883	High	16.9	5	40	35	54.68	10%	60%	50%	11.77	10%	80%	70%	6,688
951	High	11.14	5	40	35	36.04	10%	60%	50%	7.76	10%	80%	70%	4,409
1166	High	12.57	5	40	35	40.67	10%	60%	50%	8.76	10%	80%	70%	4,975
1633	High	23.75	5	40	35	76.84	10%	60%	50%	16.54	10%	80%	70%	9,399
349	Medium	11.57	5	40	35	37.43	10%	60%	50%	8.06	10%	80%	70%	4,579
379	Medium	64.1	5	40	35	207.38	10%	60%	50%	44.65	10%	80%	70%	25,368
529	Medium	22	5	40	35	71.18	10%	60%	50%	15.32	10%	80%	70%	8,707
876	Medium	23.4	5	40	35	75.70	10%	60%	50%	16.30	10%	80%	70%	9,261
919	Medium	12.63	5	40	35	40.86	10%	60%	50%	8.80	10%	80%	70%	4,998
1040	Medium	26.53	5	40	35	85.83	10%	60%	50%	18.48	10%	80%	70%	10,500
399	Low	35.48	5	40	35	114.79	10%	60%	50%	24.71	10%	80%	70%	14,042
610	Low	47.4	5	40	35	153.35	10%	60%	50%	33.01	10%	80%	70%	18,759
877	Low	14	5	40	35	45.29	10%	60%	50%	9.75	10%	80%	70%	5,541
878	Low	27.89	5	40	35	90.23	10%	60%	50%	19.43	10%	80%	70%	11,038
1850	Low	16.69	5	40	35	54.00	10%	60%	50%	11.62	10%	80%	70%	6,605

3.4.2.4 Stormwater Retrofits

Proposed stormwater retrofits for the purposes of this SWAP refer to implementing BMPs to capture and treat runoff from impervious surfaces (i.e., parking lots, alleys) which are currently untreated. This includes sites identified for retrofit potential during uplands surveys for neighborhoods, institutions, hotspots, and pervious areas. Pollutant reductions for stormwater retrofits are calculated based on the approximated pollutant load received from the impervious drainage area (DA) and removal efficiency (RE) of bioretention and underground structure type BMPs. The equation used to estimate total nitrogen (TN) load reductions for stormwater retrofits is expressed as:

[9.24 (lbs/ac/yr) DA (acres)]* RE (%)*

The equation used to estimate total phosphorus (TP) load reductions for stormwater retrofits is expressed as:

[1.39 (lbs/ac/yr) DA (acres)]* RE (%)*

The equation used to estimate sediment load reductions for stormwater retrofits is expressed as:

[565 (lbs/ac/yr) DA (acres)]* RE (%)*

The pollutant load received from the drainage area contributing to the SWM facility is denoted by the first expression in brackets in the equation above. The pollutant loading rates shown, 9.24 lbs TN/ac/yr, 1.39 lbs TP/ac/yr, and 565 lbs sediment/ac/yr, are the impervious urban rates used in the pollutant loading analysis (Table 3-1) since this represents the source of runoff being treated. Pollutant removal efficiencies are those reported for bioretention and infiltration basin, based on CBP guidance shown in Appendix D under Urban and Mixed Open BMPs, Stormwater Management. A summary of stormwater retrofit load reduction calculations and results are shown in Table 3-7.

Table 3-7: Stormwater Retrofit Load Reduction

Pollutant	Impervious Urban Loading Rate (lbs/ac/yr)	Impervious Area for SW Retrofit (acres)	Load for DA (lbs/yr)	RE (%)	Max Potential Load Reduction (lbs/yr)
Bioretention/Rain Gardens					
TN	9.24	14.0	130	25	32.42
TP	1.39	14.0	20	45	8.79
Sediment	565	14.0	7,931	55	4,362
Infiltration Basins					
TN	9.24	6.9	64	85%	53.99
TP	1.39	6.9	10	85%	8.14
Sediment	565	6.9	3885	95%	3,691

3.4.2.5 Impervious Cover Removal

Potential sites for impervious cover removal were identified at several institutions. Pollutant reductions for impervious cover removal are calculated based on a land conversion from

impervious to pervious urban. The equation used to estimate total nitrogen (TN) load reductions for stormwater retrofit is expressed as:

[9.24 (lbs/ac/yr) - 5.85 (lbs/ac/yr)] Impervious Area (acres)*

The equation used to estimate total phosphorus (TP) load reductions for stormwater retrofits is expressed as:

[1.39 (lbs/ac/yr) - 0.25 (lbs/ac/yr)] Impervious Area (acres)*

The equation used to estimate sediment load reductions for stormwater retrofits is expressed as:

[565 (lbs/ac/yr) - 76.9 (lbs/ac/yr)] Impervious Area (acres)*

Impervious cover removal would involve converting impervious surfaces to pervious surfaces. Therefore, the loading rate would be reduced by a factor equal to the difference between impervious and pervious urban loading rates in the watershed pollutant loading analysis as shown in the first expression in brackets in the equations above. The approximate reduction in pollutant load is then the reduced loading rate multiplied by the area proposed for impervious cover removal. A summary of impervious cover removal reduction calculations and results are shown in the Table 3-8.

Table 3-8: Impervious Cover Removal Load Reductions

Pollutant	Impervious Urban Loading Rate (lbs/ac/yr)	Pervious Urban Loading Rate (lbs/ac/yr)	Reduction in Loading Rate (lbs/ac/yr)	Impervious Area (acres)	Max Potential Load Reduction (lbs/yr)
TN	9.24	5.85	3.40	0.4	1.4
TP	1.39	0.25	1.15	0.4	0.5
Sediment	565	76.9	488.5	0.4	206

3.4.2.6 Stream Buffer Reforestation

The current vegetative condition of the stream riparian buffer (100 feet on either side of the stream system, total area 2,177 acres) was analyzed in Chapter 2 of the Watershed Characterization Report (Appendix E). Buffer conditions were classified as impervious, open pervious, or forested areas. Open pervious areas are the best areas to initially target for restoration. Approximately 613 acres of open pervious area were identified within the stream buffer zone.

Pollutant reductions for stream buffer reforestation are calculated based on a land use conversion from pervious urban to forest plus an additional reduction efficiency per BMP performance guidance from CBP (Appendix D). The equation used to estimate total nitrogen (TN) load reductions for the land use conversion portion of stream buffer reforestation is expressed as:

Land Use Conversion (TN) = [5.85 (lbs/ac/yr) - 1.49 (lbs/ac/yr)] Open Pervious Area (acres)*

The equation used to estimate total phosphorus (TP) load reductions for the land use conversion portion of stream buffer reforestation is expressed as:

Land Use Conversion (TP) = [0.25 (lbs/ac/yr) – 0.04(lbs/ac/yr)] Open Pervious Area (acres)*

The equation used to estimate sediment load reductions for the land use conversion portion of stream buffer reforestation is expressed as:

Land Use Conversion (sediment) = [77 (lbs/ac/yr) – 21(lbs/ac/yr)] Open Pervious Area (acres)*

The first expression in brackets in the equation above represents the difference between pervious urban and forest loading rates used in the watershed pollutant loading analysis. This reduction in loading rate is then multiplied by the available open pervious area for reforestation to determine the loads from land use conversion.

An additional pollutant removal factor is added to the land use conversion to determine the total removal capacity of buffer reforestation. Per the BMP performance guidance in Appendix D, one acre of buffer treats approximately one acre of upland area for nitrogen with an efficiency of 25 percent for urban and mixed open buffers. The total nitrogen (TN) load reduction for the removal efficiency portion of buffer reforestation can be expressed as:

Buffer BMP Removal (TN) = [Open Pervious Area (acres)] 6.58(lbs/ac/yr]* 25%*

Similarly, one acre of buffer treats approximately one acre of upland area for phosphorus with an efficiency of 50 percent for urban and mixed open buffers. The total phosphorus (TP) load reductions for the removal efficiency portion of buffer reforestation can be expressed as:

Buffer BMP Removal (TP) = [Open Pervious Area (acres) 0.54 (lbs/ac/yr] 50%*

Similarly, one acre of buffer treats approximately one acre of upland area for sediment with an efficiency of 50 percent for urban and mixed open buffers. The sediment load reductions for the removal efficiency portion of buffer reforestation can be expressed as:

Buffer BMP Removal (sediment) = [Open Pervious Area (acres) 210 (lbs/ac/yr] 50%*

The loading rates shown in the equation above, 6.58 lbs TN/ac/yr, 0.54 TP/ac/yr, and 210 lbs sediment/ac/yr, represent overall watershed loading rates. This is estimated as the total watershed nutrient load (108,006 lbs TN/yr, 8,892 lbs TP/yr, and 3,452,504 lbs sediment/yr) divided by the total area (16,408 acres), which is the area used to calculate the pollutant load from the upland area that would be treated by buffer reforestation. As mentioned, the land use conversion and additional removal efficiency are added to yield a total pollutant load reduction. A summary of stream buffer reforestation reduction calculations and results are shown in Table 3-9.

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Table 3-9: Stream Buffer Reforestation Load Reductions

		Land Use Conversion		Buffer BMP Removal			
Pollutant	Open Pervious Area (acres)	Reduced Loading Rate (lbs/ac/yr)	Land Use Conversion Reduction (lbs/yr)	RE (%)	Overall Watershed Loading Rate (lbs/ac/yr)	Overall Watershed Load (lbs/yr)	Max Potential Load Reduction (lbs/yr)
TN	613	4.35	2,668	25	6.58	4,034	3,676
TP	613	0.21	130	50	0.54	332	296
Sediment	613	56	34,045	50	210	128,957	98,523

3.4.2.7 Urban Nutrient Management – Maryland Fertilizer Use Act of 2011

The State of Maryland recently passed the Maryland Fertilizer Use Act of 2011 (the Act) that took effect in October 2013. The Act bans phosphorus and provides a greater percentage of slow release nitrogen in fertilizer. The fertilizer bags have better labeling and lawn care professionals are required to be certified in proper fertilizer application. The Chesapeake Bay Program Urban Nutrient Management Expert Panel Report recommendations include TN reductions of 9 percent for commercial applicators of fertilizer and 4.5 percent for "do-it yourself" fertilizer applicators for the State of Maryland (Schueler and Lane, 2013). A 25% reduction is given to TP for urban nutrient management. In Bird River, this reduction will apply to an estimated 1,530 acres of residential parcels (lawns), and 711 acres of non-residential parcels (pervious area of the golf course, open urban areas, institutional and commercial areas). Pollutant reductions applied for the Act are calculated based on the urban pervious pollutant load multiplied by the acres of managed turf, then the pollutant reduction efficiency. The equation used to estimate total nitrogen (TN) load reductions for commercial applicators, or non-residential parcels is expressed as:

[5.85 (lbs/acre/yr) x managed turf (acres)] x 9%

The equation used to estimate total nitrogen (TN) load reductions for residential applicators, or non-residential parcels is expressed as:

[5.85 (lbs/acre/yr) x managed turf (acres)] x 4.5%

The equation used to estimate total phosphorus (TP) load reductions for the Act reduction is expressed as:

[0.25 (lbs/acre/yr) x managed turf (acres)] x 25%

The pollutant load received from the urban pervious area that the Act will be applied to is denoted by the first expression in brackets in the equations above. The pollutant loading rates shown, 5.85 lbs/ac/yr of TN and 0.25 lbs/ac/yr of TP, are the pervious urban rates used in the pollutant loading analysis. Pollutant removal efficiencies are those reported by the State to be applied from the Act. A summary of fertilizer load reduction calculations and results are shown in Table 3-10.

Table 3-10: Maryland Fertilizer Use Act of 2011 Load Reductions

Pollutant	Pervious Urban Loading Rate (lbs/ac/yr)	Acres of Managed Turf	RE (%)	Max Potential Load Reduction (lbs/yr)
TN (Residential)	5.85	1,530	4.5	402
TN (Non-residential)	5.85	711	9	374
TP	0.25	2,241	25	138

3.4.2.8 Pervious Area Reforestation

Open pervious areas with reforestation potential have been identified in the Bird River watershed equaling 63 acres. Pollutant reductions for pervious area reforestation are calculated based on land use conversion from pervious urban to forest. The equation used to estimate total nitrogen (TN) load reductions for pervious area reforestation is expressed as:

Land Use Conversion (TN) = [5.85 (lbs/ac/yr) – 1.49 (lbs/ac/yr)] Open Pervious Area (acres)*

The equation used to estimate total phosphorus (TP) load reductions for the land use conversion portion of stream buffer reforestation is expressed as:

Land Use Conversion (TP) = [0.25 (lbs/ac/yr) – 0.04 (lbs/ac/yr)] Open Pervious Area (acres)*

The equation used to estimate sediment load reductions for the land use conversion portion of stream buffer reforestation is expressed as:

Land Use Conversion (sediment) = [77 (lbs/ac/yr) – 21 (lbs/ac/yr)] Open Pervious Area (acres)*

Pervious area reforestation would involve converting open pervious area to forest. Therefore, the loading rate would be reduced by a factor equal to the difference between pervious urban and forest loading rates used in the watershed pollutant analysis as shown in the first expression in brackets in the equations above. The approximate reduction in pollutant load is then the reduced loading rate multiplied by the open pervious area available for reforestation. A summary of pervious area reforestation reduction calculations and results are shown in Table 3-11. Note that assessments were performed and plantings recommended at four State Highway Administration (SHA) properties. While the County may encourage plantings at these sites, any pollution reduction benefits would be credited to SHA, as the agency has its own NPDES permit and associated reduction goals. Therefore, acres recommended for planting at these sites were not included in the model.

Table 3-11: Pervious Area Reforestation Load Reductions

Pollutant	Pervious Urban Loading Rate (lbs/ac/yr)	Forest Loading Rate (lbs/ac/yr)	Reduced Loading Rate (lbs/ac/yr)	Open Pervious Area (acres)	Max Potential Load Reduction (lbs/yr)
TN	5.85	1.49	4.35	63	274.30
TP	0.25	0.04	0.21	63	13.35
Sediment	77	21	56	63	3,501

3.4.2.9 Stream Corridor Restoration

Several potential stream restoration sites were identified during the stream corridor assessments to address stream stability issues (i.e., significant erosion and channel alterations) and improve water quality. These sites are discussed in Section 3.6 of the Watershed Characterization Report (Appendix E). Pollutant load reduction estimates in pounds per linear foot of stream restoration were developed by an expert panel convened to review the available science (Schueler and Stack 2013). These were also used to calculate load reductions for proposed stream restoration activities (i.e., restoration lengths (RL)) in the Bird River watershed. The equation used to estimate total nitrogen (TN) reductions for stream restoration is expressed as:

$$0.2\ (lbs/ft) * RL\ (ft)$$

The equation used to estimate total phosphorus (TP) load reductions for stream restoration is expressed as:

$$0.068\ (lbs/ft) * RL\ (ft)$$

The equation used to estimate sediment load reductions for stream restoration is expressed as:

$$54.25\ (lbs/ft) * RL\ (ft)$$

Edge-of-Stream 2011 interim approved removal rates per linear foot of qualifying stream restoration were obtained from Table 3 in Schueler and Stack (2013). The sediment loss between the edge-of-field and the edge-of-stream is incorporated into the Chesapeake Bay Watershed Model (CBWM) as a sediment delivery ratio. This ratio is multiplied by the predicted edge-of-field erosion rate to estimate the eroded sediments actually delivered to a specific reach. Sediment delivery ratios in the Phase 5.3 CBWM range from 0.1 to 0.25; the median of this range, 0.175, was used to adjust the sediment load reduction factor from Table 3 in Schueler and Stack (2013).

All of the erosion and channel alteration sites, as well as their severity ratings, are summarized in Table 3-24 in Section 3.6 of the Watershed Characterization Report. For the model, potential stream restoration sites were identified as moderately to severely impaired stream lengths totaling up to 31,074 feet. Lower severity impairments were not included in the model. A summary of stream corridor restoration reduction calculations and results are shown in Table 3-12.

Table 3-12: Stream Corridor Restoration Load Reduction

Pollutant	Reduction in Loading Rate (lbs/ft)	Total Stream Length in Watershed (ft)	Potential Stream Restoration Length (ft)	Max Potential Load Reduction (lbs/yr)
TN	0.2	474,302	31,074	6,215
TP	0.068	474,302	31,074	2,113
Sediment	54.25	474,302	31,074	1,685,765

3.4.2.10 Downspout Disconnection

A total of 55 neighborhoods (out of 100 surveyed) have potential for downspout disconnection. A neighborhood is recommended for disconnection if at least 25 percent of the downspouts are directly and/or indirectly connected to the storm drain system and the average lot has at least 15 feet of pervious area available down gradient from the downspout. During the uplands survey, the percentage of homes with connected downspouts was noted. This percentage was used to determine the rooftop area that could be addressed by disconnection in recommended neighborhoods. This is explained in further detail in Chapter 4 of the Watershed Characterization Report (Appendix E).

Pollutant reductions for downspout disconnection are calculated based on the pollutant load received from the total rooftop drainage area (DA) recommended for disconnection and the removal efficiency (RE) of based on removal efficiency for environmental site design (ESD) to the maximum extent practicable (MEP) (MDE 2011). The equation used to estimate total nitrogen (TN) load reductions for downspout disconnection is expressed as:

$$[9.24\ (lbs/ac/yr) * DA\ (acres)] * RE\ (\%)$$

The equation used to estimate total phosphorus (TP) load reduction for downspout disconnection is expressed as:

$$[1.39\ (lbs/ac/yr) * DA\ (acres)] * RE\ (\%)$$

The equation used to estimate sediment load reduction for downspout disconnection is expressed as:

$$[565\ (lbs/ac/yr) * DA\ (acres)] * RE\ (\%)$$

The pollutant load received from the impervious rooftop drainage area recommended for disconnection is denoted by the first expression in brackets in the equations above. The pollutant loading rates shown (9.24 lbs TN/ac/yr, 1.39 lbs TP/ac/yr, and 565 lbs sediment/ac/yr) are the impervious urban rates used in the pollutant loading analysis. Pollutant removal efficiencies are those reported for filtration practices, based on CBP guidance shown in Appendix D under Urban and Mixed Open BMPs, Stormwater Management. A summary of downspout disconnection load reduction calculations and results are shown in Table 3-13.

Table 3-13: Downspout Disconnection Load Reductions

Pollutant	Impervious Urban Loading Rate (lbs/ac/yr)	DA (Rooftop Area Recommended for Downspout Disconnect) (acres)	RE (%)	Max Potential Load Reduction (lbs/yr)
TN	9.24	177.3	50	819
TP	1.39	177.3	60	148
Sediment	565	177.3	90	90,217

3.4.2.11 Tree Plantings

Several opportunities for planting street and open space shade trees were identified in neighborhoods throughout the watershed. Similarly, tree planting opportunities were also identified at many institutional sites. For both neighborhood and institutional tree planting opportunities, the number of trees was estimated based on a spacing of one tree per 15 to 20 feet. Pollutant reductions for pervious area reforestation are calculated based on a land use conversion from pervious urban to forest. An approximation of 100 trees per acre is used to calculate the area available for conversion. The equation used to estimate total nitrogen (TN) load reductions for tree plantings is expressed as:

*[5.85 (lbs/ac/yr) – 1.49 (lbs/ac/yr)] * [# Trees * (1 acre/100 trees)]*

The equation used to estimate total phosphorus (TP) load reductions for tree plantings is expressed as:

*[0.25 (lbs/ac/yr) – 0.04 (lbs/ac/yr)] * [# Trees * (1 acre/100 trees)]*

The equation used to estimate sediment load reductions for tree plantings is expressed as:

*[77 (lbs/ac/yr) – 21 (lbs/ac/yr)] * [# Trees * (1 acre/100 trees)]*

Tree plantings would involve converting open pervious area to forest. Therefore, the loading rate would be reduced by a factor equal to the difference between pervious urban and forest loading rates used in the watershed pollutant loading analysis, as shown in the first expression in brackets in the equations above. The approximate reduction in pollutant load is then the reduced loading rates multiplied by the open pervious available for reforestation (i.e., the expression in the second brackets in the equations above). A summary of tree planting load reduction calculations and results are shown in Table 3-14 and Table 3-15.

Table 3-14: Neighborhood Tree Planting Load Reductions

Pollutant	Pervious Urban Loading Rate (lbs/ac/yr)	Forest Loading Rate (lbs/ac/yr)	Reduced Loading Rate (lbs/ac/yr)	Estimated # Trees	Equivalent Forest Area (acres)	Max Potential Load Reduction (lbs/yr)
TN	5.85	1.49	4.35	7,567	76	329
TP	0.25	0.04	0.21	7,567	76	16.0
Sediment	77	21	56	7,567	76	4,203

Table 3-15: Institution Tree Planting Load Reductions

Pollutant	Pervious Urban Loading Rate (lbs/ac/yr)	Forest Loading Rate (lbs/ac/yr)	Reduced Loading Rate (lbs/ac/yr)	Estimated # Trees	Equivalent Forest Area (acres)	Max Potential Load Reduction (lbs/yr)
TN	5.85	1.49	4.35	666	0.66	29
TP	0.25	0.04	0.21	666	0.66	1.41
Sediment	77	21	56	666	0.66	370

3.4.2.12 Street Sweeping

Approximately 73 miles of road were reported to have street sweeping in the Bird River watershed. Records from the Department of Public Works (DPW) Street Sweeping Program (EPS 2013) showed that 127.3 lbs TN, 50.9 lbs TP, and 50,905.2 lbs TSS were removed. A summary of street sweeping reduction calculations and results are shown in Table 3-16.

Table 3-16: Street Sweeping Load Reductions

Pollutant	Actual Miles of Street Sweeping	Max Potential Load Reduction (lbs/yr)
TN	73	127
TP	73	51
Sediment	73	50,905

As noted in Section 4.2 of the Watershed Characterization Report, Additionally, four neighborhoods were recommended during Neighborhood Source Assessments (NSAs) for street sweeping. Approximately 2.6 miles of roads were recommended for addition to DPW's Street Sweeping Program which would result in load reductions of 4.56 lbs TN, 1.82 lbs TP, and 1,823 lbs TSS (Table 3-17).

Table 3-17: Potential Street Sweeping Load Reductions Based on NSA Recommendations

Pollutant	Miles of Street Sweeping Recommended (NSAs)	Max Potential Load Reduction (lbs/yr)
TN	2.6	4.56
TP	2.6	1.82
Sediment	2.6	1,823

3.4.2.13 Sanitary Sewer Overflows

As described in Chapter 3 of the Watershed Characterization Report (Appendix E), sanitary sewer overflows over the past 12 years are estimated to contribute 71 pounds per year of TP and 214 pounds per year of TN. These are assumed to be eliminated by 2020 through sewer line upgrades occurring as a result of the consent decree.

A total of 88 sanitary sewer overflow (SSO) events were documented between 2000 and 2011 within Bird River watershed. An estimated 856,000 gallons were discharged over this 12-year period. Pollutant loads associated with these SSO events and volume were calculated based on the following assumptions (more detail can be found in Section 3.5 of the Watershed Characterization Report, found in Appendix E):

- Total Nitrogen (TN): A conversion factor of 2.5×10^{-4} was used to convert gallons of overflow to pounds of pollutant. This is based on a 30 mg/L TN concentration for raw sewage and a multiplier of 8.3×10^{-6} lb•L/mg•gal.

- Total Phosphorus (TP): A conversion factor of 8.3×10^{-5} was used to convert gallons of overflow to pounds of pollutant. This is based on a 10 mg/L TP concentration for raw sewage and a multiplier of 8.3×10^{-6} lb•L/mg•gal.

- Fecal Coliform (FC): A conversion factor of 2.4×10^{8} was used to convert gallons of overflow to MPN fecal coliform. This is based on a multiplier of 6.4×10^{6} MPN/100 ml.

Based on these conversion factors, approximately 214 lbs of total nitrogen and 71 lbs of total phosphorus were released over the 12-year period as a result of SSOs. This is equivalent to pollutant reduction capabilities of 17.8 lbs TN/yr (i.e., 213.9 lbs TN/12 yrs) and 5.9 lbs TP/yr (i.e., 71 lbs TP/12 yrs). Note that TN and TP concentrations shown above are values for waste and wash water combined from CWP's Watershed Treatment Model version 3.1.

3.4.2.14 Overall Pollutant Load Reductions

The sum of maximum potential pollutant load reductions calculated for individual BMPs represents the overall pollutant removal capacity for a maximum implementation scenario (i.e., 100% of the projects implemented). A practicable pollutant load reduction was estimated for each BMP as the maximum potential load reduction multiplied by a projected participation factor. An overall projected pollutant removal capacity is the sum of practicable pollutant load reductions for individual BMPs. Projected participation factor assumptions are described in Table 3-18.

Table 3-19 presents a summary of estimated pollutant load reductions for both scenarios – maximum implementation and projected practicable – including how reductions were credited, pollutant removal efficiencies, maximum potential load reductions, units available for restoration, projected participation, and projected load reductions.

The projected, practicable implementation of proposed restoration BMPs, shown in Table 3-19, would nearly meet the 32 percent reduction for nitrogen and would meet the 47 percent reduction for phosphorus needed to meet water quality standards for the Bird River watershed as specified by Chesapeake Bay TMDL; the Bay TMDL is included in Appendix I of the Characterization Report (Appendix E). There is opportunity to achieve greater reductions if more stormwater retrofit opportunities are identified or are implemented to a greater extent than those assumed by projected participation factors. Greater reductions may also be achieved through restoration actions not included in this analysis such as public education/outreach efforts (e.g., watershed trash and recycling campaign and tours of completed projects). These types of actions are not included in the pollutant removal analysis because reductions efficiencies are not well known and are difficult to estimate. Also not included in this analysis were opportunities for shoreline management projects. Although there are 16 miles of coastline in Bird River, a feasibility study conducted by DEPS in 1998 showed low potential for shoreline management projects here. See section 2.2.8 in the Characterization Report (Appendix E) for more information.

Table 3-18: Projected Participation Factors

BMP	Projected Participation	Basis of Assumption
Capital Investment – Filtration	100	Existing - pond retrofits already implemented
Existing SWM	100	Existing - BMP already implemented
SWM Conversion	100	Completion of 15 conversions recommended
SW Retrofits (NSA, ISI, PAA, HSI)*	50	General estimate to achieve reduction goal
ISI Impervious Cover Removal	50	General estimate to achieve reduction goal
Reforest Stream Buffer	80	General estimate to achieve reduction goal
Pervious Area Reforestation	50	General estimate to achieve reduction goal
Stream Restoration	85	General estimate to achieve reduction goal
NSA Downspout Disconnection	33	33% willingness factor
NSA Tree Plantings	50	General estimate to achieve reduction goal
ISI Tree Plantings	66	66% of estimated trees located on public lands
Urban Nutrient Management	100	State Mandate
Street Sweeping	100	General estimate to achieve reduction goal
SSO Reduction/Elimination	100	Consent Decree requirements

* NSA (Neighborhood Source Assessment); ISI (Institutional Site Investigation); PAA (Pervious Area Assessment); HSI (Hotspot Investigation)

Table 3-19: Summary of Pollutant Load Reduction Estimates

BMP	How Credited	TN Efficiency	TP Efficiency	Sediment Efficiency	Max Potential TN Load Reduction (lbs/yr)	Max Potential TP Load Reduction (lbs/yr)	Max Potential Sediment Load Reduction (lbs/yr)	Units Available		Projected Participation (%)	Projected TN Load Reduction (lbs/yr)	Projected TP Load Reduction (lbs/yr)	Projected Sediment Load Reduction (lbs/yr)
Existing BMPs	Efficiency	varies	varies	varies	697	123	66,443	456	acres	100	697	123	66,443
Existing Stream Restoration	lbs per Ln Ft	0.2	0.068	54.25	5,100	1734	1,383,375	25,500	ft	100	5,100	1,734	1,383,375
Existing SWM	Efficiency	varies	varies	varies	4,076	585	355,888	3,382	acres	100	4,076	585	355,888
SWM Conversion	Efficiency	varies	varies	varies	727	156	88,884	225	acres	100	727	156	88,884
SW Retrofits (NSA, ISI, PAA, HSI)	Efficiency	varies	varies	varies	86.4	16.9	8,052	20.90	acres	50	43.2	8.46	4,026
ISI Impervious Cover Removal	LU Conversion	N/A	N/A	N/A	1.43	0.48	206	0.42	acres	50	0.72	0.24	103
Reforest Stream Buffer	LU Conversion + Efficiency	25%	50%	50%	3,676	296	98,523	613	acres	80	2,941	237	78,819
Urban Nutrient Management.	Efficiency	varies	varies	N/A	776	138	N/A	2,241	acres	100	776	138	N/A
Pervious Area Reforestation	LU Conversion	N/A	N/A	N/A	274	13	3,501	63	acres	50	137	6.68	1,750
New Stream Restoration	lbs per Ln Ft	0.2	0.068	54.25	6,215	2,113	1,685,765	31,074	ft	85	5,283	1,796	1,432,900
NSA Downspout Disconnection	Efficiency	50%	60%	90%	819	148	90,217	177	acres	33	270	49	29,772
NSA Tree Plantings	LU Conversion	N/A	N/A	N/A	329	16	4,203	76	acres	50	165	8	2,102
ISI Tree Plantings	LU Conversion	N/A	N/A	N/A	29	1.41	370	0.66	acres	66	19	0.93	244
Street Sweeping (Current and NSA Recommended)	Direct Removal	N/A	N/A	N/A	132	53	52,728	75	miles	100	132	53	52,728
SSO Reduction/Elimination	Direct Removal	N/A	N/A	N/A	18	6	N/A	855,770	gallons	100	18	6	N/A
				Total	22,957	5,400	3,838,156				20,385	4,901	3,497,034
				Total Existing Urban Load (lbs/yr)	63,296	5,740	2,189,630				63,296	5,740	2,189,630
				Reduction Achieved	36.3%	94.1%	175.3%				32.2%	85.4%	159.7%

CHAPTER 4: SUBWATERSHED MANAGEMENT STRATEGIES

4.1 Introduction

This chapter describes the criteria and methodology used to rank the eight subwatersheds within the Bird River watershed (Figure 4-1). The subwatershed ranking provides a tool for targeting restoration actions by location/waterbody. This chapter also summarizes management strategies and implementation priorities within each subwatershed.

Individual subwatershed summaries include key subwatershed characteristics. More detailed information on a subwatershed basis can be found in the Watershed Characterization Report, included as Appendix E.

4.2 Subwatershed Prioritization

A ranking methodology was developed to prioritize subwatersheds in terms of restoration need and potential. Subwatersheds are represented by an overall prioritization score on a scale of 48, based on a set of 12 criteria each worth a maximum of four points. A total score of 0 denotes the least significant impacts to water quality and a total score of 48 corresponds to the greatest water quality improvement potential. The total prioritization score for a subwatershed is comprised of the following ranking criteria:

- Phosphorus Loads,
- Nitrogen Loads,
- Impervious Surfaces,
- Neighborhood Restoration Opportunity/Pollution Source Indexes,
- Neighborhood Downspout Disconnection,
- Institutional Site Investigations,
- Pervious Area Assessments,
- Municipal Street Sweeping,
- Municipal Stormwater Conversions,
- Illicit Discharge Data,
- Stream Buffer Improvement, and
- Stream Restoration Potential.

In general, subwatersheds were grouped into quartiles based on supporting criterion data to yield an even distribution of the number of watersheds per possible score (i.e., 1, 2, 3, and 4). In some cases, criterion data did not support dividing the subwatersheds into four equal parts. Examples include a distribution of data that is too narrow or clustered, or cases where zero values were assigned to subwatersheds that had no recommended action for a particular criterion.

Criteria used to calculate overall prioritization scores were selected considering SWAP goals and information compiled during watershed characterization and field efforts. Criteria and scoring designations are described in the sections below. Subwatershed restoration prioritization scoring and ranking results are summarized at the end of this section.

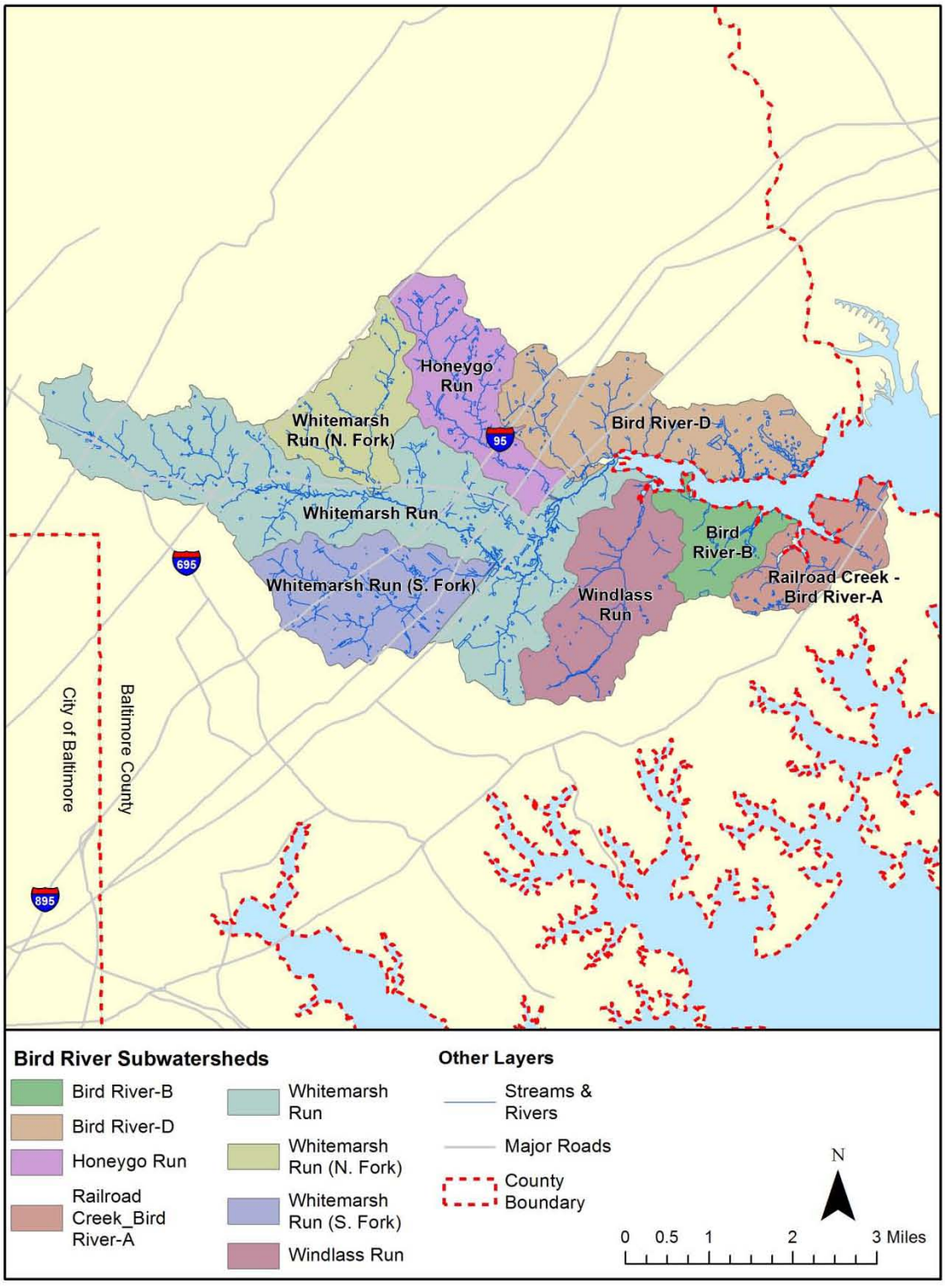

Figure 4-1: Bird River Subwatersheds

4.2.1 Phosphorus and Nitrogen Loads

One of the objectives that will improve and maintain water quality in the Bird River watershed streams and tidal area and help meet the Chesapeake Bay TMDLs is to reduce annual average total phosphorus and nitrogen loads. Annual pollutant loads (lbs/year) for total nitrogen and total phosphorus were calculated for each subwatershed based on loading rates established by MDE and the Chesapeake Bay Program (CBP) for various land use types and subwatershed land use distributions. The pollutant loading analysis for Bird River watershed is explained in further detail in Section 3.4 of the Watershed Characterization Report (Appendix E).

For each subwatershed, annual nitrogen and phosphorus loads were divided by the subwatershed's area. This represents pollutant loading rates (lbs/acre/year) and allows a direct comparison among the eight subwatersheds since they vary greatly in size. Subwatersheds with higher pollutant loading rates are higher priorities for restoration within the Bird River watershed. Therefore, higher pollutant loading rates are assigned high scores to denote greater water quality impacts and restoration needs.

Subwatershed nitrogen loading rates ranged from 5.0 to 8.3 lbs/acre/year. The following point system was used to assign nitrogen load scores to the eight subwatersheds based on the range and distribution of subwatershed nitrogen loading rates:

- ≥ 7.0 lbs/acres/year = 4 pts;
- 6.5 – 6.9 lbs/acre/year = 3 pts;
- 5.6 – 6.4 lbs/acre/year = 2 pts;
- ≤ 5.5 lbs/acre/year = 1 pt.

Subwatershed phosphorus loading rates ranged from 0.42 to 0.57 lbs/acre/year. The following point system was used to assign phosphorus load scores to the eight subwatersheds based on the range and distribution of subwatershed phosphorus loading rates:

- ≥ 0.55 lbs/acres/year = 4 pts;
- 0.50 – 0.54 lbs/acre/year = 3 pts;
- 0.46 – 0.49 lbs/acre/year = 2 pts;
- ≤ 0.45 lbs/acre/year = 1 pt.

Nitrogen and phosphorus loading rates and corresponding scores are summarized in Table 4-1 by subwatershed.

Table 4-1: Nitrogen and Phosphorus Load Scores

Subwatershed	Nitrogen Loading Rate (lbs/acre/yr)	Nitrogen Load Score	Phosphorus Loading Rate (lbs/acre/yr)	Phosphorus Load Score
Bird River-B	8.3	4	0.53	3
Bird River-D	5.0	1	0.57	4
Honeygo Run	7.0	4	0.54	3
Railroad Creek_Bird River-A	5.7	2	0.42	1
Whitemarsh Run	5.8	2	0.56	4
Whitemarsh Run (N. Fork)	5.4	1	0.51	2
Whitemarsh Run (S. Fork)	5.1	1	0.49	2
Windlass Run	6.6	3	0.44	1

4.2.2 Impervious Surfaces

Various studies have shown a correlation between the amount of impervious surface within a watershed and water quality degradation. Impervious surfaces prevent precipitation from naturally infiltrating into the ground, which prohibits the natural filtration of pollutants and conveys concentrated, accelerated stormwater runoff directly to the stream system. Consequently, stormwater runoff from impervious surfaces can cause stream erosion and habitat destruction from the high energy flow, and is likely more polluted than runoff generated from pervious areas. Undeveloped watersheds with small amounts of impervious cover are more likely to have better water quality in local streams than urbanized watersheds with greater amounts of impervious cover.

As described in the Watershed Characterization Report (Appendix E), roads and buildings data layers were used to derive impervious surface areas and the percent impervious area for each subwatershed. Similar to the pollutant load criteria, percentages of impervious area for subwatersheds were used to assign scores, as this indicator allows a direct comparison between the eight subwatersheds. Subwatersheds with higher percentages of impervious cover are higher priorities for restoration and were assigned high scores to denote greater water quality impacts and restoration needs.

Impervious surfaces cover about 19 percent of the overall Bird River watershed. Subwatershed impervious values range from approximately 4 to 27 percent. The following point system was used to assign percent impervious scores to the eight subwatersheds based on CWP's Impervious Cover model (see Chapter 2.3.3 of Appendix E) and subwatershed impervious surface percentages:

- > 25% = 4 pts;
- 16 – 25% = 3 pts;
- 11 – 15% = 2 pts;
- < 11% = 1 pt.

Percent impervious values and corresponding scores are summarized in Table 4-2 by subwatershed.

Table 4-2: Percent Impervious Cover Scores

Subwatershed	% Impervious	% Impervious Score
Bird River-B	4	1
Bird River-D	13	2
Honeygo Run	16	3
Railroad Creek_Bird River-A	13	2
Whitemarsh Run	25	3
Whitemarsh Run (N. Fork)	27	4
Whitemarsh Run (S. Fork)	26	4
Windlass Run	7	1

4.2.3 Neighborhood Restoration Opportunity/Pollution Source Indexes

As described in the Watershed Characterization Report, neighborhood pollution severity and restoration potential were rated during neighborhood source assessments (NSA). The severity of potential pollution generated by a neighborhood is denoted by the Pollution Severity Index

(PSI) and was rated as severe, high, moderate, or none. A neighborhood's potential for residential restoration projects was also rated as high, moderate, or low according to the Restoration Opportunity Index (ROI). Out of the 100 neighborhoods assessed, 17 were rated as high for both PSI and ROI, and nine neighborhoods were rated as a high PSI with a moderate ROI. Neighborhoods with high PSI and high ROI ratings represent the best areas to initially target for restoration. Neighborhoods that had PSI ratings of low were discarded from this ranking.

Subwatersheds with the most neighborhoods rated as high for both pollution severity and restoration potential received the highest score (4 points). Subwatersheds with a single neighborhood rated as high for both pollution severity and restoration received the second highest score (3 points). Subwatersheds with no neighborhoods rated as high for both PSI and ROI but with neighborhoods rated as high for pollution severity and moderate for restoration potential, or moderate for pollution severity and high for restoration potential, were assigned the third highest score or moderate for (2 points). All other subwatersheds were assigned the lowest score (1 point).

The following point system summarizes PSI/ROI rating scores to the eight subwatersheds:

- High/High; $\geq$2 NSAs = 4 pts;
- High/High; 1 NSA = 3 pts;
- High/Moderate or Moderate/High = 2 pts;
- All other ratings = 1 pt.

The number of NSAs associated with various PSI/ROI ratings and corresponding PSI/ROI scores are summarized by subwatershed in Table 4-3.

Table 4-3: NSA PSI/ROI Scores

Subwatershed	# of NSAs by PSI/ROI Rating			NSA PSI/ROI Score
	High/ High	High/ Moderate	Moderate/ High	
Bird River-B				1
Bird River-D	1			3
Honeygo Run	1		1	3
Railroad Creek_Bird River-A				1
Whitemarsh Run	8	2	2	4
Whitemarsh Run (N. Fork)	3	5	8	4
Whitemarsh Run (S. Fork)	4	2	1	4
Windlass Run				1

4.2.4 Neighborhood Downspout Disconnection

Connected downspouts discharge rooftop runoff either directly to the storm drain system or to impervious surfaces. In either case, there is little to no treatment of stormwater runoff before it reaches the stream system. Disconnected downspouts drain to pervious areas such as yards and lawns, rain barrels, or rain gardens, all of which allow rooftop runoff to infiltrate into the ground and enter streams through the groundwater system in a slower, more natural fashion. Downspout disconnection is desirable because it decreases flow and reduces pollutant loads to streams during storm events.

Downspout disconnection was recommended for neighborhoods where at least 25 percent of the downspouts are connected to impervious area or directly to the storm drain system and where the average lot has at least 15 feet of pervious area available down gradient from the connected downspout for redirection. Similar to lawn fertilizer reduction, this criterion is used for subwatershed prioritization because it has a quantitative pollution reduction efficiency related to nutrient reduction goals.

The acres of rooftop that would be addressed if downspout disconnection were initiated in the recommended neighborhoods were calculated in the Watershed Characterization Report. The percentage of subwatershed rooftop area addressed was also calculated and was used to compare the restoration potential among the eight subwatersheds. Subwatersheds with the highest percentages of impervious rooftop acres and greatest acres of rooftop addressed through downspout disconnection denote the greatest restoration potential and therefore, received the highest scores. Percentages of rooftop areas addressed through downspout disconnection range from approximately 19 to 46 percent, by subwatershed.

The following point system was used to assign downspout disconnection scores to the eight subwatersheds based on the distribution and range of percentages of subwatershed rooftop area addressed:

- $\geq$ 35% and ≥ 15 acres = 4 pts;
- $\geq$ 35% and 5 - 15 acres = 3 pts;
- $\geq$ 35% and <5 acres = 2 pts;
- <35% = 1 pt.

Percentage of rooftop area addressed by downspout disconnection and corresponding scores are summarized by subwatershed in Table 4-4.

Table 4-4: NSA Downspout Disconnection Scores

Subwatershed	Rooftop Acres Addressed	% of Total NSA Rooftop Acres Addressed	NSA Downspout Disconnection Score
Bird River-B	1.3	39	2
Bird River-D	11.5	40	3
Honeygo Run	7.7	46	3
Railroad Creek_Bird River-A	15.1	41	4
Whitemarsh Run	81.3	43	4
Whitemarsh Run (N. Fork)	48.3	38	4
Whitemarsh Run (S. Fork)	10.5	19	1
Windlass Run	1.6	23	1
Total	177.3	38	

4.2.5 Institutional Site Index

Institutions offer unique opportunities for watershed restoration. Typically, institutional properties encompass considerable portions of land that contain various natural resources. In addition, they offer the opportunity to engage a wide range of citizens in restoration activities. This raises community awareness while also providing water quality improvement benefits in the watershed. A total of 40 community-based facilities were surveyed during Institutional Site Investigations

(ISIs) including faith-based facilities, hospitals/care centers, public schools, colleges/research centers, municipal facilities (e.g., public libraries), golf courses, and other facilities. The focus of an ISI is to identify potential restoration opportunities, particularly those with opportunities both for community education and water quality benefits. Subwatersheds with more institutional sites present more opportunities for implementing restoration actions (e.g., tree planting, stormwater retrofits, community cleanups, etc.) and encouraging citizen participation. Public institutional sites are good candidates for initial restoration efforts because there are opportunities to make use of and build upon existing partnerships, and in many cases, incorporate student projects. While private institutions also have restoration potential, they will require a different approach and the development of new partnerships to implement restoration efforts.

For all of these reasons, prioritization for this criterion was based on the number of institutions and ownership (public versus private), according to the following point system:

- 2 public ISIs, at least 1 private ISI = 4 pts;
- 1 public ISI, at least 1 private ISI= 3 pts;
- 1 public ISIs, no private ISIs = 2 pts;
- Only private ISIs = 1 pt.

The total numbers of institutions, including ownership and corresponding institutional site index scores, are summarized by subwatershed in Table 4-5.

Table 4-5: ISI Scores

Subwatershed	# of Public ISIs	# of Private ISIs	Total # of ISIs	ISI Score
Bird River-B	0	2	2	1
Bird River-D	1	0	1	2
Honeygo Run	1	4	5	3
Railroad Creek_Bird River-A	0	2	2	1
Whitemarsh Run	4	9	13	4
Whitemarsh Run (N. Fork)	2	6	8	4
Whitemarsh Run (S. Fork)	2	6	8	4
Windlass Run	1	0	1	2
Total	11	29	40	

4.2.6 Pervious Area Reforestation

The most likely candidates for successful pervious area reforestation efforts are those on public lands with minimal site preparation required. Public sites are eligible for tree planting through DNR's "Tree-Mendous Maryland" program and are good opportunities for volunteer or community projects. Privately-owned lands are often planned for future development or expansion of an existing facility. In addition, larger open parcels have greater potential for reforestation and water quality benefits than smaller areas.

Subwatershed prioritization related to pervious area reforestation was based on the total acres of reforestation recommended during PAAs. Recommended acres for reforestation within the eight subwatersheds range from 0 to 31.26 acres. Scoring for this criterion is as follows:

- $\geq$ 30 acres = 4 pts;

- 10-30 acres = 3 pts;
- 2-9 acres = 2 pts;
- < 2 acres = 1 pt;
- 0 acres = 0 pts.

Pervious reforestation acreages and corresponding scores are summarized by subwatershed in Table 4-6.

Table 4-6: Pervious Area Reforestation Scores

Subwatershed	Acres Recommended for Reforestation	Pervious Area Reforestation Score
Bird River-B	0.00	0
Bird River-D	31.26	4
Honeygo Run	16.67	3
Railroad Creek_Bird River-A	0.80	1
Whitemarsh Run	13.77	3
Whitemarsh Run (N. Fork)	1.55	1
Whitemarsh Run (S. Fork)	5.87	2
Windlass Run	0.00	0
Total	69.92	

4.2.7 Municipal Street Sweeping

Baltimore County provides street sweeping services throughout the jurisdiction to help remove trash, sediment, and other organic matter such as leaves and grass clippings from the curb and gutter system and prevent them from entering the storm drain system and nearby streams. Street sweeping also reduces sediment and other pollutant loads such as oil and metals to the stream system. During the NSAs, neighborhoods where 20 percent or more of the curbs and gutters were covered with excessive trash, sediment, and/or organic matter were recommended for street sweeping. As described in the Watershed Characterization Report, the miles of streets that would be addressed if street sweeping were implemented in the recommended neighborhoods were estimated by subwatershed. There were only four neighborhoods in the Bird River watershed that were suitable candidates for street sweeping. Subwatersheds with more miles of road that could be addressed through street sweeping would denote the greatest restoration potential and would therefore be scored the highest. Miles addressed through street sweeping range from 0 to 2.0 so few points were awarded for this watershed ranking factor.

The following point system was used to assign street sweeping scores to the eight subwatersheds based on the distribution and range of miles addressed:

- $\geq$ 10 miles = 4 pts;
- 5.0 – 9.9 miles = 3 pts;
- 1 – 4 miles = 2 pts;
- < 1 mile = 1 pt;
- 0 miles = 0 pts.

Miles that could be addressed by municipal street sweeping and corresponding scores are summarized by subwatershed in Table 4-7.

Table 4-7: Street Sweeping Scores

Subwatershed	Miles of Road Addressed	Street Sweeping Score
Bird River-B	0.0	0
Bird River-D	0.0	0
Honeygo Run	0.0	0
Railroad Creek_Bird River-A	0.0	0
Whitemarsh Run	2.0	2
Whitemarsh Run (N. Fork)	0.0	0
Whitemarsh Run (S. Fork)	0.6	1
Windlass Run	0.0	0
Total	2.6	

4.2.8 Stormwater Conversions

Existing dry detention ponds within the Bird River watershed were investigated for potential conversion to water quality management facilities. Dry ponds were assessed since they have the greatest potential for conversion to a type of facility, such as a dry extended detention facility, that provides water quality benefits in addition to quantity control. Dry extended detention ponds are designed to capture and retain stormwater runoff from a storm for a minimum duration, in order to allow sediment and pollutants to settle out while also providing flood control.

Twenty existing dry detention ponds were assessed for their potential to be converted to an extended detention facility. Information and measurements collected at each facility included: orifice, riser, ponding, debris, vegetation, adjacent land use, physical expansion capabilities, outfall, and downstream conditions. Out of the 20 detention ponds assessed, four were considered as having the greatest potential for conversion to an extended detention facility. Six other ponds were considered to have moderate potential for conversion. Four ponds that were considered to have no potential for conversion and the facility that was not located in the field (five of the 20 ponds) were not included in this ranking analysis.

The following point system was used to assign stormwater conversion scores to the eight subwatersheds based on conversion potential of ponds within the subwatershed:

- >1 pond ranked High = 4 pts;
- 1 pond ranked High and ≥2 ponds ranked Moderate = 3 pts;
- 1 pond ranked High and 1 pond ranked Moderate = 2 pts;
- No ponds ranked High or Moderate, ≥2 ponds ranked Low = 1 pt;
- 0 ponds ranked Moderate or above = 0 pts.

Number of dry ponds and their conversion potential, along with corresponding scores are summarized by subwatershed in Table 4-8.

Table 4-8: Stormwater Conversion Scores

Subwatershed	# of Dry Ponds by Conversion Potential			Stormwater Conversion Score
	High	Moderate	Low	
Bird River-B				0
Bird River-D				0
Honeygo Run				0
Railroad Creek_Bird River-A				0
Whitemarsh Run	2	3	1	4
Whitemarsh Run (N. Fork)	1	2	4	3
Whitemarsh Run (S. Fork)	1	1		2
Windlass Run				0
Total	4	6	5	

4.2.9 Illicit Discharge Data

Baltimore County tracks illicit discharges through a program of routine outfall screening. Illicit discharges refer to leaking pipes or incorrectly connected pipes. The County has an outfall prioritization system based on data from the outfall screening. Under this system, major outfalls are assigned one of the following priority ratings: none, low, high, or critical. Critical outfalls are those with major problems that require immediate correction and/or close monitoring, or outfalls with recurring problems. These are sampled the most frequently (four times per year). On the other end of the rating scheme, outfalls that are not prioritized have insufficient data to determine a priority rating. More information regarding the County's outfall screening and prioritization system is included in the Watershed Characterization Report (Appendix E).

There are 45 major outfalls in the Bird River watershed. Subwatersheds with the most illicit discharge data and highest prioritization ratings represent the best areas to target for restoration initially. The following point system was used to rank illicit discharge connection data scores in the eight subwatersheds based on the number of major outfalls and their prioritization rankings:

- ≥1 outfalls ranked Critical = 4 pts;
- ≥1 outfalls ranked High = 3 pts;
- ≥1 outfalls ranked Low = 2 pts;
- ≥1 outfalls without a ranking = 1 pt;
- 0 outfalls = 0 pts.

The number of major outfalls associated with various County outfall prioritization ratings and corresponding illicit discharge data scores are summarized by subwatershed in Table 4-9.

Table 4-9: Illicit Discharge Data Scores

Subwatershed	County Outfall Prioritization Rankings				Illicit Discharge Data Score
	Critical	High	Low	None	
Bird River-B					0
Bird River-D					0
Honeygo Run			3		2
Railroad Creek_Bird River-A				2	1
Whitemarsh Run	1	7	9	1	4
Whitemarsh Run (N. Fork)		2	11	2	3
Whitemarsh Run (S. Fork)	1		5		4
Windlass Run				1	1
Total	2	9	28	6	

4.2.10 Stream Buffer Improvements

Forested buffers along streams play a crucial role in improving water quality and flood mitigation. They can reduce surface runoff and pollutant loads, stabilize stream banks, trap sediment, and provide habitat for various types of terrestrial and aquatic life, including fish. Maintaining healthy streams and forest buffers is important for reducing nutrient and sediment loadings to the Bird River and the Chesapeake Bay. When forested stream buffers are cleared and developed, their beneficial functions are lost and stream health declines. Riparian buffer zones can be re-established or preserved as a BMP, reducing land use impacts by intercepting and controlling pollutants entering a water body.

In the Watershed Characterization Report, the vegetative condition of a 100-foot buffer zone on either side of the stream system was analyzed. Three conditions were used to classify stream buffer conditions: impervious, open pervious, or forested. For each subwatershed, acreages and percentages of stream buffer area were determined for the three conditions. Open pervious areas (e.g., mowed lawns) represent the greatest potential for stream buffer reforestation. Subwatersheds with greater percentages of open pervious buffer areas denote the greatest potential for stream buffer improvement and were scored the highest.

Open pervious buffer area ranges from 14% to 66% of the buffer zone. The following point system was used to assign stream buffer improvement scores to the eight subwatersheds based on the distribution and range of open pervious buffer area percentages:

- > 50% = 4 pts;
- 25-50% = 3 pts;
- 15-25% = 2 pts;
- <15% = 1 pt.

Percentages of open pervious stream buffer areas and corresponding scores are summarized by subwatershed in Table 4-10.

Table 4-10: Stream Buffer Improvement Scores

Subwatershed	% Open Pervious Stream Buffer Area	Stream Buffer Improvement Score
Bird River-B	21	2
Bird River-D	27	3
Honeygo Run	29	3
Railroad Creek_Bird River-A	66	4
Whitemarsh Run	29	3
Whitemarsh Run (N. Fork)	21	2
Whitemarsh Run (S. Fork)	26	3
Windlass Run	14	1

4.2.11 Stream Restoration Potential

As detailed in Section 3.6 of the Watershed Characterization Report, stream corridor assessments (SCAs) were conducted for a subset of stream reaches within the Bird River-D, Honeygo Run, and Whitemarsh Run subwatersheds. The SCAs provided an inventory of various problems and general stream conditions found throughout the surveyed stream network. Two of the problem types, Erosion and Channel Alteration, indicate areas that may be good candidates for stream restoration. Eroding stream banks can be a clear, visible sign of stream impairments. Other alterations to the natural stream channel, such as armoring banks and the channel bottom with concrete, gabion baskets, and rip-rap, may impair stream habitat and cause channel instabilities further downstream.

The stabilization of streambanks and other channel restoration measures can provide numerous benefits, including nutrient and sediment load reductions and improved habitat health for aquatic biota. Subwatersheds with a greater length of moderately to severely eroding or altered stream channel present a greater opportunity for restoration and pollutant load reductions and are therefore ranked higher than those with a shorter total length of eroding or altered stream channel or lower severity impairments.

This ranking factor is limited because it is only applicable to the three subwatersheds where these surveys were performed. During analyses of data collected for these subwatersheds, a subset of erosion and channel alteration sites were deemed to be the most significant areas of concern within each subwatershed. A detailed accounting of the significant erosion sites is found in Table 3-35 in Section 3.6 of the Watershed Characterization Report. The following point system was used to assign stream restoration potential scores to the three subwatersheds based on the distribution and range of the length of moderately to severely impaired stream in need of restoration:

- ≥ 2,500 feet = 4 pts;
- 1, 500 – 2,499 feet = 3 pts;
- 501 – 1,499 feet = 2 pts;
- ≤ 500 feet = 1 pt;
- SCAs not performed in subwatershed = 0 pts.

The lengths of streams exhibiting erosion or alterations, which may have potential for restoration, are summarized by subwatershed in Table 4-11 along with corresponding scores.

Table 4-11: Stream Restoration Potential Scores

Subwatershed	Linear Feet of Stream in Need of Restoration	Stream Restoration Potential Score
Bird River-B		0
Bird River-D	1,185	2
Honeygo Run	2,880	4
Railroad Creek_Bird River-A		0
Whitemarsh Run	2,859	4
Whitemarsh Run (N. Fork)		0
Whitemarsh Run (S. Fork)		0
Windlass Run		0
Total	6,924	

4.2.12 Subwatershed Prioritization Summary

The Bird River watershed comprises eight subwatersheds that are ranked according to the total restoration prioritization score (i.e., the sum of prioritization criterion scores). Subwatershed restoration ranking results are summarized in Table 4-12 including individual criterion scores, total scores, and rankings by subwatershed.

Table 4-12: Subwatershed Ranking Results

Subwatershed	Nitrogen Load	Phosphorus Load	% Impervious Cover	NSA PSI/ROI	NSA Downspout Disconnection	ISI Site Index	Pervious Area Reforestation	Street Sweeping	Stormwater Conversion	Illicit Discharge Data	Stream Buffer Improvement	Stream Restoration Potential	TOTAL SCORE	SUBWATERSHED RANK
Bird River-B	4	3	1	1	2	1	0	0	0	0	2	0	14	7
Bird River-D	1	4	2	3	3	2	4	0	0	0	3	2	24	5
Honeygo Run	4	3	3	3	3	3	3	0	0	2	3	4	31	2
Railroad Creek_Bird River-A	2	1	2	1	4	1	1	0	0	1	4	0	17	6
Whitemarsh Run	2	4	3	4	4	4	3	2	4	4	3	4	41	1
Whitemarsh Run (N. Fork)	1	2	4	4	4	4	1	0	3	3	2	0	28	3
Whitemarsh Run (S. Fork)	1	2	4	4	1	4	2	1	2	4	3	0	28	3
Windlass Run	3	1	1	1	1	2	0	0	0	1	1	0	11	8

Subwatersheds were placed into one of four restoration priority categories based on ranking results: very high, high, medium, and low. These results are summarized in Table 4-13 and illustrated in Figure 4-2**.**

Subwatersheds with a total prioritization score greater than 30 received a priority rating of Very High (Whitemarsh Run and Honeygo Run). A rating of High was assigned to the next logical grouping of subwatersheds, with total prioritization scores of 25-30 (Whitemarsh Run (N. Fork) and Whitemarsh Run (S. Fork)). A rating of Medium was assigned to the subwatersheds with total prioritization scores of 15-24. Watersheds with total prioritization scores of less than 15 were assigned a priority rating of Low. Restoration actions will have to occur throughout the

entire Bird River watershed in order to meet environmental goals and requirements. However, subwatershed prioritization provides a tool/framework for focusing initial restoration efforts.

Table 4-13: Subwatershed Restoration Prioritization

Rank	Subwatershed	Total Score	Prioritization Category
1	Whitemarsh Run	41	Very High
2	Honeygo Run	31	Very High
3	Whitemarsh Run (N. Fork)	28	High
3	Whitemarsh Run (S. Fork)	28	High
5	Bird River-D	24	Medium
6	Railroad Creek_Bird River-A	17	Medium
7	Bird River-B	14	Low
8	Windlass Run	11	Low

As noted in the goals for the SWAP laid out in Chapter 2, in addition to improving the quality of Bird River and the impaired sections of the watershed, it is also important to protect those areas that are in good condition. Degradation of streams and subwatersheds that are in relatively good condition already will only make attaining the goals set for the Bird River watershed that much harder. For this reason, the subwatersheds were also ranked in order of protection priorities (Table 4-14). Identifying these subwatersheds is simply a matter of reversing the subwatershed restoration prioritization. For example, a watershed with a lesser amount of impervious surface and fewer areas of inadequate stream buffer would receive fewer points, indicating less impairment and degradation. These subwatersheds would be ideal targets for protective measures such as pursuing conservation easements and enforcing stricter riparian buffer regulations.

Table 4-14: Subwatershed Protection Prioritization

Rank	Subwatershed	Total Score	Prioritization Category
1	Windlass Run	11	Very High
2	Bird River-B	14	Very High
3	Railroad Creek_Bird River-A	17	High
3	Bird River-D	24	High
5	Whitemarsh Run (N. Fork)	28	Medium
6	Whitemarsh Run (S. Fork)	28	Medium
7	Honeygo Run	31	Low
8	Whitemarsh Run	41	Low

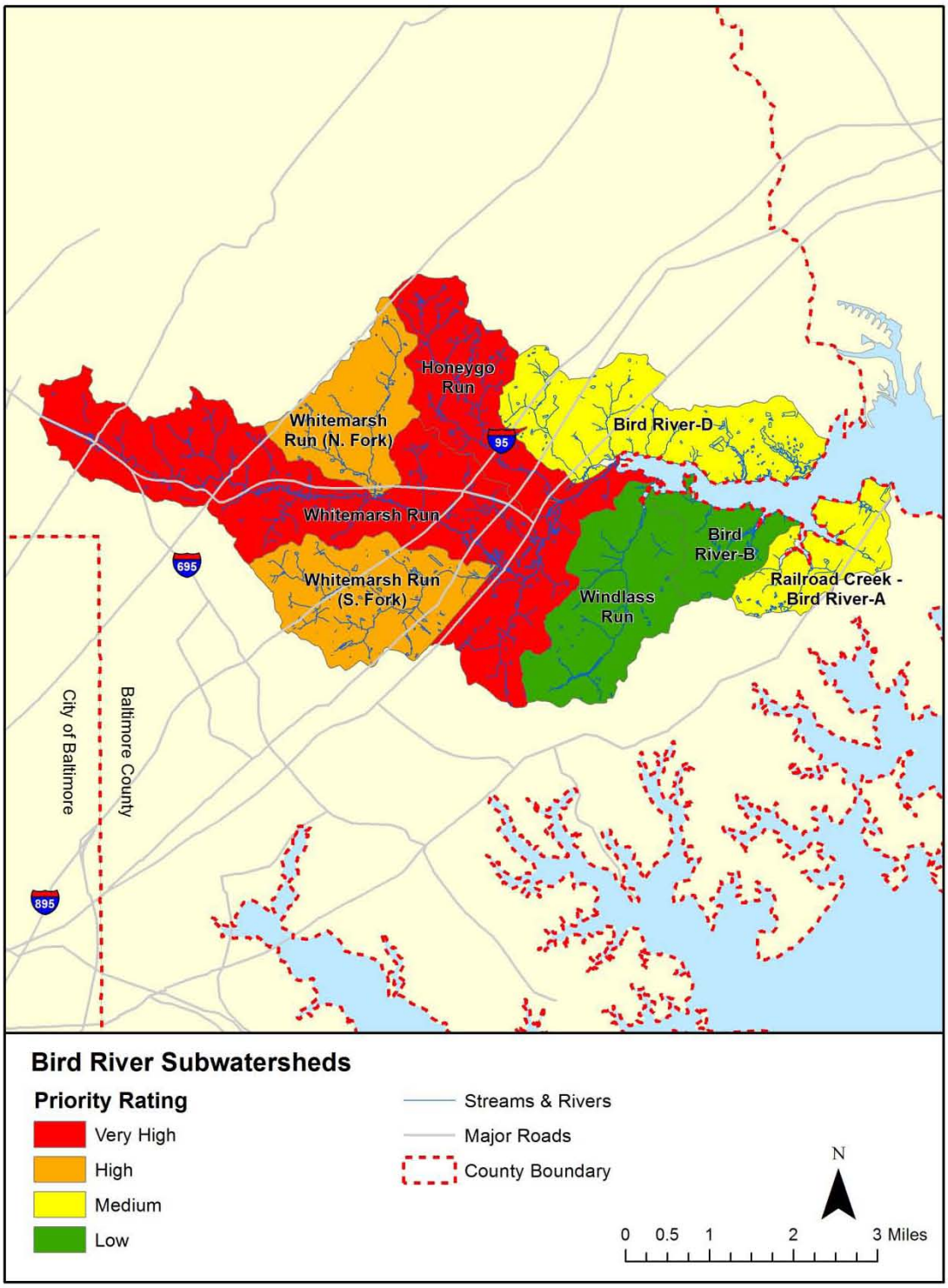

Figure 4-2: Bird River Subwatershed Restoration Prioritization

4.3 Subwatershed Restoration Strategies

Restoration strategies for each subwatershed are presented in the following subsections. Subwatersheds are presented in order of their "Subwatershed Code," a number assigned to the watershed by Baltimore County. A description of key watershed characteristics is presented for each subwatershed including drainage area, stream length, population, land use/land cover, impervious cover, soils, and stormwater management (SWM) facilities. Assessment results for neighborhoods, hotspots, institutions, pervious areas, potential stream restoration sites, illicit discharges, and stormwater conversions are also summarized for each subwatershed. Details on these assessment techniques can be found in Appendix E Chapter 4. Finally, a subwatershed management strategy including recommended citizen and municipal actions is presented at the end of each subsection.

Note that because there are numerous operations in the Bird River watershed that might qualify as stormwater hotspots, not all could be individually evaluated during the uplands survey. Hotspot Site Investigations (HSIs) were focused on 29 sites identified through desktop GIS analysis and through crew leaders' best professional judgment. This sample assessment is intended to represent common types of hotspot operations located throughout the watershed and help develop an overall strategy to encompass all hotspot operations occurring in the watershed.

Likewise, there are a large number of institutions (i.e. community-based facilities) in the Bird River watershed; however, only 40 of those were surveyed in order to determine which retrofit and restoration strategies are best-suited to the Bird River SWAP area. In order to be as representative as possible, a range of institutions were surveyed, including faith-based facilities, hospitals/care centers, public schools, colleges/research centers, municipal facilities (e.g., public libraries), and other facilities (e.g., VFW post, American Cancer Society).

On a similar note, there are various open pervious areas throughout the watershed with reforestation potential. Twenty-five pervious area assessments (PAAs) were conducted, all of which are large open parcels, and most with minimal site preparation required for reforestation. Twenty-four of these PAAs were judged to represent the best available opportunities for reforestation, although there are likely many more opportunities throughout the watershed.

4.3.1 Whitemarsh Run (N. Fork) (Subwatershed Code 100)

Whitemarsh Run (N. Fork), where Perry Hall is located, is in the northern and central portion of Bird River watershed and is the third smallest of the eight subwatersheds in the SWAP area. This subwatershed is the most densely populated and has the highest proportion of high density residential land use in the entire Bird River watershed (22%). It also includes a high proportion of medium density residential land (53%). Table 4-15 summarizes key subwatershed characteristics of Whitemarsh Run (N. Fork).

Table 4-15: Key Subwatershed Characteristics – Whitemarsh Run (N. Fork)

Drainage Area	1,374.4 acres (2.15 sq. mi.)	
Stream Length	6.4 miles	
Population	11,605 (2010 Census)	
	8.4 people/acre	
Land Use/Land Cover	Very Low Density Residential:	0.0%
	Low Density Residential:	2.4%
	Medium Density Residential:	53.4%
	High Density Residential:	22.0%
	Commercial:	6.5%
	Industrial:	0.0%
	Institutional:	6.9%
	Extractive:	0.0%
	Open Urban Land:	0.0%
	Agriculture:	0.1%
	Forest:	8.5%
	Barren Land:	0.0%
	Water/Wetlands:	0.0%
	Transportation	0.2%
Impervious Cover	27% of subwatershed	
Soils	A Soils (low runoff potential):	14.4%
	B Soils:	25.1%
	C Soils:	50.7%
	D Soils (high runoff potential):	9.8%
SWM Facilities	42% of urban land use treated	
Priority Rating	High	

Neighborhoods

A total of 27 distinct neighborhoods were identified and assessed within Whitemarsh Run (N. Fork) during the uplands assessment of the Bird River watershed. Recommendations for addressing stormwater volume and pollutants within this subwatershed include rain barrels, rain gardens, storm drain marking, education regarding cleaning up pet waste, Bayscaping, and stream buffer improvements. A summary of neighborhood recommended actions is presented in Table 4-16.

Table 4-16: NSA Recommendations – Whitemarsh Run (N. Fork)

		RECOMMENDED ACTIONS													
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K-12	<1/8	70			✓			✓		✓			0	0	75 % of storm drain markings are faded. Stream buffer <100 ft due to encroachment (mowing and fence lines). Potential planting area.
NSA-K-17b	<1/4	55	✓		✓	✓				✓			0	0	Stream buffer <100 ft due to mowing and road crossing.
NSA-K-17	<1/4	40	✓		✓					✓			0	0	Severe buffer encroachment, mowed lawn right up to concrete channel.
NSA-K-19	<1/4	70	✓		✓	✓							0	0	
NSA-K-24	<1/4	65	✓		✓	✓		✓					0	0	
NSA-K-26	<1/4	35	✓		✓	✓							0	0	
NSA-K-27	<1/4	60			✓					✓			0	32	Potential conversion of drainage swale to bioswale. Potential planting areas.
NSA-K-28	<1/4	40	✓		✓					✓			0	0	Stream buffer is present, but <100 ft due to mowing.
NSA-K-29	<1/4	95	✓		✓	✓				✓			0	0	
NSA-K-30	<1/4	25			✓	✓				✓			0	280	Stream buffer < 100 ft due to encroachment (yards, mowing).
NSA-K-33		85			✓								0	0	
NSA-K-34	<1/4	45	✓		✓	✓				✓			0	0	Stream buffer <100 ft due to encroachment (fence, shed, lawn, road).
NSA-K-36	<1/8	100			✓								0	20	
NSA-K-37	<1/8	85			✓					✓			0	320	Stream buffer <100 ft due to mowing. Many planting opportunities.
NSA-K-62	<1/4	35	✓					✓					0	0	
NSA-K-63b	<1/8	40	✓							✓			0	0	Stream buffer is present, but is <100 ft. Moderate to severe encroachment from fencing and shed.
NSA-K-63	<1/8	70			✓			✓					0	8	Lot pervious areas too small for downspout retrofit. Potential planting areas.
NSA-K-64	<1/8	65			✓			✓		✓			0	0	Not a lot of room for downspout disconnection. Mowing within approximately 50 ft of stream
NSA-K-65	<1/4	33			✓								0	26	Although a few rooftops discharge to impervious surface, lot sizes too small to redirect. Potential planting areas.

		RECOMMENDED ACTIONS													
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K-66	<1/8	60	✓					✓		✓			0	0	Excessive pet waste.50% of the marked storm drains are faded. Stream buffer <100 ft due to mowing. Potential planting area.
NSA-K-80		65			✓								0	0	Potential retrofit of drainage swale to bioswale.
NSA-K-82	<1/4	70	✓		✓	✓				✓			0	86	Stream buffer < 100 ft due to mowing. Consider converting Perry Hall Boulevard median to bioretention/ rain garden.
NSA-K-83	<1/4	75	✓		✓	✓				✓			0	0	Potential SWM retrofit off of Penn Avenue to replace concrete drainage channel. Stream buffer < 100 ft. due to mowing.
NSA-K-84	<1/4	45	✓		✓					✓			0	0	Stream buffer < 100 ft due to severe encroachment from mowing and road. Many planting opportunities available.
NSA-K-87	<1/4	45	✓		✓	✓							0	26	
NSA-K-91	1/4	35	✓		✓	✓				✓			0	230	Stream buffer < 100 ft due mowing. Potential planting area.
NSA-K-102		85			✓					✓			0	54	Severe buffer encroachment (mowing and building). One drainage pipe drains directly into stream.

All of the neighborhoods assessed within Whitemarsh Run (N. Fork) had opportunities for improvement. Storm drain marking, rain barrels and stream buffer improvements were widely recommended. Storm drain marking is popular because this relatively easy and inexpensive action can have a great effect by reminding residents not to dump potentially dangerous materials into the storm drain. It can also be easily paired with other education efforts, for example, with education regarding the effects of pet waste on water quality, in neighborhoods where both were recommended. Rain barrels serve as temporary storage of roof runoff, decreasing the volume of stormwater running off site. Tree planting opportunities were also spread throughout the subwatershed with three neighborhoods recommended for the planting of more than 200 trees each (Figure 4-3). Projects on this scale may encourage widespread community engagement and are ideal opportunities for children and families to participate and become involved with their watershed in a concrete way. In addition, actions as simple as adjusting mowing practices and tree plantings along stream channels and drainage ditches may help to slow down high stream flows that cause bank erosion and intercept nutrients and toxins before they enter the aquatic ecosystem (Figure 4-4).

Figure 4-3: Opportunities for Open Space Trees in NSA_K_37 (left) and NSA_K_91 (right)

Figure 4-4: Stream Buffer Improvement Opportunity Where Excessive Mowing Occurs in NSA_K_82

Hotspots

There were six facilities assessed in the Whitemarsh Run (N. Fork) subwatershed during the uplands assessment of the Bird River watershed. Three of these were confirmed as hotspots, and the other three were potentially hotspots. Table 4-17 summarizes Whitemarsh Run (N. Fork) potential pollution sources from facilities visited. Crews noted certain conditions during the field investigations that they felt merited immediate notification of Baltimore County for further investigation and/or follow-up action. Section 4.3 of the Watershed Characterization Report summarizes the field crew reports, as well as subsequent actions taken by the County.

Table 4-17: Hotspot Summary – Whitemarsh Run (N. Fork)

			POTENTIAL POLLUTION SOURCES						
Site ID	HSI Status (# filled circles)	Description	Vehicle Operations	Outdoor Materials	Waste Management	Physical Plant	Turf / Landscaping	Stormwater	Notes
HSI_K_101	Confirmed (13)	Commercial-Shopping center				✓			Multiple dumpsters with lids open in back. Grease dumpsters have grease/oil dripping down the sides but do not appear to be broken. One restaurant storing dirty fryers outside with possible intent to wash them.
HSI_K_103	Confirmed (11)	Commercial-Small machines and table rental, etc.							Lots of small machinery and some hydraulic equipment and maintenance done on site. Offers good opportunities for non-stormwater discharges. Plenty of fresh oil stains on asphalt. 55 gallon drums of petroleum inside bay doors. Opportunity for education.
HSI_K_104	Potential (9)	Commercial-Strip mall/shopping center							Clean site.
HSI_K_132	Potential (7)	Commercial-Fast food restaurant							Site looks clean and orderly.
HSI_K_143	Confirmed (8)	Commercial-Restaurant			✓				Trash and grease dumpster uncovered and leaking. A lot of staining and garbage on ground around dumpsters, including fried food remnants.
HSI_K_148	Potential (9)	Commercial-Grocery store							A lot of impervious surface in the rear that could be reduced/removed. Also a lot of bare grass in rear and alongside of building that can be turned into a rain garden, which would capture roof runoff. Great retrofit opportunity.

The first confirmed hotspot site was a large shopping center with a wide variety of businesses (HSI_K_101.) Several of the tenants in the shopping center have open dumpsters; one restaurant has a dirty grease dumpster and another restaurant has filthy deep fryers sitting behind the building. The restaurant may have intended to clean the deep fryers outside on the asphalt, as suggested by a nearby hose (Figure 4-5). Another confirmed hotspot involving a grease bin was found at a restaurant (HSI_K_143). Here was found extensive staining around the grease bin and nearby dumpsters as well (Figure 4-6). The third confirmed hotspot in this subwatershed was at a small machine (and other miscellaneous items) rental center (HSI_K_103). The large back storage lot contained various hardware, machines, and tools. Maintenance of the inventory is evidently performed here, as a number of fresh stains were found on the asphalt (Figure 4-7).

A potential hotspot was found at a shopping center with a variety of businesses (HSI_K_104). Some open dumpsters were observed, as well as a few 55 gallon barrels containing used cooking oil, but none of these were an obvious problem. A fast food restaurant (HSI_K_132) was also a potential hotspot but their dumpster and kitchen grease situation was well taken care of. The third potential hotspot was at a grocery store (HSI_K_148). The site was well

maintained, and could present a good retrofit opportunity for a rain garden, as some downspouts already discharge to a grassy area.

Figure 4-5: Dirty Grease Bin and Dirty Deep Fryers

Figure 4-6: Open Grease Dumpster with Fresh Staining

Figure 4-7: Oil-stained Ground and Evidence of Maintenance Work Performed On-site

Institutions

In the Whitemarsh Run (N. Fork) subwatershed, ISIs were performed at two public schools and six privately owned churches. A summary of restoration opportunities that were identified at the sites is presented in Table 4-18.

Table 4-18: ISI Recommendations – Whitemarsh Run (N. Fork)

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_101	Perry Hall Middle School	Public	✓	97		✓	✓			
ISI_K_102	Perry Hall High School	Public		95						
ISI_K_103	White Marsh Baptist Church	Private	✓	7	✓	✓	✓			
ISI_K_104	Zion United Church of Christ	Private	✓	3	✓	✓				
ISI_K_105	Faith Fellowship Church of Baltimore	Private	✓	5		✓				
ISI_K_106	Evangelical Cathedral Church of God	Private	✓	10	✓	✓	✓			
ISI_K_107	St. Michael's Church	Private	✓	2		✓				
ISI_K_108	Perry Hall Methodist Church	Private		1	✓	✓	✓		✓	

The public schools that were investigated provided the greatest opportunities for tree planting in this subwatershed. Available turf areas at the two schools could enable a total of 192 trees to be planted. At Perry Hall Middle School (ISI_K_101), turf areas abutting the adjacent community center as well as an open area on the southeast corner of the property were identified as potential afforestation areas. At Perry Hall High School (ISI_K_102), the southwest portion of

the property, adjacent to athletic fields, was the primary area identified (Figure 4-8). These tree planting projects would provide a wealth of aesthetic and environmental benefits beyond the improvement of stormwater infiltration.

Figure 4-8: Tree Planting Opportunity at ISI_K_101 (left)

In a maintenance area of Perry Hall High School, the field team noted washwater on the asphalt near a rear entrance as well as an uncovered outdoor fueling area (Figure 4-9). Both of these items provide opportunities to improve maintenance procedures and train employees at the school with a goal to reduce the risk of polluted runoff entering waterways.

Figure 4-9: Uncovered Outdoor Fueling Area (left) and Evidence of Washwater on Pavement at ISI_K_102 (right)

At the several churches that field teams investigated, areas were identified at each where trees could be planted and stormwater retrofits installed. At White Marsh Baptist Church (ISI_K_103), for example, an area of excess impervious cover in the form of a legacy driveway located behind the administrative building could be removed and bioretention installed. While a sizable dry pond already exists on the property, downspouts can be disconnected and rerouted to the bioretention area to provide stormwater pre-treatment as well as volume reduction not only from the rooftops, but the impervious area that will be removed. Downspout disconnection and bioretention can also be employed at Zion United Church of Christ (ISI_K_104) where ample turf areas exist (Figure 4-10). The sloping land on which Perry Hall Methodist Church sits provides opportunities to install bioretention to receive rooftop runoff (via downspout disconnection) and to treat impervious area runoff at the foot of the parking area (via removal of excess impervious area). Removing a portion of the parking lot would still leave adequate space for church events, such as picnics and the annual carnival. Treatment of stormwater would improve beyond the current, modest benefits from a grassy filter strip and swale along Horn Avenue. An appropriately-sized dumpster and secondary containment would add to the church's visible commitment to environmental stewardship.

Figure 4-10: Overflowing Dumpster with Localized Staining at ISI_K_108 (left), and a Rooftop Disconnection Opportunity at ISI_K_104 (right)

At Evangelical Cathedral Church of God (ISI_K_106), much of the southern side of the site is pavement, a portion of which could be removed and planted to improve stormwater infiltration (Figure 4-11). Field teams noted that the surrounding pavement is breaking up; therefore, removal of the pavement would have the additional benefit of reducing transport of sediment to the storm sewer system. If resurfacing of the lot is planned, only a portion of the existing lot need be included, thereby reducing the overall cost of resurfacing. Additionally, a substantial grassy area exists on the northern portion of the property which can be planted with trees and linked to the existing wooded area to the northeast of the parcel. The expansion of the woodlands would reduce maintenance obligations and increase habitat for local wildlife. These restoration projects would be a first step to increasing environmental awareness by the congregation.

Figure 4-11: Excess Pavement Removal Opportunity (left) and Tree Planting Opportunity (right) at ISI_K_106

Pervious Areas

Pervious area restoration has the potential to convert areas of turf, often with high nutrient inputs, to forest, which can instead absorb and filter nutrients. Two pervious areas were assessed for restoration potential in Whitemarsh Run (N. Fork). These sites include County Open Space - A and County Open Space- B. The County Open Space - A site is located in a residential neighborhood to the north of Four Mills Road. It is publicly-owned and maintained and is easily accessible by foot, vehicle, or heavy equipment. It is mostly covered by turf (90%) with some existing small trees along its edges. Nearly the entire site would be appropriate for tree planting. This site was recommended for reforestation with minimal site preparation to buffer the existing non-forested stream buffer south of the property. The County Open Space - B site is located immediately north of Ramblebrook Road, south of Ridge Road. It is publicly-owned and maintained and is easily accessible by foot, vehicle, or heavy equipment. It is mostly covered by turf (90%) with some existing small trees along the edges. Nearly the entire site would be appropriate for tree planting.

A summary is provided in Table 4-19.

Table 4-19: PAA Summaries – Whitemarsh Run (N. Fork)

Site ID	Location	Description	Acres	Ownership
PAA_K_101	County Open Space - A	Open Space	Parcel - 0.78 Recommended planting - 0.73	Public
PAA_K_102	County Open Space - B	Open Space	Parcel - 0.82 Recommended planting - 0.82	Public

Stream Corridor Assessments

SCAs were not performed in the Whitemarsh Run (N. Fork) subwatershed.

Illicit Discharges

Whitemarsh Run (N. Fork) contains 15 major outfalls, two of which are rated priority 0, another two are rated priority 2, and the other 11 are rated priority 3. Priority 0 outfalls are outfalls with insufficient data to determine a priority rating. This may be due to inaccessibility or if there has been only a single screening. Priority 2 outfalls have minor to moderate problems that have the

potential to become severe and are sampled once a year. Priority 3 outfalls with minor or no problems that do not require close monitoring. These outfalls are sampled on a 10-year cycle. Baltimore County will continue its Illicit Discharge Detection and Elimination program while seeking to improve techniques for more effective reductions of these discharges.

Stormwater Conversions

Baltimore County EPS identified seven stormwater management ponds in Whitemarsh Run (N. Fork) as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential. One pond was ranked as High, two as Medium, and four as Low for their conversion feasibility and their subsequent potential to improve water quality.

Subwatershed Management Strategy

Figure 4-12 provides a visual summary of restoration opportunities in the subwatershed.

Engaging Citizens & Watershed Groups

1. Conduct appropriate downspout rain barrel installation measures in neighborhoods according to Table 4-16.
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-16.
3. Raise awareness among citizens about the benefits and importance of Bayscaping for the recommended neighborhoods in Table 4-16.
4. Raise awareness among citizens about the importance of cleaning up after their pets and the role pet waste plays in polluting waterways in the neighborhoods indicated in Table 4-16.
5. Raise awareness among property owners about improving stream buffer management at locations indicated in Table 4-16.
6. Encourage communities to plant open space trees. Table 4-16 shows potential neighborhoods for planting as many as 1,082 open space trees.
7. Raise awareness among staff and members of institutional sites about the importance of proper trash management and outdoor material storage techniques at sites listed in Table 4-18.
8. Engage institutional sites listed in Table 4-18 in other recommended restoration actions including downspout disconnection, tree planting and impervious cover removal.
9. Investigate the pervious areas described in Table 4-19 for potential tree planting.

Municipal Actions

1. Follow-up regarding conditions at confirmed hotspots and continue to monitor conditions at potential hotspots indicated in Table 4-17. Also investigate retrofit opportunity at HSI_K_148 and engage with property owner if it is a suitable opportunity.
2. Work with the institution owners to pursue retrofit and impervious cover removal opportunities at public institutions noted in Table 4-18.
3. Continue to monitor illicit discharges.

4. Conduct follow-up investigations of outfalls with insufficient data for priority rating and those with minor to moderate problems that have the potential to become severe as described above and in the Watershed Characterization Report.
5. Consider retrofitting the seven stormwater management ponds described above that were ranked High for their potential conversion to improve water quality.

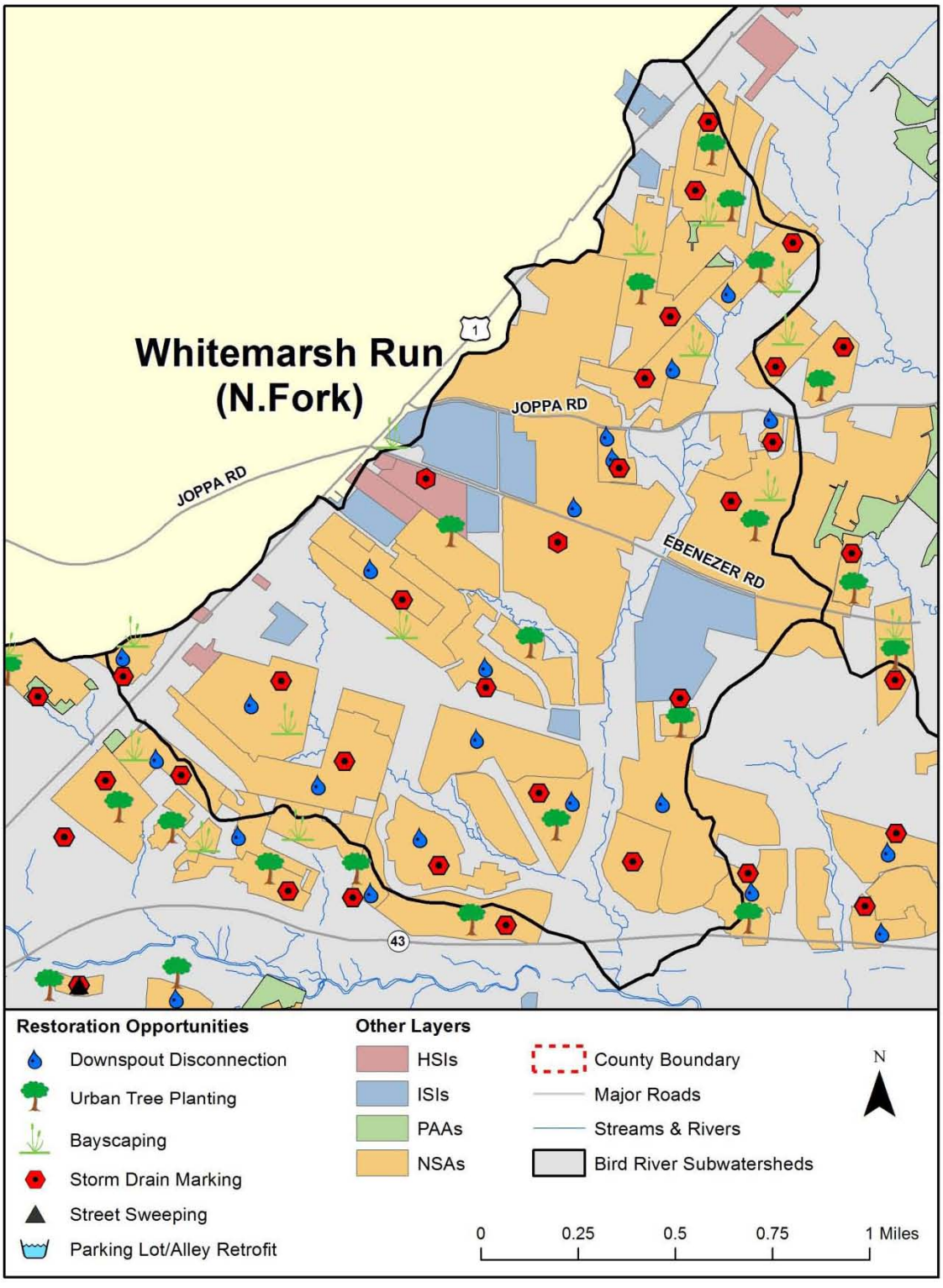

Figure 4-12: Restoration Opportunities in Whitemarsh Run (N. Fork)

4.3.2 Whitemarsh Run (Subwatershed Code 200)

Whitemarsh Run is the largest subwatershed in the Bird River watershed, and is located in the western and central portion of the watershed. Land use in the Whitemarsh Run subwatershed is primarily urban; this subwatershed has the highest percentage of commercial land use (12%) of all of the subwatersheds. It is the second most densely populated of all the subwatersheds. Table 4-20 summarizes key subwatershed characteristics of Whitemarsh Run.

Table 4-20: Key Subwatershed Characteristics – Whitemarsh Run

Drainage Area	5,454.4 acres (8.52 sq. mi.)	
Stream Length	32.4 miles	
Population	30,182 (2010 Census) 5.5 people/acre	
Land Use/Land Cover	Very Low Density Residential: Low Density Residential: Medium Density Residential: High Density Residential: Commercial: Industrial: Institutional: Extractive: Open Urban Land: Agriculture: Forest: Barren Land: Water/Wetlands: Transportation	2.7% 4.9% 21.2% 13.1% 11.9% 5.8% 2.7% 0.0% 2.0% 5.9% 22.6% 1.8% 1.6% 4.0%
Impervious Cover	25% of subwatershed	
Soils	A Soils (low runoff potential): B Soils: C Soils: D Soils (high runoff potential):	10.3% 23.1% 40.5% 26.1%
SWM Facilities	48% of urban land use treated	
Priority Rating	Very High	

Neighborhoods

A total of 43 distinct neighborhoods were identified and assessed within Whitemarsh Run during the uplands assessment of the Bird River watershed. Recommendations for addressing stormwater volume and pollutants within this subwatershed include rain barrels, rain gardens, storm drain marking, education regarding cleaning up pet waste, Bayscaping, and stream buffer improvements. A summary of neighborhood recommended actions is presented in Table 4-21.

Table 4-21: NSA Recommendations – Whitemarsh Run

		RECOMMENDED ACTIONS													
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_5	1/4	65	✓		✓	✓						✓	0	28	Potential planting area. Rain barrels may be suitable in this neighborhood.
NSA-K_6	1/4	15			✓	✓		✓					0	0	
NSA-K_9	<1/4	20			✓	✓				✓			0	0	
NSA-K_10	1/4	30	✓		✓	✓							0	0	
NSA-K_11	1/4	35	✓	✓	✓	✓							0	74	Some homes have room in front or side yards for rain garden retrofits. Common areas have planting potential.
NSA-K_13		62			✓								0	208	Large percentage of apartment complex candidate for downspout disconnection. Potential planting area.
NSA-K_14	<1/4	5			✓	✓							0	116	Consider converting drainage swale to bioswale.
NSA-K_15		35	✓		✓	✓				✓			0	40	Stream buffer present but < 100 ft due to mowing.
NSA-K_16	<1/4	50	✓		✓	✓							0	0	
NSA-K_18	<1/4	40			✓	✓		✓		✓			0	74	Stream buffer present, but < 100 ft due to mowing. Lots are too small to redirect downspouts, but could increase landscaping.
NSA-K_20b	<1/8	75			✓			✓					0	0	Not much room for plantings in this neighborhood but could add plantings on school property which is adjacent to neighborhood.

RECOMMENDED ACTIONS															
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_20	<1/8	60	✓		✓			✓				✓	0	72	Majority of downspouts discharge to pervious areas, but areas may be insufficient for infiltration; recommend rain barrels.
NSA-K_21		50			✓			✓		✓			0	140	Room for additional plantings in common area near pool and tennis court. Storm drains need cleaning.
NSA-K_22	<1/4	45	✓		✓								0	0	Storm drains need to be re-marked.
NSA-K_22c	<1/4	35	✓		✓								0	0	
NSA-K_22b	<1/4	40			✓			✓					0	0	Leaf litter in storm drains.
NSA-K_44	<1/4	70	✓		✓	✓				✓	✓		0	0	Parking lot retrofit recommended is actually a cul-de-sac that may have room for a rain garden. Stream buffer is present but <100 ft due to encroachment (mown lawn).
NSA-K_45	<1/4	55											0	0	100% of storm drains are marked, but about 25% of those are faded and need re-marking.
NSA-K_46	<1/4	75	✓		✓	✓							0	0	
NSA-K_50	<1/4	70	✓		✓	✓				✓			0	0	Stream buffer present but < 100 ft due to encroachment (mowing).
NSA-K_51	<1/4	80	✓		✓	✓		✓		✓			0	0	Stream buffer present but < 100 ft due to encroachment (yards, road crossing).
NSA-K_52	<1/4	60			✓					✓			0	140	Stream buffer is present but <100 ft due to encroachment (mowing).
NSA-K_56		65			✓			✓		✓			0	200	Little can be done to improve downspout

RECOMMENDED ACTIONS															
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
															direct connections to storm drain system because lots are small. Excessive asphalt eroding on Stewarton Court. Potential planting areas.
NSA-K_57	<1/8	67			✓								0	0	Excessive sand / gravel erosion from Tapu Court. Little opportunity to redirect downspouts.
NSA-K_58	<1/8	80			✓								0	80	Existing stream buffer is <100 ft due to encroachment (mowing). Potential planting area; some trees in area, but compacted, bare soil.
NSA-K_60	<1/4	65	✓		✓	✓				✓			0	0	Stream buffer is present but < 10 due to encroachment (mowing).
NSA-K_61	<1/8	75			✓								0	80	Stream Buffer present but < 100 ft due to encroachment (mowing). Trash near stream.
NSA-K_71	1/4	40	✓		✓	✓				✓			0	0	Severe encroachment along the shoreline of Bird River (mown lawn). Need to encourage plantings along shoreline. Lot size varies between 1/4 and 1/2 acre.
NSA-K_75	1/4	75			✓					✓		✓	7	140	Stream buffer is <100 ft due to encroachment (mowing).
NSA-K_76	<1/8	65			✓								0	30	Insufficient space to disconnect downspouts. Potential planting area.
NSA-K_78	<1/8	65	✓		✓					✓			0	150	May be able to retrofit concrete channels. Lack of buffer/

RECOMMENDED ACTIONS															
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
															plantings around the stormwater conveyance system is of concern for excess nutrient contributions.
NSA-K_79	1/4	30	✓		✓	✓							0	56	Most downspouts directly connected; looks like they were set up by homeowners. Opportunity to provide education and promote awareness. Potential planting area.
NSA-K_85	1/4	25	✓		✓	✓							0	0	A few yards may have room for rain gardens. Potential for SWM retrofit in circle off of Queensberry Road.
NSA-K_86	<1/8	90			✓					✓			0	88	Stream buffer is < 100 ft, minor encroachment (Kinfield Drive), but not much can done to restore. Potential for rain gardens or bioswale retrofit. Opportunity for plantings.
NSA-K_88	<1/4	60			✓					✓	✓		0	660	Stream buffer< 100ft due to encroachment (mowing). Some concrete areas not being used; potential area for impervious cover removal and stormwater retrofit.
NSA-K_96	1/4	10			✓	✓							0	0	Signs indicate area along stream is a forest conservation area. Increase landscaping on properties.
NSA-K_97		90			✓					✓			0	80	Pet waste in open space. Stream buffer < 100ft due to mowing.
NSA-K_98	<1/8	65			✓								0	20	Potential planting area.

RECOMMENDED ACTIONS															
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_99	<1/4	65	✓		✓			✓					0	40	75% of marked storm drains are faded. Potential for some rain barrels; many downspouts drain to <15 ft of pervious area. There are potential planting areas adjacent to existing forest.
NSA-K_105		85			✓					✓			0	0	Stream buffer <100 ft due to mowing.
NSA-K_105b		50											0	0	20% of marked storm drains are faded.
NSA-K_106		90			✓								0	0	Bare soil noted in some areas.
NSA-K_109		70											0	0	

All but three of the neighborhoods assessed within Whitemarsh Run had at least some opportunities for improvement. Storm drain marking, rain barrels and stream buffer improvements were widely recommended. Storm drain marking is popular because this relatively easy and inexpensive action can have a great effect by reminding residents not to dump potentially dangerous materials into the storm drain. It can also be easily paired with other education efforts, for example, with education regarding the effects of pet waste on water quality, in neighborhoods where both were recommended. Rain barrels serve as temporary storage of roof runoff, decreasing the volume of stormwater running off site. Tree planting opportunities were also spread throughout the subwatershed with eight neighborhoods recommended for the planting of more than 100 trees each (Figure 4-13). Projects on this scale may encourage widespread community engagement and are ideal opportunities for children and families to participate and become involved with their watershed in a concrete way. In addition, actions as simple as adjusting mowing practices and tree plantings along stream channels and drainage ditches may help to slow down high stream flows that cause bank erosion and intercept nutrients and toxins before they enter the aquatic ecosystem. Other conditions in the neighborhood, such as a riparian stream buffer littered with trash, present excellent opportunities for education and engaging the community directly with their watershed (Figure 4-14).

Figure 4-13: Opportunities for Open Space Trees in NSA_K_13 (left) and NSA_K_21 (right)

Figure 4-14: Trash Near a Stream in NSA_K_61

Hotspots

There were a total of eleven facilities assessed in the Whitemarsh Run subwatershed during the uplands assessment of the Bird River watershed. Six sites were found to be confirmed hotspots. Four were judged to be potential hotspots. The remaining site was well maintained and not a hot spot. Table 4-22 summarizes Whitemarsh Run potential pollution sources from facilities visited. Crews noted certain conditions during the field investigations that they felt merited immediate notification of Baltimore County for further investigation and/or follow-up action. Section 4.3 of the Watershed Characterization Report summarizes the field crew reports, as well as subsequent actions taken by the County.

Table 4-22: Hotspot Summary – Whitemarsh Run

			POTENTIAL POLLUTION SOURCES						
Site ID	HSI Status (# filled circles)	Description	Vehicle Operations	Outdoor Materials	Waste Management	Physical Plant	Turf / Landscaping	Stormwater	Notes
HSI_K_212	Potential (9)	Commercial-Construction office/storage yard							There is opportunity for bioretention cell retrofit along northern boundary of property.
HSI_K_233	Confirmed (10)	Commercial-Auto dealership/repair facility	✓						Three problems noted at this facility: uncovered dumpsters (4); washbay water should be tested for detergents; and cars observed being washed outside.
HSI_K_234	Confirmed (10)	Commercial-Heavy truck repair							May be able to create infiltration basin where white riprap divides two plots; however sediment would likely choke it up fairly quickly. Poor materials storage (parts and drums of liquids) is the biggest problem.
HSI_K_235	Potential (6)	Commercial-Fast food restaurant							Clean site. Move grease dumpsters away from storm drain inlets.
HSI_K_236	Confirmed (9)	Commercial-Restaurant			✓				Grease dumpster with open lid leaking directly to storm drain. Located behind trash dumpsters, along NE side of building. Otherwise site is fine, if not great.
HSI_K_238	Potential (8)	Commercial-Warehouse retailer							Education suggested regarding dumpsters.
HSI_K_239	Confirmed (12)	Commercial-Restaurant							State filtration area that helps approximately 30% of the parking lot. Retrofit opportunity behind the fence. Check white pipe draining grease from dumpster into storm drain inlet in front of the dumpster.
HSI_K_240	Confirmed (4)	Commercial-Used car sales	✓						May be opportunity here for retrofit, but no formal conveyance on property. Half of the property drains into roadway and half drains to rear dirt lot.
HSI_K_241	Potential (7)	Commercial-Home repair retail/outdoor storage							Education recommended regarding outdoor storage area runoff.
HSI_K_242	Confirmed (14)	Commercial-Warehouse/storage lot.							Because of volume of bulk liquids stored on-site, this business would be a good candidate for education efforts. Some sediment observed in parking lot which could be swept up, but no worse than dirt parking lots.
HSI_K_244	Not a hotspot (4)	Commercial-Car repair /parts retailer							Looks great. Even dumpster lid was closed.

Two separate confirmed hotspots had observed pollution sources in the form of cars being washed outside without washwater containment (Figure 4-15). One was a car dealership and repair facility (HSI_K_233) while the other was a used car sales lot (HSI_K_240). Another

confirmed hotspot was a heavy truck repair shop (HSI_K_234) with poor outdoor material storage practices including what appeared to be an oil storage tank (Figure 4-16). Two of the confirmed sites in this subwatershed were restaurants (HSI_K_236 and HSI_K_239), both of whose primary issue was with their grease storage containers. One of these was allowing spilled material to go directly towards a storm drain (Figure 4-17). The final confirmed hotspot here was a warehouse and storefront with a large amount of outdoor storage in the back lot (HSI_K_242). Among the materials were several dozen large (~200 gallon) plastic liquid storage units (Figure 4-18).

One potential hotspot in the Whitemarsh Run subwatershed was a large storage lot for a construction company (HSI_K_212) where the materials and machinery were stored on grassy areas. Two potential hotspots were two large retail stores (HSI_K_238 and HSI_K_241) with minor dumpster and outdoor storage issues. A fast food restaurant (HSI_K_235) was assessed and found to have grease dumpsters close to a storm drain inlet, but the area was not found to be filthy. An auto parts store was considered to not be a hotspot (HSI_K_244).

Figure 4-15: Uncontained Washwater

Figure 4-16: Poor Materials Storage

Figure 4-17: Waste Grease Entering Storm Drain

Figure 4-18: Large Liquid Storage Containers

Institutions

Within Whitemarsh Run subwatershed, 13 institutional sites were assessed for restoration opportunities. Several of each type of opportunity, included in the standard assessment, were identified by field teams. The sites include several privately owned churches, a private assisted living facility, a public high school, a County police barracks, and others. A summary of the sites visited and their restoration opportunities appears in Table 4-23.

Stream buffer expansion opportunities were noted at both the White Marsh Barracks of the Baltimore County Police Department (ISI_K_219; Figure 4-19) and the nearby Immanuel Baptist Church (ISI_K_218). The church is located upstream of the barracks and the buffer improvement on both properties will result in a nearly continuous reach of stream with enhanced riparian buffer. Buffers shade streams as well as better filter overland storm runoff, thereby reducing erosion and improving water quality and in-stream habitat.

Opportunities to improve stormwater control were identified at the White Marsh Barracks of the Baltimore County Police Department. A bioretention area could be placed at an existing concrete gutter leading from the visitor parking lot to a storm drain inlet. Instead of stormwater running straight to the network (and to the dry pond), the runoff could be intercepted, reduced in volume, and treated so that the dry pond is not given sole responsibility for the site's stormwater treatment (Figure 4-19). Signage will demonstrate to visitors that the police department is committed to reducing pollution as well as crime.

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Table 4-23: ISI Recommendations – Whitemarsh Run

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_209	Parkville High School	Public	✓	77		✓			✓	Stormwater pollution prevention plan recommended.
ISI_K_210	St. Ursula's Roman Catholic Church	Private	✓	2	✓				✓	
ISI_K_213	Joppa Road Baptist Church	Private		9	✓	✓	✓			Site appears abandoned or it is not well-maintained.
ISI_K_215	St. John's Evangelical Lutheran Church	Private		1	✓	✓				
ISI_K_216	Morningside House Assisted Living	Private	✓	17	✓	✓			✓	
ISI_K_217	Parkville-Carney Library	Public		2						
ISI_K_218	Immanuel Baptist Church	Private		76	✓	✓		✓		
ISI_K_219	Precinct 9 - White Marsh	Public	✓	7		✓		✓	✓	
ISI_K_221	American Cancer Society	Public	✓						✓	
ISI_K_222	Maryland Transportation Authority Lodge	Private		17						
ISI_K_223	Our Lady Queen of Peace Catholic Church & School	Private	✓	2			✓			
ISI_K_224	Victory Villa Community Church	Private		6						
ISI_K_225	Harmony Freewill Baptist Church	Private		9			✓			

Figure 4-19: Stream Buffer Restoration Opportunity at ISI_K_218 (left) and Bioretention Stormwater Retrofit Opportunity at ISI_K_219 (right)

Additional restoration opportunities at the barracks include covering an outdoor fueling station (Figure 4-20) and removing excess organic material that has collected along the curb in the parking lot.

Figure 4-20: Uncovered Fueling Station (left) and Excess Organic Material Along Curb (right) at ISI_K_219

Waste management improvement opportunities can be found in the subwatershed, for example, at Morningside House Assisted Living Facility (ISI_K_216), where discarded material was found stored adjacent to dumpsters and much staining was noted leading away from dumpsters (Figure 4-d3). Another example was found at St. Ursula's Roman Catholic Church (ISI_K_210), where uncovered trash cans were lined up on the parking lot awaiting removal by the solid waste utility (Figure 4-21). At the American Cancer Society facility, the stormwater treatment area was found to be in need of cleaning to remove accumulated trash. A dumpster was located nearby, which raises the risk of leached material easily reaching the storm sewer system. Improvements to waste management frequently consist of training staff and modifying procedures, such as covering dumpsters and trash bins in order to prevent infiltration by rain water and leaching of contents onto impervious surfaces and eventually into the storm sewer system.

Figure 4-21: Waste Management Improvement Opportunities at ISI_K_216 (left) and ISI_K_210 (right)

Other bioretention areas can be installed at the edge of asphalt parking areas (Immanuel Baptist Church), concrete sidewalks (Parkville High School), and to treat rooftop runoff via disconnected downspouts (Morningside Assisted Living, Joppa Road Baptist Church, and St. John's Evangelical Lutheran Church). Redirecting stormwater runoff to bioretention areas reduces the volume of stormwater reaching the storm drain network and streams and also reduces pollution that is mobilized and transported by runoff across impervious surfaces.

Excess impervious areas could be removed at Joppa Road Baptist Church and Our Lady Queen of Peace Catholic Church. In both instances, the removal of unused or under-used asphalt would remove a source of pollution and reduce the volume of stormwater runoff. Impervious cover removal would also reduce heating of the parcel and may reduce summertime facility cooling expenses.

Tree planting opportunities of various scales exist on nearly all parcels in Whitemarsh Run subwatershed where ISIs were conducted. Sites that are especially suited for a significant number of trees include Immanuel Baptist Church, where substantial amounts of trees can be planted in existing meadows. At Parkville High School, a total of 77 trees may be planted along the edges of athletic fields and grassy areas that are not used, primarily on the east and southeast edges of the school property (Figure 4-22).

Figure 4-22: Tree Planting Opportunities at ISI_K_218 (left) and ISI_K_209 (right)

Finally, a Stormwater Pollution Prevention Plan (SWPPP) is recommended for Parkville High School, where maintenance activities and chemical storage is concentrated in an outside, fenced in area, close to storm drain inlets (Figure 4-23). A SWPPP includes the development of procedures and implementation of training plans for the purpose of reducing the possibility of stormwater pollution caused by maintenance and material handling activities. At present, the school's "lay down" area is situated on a paved pad where equipment and fuel are stored outside in the open, within easy access of storm drains. Fueling and loading operations are best conducted under hard canopy cover and awnings, respectively, to reduce the possibility of transport of pollutants from those areas.

Figure 4-23: Storm Drain Inlets Amidst Outside Storage and Uncovered Fueling at ISI_K_209

Pervious Areas

Pervious area restoration has the potential to convert areas of turf, often with high nutrient inputs, to forest, which can absorb and filter rather than contribute nutrients. Ten pervious areas were assessed for restoration potential in Whitemarsh Run.

The JHP Open Space site is located near the intersection of Kintore Road and Upton Road. It is privately owned and maintained and is easily accessible by foot, vehicle, or heavy equipment. It

is virtually all covered by turf (99%), with a few small trees on its western edge. While there is no visible stream buffer in the vicinity of the site, benefits of tree planting here would include reduction of surface flow runoff. This site possesses one linear section of steep slopes along Kintore Road where tree planting should be avoided.

The County Open Space – D site is located off Ridgely Avenue, near its intersection with Rader Court. It is publicly-owned open space, currently used in part as a children's playground. It is virtually all covered by turf (98%). While there is no visible stream buffer in the vicinity of the site, benefits of tree planting here would include reduction of surface flow runoff. A few small landscaping trees are currently present at the site.

The Belmont Park site is located off Walther Boulevard, adjacent to Ramort Drive. It is a medium-sized publicly-owned park that possesses areas of playing fields, other open turf areas, and deciduous forest. Much of the Park is covered by maintained turf (80%). It is a busy park, and tree planting here would have to be balanced with its current uses. Tree planting here (in current turf areas) provides the opportunity to add to the existing forest at the site.

The Ridgely's Choice HOA site is located off of Ridgely's Choice Drive, on Foxford Stream Road. It is privately-owned, and has three small potential tree planting areas adjacent to existing stormwater facilities. A small amount of the site currently possesses turf (30%). Benefits of tree planting here would include slowing of surface flow runoff to the existing storm facilities.

The SHA-A site is located at the intersection of Belair Road and Necker Avenue. The site is publicly-owned, and is a good candidate for natural regeneration. Some intensive invasive species management should be done initially, followed with bi-annual treatments. Existing areas of rip-rap along the road could be left as-is. Only a small area of turf currently exists at the site (15%). Benefits of tree planting here would include slowing of surface flow runoff to the adjacent stream corridor.

The SHA-C site is located off Hilltop Road, adjacent to White Marsh Boulevard. The site is publicly-owned, and would be a good candidate for tree planting with minimal site preparation. About half of the site (40%) currently possesses maintained turf. While there is no visible stream buffer in the vicinity of the site, benefits of tree planting here would include slowing of surface flow runoff.

The SHA-D site is located off of Mercantile Road, near its intersection with Honeygo Boulevard. The site is publicly-owned, and would be a good candidate for tree planting with minimal site preparation. About half of the site (40%) currently possesses maintained turf. Parts of the site adjacent to Whitemarsh Run would be good candidates for a combination of natural regeneration and planting. Other areas of site are small, but a good candidate for planting. Benefits of tree planting here would definitely include slowing of surface flow runoff to the adjacent stream corridor.

The County Open Space – G site is located immediately north of Rose Haven Road. The site is publicly-owned, and would be a good candidate for tree planting with minimal site preparation. Only a small part of the site (20%) currently possesses maintained turf. Parts of the eastern-most planting parcels are clearly within the 100-year floodplain, and are likely in nontidal wetlands. Benefits of tree planting here would definitely include slowing of surface flow runoff to the adjacent stream corridor.

The Glen Arbor North HOA site is located off Tulip Poplar Court, near its intersection with White Marsh Road. It is privately-owned, and has one potential tree planting area partly bordered by existing forest. It is easily accessed, and could be planted with minimal site preparation. The entire site is currently covered in turf (100%). Benefits of tree planting here would include slowing of surface flow runoff to the adjacent stream corridor.

The County Open Space – H site is located off Cool Meadow Court, near its intersection with White Marsh Road. The site is publicly-owned, and would be a good candidate for tree planting with minimal site preparation. An existing stormwater facility exists in the eastern part of the site. Only a small part of the site (30%) currently possesses maintained turf. Benefits of tree planting here would include slowing of surface flow runoff to the adjacent stream corridor.

A summary of these sites is provided in Table 4-24.

Table 4-24: PAA Summaries – Whitemarsh Run

Site ID	Location	Description	Acres	Ownership
PAA_K_203	JHP Open Space	Open Space	Parcel - 1.18 Recommended planting - 1.03	Private
PAA_K_204	County Open Space - D	Playground	Parcel - 0.72 Recommended planting - 0.64	Public
PAA_K_205	Belmont Park	Park	Parcel - 6.81 Recommended planting - 2.17	Public
PAA_K_206	Ridgely's Choice HOA	Open Space	Parcel - 3.12 Recommended planting - 0.64	Private
PAA_K_207	SHA - A	Open Space	Parcel - 1.19 Recommended planting - 0.38	Public
PAA_K_208	SHA - C	Right-of-way/Open Space	Parcel - 10.52 Recommended planting - 3.61	Public
PAA_K_209	SHA - D	Right-of-way	Parcel - 8.09 Recommended planting - 2.11	Public
PAA_K_210	County Open Space - G	Open Space	Parcel - 5.27 Recommended planting - 1.22	Public
PAA_K_211	Glen Arbor North HOA	Open Space	Parcel - 0.65 Recommended planting - 0.55	Private
PAA_K_212	County Open Space - H	Open Space	Parcel - 5.86 Recommended planting - 1.43	Public

Stream Corridor Assessments

Field crews walked 5.55 miles of stream (17.1% of total stream miles) within the Whitemarsh Run subwatershed to identify water quality problems and restoration opportunities. This survey focused on first through fourth order stream reaches. A total of 279 problems were identified throughout the subwatershed. The predominant issues noted were pipe outfalls, erosion, and channel alteration. Conditions observed at 18 locations during the field survey were designated unusual conditions, one of which was noted as being Very Severe; examples of such conditions include headcuts, excessive algae, and downed powerlines. Maps showing key findings of the stream corridor assessments are found in Section 3.6 of the Watershed Characterization Report (Appendix E).

Illicit Discharges

Whitemarsh Run contains 18 major outfalls, one of which is rated priority 0, another one of which is rated priority 1, seven of which are rated priority 2, and the other nine of which are rated priority 3. Priority 0 outfalls are outfalls with insufficient data to determine a priority rating. This may be due to inaccessibility or if there has been only a single screening. Priority 1 outfalls

have major problems that require immediate correction and/or close monitoring, or outfalls with recurring problems. These outfalls are sampled four times each year. Priority 2 outfalls have minor to moderate problems that have the potential to become severe and are sampled once a year. Priority 3 outfalls with minor or no problems that do not require close monitoring. These outfalls are sampled on a 10-year cycle. Baltimore County will continue its Illicit Discharge Detection and Elimination program while seeking to improve techniques for more effective reductions of these discharges.

Stormwater Conversions

Baltimore County EPS identified eight stormwater management ponds in Whitemarsh Run as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential. Two ponds were ranked as High, three as Medium, and one as Low for their conversion feasibility and their subsequent potential to improve water quality. Two other ponds were considered to have no potential for conversion.

Subwatershed Management Strategy

Figure 4-24 and Figure 4-25 provide a visual summary of restoration opportunities in the subwatershed.

Engaging Citizens & Watershed Groups

1. Conduct appropriate downspout rain barrel installation measures in neighborhoods according to Table 4-21.
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-21.
3. Raise awareness among citizens about the benefits and importance of Bayscaping for the recommended neighborhoods in Table 4-21.
4. Raise awareness among citizens about the importance of cleaning up after their pets and the role pet waste plays in polluting waterways in the neighborhoods indicated in Table 4-21.
5. Raise awareness among property owners about improving stream buffer management at locations indicated in Table 4-21.
6. Encourage the community to engage in a stream cleanup day in NSA_K_61.
7. Encourage communities to plant open space trees. Table 4-21 shows potential neighborhoods for planting as many as 2,164 open space trees.
8. Raise awareness among staff and members of institutional sites about the importance of proper trash management and outdoor material storage techniques at sites listed in Table 4-23.
9. Engage institutional sites listed in Table 4-23 in other recommended restoration actions including downspout disconnection, tree planting, stream buffer improvement and impervious cover removal.
10. Investigate the pervious areas described in Table 4-24 for potential tree planting.

Municipal Actions

1. Investigate current street sweeping practices at locations indicated in Table 4-21and increase frequency or implement programs as necessary.
2. Follow-up regarding conditions at confirmed hotspots and continue to monitor conditions at potential hotspots indicated in Table 4-22. Also investigate retrofit opportunities at HSI_K_212 and HSI_K_239; engage with property owners if they are suitable opportunities.
3. Work with the institution owners to pursue retrofit and impervious cover removal opportunities at public institutions noted in Table 4-23.
4. Continue to monitor illicit discharges.
5. Conduct follow-up investigations of outfalls with insufficient data for priority rating and those with minor to moderate problems that have the potential to become severe as described above and in the Watershed Characterization Report.
6. Consider retrofitting the two stormwater management ponds described above that were ranked High for their potential conversion to improve water quality.
7. Consider recommendations for stream restoration in areas of moderate to severe bank erosion and channel alteration, as noted during the SCA.

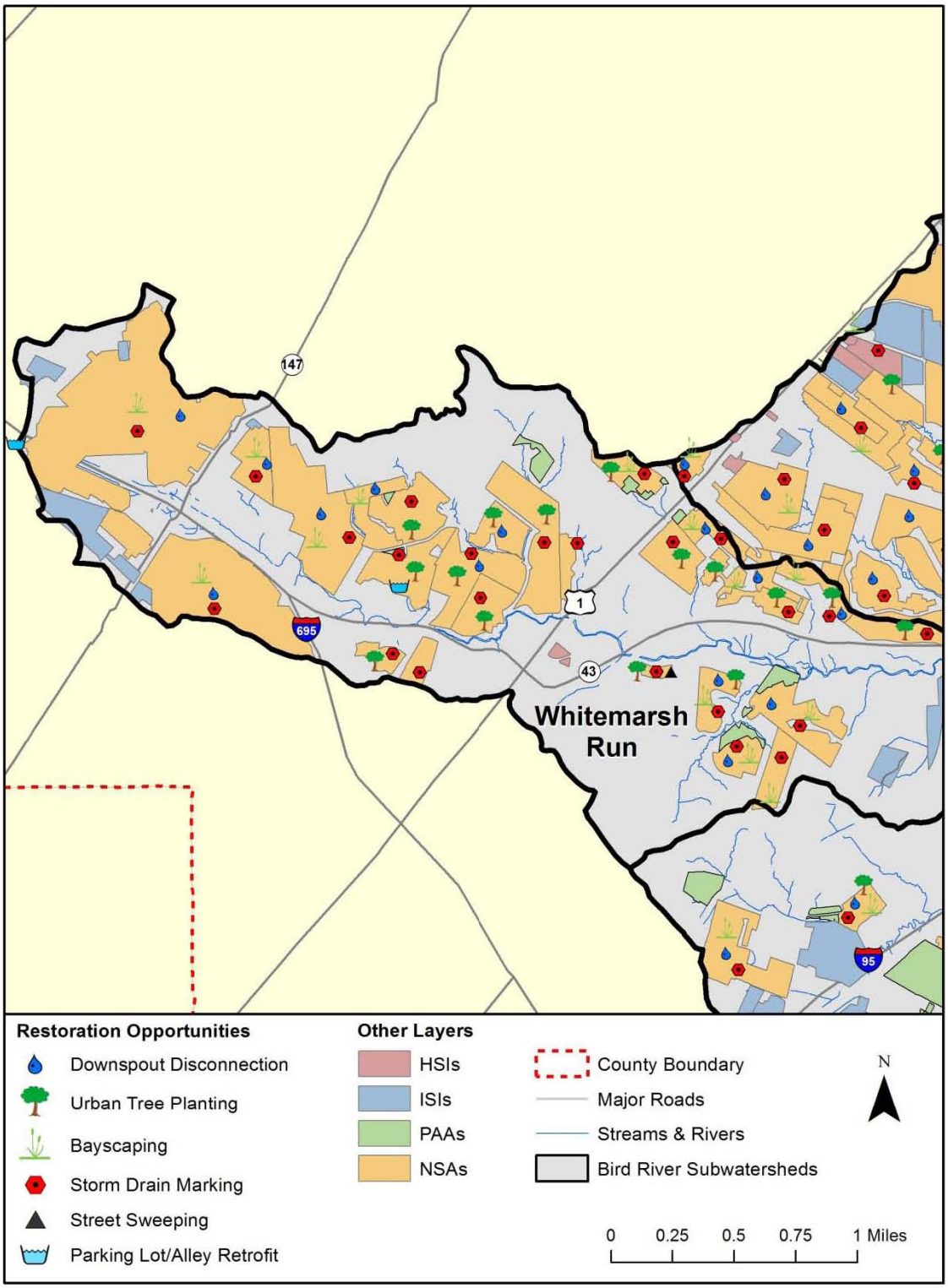

Figure 4-24: Restoration Opportunities in Whitemarsh Run (Western Section)

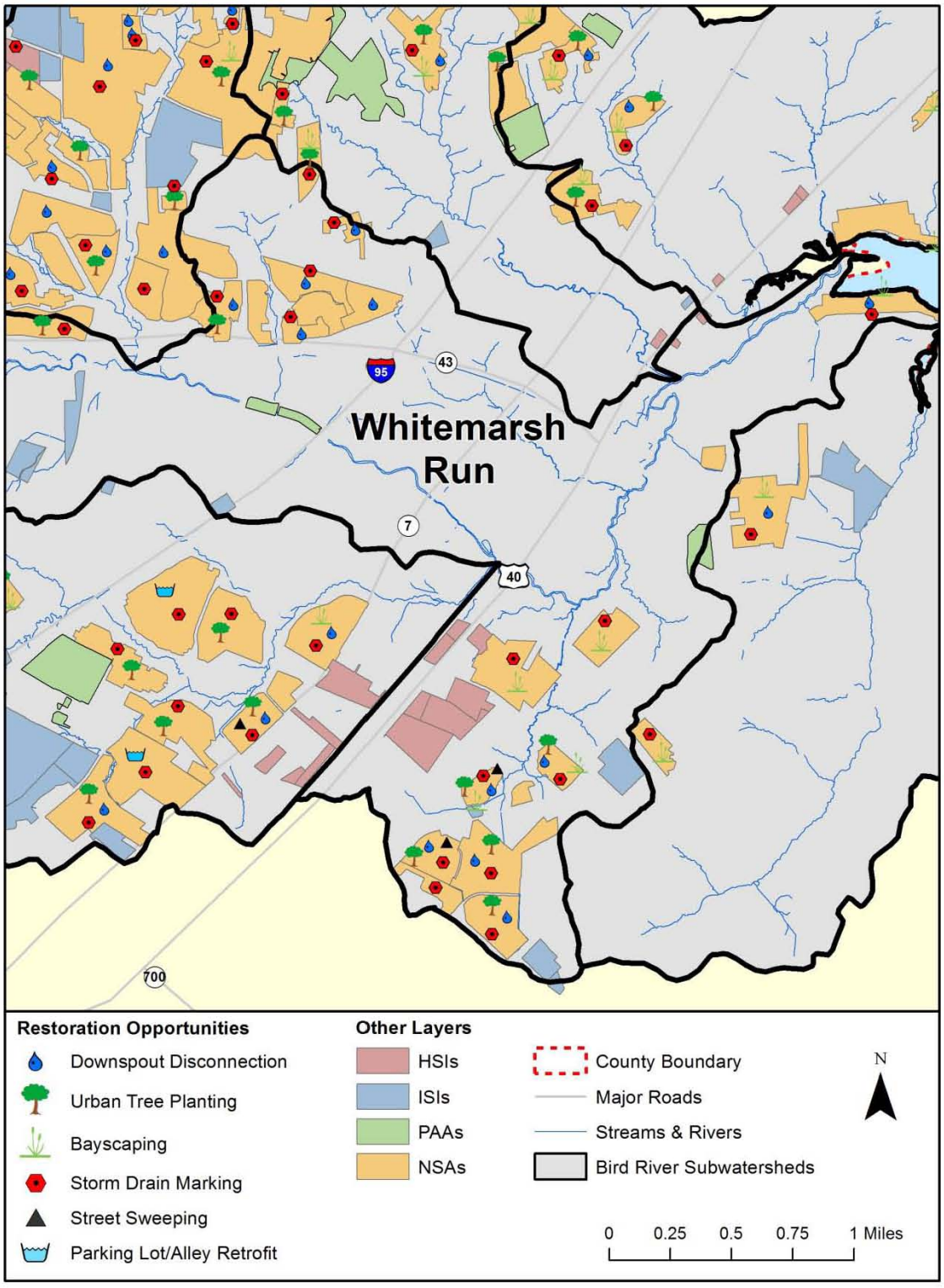

Figure 4-25: Restoration Opportunities in Whitemarsh Run (Eastern Section)

4.3.3 Whitemarsh Run (S. Fork) (Subwatershed Code 300)

Whitemarsh Run (S. Fork), where Nottingham is located, is the fourth largest subwatershed in Bird River watershed, and is in the southern central portion of the watershed. Land use within the subwatershed is primarily urban; Whitemarsh Run (S. Fork) has the highest percentage of industrial land use (18%) of any of the subwatersheds, though 25% of the subwatershed is still forested. Table 4-25 summarizes key subwatershed characteristics of Whitemarsh Run (S. Fork).

Table 4-25: Key Subwatershed Characteristics – Whitemarsh Run (S. Fork)

Drainage Area	1,884.1 acres (2.94 sq. mi.)	
Stream Length	12.2 miles	
Population	7,682.8 (2010 Census) 4.2 people/acre	
Land Use/Land Cover	Very Low Density Residential:	1.7%
	Low Density Residential:	7.4%
	Medium Density Residential:	10.0%
	High Density Residential:	17.7%
	Commercial:	6.4%
	Industrial:	16.0%
	Institutional:	6.9%
	Extractive:	0.0%
	Open Urban Land:	2.1%
	Agriculture:	2.3%
	Forest:	26.8%
	Barren Land:	0.0%
	Water/Wetlands:	0.0%
	Transportation	2.5%
Impervious Cover	26% of subwatershed	
Soils	A Soils (low runoff potential):	12.0%
	B Soils:	12.5%
	C Soils:	50.7%
	D Soils (high runoff potential):	24.8%
SWM Facilities	73% of urban land use treated	
Priority Rating	High	

Neighborhoods

A total of 11 distinct neighborhoods were identified and assessed within Whitemarsh Run (S. Fork) during the uplands assessment of the Bird River watershed. Recommendations for neighborhoods in this subwatershed included actions to reduce stormwater volume and pollutants including downspout disconnection, use of rain barrels, installation of rain gardens, Bayscaping, storm drain marking, stream buffer improvements, a parking lot retrofit, street sweeping, and tree planting. A summary of neighborhood recommended actions is presented in the Table 4-26.

Table 4-26: NSA Recommendations – Whitemarsh Run (S. Fork)

			RECOMMENDED ACTIONS												
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_1	<1/4	40	✓	✓	✓	✓				✓			0	60	Stream buffer <100 ft due to encroachment (road); however, signage indicates a forest conservation area, so no further action is required.
NSA-K_2	<1/8	90			✓								0	15	Tree planting opportunity at intersection of Red Hill & Kelmscot. Common areas in great condition; clean, trees.
NSA-K_3		90			✓						✓		0	200	Potential planting area. Parking lot off of Daybrook Circle not draining well; sediment build-up noted.
NSA-K_4	<1/8	75			✓								0	572	Several potential planting areas.
NSA-K_7	1/2	30	✓	✓	✓	✓							0	0	Potential to replace drainage swales with bioswales throughout the neighborhood.
NSA-K_73		60			✓					✓		✓	7	140	Severe stream buffer encroachment from mowing.
NSA-K_74	<1/4	20			✓					✓	✓		0	0	Excess pavement along Beowulf Circle may be good candidate for impervious cover removal; may be good location for stormwater retrofit
NSA-K_77	<1/8	95			✓					✓			0	574	Large common area with planting potential.
NSA-K_81		75			✓					✓			0	260	Stream buffer <100 ft due to encroachment (road).
NSA-K_108	1/4	60	✓	✓	✓	✓				✓			0	0	Stream buffer < 100 ft due mowing.
NSA-K_110		20	✓							✓			0	340	No buffer due to mowing.

All of the neighborhoods assessed within Whitemarsh Run (S. Fork) had at least some opportunities for improvement. Storm drain marking was recommended in all but one neighborhood assessed; it not only engages residents, but the markers also serve as a visual reminder not to dump potentially dangerous materials into the storm drain and the connection between their actions and streams. It can also be easily paired with other education efforts, for example, with education regarding residential lot runoff and the possibility of disconnecting downspouts so that rooftop runoff has time to infiltrate the ground rather than entering the storm drain via impervious surfaces. Rain barrels serve as temporary storage of roof runoff, decreasing the volume of stormwater running off site. Tree planting opportunities were also spread throughout the subwatershed with six neighborhoods recommended for the planting of more than 100 trees each (Figure 4-26). Projects on this scale may encourage widespread

community engagement and are ideal opportunities for children and families to participate and become involved with their watershed in a concrete way.

Two parking lot retrofits were also suggested in Whitemarsh Run (S. Fork). One retrofit, at NSA_K_3 (Figure 4-27), was recommended where standing water was spread across several parking spaces indicating an area that would benefit from improved infiltration, and would provide an opportunity for water quality treatment, as well. Another practice suggested was to upgrade an existing grass swale (a depression that collects and channels runoff and storm flows; Figure 4-28) to a bioswale (a depression that is lined with materials that allow for additional infiltration and plants that can help intercept nutrients and other pollutants). In addition, actions as simple as adjusting mowing practices and tree plantings along stream channels and drainage ditches may help to slow down high stream flows that cause bank erosion and intercept additional nutrients and pollutants before they enter the aquatic ecosystem.

Figure 4-26: Opportunities for Open Space Trees in NSA_K_111

Figure 4-27: Potential Parking Lot Retrofit in NSA_K_3

Figure 4-28: Potential Conversion From Grass Swale to Bioswale at NSA_K_7

Hotspots

There were six facilities assessed in the Whitemarsh Run (S. Fork) subwatershed during the uplands assessment of the Bird River watershed. Two of the six were classified as confirmed hotspots and the remaining four were classified as potential pollution sources. Table 4-27 summarizes Whitemarsh Run (S. Fork) potential pollution sources from facilities visited. Crews noted certain conditions during the field investigations that they felt merited immediate

notification of Baltimore County for further investigation and/or follow-up action. Section 4.3 of the Watershed Characterization Report summarizes the field crew reports, as well as subsequent actions taken by the County.

Table 4-27: Hotspot Summary – Whitemarsh Run (S. Fork)

			POTENTIAL POLLUTION SOURCES						
Site ID	HSI Status (# filled circles)	Description	Vehicle Operations	Outdoor Materials	Waste Management	Physical Plant	Turf / Landscaping	Stormwater	Notes
HSI_K_313	Confirmed (10)	Commercial-Freight shipping/trucking facility	✓	✓					Recommend on-site inspection of Spill Prevention, Control, and Countermeasure (SPCC) practices. Site is potential source of sediment and petroleum products from stockpile storage and outdoor uncovered fueling operation with signs of staining. Site is partially dirt covered or "unimproved surface".
HSI_K_314	Potential (8)	Commercial-Construction storage							Education regarding open dumpster.
HSI_K_316	Potential (7)	Commercial-Motorcycle repair							No follow-up actions recommended.
HSI_K_317	Potential (9)	Commercial-Home repair company/storage lot							Suggest inspection for SPCC plan - is it up-to-date for fueling operations? Hoses are dragging on ground and staining on dirt parking lot.
HSI_K_318	Confirmed (14)	Commercial-Heavy equipment rental							Site could potentially divert runoff to pond on adjacent property. Education recommended regarding outdoor storage of materials. Outdoor AST has no protection from collisions and has stains on tank. Multiple un-labeled 55-gallon drums at site.
HSI_K_331	Potential (10)	Commercial-Business park							Dumpsters not covered and some leaking, otherwise facility looks relatively well maintained.

The first confirmed hotspot was at a construction/trucking contracting business (HSI_K_313). Most of the parcel is a storage lot for large, uncovered piles of gravel and sand. At the edge of the lot, two large fueling tanks were found immediately adjacent to a marshy area. The tanks lacked secondary containment, and evidence of spillage was on the ground (Figure 4-29). The other confirmed hotspot was a machine sales and rental company (HSI_K_318). Many pieces of heavy machinery were stored outside here, as well as spare parts and other maintenance items including many unmarked barrels and drums. A washout bay looks to be well contained (Figure 4-30).

The potential hotspots included a construction contractor with some outdoor material storage and a number of vehicles stored on a mostly gravel lot (HSI_K_314). Another potential hotspot was a parcel with two buildings and some materials stored outside (HSI_K_316). The company

located here may have gone out of business as the signboard was blank, and one of the buildings was obviously a current residence. A roofing company with a storage lot was in generally good shape (HSI_K_317). The biggest issue here is a fueling tank lacking secondary containment with some stains (Figure 4-31). The last potential hotspot is a single building housing several automotive related businesses (HSI_K_331). Here were several open dumpsters on the verge of overflowing located very close to a storm drain inlet (Figure 4-32), and several heavily damaged cars.

Figure 4-29: Active Fueling Tanks Next to Marsh

Figure 4-30: Washout Bay

Figure 4-31: Fuel Tanks Lacking Secondary Containment

Figure 4-32: Open Dumpsters Near Storm Drain Inlet

Institutions

In the Whitemarsh Run (S. Fork) subwatershed, public institutions that field staff investigated included the Essex Campus of the Community College of Baltimore County (CCBC) and the White Marsh Branch of the Baltimore County Library. Private institutions included four churches or other faith-based organizations, Franklin Square Nursing Home, and Franklin Square Hospital. A summary of opportunities for restoration are presented in Table 4-28.

Table 4-28: ISI Recommendations – Whitemarsh Run (S. Fork)

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_326	Boumi Temple	Private	✓			✓				Eastern portion of lot already planted.
ISI_K_327	Franklin Square Nursing Home	Private	✓	5						
ISI_K_328	Franklin Square Hospital	Private	✓						✓	
ISI_K_329	Essex Campus, CCBC	Public	✓	127		✓		✓		Stormwater pollution prevention plan recommended, if not already in place.
ISI_K_330	Chesapeake Conference of Seventh Day Adventists	Private	✓	9					✓	
ISI_K_331	Central Christian Assembly	Private	✓	14					✓	
ISI_K_332	Rosedale Baptist Church	Private	✓							
ISI_K_333	White Marsh Branch, Baltimore County Public Library	Public	✓							

Staff investigating the Essex Campus of CCBC (ISI_K_329) noted much green space, primarily on the southwest corner, providing excellent opportunities for tree planting. The acreage of trees would provide additional beneficial habitat, improve stormwater infiltration, improve campus aesthetics, cool the campus via shading, reduce the need for mowing, and improve the buffer near a headwaters stream (Figure 4-33). Additionally, improvements in the maintenance procedures at the campus, through implementation of a stormwater pollution prevention plan, would reduce the probability of pollution entering the storm sewer system and adjacent stream at the peripheral maintenance facility located to the northwest. Expansion of the existing stormwater treatment pond and wetland, currently serving a portion of the major southwestern parking lot, would improve treatment of runoff from this impervious area and further reduce the impact of stormwater to a headwaters stream. These restoration measures, which are conveniently located within walking distance of campus buildings, would also provide examples to enhance environmental educational experience and awareness. . The area would also present an opportunity to create a walking path with signage to present the benefits of the stormwater retrofit, buffer enhancement, and tree canopy improvement.

Figure 4-33: Tree Planting Opportunity and Stream Buffer Improvement Area at ISI_K_329 (left), Uncovered Outside Fueling Area at ISI_K_329 (right)

Waste management improvement measures, such as those identified at Franklin Square Hospital (uncovered rollaway dumpster) and at the Chesapeake Conference of Seventh Day Adventists (dumpster placed adjacent to storm drain inlet; Figure 4-34), along with appropriate training of facility staff, would reduce the exposure of materials to the effects of rain. Covering waste containers and relocating them away from storm drain inlets are readily available methods for preventing leached material from entering storm drain inlets and impacting local streams.

Figure 4-34: Waste Management Improvement Opportunity at ISI_K_330 (left), Open Roll-away Dumpster at ISI_K_328 (right)

Much additional local tree cover could be created through tree planting programs at the adjacent properties of the Seventh Day Adventist Church (ISI_K_330) and the Central Christian Assembly (ISI_K_331). Expansive grassy areas would be replaced with tree canopy to improve stormwater infiltration in the surrounding soils and reduce nutrient transport to the storm sewer system. The additional trees would create a contiguous “greenway” linking existing wooded areas on the church properties. The reduction in the size of the turf areas would have the possible additional benefit of reducing the size of the church grounds maintenance budget (Figure 4-35).

Storm drain stenciling opportunities exist at all properties investigated in this subwatershed. Stenciling opportunities should be taken advantage of to increase awareness of the connection between human activities and healthy streams and as a jumping-off point to put environmental stewardship into action.

Figure 4-35: Stormwater Retrofit Opportunity at ISI_K_326 (left) and Tree planting Opportunity at ISI_K_331 (right)

Pervious Areas

Pervious area restoration has the potential to convert areas of turf, often with high nutrient inputs, to forest, which can absorb and filter rather than contribute nutrients. Four pervious areas were assessed for restoration potential in Whitemarsh Run (S. Fork); these include the Nottingham Park; Winters Manor Community Association & County; County Open Space – F; and the Baltimore City Sewer Pumping Station.

The Nottingham Park site is located off King Avenue, adjacent to Stapleford Road. It is a medium-sized publicly-owned park that possesses areas of playing fields on its southern side, other turf areas, and deciduous forest on its northern side. Much of the Park is covered by maintained turf (80%). It is a busy park, and tree planting here would have to be balanced with its current park uses. Tree planting here (in current turf areas) provides the opportunity to add to the existing forest and the existing stormwater facility at the site.

The Winters Manor Community Association and County site is located off Chesterfield Way, near its intersection with King Avenue. The northern part is privately-owned, and the southern part is County-owned. The site possesses one potential tree planting area in the northern part of the site; it is a green space surrounded by residences. An existing stormwater feature is located in the southern part of the site. The planting area could be easily accessed, and could be planted with minimal site preparation. The site is almost entirely covered by turf (80%). Benefits of tree planting here would include slowing of surface flow runoff to the adjacent stream corridor in the southern part of the site.

The County Open Space – F site is located off of Springhouse Circle, near its intersection with Babikow Road. The site is publicly-owned, and would be a good candidate for tree planting with minimal site preparation. Nearly half of the site (40%) currently possesses maintained turf. Parts of the two larger planting parcels close to the stream are clearly within the 100-year floodplain,

and are likely in nontidal wetlands. Benefits of tree planting here would definitely include slowing of surface flow runoff to the adjacent stream corridor, as well as enhancing protections for the stream buffer and wetlands. While there would certainly be benefits to planting at this site, there would not be any additional benefits in terms of pollution reductions, as the model used to calculate those benefits considers wetlands to have the same pollutant loads as forest.

The Baltimore City Sewer Pumping Station site is located off Perry Hall Boulevard. The site is publicly-owned, and would be a good candidate for tree planting with minimal site preparation. Only a small part of the site (20%) is covered by maintained turf. Benefits of tree planting here would include slowing of surface flow runoff to the adjacent stream corridor. A review of available data suggests that planting in recommended areas would not interfere with underground utilities; however, a consultation will be necessary with staff responsible for the site to confirm that this is the case prior to moving forward with planting.

A summary of these sites is provided in Table 4-29.

Table 4-29: PAA Summaries – Whitemarsh Run (S. Fork)

Site ID	Location	Description	Acres	Ownership
PAA_K_313	Nottingham Park	Park	Parcel - 36.13 Recommended planting - 2.83	Public
PAA_K_314	Winters Manor Community Association & County	Open Space	Parcel - 2.52 Recommended planting - 0.78	Public & Private
PAA_K_315	County Open Space - F	Right-of-way	Parcel - 3.39 Recommended planting - 0.79	Public
PAA_K_316	Baltimore City Sewer Pumping Station	Public Utility	Parcel - 9.91 Recommended planting - 1.47	Public

Stream Corridor Assessments

SCAs were not performed in the Whitemarsh Run (S. Fork) subwatershed.

Illicit Discharges

Whitemarsh Run (S. Fork) contains six major outfalls, one of which is rated priority 1 and the other five of which are rated priority 3. Priority 1 outfalls have major problems that require immediate correction and/or close monitoring, or outfalls with recurring problems. These outfalls are sampled four times each year. Priority 3 outfalls have minor or no problems and do not require close monitoring. These outfalls are sampled on a 10-year cycle. Baltimore County will continue its Illicit Discharge Detection and Elimination program while seeking to improve techniques for more effective reductions of these discharges.

Stormwater Conversions

Baltimore County EPS identified four stormwater management ponds in Whitemarsh Run (S. Fork) as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential. One pond was ranked as High and another as Medium for their conversion feasibility and their subsequent potential to improve water quality. Two other ponds evaluated were determined to not have any conversion potential.

Subwatershed Management Strategy

Figure 4-36 provides a visual summary of restoration opportunities in the watershed.

Engaging Citizens & Watershed Groups

1. Conduct appropriate downspout rain barrel installation measures in neighborhoods according to Table 4-26.
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-26.
3. Raise awareness among citizens about the benefits and importance of Bayscaping for the recommended neighborhoods in Table 4-26.
4. Raise awareness among property owners about improving stream buffer management at locations indicated in Table 4-26.
5. Encourage communities to plant open space trees. Table 4-26 shows potential neighborhoods for planting as many as 2,161 open space trees.
6. Raise awareness among staff and members of institutional sites about the importance of proper trash management and outdoor material storage techniques at sites listed in Table 4-28.
7. Engage institutional sites listed in Table 4-28 in other recommended restoration actions including storm drain marking, tree planting, retrofit opportunities and stream buffer improvement.
8. Investigate the pervious areas described in Table 4-29 for potential tree planting.

Municipal Actions

1. Investigate retrofit opportunities for parking lots noted in Table 4-26 and, if possible, engage community and pursue opportunities.
2. Investigate current street sweeping practices at NSA_K_73 and increase frequency or implement programs as necessary.
3. Investigate retrofit opportunities and evaluate need for development of a Storm Water Pollution Prevention Plan (SWPPP) at ISI_K_329, if one does not already exist.
4. Follow-up regarding conditions at confirmed hotspots and continue to monitor conditions at potential hotspots indicated in Table 4-27. Pursue outreach and raise awareness regarding site housekeeping practices, and improved outdoor materials storage and vehicle operations.
5. Continue to monitor illicit discharges.
6. Conduct follow-up investigations at those outfalls with minor to moderate problems that have the potential to become severe as described above and in the Watershed Characterization Report.
7. Consider retrofitting the two stormwater management ponds described above that were ranked High and Medium for their potential conversion to improve water quality.

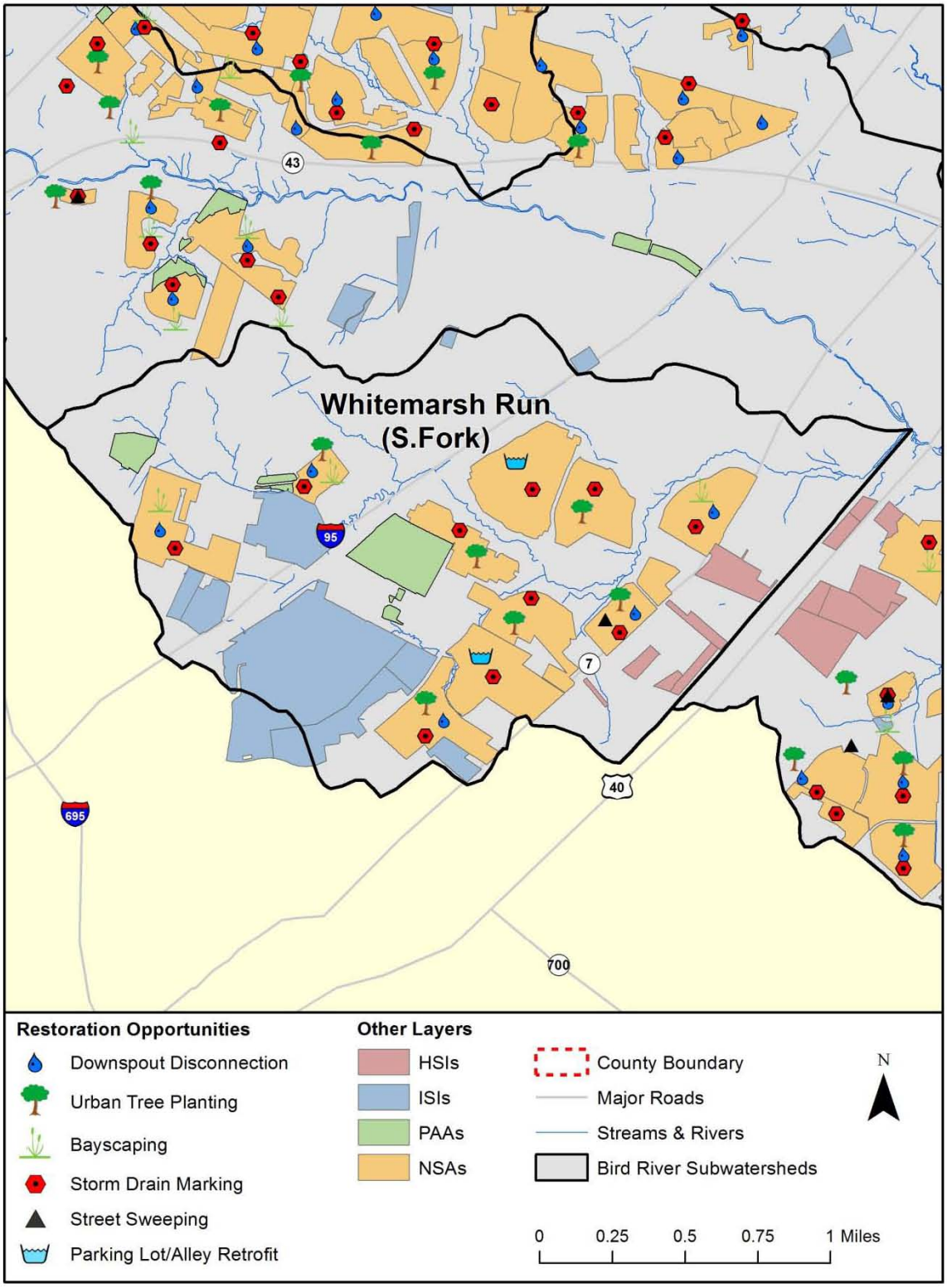

Figure 4-36: Restoration Opportunities in Whitemarsh Run (S. Fork)

4.3.4 Honeygo Run (Subwatershed Code 400)

Honeygo Run, where White Marsh is located, is the fourth smallest subwatershed in the Bird River watershed. It is in the northern central portion of the watershed, sandwiched between Whitemarsh Run (N. Fork) and Bird River-D. The subwatershed is primarily urban, though cropland and forest (16% and 19%, respectively) still account for a sizeable portion of the land use within the subwatershed. Table 4-30 summarizes key subwatershed characteristics of Honeygo Run.

Table 4-30: Key Subwatershed Characteristics – Honeygo Run

Drainage Area	1,644.9 acres (2.57 sq. mi.)	
Stream Length	11.7 miles	
Population	4,533.3 (2010 Census) 2.8 people/acre	
Land Use/Land Cover	Very Low Density Residential:	8.3%
	Low Density Residential:	10.9%
	Medium Density Residential:	14.3%
	High Density Residential:	6.3%
	Commercial:	6.4%
	Industrial:	2.6%
	Institutional:	0.8%
	Extractive:	3.2%
	Open Urban Land:	4.3%
	Agriculture:	15.7%
	Forest:	26.0%
	Barren Land:	0.0%
	Water/Wetlands:	0.1%
	Transportation	1.2%
Impervious Cover	16% of subwatershed	
Soils	A Soils (low runoff potential):	13.6%
	B Soils:	34.8%
	C Soils:	48.3%
	D Soils (high runoff potential):	3.3%
SWM Facilities	43% of urban land use treated	
Priority Rating	Very High	

Neighborhoods

A total of six distinct neighborhoods were identified and assessed within Honeygo Run during the uplands assessment of the Bird River watershed. Recommendations for neighborhoods in this subwatershed included: downspout disconnection, rain barrels, rain gardens, storm drain marking, Bayscaping, stream buffer improvement and tree planting. A summary of neighborhood recommended actions is presented in the Table 4-31.

Table 4-31: NSA Recommendations – Honeygo Run

			RECOMMENDED ACTIONS												
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA_K_23	< 1/4	60			✓	✓							0	80	Lots are too small to redirect downspouts. Potential planting areas.
NSA-K_32	< 1/4	75			✓					✓			8	0	Slight buffer encroachment near outfall (mown lawn). Many downspouts discharge to pervious area but < 15ft. Potential planting areas. Storm drain covered in leaves
NSA-K_35	< 1/4	62		✓	✓					✓			0	160	Lots too small for stormwater retrofit. Stream buffer present but < 100 ft due to extensive mowing.
NSA-K_67		95			✓								0	0	Lots too small to redirect downspouts.
NSA-K_103	1/2	60	✓		✓	✓							0	720	Room to redirect downspouts.
NSA-K_104		60			✓								0	0	Lots too small for downspout redirection.

All of the neighborhoods assessed within Honeygo Run had opportunities for improvement. In a few neighborhoods, while downspout disconnection would be desirable, small lot sizes constrained potential retrofits. Storm drain marking was recommended in every neighborhood (Figure 4-37). Storm drain marking is popular because this relatively easy and inexpensive action can have a great effect by reminding residents not to dump potentially dangerous materials into the storm drain. It can also be easily paired with other education efforts, for example, with education regarding the effects of pet waste on water quality, in neighborhoods where both were recommended. Rain barrels serve as temporary storage of roof runoff, decreasing the volume of stormwater running off site. Two neighborhoods were also noted as providing an opportunity to plant more than 100 trees each (Figure 4-38). Projects on this scale may encourage widespread community engagement and are ideal opportunities for children and families to participate and become involved with their watershed in a concrete way. In addition, actions as simple as adjusting mowing practices and tree plantings along stream channels and drainage ditches may help to slow down high stream flows that cause bank erosion and intercept nutrients and toxins before they enter the aquatic ecosystem.

Figure 4-37: Unmarked Storm Drain Inlet That Is Also in Need of Cleaning in NSA_K_32

Figure 4-38: Tree Planting Opportunity at NSA_K_35

Hotspots

There were three facilities assessed in the Honeygo Run subwatershed during the uplands assessment of the Bird River watershed. All of the visited sites were rated as potential hotspots. Table 4-32 summarizes Honeygo Run potential pollution sources from facilities visited. Crews noted certain conditions during the field investigations that they felt merited immediate notification of Baltimore County for further investigation and/or follow-up action. Section 4.3 of

the Watershed Characterization Report summarizes the field crew reports, as well as subsequent actions taken by the County.

Table 4-32: Hotspot Summary – Honeygo Run

			POTENTIAL POLLUTION SOURCES						
Site ID	HSI Status (# filled circles)	Description	Vehicle Operations	Outdoor Materials	Waste Management	Physical Plant	Turf / Landscaping	Stormwater	Notes
HSI_K_420	Potential (9)	Commercial-Grocery store							New dumpster with functioning lid needed behind building. Some garbage on ground behind facility, but not excessive.
HSI_K_421	Potential (10)	Commercial-Car repair							55-gallon drum in rear open and half-filled with oil
HSI_K_446	Potential (8)	Commercial-Gas station/car wash/convenience store							Good opportunity for bioretention retrofits for this high traffic facility.

The first was a grocery store (HSI_K_420) where a discharge was found in a downspout and connected directly to storm drain, though the weather had been dry recently. Also found was trash in the back area, some of which was on top of trench drains (Figure 4-39), and a dumpster lacking a cover. The second site was a car repair company (HSI_K_421) which had an open 55- gallon drum, half filled with what appeared to be waste motor oil (Figure 4-40). A container for used oil filters on site appeared in good shape and was shielded from rain. The final site was a convenience store with a gas station and car wash was in good condition (HSI_K_446).

Figure 4-39: Waste Material on Top of Trench Drains

Figure 4-40: Open Waste Oil Drum Exposed to Precipitation

Institutions

Five institutions were assessed in Honeygo Run, consisting of three privately owned churches, the privately owned Overlea Post of the American Legion, and the Perry Hall Branch of the Baltimore County Public Library. Recommended actions at the above sites are summarized in Table 4-33.

Table 4-33: ISI Recommendations – Honeygo Run

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_434	American Legion – Overlea Post	Private								Open space used for recreation.
ISI_K_435	Camp Chapel United Methodist Church	Private	✓	5						
ISI_K_436	Perry Hall Family Worship Center	Private	✓							Around playground and parking lot already planted.
ISI_K_437	Cowenton United Methodist Church	Private								
ISI_K_438	Perry Hall Branch, Baltimore County Public Library	Public	✓							Open area already planted.

Most restoration actions proposed in Honeygo Run consist of storm drain stenciling. Storm drain marking is an outreach activity that will increase awareness of the connection between human activity and waterways that are often out of view. Congregations will become more aware of the close link between parking areas on their properties and streams. As a bonus, a total of five trees can be planted at Camp Chapel United Methodist Church, which will reduce the contribution of excess stormwater runoff from the church property to the storm drain system. Much of Perry Hall Family Worship Center and the Perry Hall Branch of the Baltimore County Public Library have been planted and these two restored areas can serve as examples for the Camp Chapel congregation.

Figure 4-41: Storm Drain Stenciling (ISI_K_436, left) and Tree Planting Opportunities (ISI_K_435, right)

Pervious Areas

Pervious area restoration has the potential to convert areas of turf, often with high nutrient inputs to forest, which can absorb and filter rather than contribute nutrients. Five pervious areas were assessed for restoration potential in Honeygo Run; these include the Honeygo Park; North Gate Hall Community Association – A; North Gate Hall Community Association – B; Perry Hall Crossing II HOA & County; and Perry Hall Crossing I HOA.

The Honeygo Park site is located off of Honeygo Boulevard. It is a medium-sized publicly-owned park that is divided into an east and a west parcel, divided by Honeygo Boulevard. The Park possesses areas of playing fields in both the east and west parcels; tennis courts, parking, and other facilities are located on the much larger east parcel. Most of the Park is covered by maintained turf (90%). It is an active, busy park, and tree planting here would have to be balanced with its current park uses. Tree planting here (in current turf areas) provides the opportunity to add to the existing forest and buffer the stream corridors on the east parcel; planting on the west parcel would help to slow surface runoff.

The North Gate Hall Community Association - A site is located off Bowline Road, near its intersection with Vicky Road. The site is privately-owned. It possesses one relatively large contiguous potential tree planting area that is currently a green space surrounded by residences. An existing stormwater feature is located in the eastern part of the site; this facility drains to an unnamed tributary to Honeygo Run. The planting area is easily accessed, and

could be planted with minimal site preparation. Nearly the entire site is covered in turf (80%). Benefits of tree planting here would include slowing of surface flow runoff to the adjacent stream corridor in the southeastern part of the site.

The North Gate Hall Community Association - B site is located off of Kahl Avenue, near its intersection with Joppa Road. The site is privately-owned, and would be a good candidate for tree planting with minimal site preparation. Virtually the entire site (99%) is covered by maintained turf. Benefits of tree planting here would definitely include slowing of surface flow runoff.

The Perry Hall Crossing II HOA & County site is located off Cross Brook Drive and Florio Drive. The site is privately and publicly-owned. None of the site (0%) currently possesses maintained turf. It is not currently a candidate for tree planting, as the majority of green space here already consists of forest conservation area plantings. Some small areas of the site, however, would benefit from natural regeneration and invasive species management.

The Perry Hall Crossing I HOA site is located off Cross Brook Drive. The site is privately-owned. None of the site (0%) is covered in turf. It is not currently a candidate for tree planting, as the majority of green space here already consists of forest conservation area plantings. Some small areas of the site, however, would benefit from invasive species management.

A summary of these sites is provided in Table 4-34.

Table 4-34: PAA Summaries – Honeygo Run

Site ID	Location	Description	Acres	Ownership
PAA_K_417	Honeygo Park	Park	Parcel - 35.59 Recommended planting - 7.26	Public
PAA_K_418	North Gate Hall Community Association - A	Open Space	Parcel - 8.86 Recommended planting - 6.39	Private
PAA_K_419	North Gate Hall Community Association - B	Open Space	Parcel - 3.08 Recommended planting - 3.01	Private
PAA_K_420	Perry Hall Crossing II HOA & County	Open Space	Parcel – 18.15 Recommended planting – 0.00	Private & Public
PAA_K_421	Perry Hall Crossing I	Open Space	Parcel – 11.0 Recommended planting – 0.00	Private

Stream Corridor Assessments

Field crews walked 6.45 miles of stream (55.0% of total stream miles) within the Honeygo Run subwatershed to identify water quality problems and restoration opportunities. This survey focused on first through fourth order stream reaches. A total of 213 problems were identified throughout the subwatershed. The predominant issues noted were trash dumping, pipe outfalls, and erosion. Conditions observed at 27 locations during the field survey were designated unusual conditions, five of which were noted as being Severe; examples of such conditions

include headcuts, excessive algae, and downed powerlines. Maps showing key findings of the stream corridor assessments are found in Section 3.6 of the Watershed Characterization Report (Appendix E).

Illicit Discharges

Honeygo Run contains three major outfalls, all of which are rated priority 3. Priority 3 outfalls with minor or no problems that do not require close monitoring. These outfalls are sampled on a 10-year cycle. Baltimore County will continue its Illicit Discharge Detection and Elimination program while seeking to improve techniques for more effective reductions of these discharges.

Stormwater Conversions

Baltimore County EPS did not select any stormwater management ponds in Honeygo Run as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential.

Subwatershed Management Strategy

Figure 4-42 provides a visual summary of restoration opportunities in the watershed.

Engaging Citizens & Watershed Groups

1. Conduct appropriate downspout rain barrel and rain garden installation measures in neighborhoods according to Table 4-31.
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-31.
3. Raise awareness among citizens about the benefits and importance of Bayscaping in NSA_K_103.
4. Raise awareness among property owners about improving stream buffer management at locations indicated in Table 4-31.
5. Encourage communities to plant open space trees. Table 4-31 shows potential neighborhoods for planting as many as 960 open space trees.
6. Engage institutional sites listed in Table 4-33 in storm drain marking.
7. Investigate the pervious areas described in Table 4-34 for potential tree planting.

Municipal Actions

1. Distribute pollution prevention material to commercial property owners about importance of proper trash management and outdoor material storage techniques at hotspots identified in Table 4-32. Engage with owner at HSI_K_446 to investigate retrofit opportunity.
2. Continue to monitor conditions at potential hotspots indicated in Table 4-32.
3. Continue to monitor illicit discharges.
4. Conduct follow-up investigations at outfalls with minor to moderate problems that have the potential to become severe as described above and in the Watershed Characterization Report.

5. Consider recommendations for stream restoration in areas of moderate to severe bank erosion and channel alteration, as noted during the SCA.

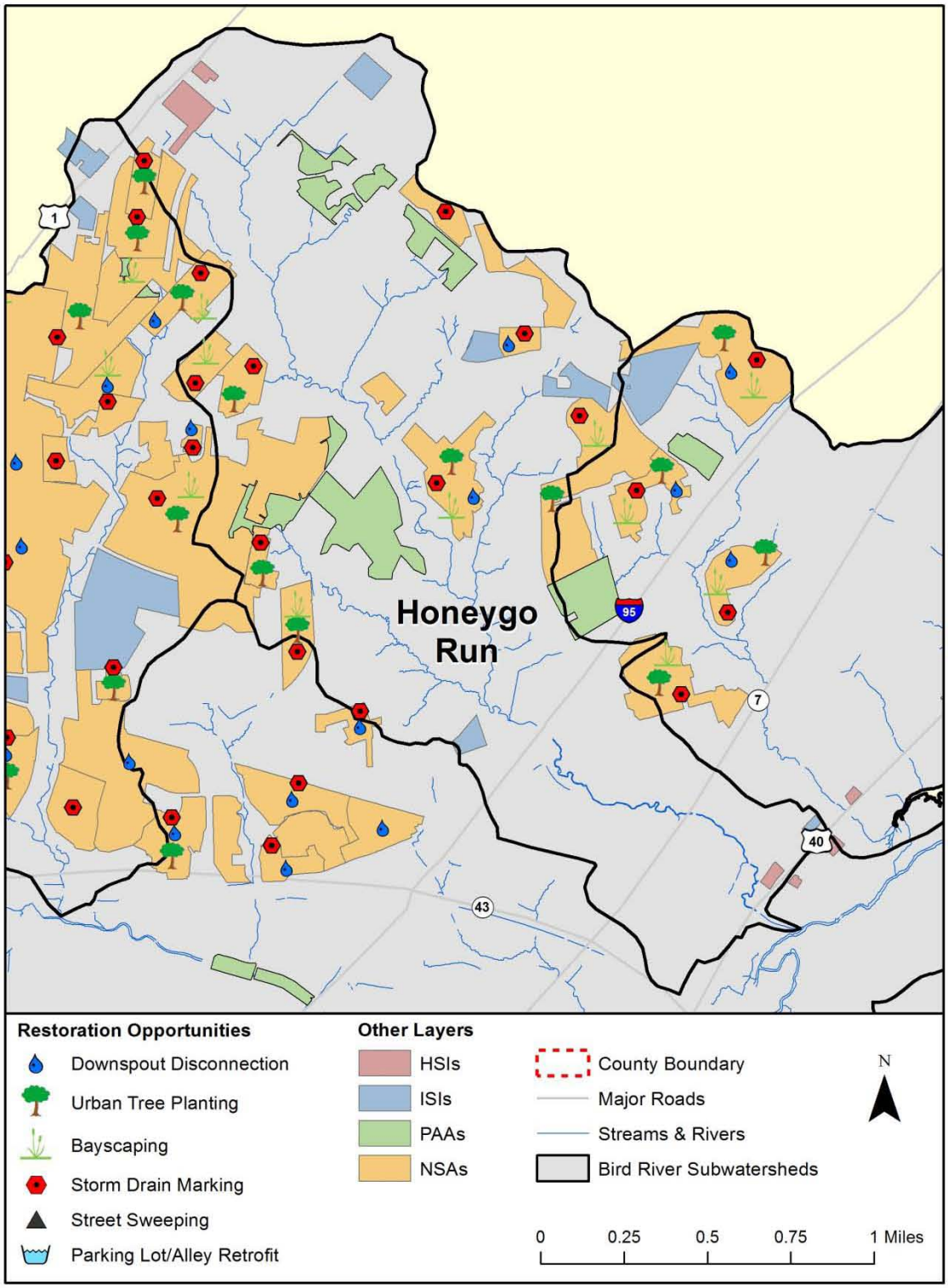

Figure 4-42: Restoration Opportunities in Honeygo Run

4.3.5 Windlass Run (Subwatershed Code 500)

Windlass Run is the third largest subwatershed though it ranks next to last in population density. The Windlass Run drainage is a mix forest (45%) and cropland (20%) and does not contain any high density residential land. Table 4-35 summarizes key subwatershed characteristics of Windlass Run.

Table 4-35: Key Subwatershed Characteristics – Windlass Run

Drainage Area	1,927.90 acres (3.01 sq. mi.)	
Stream Length	8.0 miles	
Population	1,236 (2010 Census)	
	0.6 people/acre	
Land Use/Land Cover	Very Low Density Residential:	4.7%
	Low Density Residential:	14.5%
	Medium Density Residential:	6.4%
	High Density Residential:	0.0%
	Commercial:	0.3%
	Industrial:	1.1%
	Institutional:	0.6%
	Extractive:	0.0%
	Open Urban Land:	4.1%
	Agriculture:	20.2%
	Forest:	44.9%
	Barren Land:	0.0%
	Water/Wetlands:	3.3%
	Transportation	0.0%
Impervious Cover	7% of subwatershed	
Soils	A Soils (low runoff potential):	9.0%
	B Soils:	35.9%
	C Soils:	53.3%
	D Soils (high runoff potential):	1.8%
SWM Facilities	60% of urban land use treated	
Priority Rating	Low	

Neighborhood

A total of two distinct neighborhoods were identified and assessed within Windlass Run during the uplands assessment of the Bird River watershed. Recommendations for these neighborhoods included rain barrels, storm drain marking, and Bayscaping. A summary of neighborhood recommended actions is presented in Table 4-36.

Table 4-36: NSA Recommendations – Windlass Run

RECOMMENDED ACTIONS															
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_8	1/2	10			✓	✓							0	0	
NSA-K_70	1/2	35	✓		✓	✓							0	0	

Storm drain marking was recommended for both of the neighborhoods in this subwatershed, which offers an opportunity to not only engage residents, but to serve as a visual reminder of the downstream effects of residents' actions. Bayscaping was also recommended in both neighborhoods (Figure 4-43). This practice provides an attractive way for landscaping to improve stormwater infiltration, nutrient absorption and pollutant filtration on-site, while also enhancing the aesthetic value of the property.

Figure 4-43: Areas Recommended for Bayscaping in NSA_K_8 (left) and NSA_K_70 (right)

Hotspots

No hotspot investigations were performed within Windlass Run during the uplands assessments.

Institutions

Staff visited Vincent Elementary School as the sole institution located within Windlass Run. The restoration opportunities that were identified are summarized in Table 4-37.

Table 4-37: ISI Recommendations – Windlass Run

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_539	Vincent Elementary School	Public	✓	8	✓	✓			✓	Much staining down-gradient of dumpster

Vincent Elementary School provides opportunities for restoration and environmental education in many categories, including storm drain marking, improvements to waste management, and downspout disconnection (Figure 4-44). Stormwater management, already state-of-the-art (wet ponds, wetlands, sand filters) at this recently-built school, would be further enhanced through limited downspout disconnection at the southern corner of the school. Roof runoff would be diverted to a bioretention area adjacent to bus parking, thereby providing additional treatment of rooftop runoff that may be entering an existing facility. Improvements to tree cover and storm runoff management would improve the quality of stormwater entering the stream that borders the school property to the east with the added bonus of providing excellent additions to educational opportunities on the school premises.

Figure 4-44: Waste Management Improvement Opportunity (left) and Tree Planting Opportunity (right) at ISI-K-539

Pervious Areas

No assessments of pervious areas were performed within Windlass Run during the uplands assessments.

Stream Corridor Assessments

SCAs were not performed in the Windlass Run subwatershed.

Illicit Discharges

Windlass Run contains one major outfall, which is rated priority 0. Priority 0 outfalls are outfalls with insufficient data to determine a priority rating. This may be due to inaccessibility or if there has been only a single screening. Baltimore County will continue its Illicit Discharge Detection and Elimination program while seeking to improve techniques for more effective reductions of these discharges.

Stormwater Conversions

Baltimore County EPS did not select any stormwater management ponds in Windlass Run as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential.

Subwatershed Management Strategy

Figure 4-35 provides a visual summary of restoration opportunities in the watershed.

Engaging Citizens & Watershed Groups

1. Conduct appropriate downspout rain barrel installation measures in neighborhoods according to Table 4-36.
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-36.
3. Raise awareness among citizens about the benefits and importance of Bayscaping and rain gardens in the neighborhoods indicated in Table 4-36.

Municipal Actions

1. Educate staff of the elementary school site about the importance of proper trash management as listed in Table 4-37.
2. Continue to monitor illicit discharges.
3. Conduct follow-up investigations of the outfall with insufficient data for priority as described above and in the Watershed Characterization Report.

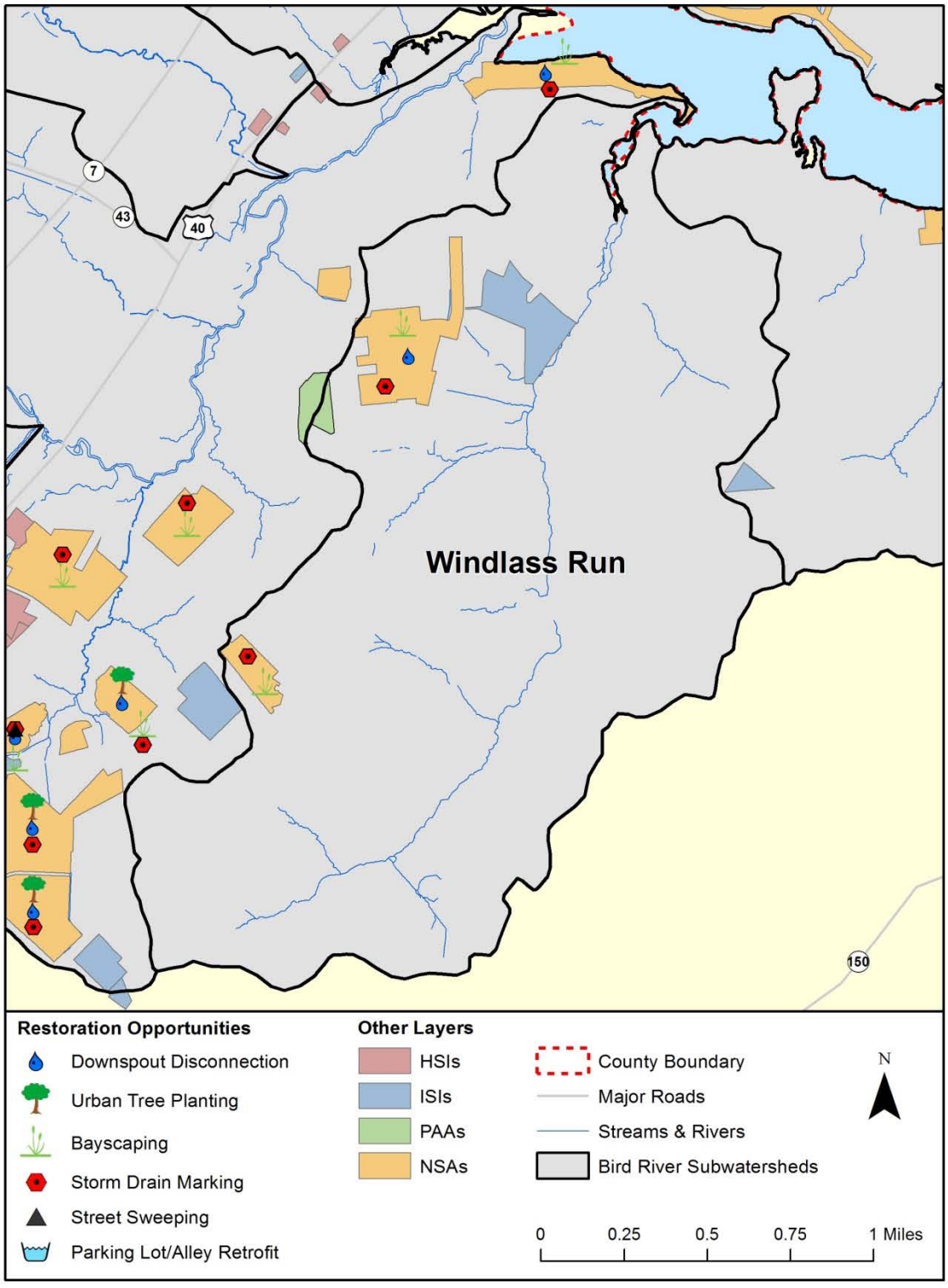

Figure 4-45: Restoration Opportunities in Windlass Run

4.3.6 Bird River-D (Subwatershed Code 600)

Bird River-D is the second largest subwatershed and borders the northern edge of the mainstem Bird River. Gunpowder Valley State Park covers the eastern half of the subwatershed and accounts for the large percentage of forest land (44%), the highest percentage of any subwatershed. Medium density residential land use accounts for almost 11% of the watershed. Table 4-38 summarizes key subwatershed characteristics of Bird River-D.

Table 4-38: Key Subwatershed Characteristics – Bird River-D

Drainage Area	2,360.1 acres (3.69 sq. mi.)	
Stream Length	12.7 miles	
Population	2,725 (2010 Census)	
	1.2 people/acre	
Land Use/Land Cover	Very Low Density Residential:	4.6%
	Low Density Residential:	7.7%
	Medium Density Residential:	10.6%
	High Density Residential:	0.7%
	Commercial:	6.1%
	Industrial:	3.6%
	Institutional:	1.0%
	Extractive:	1.7%
	Open Urban Land:	0.0%
	Agriculture:	6.1%
	Forest:	44.4%
	Barren Land:	7.4%
	Water/Wetlands:	4.3%
	Transportation	1.8%
Impervious Cover	13% of subwatershed	
Soils	A Soils (low runoff potential):	3.0%
	B Soils:	22.2%
	C Soils:	55.0%
	D Soils (high runoff potential):	19.8%
SWM Facilities	25% of urban land use treated	
Priority Rating	Medium	

Neighborhoods

A total of seven distinct neighborhoods were identified and assessed within Bird River-D during the uplands assessment of the Bird River watershed. The primary recommendations for neighborhoods in this subwatershed included rain barrels, storm drain marking, Bayscaping, and tree planting. A summary of neighborhood recommended actions is presented in Table 4-39.

Table 4-39: NSA Recommendations – Bird River-D

		RECOMMENDED ACTIONS													
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_39	1/4	60	✓	✓	✓	✓							0	26	Room available to redirect downspouts. Potential planting/stormwater retrofit area available.
NSA-K_40	1/2	65	✓		✓	✓							0	60	Many downspouts drain onto driveways.
NSA-K_41	1/4	10			✓	✓							0	340	
NSA-K_68	1/4	65	✓	✓	✓	✓							0	20	
NSA-K_72	1/2	27	✓			✓				✓			0	0	No storm drain inlets. Stream buffer is present but < 100 ft encroachment is moderate to severe (lawn, houses). Encroachment is also severe along mainstem Bird River.
NSA-K_90	1/4	60	✓	✓	✓	✓							0	280	
NSA-K_107		40	✓			✓				✓			0	0	Grass appears very compacted in some areas and may not be as pervious. Some bare soil, gravel exposed in places. Low to moderate stream buffer encroachment along ephemeral channel (trailer and fencing).

Storm drain marking was recommended for five of the neighborhoods in this subwatershed, which offers an opportunity to not only engage residents, but to serve as a visual reminder of the downstream effects of residents' actions. Bayscaping was recommended in all neighborhoods (Figure 4-46). This practice provides an attractive way for landscaping to improve stormwater infiltration, nutrient absorption and pollutant filtration on-site, while also enhancing the aesthetic value of the property. Tree planting opportunities were also spread throughout the subwatershed with two neighborhoods recommended for the planting of more than 250 trees each (Figure 4-48). Projects on this scale may encourage widespread community engagement and are ideal opportunities for children and families to participate and become involved with their watershed in a concrete way. In addition, actions as simple as adjusting mowing practices and tree plantings along stream channels and drainage ditches may help to slow down high stream flows that cause bank erosion and intercept nutrients and toxins before they enter the aquatic ecosystem.

Figure 4-46: Areas Recommended for Bayscaping in NSA_K_68 (left) and NSA_K_90 (right)

Figure 4-47: Tree Planting Opportunities in NSA_K_41 (left) and NSA_K_90 (right)

Hotspots

There were one potential hotspot and two confirmed hotspots identified and assessed within the Bird River-D subwatershed during the uplands assessment of the Bird River watershed. Table 4-40 summarizes Bird River-D potential pollution sources from facilities visited. Crews noted certain conditions during the field investigations that they felt merited immediate notification of Baltimore County for further investigation and/or follow-up action. Section 4.3 of the Watershed Characterization Report summarizes the field crew reports, as well as subsequent actions taken by the County.

The Bird River-D subwatershed had two confirmed pollution hotspots. The most severe (HSI_K_637) was found at a machine sales and repair company with dirty wastewater escaping the work bay and flowing into the adjacent roadway (Figure 4-48). The site was also found to have overflowing dumpsters and several 55-gallon drums stored outside. The other confirmed hotspot in this watershed (HSI_K_647) was an aluminum construction material fabrication company, where outdoor materials were stored on the ground and liquid storage lacked

secondary containment. Additionally, an empty 55-gallon drum was found tipped over, and sediment from a landscaping area was running down the parking lot after a recent rainfall. The third site inspected in this watershed (HSI_K_625) was a construction retail and storage building. The only notable features here were two 55-gallon drums sitting on a wooden pallet, containing an unknown substance.

Table 4-40: Hotspot Summary – Bird River-D

			POTENTIAL POLLUTION SOURCES						
Site ID	HSI Status (# filled circles)	Description	Vehicle Operations	Outdoor Materials	Waste Management	Physical Plant	Turf / Landscaping	Stormwater	Notes
HSI_K_625	Potential (9)	Commercial-Construction retailer/storage							Facility looks fine with exception of two 55-gallon drums of unknown material sitting in back parking lot.
HSI_K_637	Confirmed (13)	Commercial-Excavation equipment sales/repair	✓						Biggest problems at this facility are: uncovered, overflowing dumpster; inside bay is filled with dirty washwater, which is escaping out of bay and washing into roadway; 55-gallon drums stored outdoors, was not able to confirm if labeled or properly sealed.
HSI_K_647	Confirmed (12)	Industrial-Construction materials/aluminum awning manufacturing							Empty, tipped over 55-gallon drum in parking lot. Follow up on 1,000-gallon drum/55-gallon drum and dumpster lid. Sediment running down parking lot in front of building.

Figure 4-48: Wastewater Escaping From Maintenance Bay

Institutions

One institution was assessed in Bird River-D, Chapel Hill Elementary School. Several restoration opportunities were noted at the school, which are summarized in Table 4-41.

Table 4-41: ISI Recommendations – Bird River-D

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_640	Chapel Hill Elementary School	Public	✓	41		✓				Bioretention near eastern tennis court.

Restoration opportunities at Chapel Hill Elementary School (ISI_K_640) include the addition of bioretention stormwater control at the southeastern edge of the tennis court (Figure 4-49). Storm runoff leaving the impervious area of the tennis court is currently collected into concrete gutters and delivered to a storm drain inlet. Retrofitting the collection system to include bioretention will provide valuable water quality treatment and runoff volume reduction in a part of the school property that has inadequate treatment. Several areas of turf were also identified for the planting of a total of 41 trees. The trees can be arrayed, for example, alongside baseball fields, between the school building and tennis court, and along the south corner of the property along Joppa Road. Planting next to the north ball field will increase the buffer width along an ephemeral channel that forms the headwaters of a stream. Storm drain stenciling can be a jump-off point to enhancements to environmental education programs at the school. The other

restoration projects at the school can be a “real-world” demonstration of steps that can be taken to locally improve the quality of streams that start at the higher elevations of the school property.

Figure 4-49: Stormwater Retrofit and Tree Planting Opportunity at ISI_K_640

Pervious Areas

Pervious area restoration has the potential to convert areas of turf, often with high nutrient inputs, to forest, which can instead absorb and filter nutrients. Three pervious areas were assessed for restoration potential in Bird River-D. These sites include Gunpowder Falls State Park; Cowenton Avenue Park; and County Open Space C.

The Gunpowder Falls State Park site is located near the eastern terminus of Days Cove Road, adjacent to the Days Cove Landfill. It is publicly-owned and maintained and is easily accessible by foot, vehicle, or heavy equipment. It is mostly covered by turf (95%) with some existing small trees along its edges. Nearly the entire site could be appropriate for tree planting. An area of steep slopes is present, however, in the central part of the site, and planting here could be more difficult. Further, it appears that this site consists of re-claimed former landfill, and County health and safety plans would need to be reviewed for compatibility prior to any tree planting here.

The Cowenton Avenue Park site is located off of Cowenton Avenue, near its intersection with Honeybrook Way. It is publicly-owned and maintained and is easily accessible by foot, vehicle, or heavy equipment. A substantial part of the Park is covered by turf (60%), with a parcel of existing forest along its southern and eastern sides. The outer edges of the forest need some intensive invasive species management where they meet the Park playing fields.

The County Open Space C site is located off of Peach Blossom Avenue, near its intersection with Joppa Road. The site appears to be a former part of the active peach orchard to the west of Peach Blossom Avenue. The site is publicly-owned, and it appears to present a good opportunity for tree planting on this formerly agricultural site, with minimal site preparation. A majority of the site (95%) currently possesses maintained turf. Benefits of tree planting here would include slowing of surface flow runoff.

A summary of these sites is provided in Table 4-42.

Table 4-42: PAA Summary – Bird River-D

Site ID	Location	Description	Acres	Ownership
PAA_K_622	Gunpowder Falls State Park	Park	Parcel - 35.46 Recommended planting - 23.89	Public
PAA_K_623	Cowenton Avenue Park	Park	Parcel - 20.36 Recommended planting - 1.19	Public
PAA_K_624	County Open Space - C	Open Space	Parcel - 7.51 Recommended planting - 6.18	Public

Stream Corridor Assessments

Field crews walked 3.38 miles of stream (26.5% of total stream miles) within the Bird River-D subwatershed to identify water quality problems and restoration opportunities. This survey focused on first through third order stream reaches. A total of 104 problems were identified throughout the subwatershed. The predominant issues noted were erosion, channel alteration and trash dumping. Conditions observed at 17 locations during the field survey were designated unusual conditions, five of which were noted as being Severe; examples of such conditions include headcuts, excessive algae, and downed powerlines. Maps showing key findings of the stream corridor assessments are found in Section 3.6 of the Watershed Characterization Report (Appendix E).

Illicit Discharges

There are no major outfalls in Bird River-D. Forest is the primary land use in Bird River-D, which does not require urban stormwater conveyance systems or outfalls.

Stormwater Conversions

Baltimore County EPS identified one stormwater management pond in Bird River-D as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential. Field crews were not able to locate this pond; it was learned after the field assessments that it is a unique structure, with a low embankment and an outlet structure that consists of a concrete wall with a cut and a trash rack. This likely made it difficult for field crews to spot this facility and locate the structure.

Subwatershed Management Strategy

Figure 4-50 provides a visual summary of restoration opportunities in the watershed.

<u>Engaging Citizens & Watershed Groups</u>

1. Conduct appropriate rain barrel and rain garden installation measures in neighborhoods according to Table 4-39.
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-39.
3. Raise awareness among citizens about the benefits and importance of Bayscaping and rain gardens in neighborhoods indicated in Table 4-39.
4. Encourage communities and neighborhoods to plant open space trees. Table 4-39 shows the potential for 726 open space trees.
5. Raise awareness among property owners about improving stream buffer management at locations indicated in Table 4-39.
6. Investigate the pervious areas described in Table 4-42 for potential tree planting.

Municipal Actions

1. Engage institutional site listed in Table 4-41 in storm drain marking. Also, pursue with facility manager the feasibility of retrofits recommended.
2. Follow-up regarding conditions at confirmed hotspots and continue to monitor conditions at potential hotspot indicated in Table 4-40. Pursue outreach and raise awareness regarding site hygiene practices, improved outdoor materials storage and vehicle operations.
3. Consider recommendations for stream restoration in areas of moderate to severe bank erosion and channel alteration noted during the SCA.

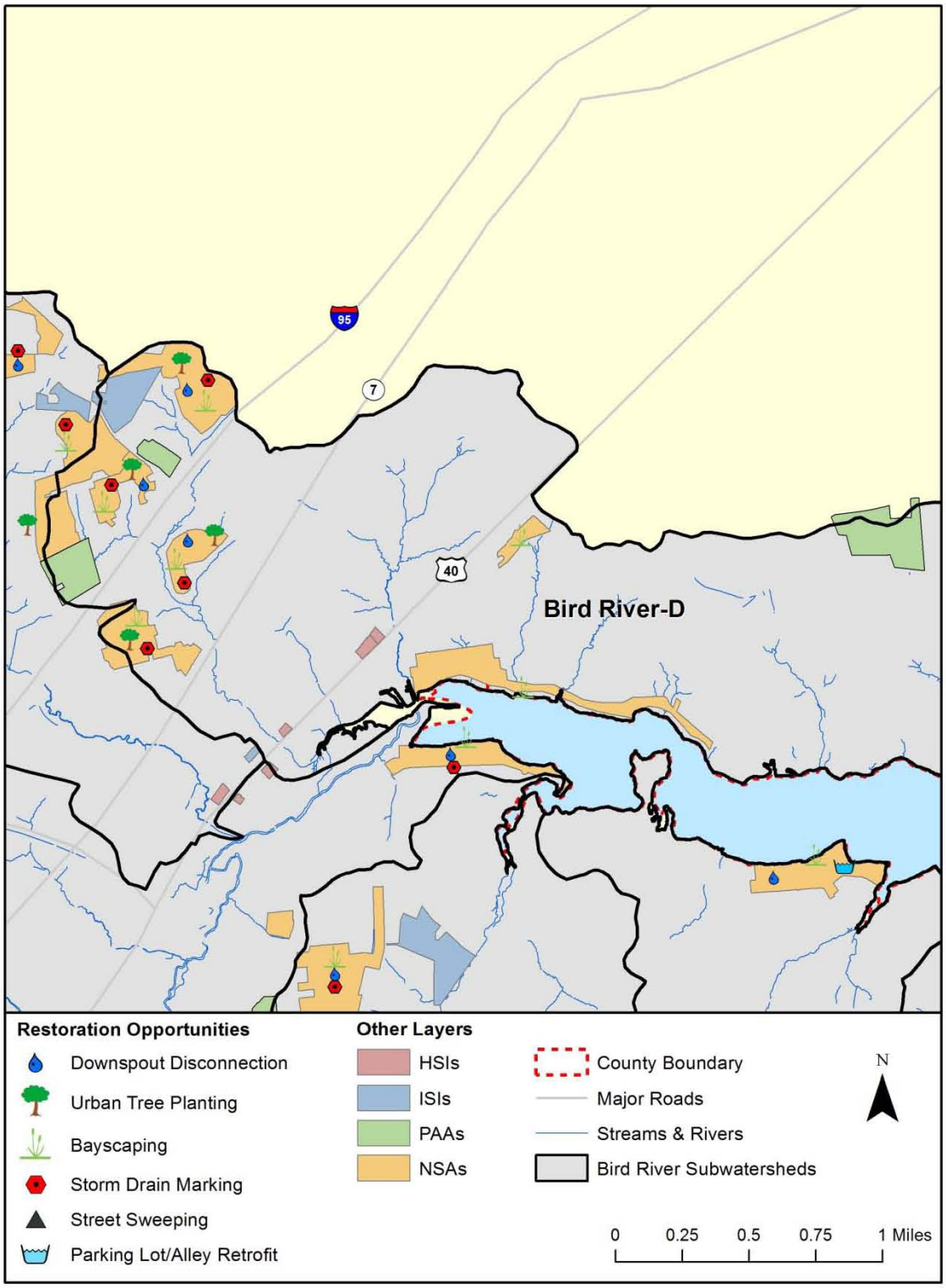

Figure 4-50: Restoration Opportunities in Bird River-D

4.3.7 Bird River-B (Subwatershed Code 700)

Bird River-B is the smallest subwatershed in the SWAP area and borders the southern edge of mainstem Bird River. The land use is mostly a mix of forest (37%) and cropland (32%), which accounts for this subwatershed having the lowest population density of all the subwatersheds. Table 4-43 summarizes key subwatershed characteristics of Bird River-B.

Table 4-43: Key Subwatershed Characteristics – Bird River-B

Drainage Area	770.4 acres (1.20 sq. mi.)	
Stream Length	2.1 miles	
Population	354 (2010 Census) 0.5 people/acre	
Land Use/Land Cover	Very Low Density Residential:	4.5%
	Low Density Residential:	8.6%
	Medium Density Residential:	5.3%
	High Density Residential:	0.0%
	Commercial:	0.0%
	Industrial:	0.0%
	Institutional:	1.1%
	Extractive:	1.4%
	Open Urban Land:	0.0%
	Agriculture:	31.8%
	Forest:	43.5%
	Barren Land:	0.0%
	Water/Wetlands:	4.0%
	Transportation	0.0%
Impervious Cover	4% of subwatershed	
Soils	A Soils (low runoff potential):	20.6%
	B Soils:	36.1%
	C Soils:	38.6%
	D Soils (high runoff potential):	4.7%
SWM Facilities	7% of urban land use treated	
Priority Rating	Low	

Neighborhoods

One distinct neighborhood was identified and assessed within Bird River-B during the uplands assessment of the Bird River watershed. Recommendations for this neighborhood included rain barrels, rain gardens, Bayscaping, stream buffer improvements, and a parking lot retrofit. A summary is presented in the Table 4-44.

Table 4-44: NSA Recommendations – Bird River-B

		RECOMMENDED ACTIONS													
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_69	1/4	40	✓	✓		✓				✓	✓		0	0	No storm drains to mark. Buffer encroachment (mown lawn) is severe along shoreline of Bird River. Need to increase planting along shoreline. Drainage swales can be converted to bioswales depending on groundwater table elevation.

Opportunities for action are plentiful in the neighborhood assessed in the Bird River-B. Rain barrels could serve as temporary storage of roof runoff, decreasing the volume of stormwater running off site. Rain gardens may provide an area for roof runoff to infiltrate, as well as plants that can absorb excess nutrients and filter out pollutants. Bayscaping was also recommended in this neighborhood (Figure 4-51). This practice provides an attractive way for landscaping to improve stormwater infiltration, nutrient absorption and pollutant filtration on-site, while also enhancing the aesthetic value of the property. In addition, actions as simple as adjusting mowing practices and tree plantings along stream channels and drainage ditches may help to slow down high stream flows that cause bank erosion and intercept nutrients and toxins before they enter the aquatic ecosystem.

Figure 4-51: Typical Yard in NSA_K_69 With Opportunities for Rain Barrels, Rain Gardens and/or Bayscaping

Hotspots

No hotspot investigations were performed within Bird River-B during the uplands assessments.

Institutions

A total of two institutions were assessed for restoration opportunities in the Bird River-B subwatershed during the uplands assessment of Bird River. These included two private institutions: a church and the Gunpowder Post of the Veterans of Foreign Wars (VFW). Table 4-45 summarizes recommendations for institutional sites assessed in Bird River-B.

Table 4-45: ISI Recommendations – Bird River-B

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_741	VFW - Gunpowder Post	Private		7						
ISI_K_742	St. John Apostolic Church	Private		4						Site may be abandoned.

Both of the institutional sites were recommended for tree planting, which provides shading on impervious surfaces as well as improves stormwater infiltration. Trees can also improve aesthetics, stabilize soils and improve nutrient uptake. A total of 11 trees can be planted in the combined area of the two institutional sites (Figure 4-52).

Figure 4-52: Tree Planting Opportunity at Under-utilized Turf Area Adjacent to Parking Area at ISI_K_742

Pervious Areas

No assessments of pervious areas were performed within Bird River-B during the uplands assessments.

Stream Corridor Assessments

SCAs were not performed in the Bird River-B subwatershed.

Illicit Discharges

There are no major outfalls in Bird River-B. Land in Bird River-B is primarily forested or used for agriculture which does not require urban stormwater conveyance systems and outfalls.

Stormwater Conversions

Baltimore County EPS did not select any stormwater management ponds in Bird River-B as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential.

Subwatershed Management Strategy

Figure 4-53 provides a visual summary of restoration opportunities in the watershed.

Engaging Citizens & Watershed Groups

1. Conduct appropriate rain barrel and rain garden installation measures in NSA_K_69.
2. Raise awareness among citizens about the benefits and importance of Bayscaping and rain gardens in NSA_K_69.
3. Raise awareness among residents about the importance of streamside buffers and encourage more environmentally friendly buffer treatments in the neighborhoods indicated in NSA_K_69.
4. Engage institutional sites listed in Table 4-45 regarding tree planting opportunities.

Municipal Actions

1. Investigate feasibility of stormwater retrofits recommended for NSA_K_69.

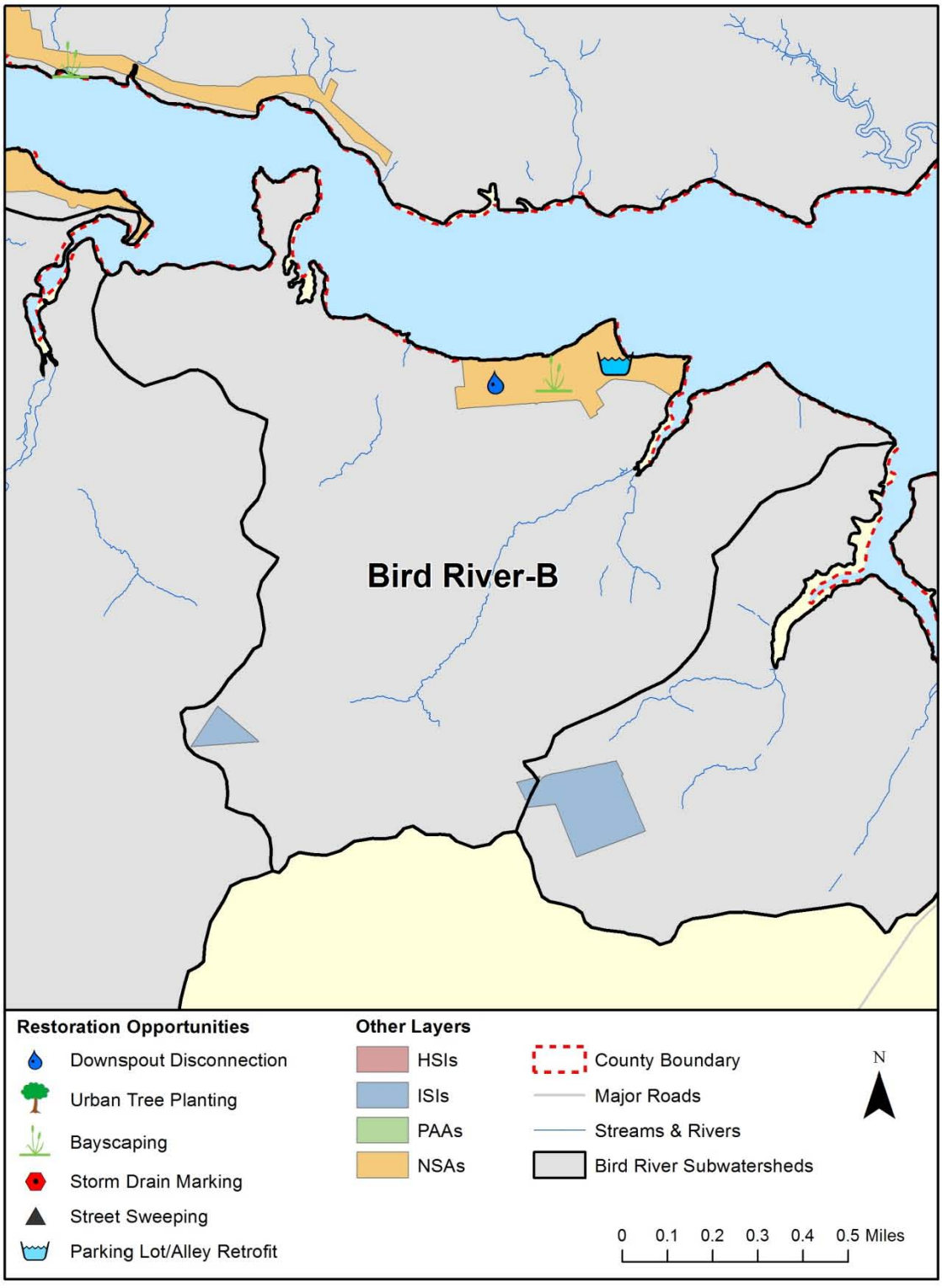

Figure 4-53: Restoration Opportunities in Bird River-B

4.3.8 Railroad Creek_Bird River-A (Subwatershed Code 800)

Railroad Creek_Bird River-A is the second smallest subwatershed and borders the southern edge of mainstem Bird River. Almost half of the subwatershed is medium density residential land use, though half, and another quarter of Railroad Creek_Bird River-A is forested Table 4-46 summarizes key subwatershed characteristics of Railroad Creek_Bird River-A.

Table 4-46: Key Subwatershed Characteristics – Railroad Creek_Bird River-A

Drainage Area	991.9 acres (1.55 sq. mi.)	
Stream Length	4.2 miles	
Population	2,397 (2010 Census)	
	2.4 people/acre	
Land Use/Land Cover	Very Low Density Residential:	3.5%
	Low Density Residential:	3.8%
	Medium Density Residential:	48.8%
	High Density Residential:	0.2%
	Commercial:	0.3%
	Industrial:	0.0%
	Institutional:	0.8%
	Extractive:	5.7%
	Open Urban Land:	0.0%
	Agriculture:	9.2%
	Forest:	25.9%
	Barren Land:	0.0%
	Water/Wetlands:	1.7%
	Transportation	0.0%
Impervious Cover	13% of subwatershed	
Soils	A Soils (low runoff potential):	4.5%
	B Soils:	39.5%
	C Soils:	50.8%
	D Soils (high runoff potential):	5.3%
SWM Facilities	20% of urban land use treated	
Priority Rating	Medium	

Neighborhood

A total of three distinct neighborhoods were identified and assessed within Railroad Creek_Bird River-A during the uplands assessment of the Bird River watershed. The recommendations for neighborhoods in this subwatershed included rain barrels, rain gardens, storm drain marking, Bayscaping, education regarding pet waste cleanup, stream buffer improvement, and tree planting. . A summary of neighborhood recommended actions is presented in Table 4-47.

Table 4-47: NSA Recommendations – Railroad Creek_Bird River-A

			RECOMMENDED ACTIONS												
Site ID	Lot Size (acres)	% Opportunity for Downspout Disconnection	Rain Barrels	Rain Gardens	Storm Drain Marking	Bayscaping	Increase Lot Canopy	Pet Waste	Trash Management	Buffer Improvement	Parking Lot/Alley Retrofit	Street Sweeping	# of Street Trees	# of Open Space Trees	Notes
NSA-K_42	< 1/4	8	✓	✓	✓	✓		✓					0	0	Potential rain garden retrofit in a few front yards.
NSA-K_43	< 1/4	50	✓		✓	✓							0	0	
NSA-K_93	< 1/4	40	✓	✓		✓				✓			0	10 0	Stream buffer is < 100 ft, severe encroachment along the shores of Bird River and Railroad Creek; moderate along other streams (mown lawn). Encourage more plantings along shorelines.

Rain barrels serve as temporary storage of roof runoff, decreasing the volume of stormwater running off site. Rain gardens may provide an area for roof runoff to infiltrate, as well as plants that can absorb excess nutrients and filter out pollutants. Bayscaping was also recommended in this subwatershed (Figure 4-54). This practice provides an attractive way for landscaping to improve stormwater infiltration, nutrient absorption and pollutant filtration on-site, while also enhancing the aesthetic value of the property. Curbs and gutters were lacking in NSA_K_93 (Figure 4-55). Standing water in the grassed roadside ditches in this neighborhood have the potential to be converted to bioswales, which may improve infiltration and add water quality treatment for stormwater runoff from the roads. There is a tree planting opportunity in NSA_K_93 for as many as 100 trees. A project on this scale may encourage widespread community engagement and is an ideal occasion for children and families to participate and become involved with their watershed in a concrete way. In addition, actions as simple as adjusting mowing practices and tree plantings along stream channels and drainage ditches may help to slow down high stream flows that cause bank erosion and intercept nutrients and toxins before they enter the aquatic ecosystem.

Figure 4-54: Typical Yard in NSA_K_93 With Opportunities for Rain Barrels, Rain Gardens and/or Bayscaping

Figure 4-55: Roadside Ditch That May Have Potential for Conversion to Bioswale in NSA_K_93

Hotspots

No hotspot investigations were performed within Railroad Creek_Bird River-A during the uplands assessments.

Institutions

Two private church or faith based organizations were assessed within Railroad Creek_Bird River-A subwatershed. Recommended restoration actions that are proposed for this SWAP are summarized in Table 4-48.

Table 4-48: ISI Recommendations – Railroad Creek_Bird River-A

			RECOMMENDED ACTIONS							
Site ID	Name	Public/ Private	Storm Drain Marking	# Trees for Planting	Downspout Disconnection	Stormwater Retrofit	Impervious Cover Removal	Buffer Improvement	Trash Management	Notes
ISI_K_844	Iglesia Evangelica Apostoles y Profetas	Private		1						
ISI_K_845	Ebenezer Methodist Church	Private								

Restoration opportunities at the sites visited in this subwatershed are limited to one tree along Eastern Avenue. The tree will provide shade to the parking lot of Iglesia Evangelica Apostoles y Profetas and improve interception and infiltration of stormwater originating from the parking lot. At Ebenezer Methodist Church, 75% of the parcel is already forested.

Figure 4-56: Tree Planting Opportunity at ISI_K_844

Pervious Areas

Pervious area restoration has the potential to convert areas of turf, often with high nutrient inputs to forest, which can instead absorb and filter nutrients. One pervious area was assessed for restoration potential in Railroad Creek_Bird River-A, SHA – B. The SHA - B site is located off Harewood Road, near its intersection with Ebenezer Road. It is publicly-owned and maintained and is easily accessible by foot, vehicle, or heavy equipment. None of it is covered by turf (0%); it currently consists of areas of scattered small trees and shrubs, interspersed with open areas covered by thick layers of wood chips. Most of the wood-chipped areas could be planted in trees, and the other areas would be best left to natural re-generation. Tree planting and natural re-generation here would provide the opportunity to add to and buffer the existing treed areas throughout, and the stream corridor (a ditch with nontidal wetlands) in the northern-most and western parts of the parcel.

A summary of this site is provided in Table 4-49.

Table 4-49: PAA Summary – Railroad Creek_ Bird River-A

Site ID	Location	Description	Acres	Ownership
PAA_K_825	SHA - B	Open Space	Parcel - 1.49 Recommended planting - 0.80	Public

Stream Corridor Assessments

SCAs were not performed in the Railroad Creek_Bird River-A subwatershed.

Illicit Discharges

Railroad Creek_Bird River-A contains two major outfalls, both of which are rated priority 0. Priority 0 outfalls are outfalls with insufficient data to determine a priority rating. This may be due to inaccessibility or if there has been only a single screening. Baltimore County will continue its Illicit Discharge Detection and Elimination program while seeking to improve techniques for more effective reductions of these discharges.

Stormwater Conversions

Baltimore County EPS did not select any stormwater management ponds in Railroad Creek_Bird River-A as part of a list of 20 existing stormwater management facilities in the Bird River watershed to be evaluated for their conversion potential.

Subwatershed Management Strategy

Figure 4-29 provides a visual summary of restoration opportunities in the watershed.

<u>Engaging Citizens & Watershed Groups</u>

1. Conduct appropriate rain garden and rain barrel installation measures in neighborhoods according to Table 4-47.
2. Engage citizens in a storm drain marking program and conduct marking activities in the neighborhoods indicated in Table 4-47.

3. Raise awareness among citizens about the benefits and importance of Bayscaping and rain gardens in the neighborhoods indicated in Table 4-47.
4. Encourage communities and neighborhoods to plant street and open space trees. Table 4-47 shows a potential for 100 open space trees.
5. Raise awareness among citizens about the importance of cleaning up after their pets and the role pet waste plays in polluting waterways in the neighborhoods indicated in Table 4-47.
6. Raise awareness among residents about the importance of streamside buffers and encourage more environmentally friendly buffer treatments in the neighborhoods indicated in Table 4-47.
7. Investigate the pervious area described in Table 4-49 for potential tree planting.

Municipal Actions

1. Continue to monitor illicit discharges, if any.
2. Conduct follow-up investigations of both outfalls with insufficient data for priority rating as described above and in the Watershed Characterization Report.

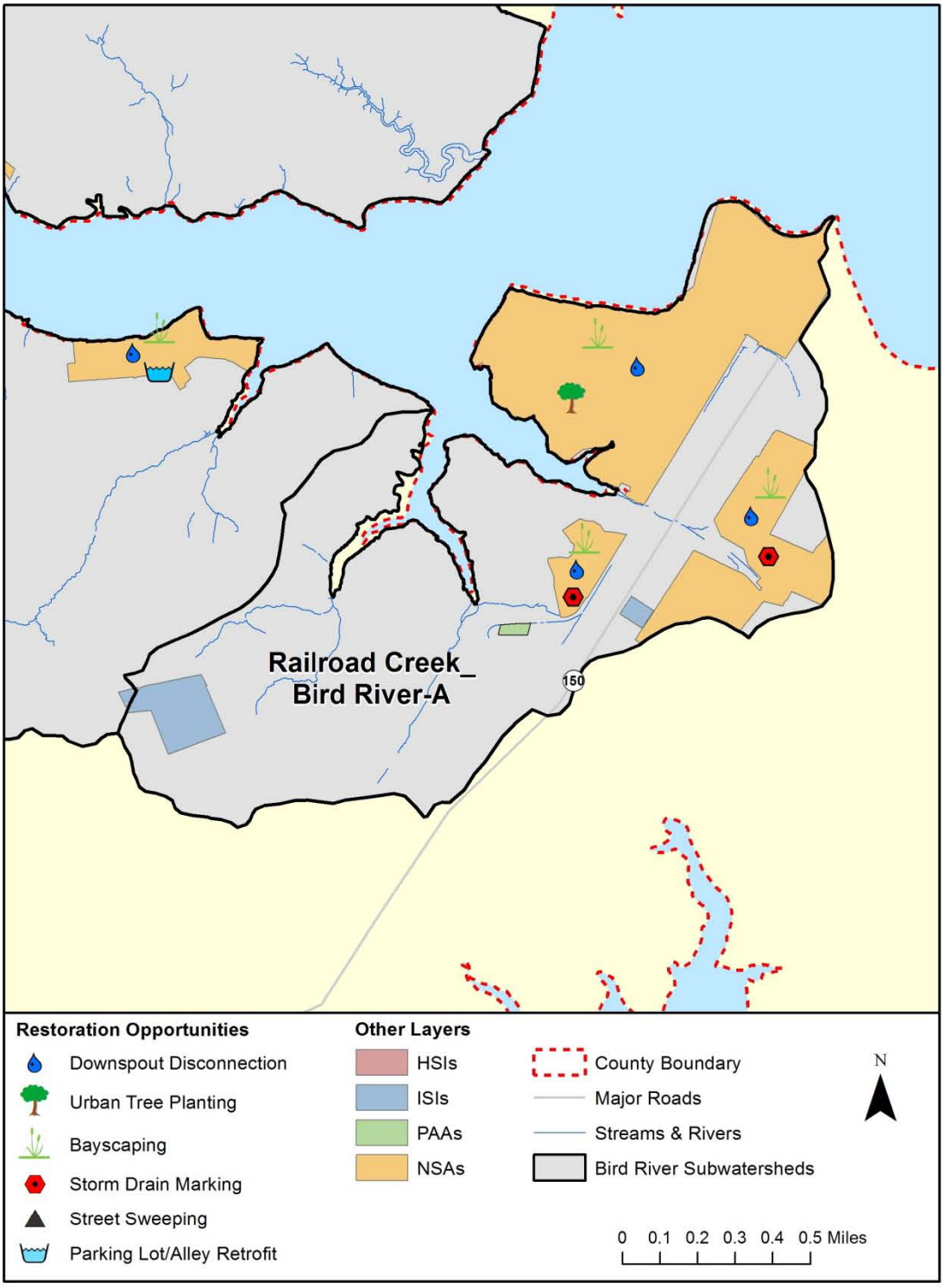

Figure 4-57: Restoration Opportunities in Railroad Creek_Bird River-A

4.4 Watershed-Wide Strategies

Some of the action strategies described in Chapter 3 and Appendix A apply to the entire Bird River watershed and were not included under the specific subwatershed management strategies. This is because these actions are recommended for the watershed as a whole in order to be effective and help achieve restoration goals and objectives.

County Strategies: One example of a county action is the work implemented under the 2005 consent decree issued by EPA and MDE to eliminate sanitary sewer overflows (SSOs). The capital improvement projects, operations improvements, and maintenance programs will result in a reduction of nutrients and bacteria entering streams throughout the entire Bird River watershed.

Citizen-based Strategies: Actions associated with citizen awareness and participation also relate to the entire watershed in order to promote a positive perception of the Bird River and to effectively meet water quality goals and objectives. Examples of watershed-wide citizen actions include conducting tours of completed water quality BMPs and stream restoration projects and encouraging community stream clean-ups.

CHAPTER 5: PLAN EVALUATION

5.1 Introduction

The Bird River SWAP is based on a 10-year implementation schedule (2024 endpoint). This timeframe is necessary to implement restoration measures that meet the Chesapeake Bay nutrient TMDL and address other impairments. The ability to implement this plan within the 10-year timeframe is dependent upon the availability of staff and sufficient funding. The Bird River SWAP Implementation Committee (an outgrowth of the Steering Committee) will meet twice per year to assess progress in meeting watershed goals and objectives and to discuss funding options. In addition, an annual progress report and a biennial report on water quality monitoring results will be produced. An adaptive management approach will be used to meet watershed goals and objectives based on SWAP evaluation data. Adaptive management will allow the committee to discuss changes to the action schedule depending on the success of individual actions and the overall progress with the plan. As the Phase II Watershed Implementation Plan (WIP) addressing the Chesapeake Bay TMDL is implemented, or if other water quality issues arise, the Bird River SWAP Implementation Committee will initiate a revision of the plan within six months of new TMDL approval or when a water quality issue arises.

Progress and success of the Bird River SWAP will be evaluated during implementation based on the following: interim measurable milestones, pollutant load reduction criteria, implementation tracking, and monitoring. These evaluation components are described in the following sections.

5.2 Interim Measurable Milestones

Performance measures have been developed for each action listed in Appendix A and will be used to gage the progress and success of proposed restoration strategies. Actions will be organized into two year milestones, with the first interval being July 1, 2014 – June 30, 2016, and the final interval being July 1, 2022 – June 30, 2024. The progress and success of actions in Appendix A will be evaluated on an annual basis. Action strategies may be modified and/or new actions may be proposed based on this annual evaluation. New actions proposed will also be evaluated on an annual basis and modified as necessary to meet watershed goals and objectives.

5.3 Pollutant Load Reduction Criteria

Current pollutant load reduction scenarios and calculations for proposed actions are presented in Chapter 3. These are mainly based on pollutant removal efficiencies used in the Chesapeake Bay Program's (CBP) Phase 5.3 Watershed Model for various nonpoint source BMPs. These pollutant removal efficiencies will continue to be used to measure progress in meeting the TMDL reduction goals (i.e., 32.2% reduction in Total Nitrogen (TN) loads from urban stormwater discharges). CBP-approved BMP removal efficiencies are summarized in the tables included as Appendix D. Actions and associated pollutant load reductions will be reevaluated if CBP revises/updates pollutant removal efficiencies within the 10-year timeframe to ensure that the nutrient TMDL reductions are met.

5.4 Implementation Tracking

Baltimore County intends to track implementation of the SWAP using a Geographic Information System (GIS), which will allow the County to record and map all actions taken per the SWAP. The data generated from the GIS will be provided to the Bird River SWAP Implementation Committee to assess annual progress through a comparison between completed restoration activities and the performance measures detailed in Appendix A. Pollutant load reductions that have been achieved through implementation of various restoration projects will also be calculated and tracked.

5.5 Monitoring

Baltimore County currently conducts water quality monitoring programs within the Bird River watershed. Additional monitoring is anticipated to assess the effectiveness of restoration projects and progress in meeting nutrient TMDL reductions.

5.5.1 Existing Monitoring

Baltimore County conducts chemical, biological, and illicit connection monitoring within the Bird River watershed. These are described in detail in Chapter 3.4 of the Bird River Watershed Characterization report (Appendix E) and listed below:

- County Recreational Water Sampling Program – Six sampling locations in freshwater and tidal portions of Bird River to measure bacteria levels;
- County Trend Chemical Monitoring Program – Three sampling locations (Windlass Run, Honeygo Run, and Whitemarsh Run), measuring chemical concentrations and pollutant loads over time, including nutrients, suspended solids, and metals;
- County Biological Monitoring Program – Randomly selected locations in the Bird River watershed using characteristics of benthic macroinvertebrates as a water quality indicator; and
- Illicit Discharge Detection and Elimination Program – Routine outfall screening and prioritization system to track and reduce illicit connections and discharges.

5.5.2 SWAP Implementation Monitoring

SWAP implementation monitoring activities will focus on project specific monitoring and targeted subwatershed monitoring. Project-specific monitoring will be identified as restoration progresses. It will not be possible to monitor all restoration projects due to the number of actions proposed. Project specific monitoring will target activities with limited data regarding removal efficiencies, such as street sweeping. Subwatershed monitoring will measure overall improvement in water quality as a result of multiple restoration activities within a subwatershed. There is potential to coordinate a citizen-based stream monitoring program, as the County has an active and interested partner in Gunpowder Valley Conservancy (GVC). The group currently organizes workshops, tree plantings and stream cleanups throughout the Gunpowder River watershed. Monitoring activities will be coordinated among SWAP participants (Baltimore County and GVC) through participation in the Bird River SWAP Implementation Committee.

CHAPTER 6: REFERENCES

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APPENDIX A: BIRD RIVER WATERSHED ACTION STRATEGIES

Bird River Watershed Action Strategies

This appendix presents the actions related to the goals and objectives presented in Chapter 2 of the Bird River SWAP. A complete list of actions proposed for the watershed including timelines, performance measures, unit cost estimates, and responsible parties is included in Table A-1. In many cases, actions relate to multiple goals and objectives, as indicated in the table. Some of the key columns included in Table A-1 are briefly described below.

Goals and Objectives

Overall goals and objectives are listed in Chapter 2 of the SWAP report, and are referred to by number in Table A-1.

Action

Actions developed to achieve watershed goals and objectives are grouped in Table A-1 according to the type of activity. Actions are grouped according to the following categories (and subcategories for restoration actions):

- Restoration Actions
  - Nutrient Reduction
  - Sediment Reduction
  - Stormwater Management
  - Urban Tree Canopy
  - Trash Management
  - Stream Corridor Restoration
- Outreach & Awareness
- Monitoring
- Funding
- Reporting

Basis for Performance Measure

This column describes how performance measures were developed for each action. Performance measures were developed using the information in this column in conjunction with the action timeline.

Timeline

This column denotes the timeline over which an action will be performed.

Performance Measure

This column describes how the success/completion of a given action will be measured. In many cases, it is the numeric basis of the performance measure divided by the proposed timeline.

Unit Cost

Unit costs are used to develop overall cost estimates for proposed watershed action strategies (see Appendix B).

Partners

Those tasked with a given action are denoted by a numeric code in this column. This does not imply a legal obligation. Partners are indicated by numerals as follows:

1. Baltimore County EPS,
2. Gunpowder Valley Conservancy (GVC), and
3. Bird River SWAP Implementation Committee.

Table A- 1: Bird River Action Strategies

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
RESTORATION ACTIONS							
Nutrient Reductions							
1 4	1,2 1	Continue municipal road maintenance street sweeping activities; investigate the 4 neighborhoods recommended for street sweeping to implement activities and/or adjust frequency as needed	2.6 miles of road identified; Existing Operations – bulk removal rates reported	On-going	Pounds removed	Existing staff	1
1 2	1,2,4,6 3	Develop a community awareness program which discusses the impacts of nutrients to the watershed, Gunpowder River and Chesapeake Bay	Community awareness work plan developed	2 years	Awareness program developed	Existing staff	1, 2
1 3	1,5 1	Continue to meet the requirements of the consent decree for the elimination of sanitary sewer overflows	Status report	On-going	Status Report	Existing staff	1
Stormwater Management							
1 3	1,2,6 1	Investigate and convert existing dry detention ponds identified for water quality treatment (among the 20 sites investigated)	15 existing detention ponds identified as having physical expansion x 100% projected participation = 15 conversions	10 years	3 conversions per 2 year period	$3,200 per acre	1
1 3	1,2,6 1	Work with institutional partners and to reduce impervious cover at the 8 institutional sites identified	Maximum potential of 0.4 acre of impervious cover removal identified x 50% participation rate (assumes 50% of acreage) = removal of 0.20 acres	8 years	1 institution per year	$25,000 per acre	1, 2
1 2 3	1,2,6 3 1	Develop and implement a downspout disconnection program; promote redirection of downspouts for downspout disconnection in the 55 recommended neighborhoods	177 acres of impervious rooftop identified x 33% participation rate = 58.4 acres	10 years	Address 6 rooftop acres per year	$152,374/acre	2, 3
1 2 3	1,2,6 3 1	Promote rain barrel and/or rain garden use in the 51 neighborhoods where such actions were recommended	Conduct 10 rain barrel and/or rain garden awareness seminars targeting 5 neighborhoods per event (142 acres of area of impervious rooftop identified x 10% participation rate = 14.2 acres)	10 years	1 event per year	$500 / event	2, 3

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
1 2 3	1,2,6 3 1	Investigate the feasibility of implementing stormwater retrofits to treat runoff from impervious surfaces (parking lots, rooftops) at the 7 hotspots identified as having retrofit potential	7 hotspot sites investigated for feasibility of stormwater retrofits	2 years	Feasible retrofit sites identified	Existing staff	1
1 2 3	1,2,6 3 1	Investigate the feasibility of implementing stormwater retrofits to treat runoff from impervious surfaces (parking lots, rooftops) at the 17 institutional sites identified	17 institutional sites identified as being possible for stormwater retrofits	2 years	Feasible retrofit sites identified	Existing staff	1, 2
1 2 3	1,2,6 3 1	Design and implement stormwater retrofits at all feasible sites	17 Institutions + 7 Hotspots x 50% participation rate = 12 stormwater retrofits	6 years	2 retrofits per year	$3,200 per acre	1, 2
1 3	1,2,6 1	Inspect and maintain stormwater conversions and retrofits	15 conversions + 12 retrofits = 27 projects	10 years	9 inspections per year	Existing staff	1
Urban Tree Cover							
1 2 3	1,2,6 3,4 1	Investigate the feasibility of planting riparian stream buffers on open pervious land	613 acres of open pervious land identified within the 100-foot stream buffer through GIS analysis	2 years	Feasible buffer planting sites identified	Existing staff	1, 2
1 2 3	1,2,6 3,4 1	Reforest stream buffer at feasible sites with a minimum width of 35 feet	613 acres of open pervious land identified in the GIS analysis x 80% participation rate = 490 acres	10 years	Reforest 49 acres per year	$15,000 per acre	1,2
1 2 3	1,2,6 3,4 1	Plant trees on Pervious Area Assessment (PAA) sites, focusing efforts on sites identified as mostly open pervious cover type requiring minimal site preparation; this includes working with MD SHA to plant trees in suitable medians and rights-of-way	70 acres of PAA sites x 50% = 35 acres	10 years	Reforest 3.5 acres per year	$6,000 per acre	1,2
1 2 3	1,2,6 3,4 1	Encourage street and open space tree planting in the 49 recommended neighborhoods	Maximum potential of 7,567 trees x (1 acre/100 trees) = 75.7 acres x 50% participation rate = 37.9 acres (or 3,790 trees)	10 years	Plant 379 trees per year	$175 per tree	1,2,3

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
1 2 3	1,2,6 3,4 1	Encourage institutions to plant trees on available open space at the 31 sites identified	Maximum potential of 666 trees x (1 acre/100 trees) = 6.7 acres x 66% participation rate = 4.4 acres (or 440 trees)	10 years	Plant 44 trees per year	$175 per tree	1,2,3
1 3	1,2,6 1	Baltimore County shall continue to require riparian buffers and forest conservation for all new and re-development	On-going, keep track of existing riparian buffer and forest preserved	On-going	Acres preserved	Existing staff	1
1 2 3	1,2,6 3,4 1	Maintain trees planted at reforestation/tree planting sites	Tree maintenance (watering, mowing, weeding, etc.) is required for the first 5 years to ensure successful growth; projected number of acres to be reforested = 567.3 acres	5 years	Maintain 567.3 acres per year	$1300 per acre per year	1,2,3
2 3	3 1	Improve forest habitat by organizing exotic invasive species removal activities every year	Organize 1 exotic species removal activity addressing 1 acre per year	10 years	Exotic species removed from 1 acre per year	$500 per year	2,3
1 3	1,2,6 1	Support the state's No-Net-Loss of Forest Policy	On-going, keep track of existing forest coverage; prioritize forest conservation; off-set all forest losses	On-going	Stabilization of the rate of loss by 2020 with the goal of maintaining the County's existing forest coverage	Existing staff	1
Trash Management							
1 2 3 4	2,6 3 1 1,2,3	Develop a trash and litter management work plan	Work plan developed	2 years	Plan completed	Existing staff	1
1 2 3 4	2,6 3 1 1,2,3	Investigate hotspots and institutions identified as having trash management related problems and/or recommended for future education for enhancing trash management, and identify areas where additional trash cans, covered receptacles, and/or better maintenance measures are needed; enforce additional measures and better maintenance where necessary	16 hotspots and 11 institutions with trash management problems identified, schedule site visits to discuss/review trash management solutions	5 years	Perform 5-6 site visits per year	Existing staff	1

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
2 4	3 1	Implement recycling and add separate receptacles for recycling on public properties such as parks and county-owned golf courses	Add recycling receptacles at public parks, county-owned golf courses, and other feasible sites	5 years	Recycling implemented at feasible sites	Existing staff	1
2 3 4	3 3 1,2,3	Post no dumping signs in problem areas identified and enforce no dumping	Signs posted at 15 hotspots, 5 institutions, and 5 neighborhoods (25 locations total) identified as having trash management/dumping issues	2 years	Post 15 signs per year	$40 per sign	1
2 3 4	3 1 1,3	Investigate potential for installing a trash boom on mainstem Bird River	Follow up on Bird River SWAP Committee's request for a trash boom on Bird River and determine if appropriate	2 years	Feasibility for trash boom determined	Existing staff	1,3
Stream Corridor Restoration							
1 3	1,2 1	Evaluate the restoration potential and feasibility of restoring eroded stream banks and channel alterations identified in the stream corridor assessments	Identify feasible restoration projects within the 5.89 miles of stream with eroding/unstable banks	2 years	Feasible restoration projects identified	Existing staff	1
1 3	1,2,6 1	Conduct a follow up inspection of the outfalls rated as potentially severe or severe-moderate issues identified during outfall screening in the Illicit Discharge and Elimination Program	2 outfall locations rated as Priority 1 (Critical) and 9 outfall locations rated as Priority 2 (High) = 11 locations total	3 years	Conduct 3-4 inspections per year	Existing staff	1
1 3	1,2 1	Complete stream restoration identified in the stream corridor assessments where feasible	Stabilize and restore 85% (5.0 miles/26,400 linear feet) of unstable streams in the Bird River watershed to provide water quality improvement	10 years	2,640 Ln ft per year	$350 / Ln ft	1
2 3	3,4 All	Continue to promote and organize water chestnut removal events	Annual or biennial events where state and local agencies, as well as community groups and citizen volunteers join together for removal of the exotic invasive water chestnut	10 years	1-2 events per year	Existing staff	1,2,3

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
OUTREACH & AWARENESS							
1 2 4	1,2,3,6 2 1,2	Distribute pollution prevention information to facilities falling within hotspot categories identified in watershed and provide guidance/workshops; include working with business partners to cut off stream access in areas with dumping issues and encourage them to keep parking lots free of trash and debris	29 potential hotspot sites assessed; Categories identified: Business centers, industrial services, and commercial services; Conduct 4 workshops and distribute outreach material	10 years	Conduct 1 workshop every 2 years	$500 /workshop	1,2,3
1 2 3	1 3 1	Develop a community outreach campaign to raise awareness about homeowner actions aimed towards nutrient reduction	Publicize several actions in E-News Stream and other media, and at environmental events	On-going	4 announcements per year	Existing Staff	1,2,3
1 2 4	1,2,6 3 1,2	Form partnerships with institutions and discuss the best management practice (BMP) recommendations from the institutional assessments and implementation options; include implementing/enhancing recycling programs on their properties	17 institutions assessed with potential for stormwater management retrofit	5 years	3-4institution meetings per year	Existing staff	1,3
1 2 4	1,2,6 3 1,2	Work with community groups to install storm drain markers in the 88 recommended neighborhoods.	Mark storm drains in 22 of the 88 potential neighborhoods identified	10 years	2 neighborhoods per year	$400 /neighborhood	2,3
1 2	1,2,6	Work with the institutional sites to install storm drain markers at the 25 recommended sites	Mark storm drains at the 25 institutional sites identified	10 years	2-3 institutions per year	$400 /institution	1,2,3
2 4	All 1,2	Develop and implement signs and educational material for a recycling campaign in the watershed	Develop signs and post throughout watershed	3 years	Develop material, post signs	Existing staff	1,3
2	All	Implement trash and litter management work plan	Submit in the NPDES Report the progress toward implementing the trash and litter work plan	5 years	Annual	Existing staff	1

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
2 4	3 All	Encourage institutional partners, community groups, and patrons of public properties to sign and support a trash treaty (a pledge to implement strategies aimed at reducing litter and promoting awareness on the effects of pollution)	Have sign-up events	10 years	1 sign-up event per year	Existing staff	1,3
1	1	Encourage and support community education and signage in the 16 neighborhoods identified as having issues with pet waste	16 neighborhoods identified as having trash management issues	5 years	1 community cleanup per year	Existing staff	1,2,3
1 3 4	4 1 3	Encourage and support waterway cleanups in streams	Conduct at least three waterway cleanups per year; cost includes supplies and tire removal	10 years	3 waterway cleanups per year	$1000 per cleanup	1,2,3
2	3	Conduct a tour of a completed water quality project/BMP on public property	Conduct two tours of completed watershed restoration projects (e.g., stormwater retrofit, stormwater conversion)	10 years	1 tour per 5 years	Existing staff	1
2	1,3	Using various media, develop and distribute information about public access points along the Bird River for recreational purposes	Distribute information to the public on access points.	10 years	1 per year	Existing staff	1,2,3
2	3	Increase public awareness about the Bird River SWAP (in an easily digestible format) and promote awareness about the extent of and connection to the Bird River watershed	SWAP Implementation Committee to design a messaging campaign (including pamphlet about the SWAP and signs to inform people they are entering or within the Bird River watershed, as well as a strategy for distribution and placement)	2 years	Design, creation and distribution/posting of pamphlets and signs	Existing staff	1,2,3
1	1,2	Encourage lawn reduction and promote Bayscaping in the 47 neighborhoods identified	Conduct 10 Bayscaping awareness events targeting 5 recommended neighborhoods per event (949 acres of lawn identified for Bayscaping x 5% participation rate = 47.5 acres)	5 years	2 events every year	$500 per event	2,3
2	3	Direct some of the outreach and education events to areas that are presently still in good condition and use those	Pursue education and outreach efforts within the high priority	10 years	1 event per year in each of the top	Cost already noted above	2,3

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
3	1	opportunities to inform residents of their ability to prevent impairment/degradation of the healthy resources in their area	"Protection Subwatersheds" listed in Section 4.2.12 of SWAP Report		three priority protection subwatersheds (total of 3 events per year)		
1 2 3	1,2,3,4 3 1	County to help facilitate meeting between Bird River Implementation Committee, GVC and appropriate agricultural agencies to determine ways interested parties may help support and cooperate in efforts to implement conservation practices on agricultural lands	Meeting held where strategies and goals for supporting conservation practices on agricultural lands are discussed and documented	2 years	Meeting with appropriate agricultural agencies	Existing staff	1,2,3
2	3	GVC to help facilitate a meeting between Bird River SWAP Implementation Committee and Clear Creeks representatives	Meeting held where productive and successful strategies used by Clear Creeks may be shared with Bird River SWAP Implementation Committee in order to help guide the Committee as they begin working towards achieving the Bird River SWAP goals	1 year	Meeting held with Clear Creeks group	Existing staff	2,3
1 2	1,2,6 3	SWAP Implementation Committee to make contact with White Marsh Mall and invite their participation on the Implementation Committee and/request their support for various initiatives	Encouraging and securing the participation of White Marsh Mall in the SWAP	1 year	Develop contact within White Marsh Mall and invite the Mall's participation	Existing staff	2,3
1 2	2 2,3	Inform residents about programs to replace failing bulkheads with living shorelines	Outreach performed to all waterfront landowners regarding the living shorelines program	2 years	Information provided to waterfront residents	Existing staff	1
MONITORING							
1	1,2,5,6	Continue to remove illicit connections when discovered through the Illicit Connect Program	As per NPDES Permit, perform 150 screenings county-wide per year	On-going	Reported annually in NPDES Permits	Existing staff	1

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
1	1,2,5,6	Continue the illicit connection monitoring at the major outfalls in the watershed and complete one inspection at each of the minor outfalls	45 major outfall locations and 225 minor outfall locations = 270 outfall inspections	10 years	27 outfalls per year	Existing staff	1
1 2 2 4	All 3 1,4 3	Continue to implement the citizen-based stream watch program to increase the ability to monitor/identify sources of water quality and habitat degradation	Promote watershed awareness and additional identification on sources of impairment, and potential restoration locations	10 years	Number of stream watcher volunteers	Existing staff	1,2,3
1	1,2,6	Conduct periodic inspection of BMPs and provide on-going maintenance to assure their continued proper functioning	Assure that each facility is inspected every 3 years	On-going	Inspections completed	Existing staff	1
3	1	Continue probabilistic biological monitoring program	Biological monitoring stations in the Bird River watershed are monitored in odd-numbered years – report produced	Odd-numbered years	Stations monitored, report produced	Existing staff	1
1 2	1,2,6 2	Work with teachers to develop meaningful watershed environmental education (MWEE) activities for students at Baltimore County public schools	4 public schools identified as having education opportunities for possible BMP monitoring (among other potential action opportunities at these sites)	10 years	1 school every 2 .5 years	Existing staff	1,2,3
1 2 3	1,2 3 1	Encourage improved communication and cooperation between MDE, SHA and the County to increase monitoring and enforcement of applicable regulations for road construction projects and lessen their impacts on the Bird River	Improved/increased inspections and follow-up on complaints/issues noted by the County and local residents	On-going	Update at each Implementation Committee Meeting regarding outcomes of inspections and follow-up visits	Existing staff	1,3
1	3,6	County to inform Implementation Committee, or list it as an interested party with Development and Review, so the Committee receives notification of potential development or re-development within the watershed	SWAP Implementation Committee informed early in the Development and Review process of new development/re-development plans so they may inject strong community feedback into the process	On-going	Committee informed of proposed development in Bird River watershed	Existing staff	1,3
FUNDING							
1	1	Coordinate grant funding requests to secure funding and implement restoration projects to meet TMDL nutrient reduction requirements	Seek a minimum of 1 grant per year to meet the TMDL requirements within 10 years	10 years	1 grant proposal per year	Existing staff	2,3

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
1 2 3	1,2,3,4 3 1	Support Soil Conservation District (SCD) and their ability to reduce pollution from agriculture lands and increasing Critical Area enforcement by supporting increased funding and staffing within State budget	Increase in number of staff within Soil Conservation District office	On-going	Contacting local legislators regarding State budget priorities	Existing staff	2,3
1 2	1,2 3	Increase applications for the Baltimore County – Green Building Tax Credit Program	Provide incentive for landowners to install BMPs to address water quality and habitat	5 years	# of applications	Existing staff	1,2,3
REPORTING							
All	All	Bird River SWAP Implementation Committee will meet to discuss implementation progress and assess any changes needed to meet the goals	Meet on a semi-annual basis	10 years	2 meetings per year	Existing staff	3
All	All	Coordinate restoration activities between and among Baltimore County and GVC	Documented in NPDES annual report	On-going	NPDES annual report	Existing staff	1,2
1	5	Designate county personnel to provide updates to the SWAP Implementation Committee on the status of the consent decree projects for sewer infrastructure repair	Present updates at the semi-annual SWAP Implementation Committee meetings	10 years	2 meetings per year	Existing staff	1
All	All	Produce State of Our Watersheds report	Report is produced biennially	2 years	Report is produced every 2 years	$11,000 per 2 years	1
All	All	Track progress toward meeting TMDL reduction requirements using GIS and other data tracking tools	Track progress using system similar to that being used for similar SWAPs (e.g., Northeastern Jones Falls, Bird River, Middle Gwynns Falls, etc.)	2 years	Annual update to Bird River SWAP Implementation Committee	Existing staff	1,3
1 2 3 4	1,2,6 1,2,3 All All	Update the status of citizen-based restoration projects and BMPs	Provide update of progress made in annual NPDES report	On-going	NPDES annual report	Existing staff	1,2
1	All	Continue to update status of county	Provide update of progress made in	On-going	NPDES annual	Existing staff	1

Goal	Objective	Action	Basis for Performance Measure	Timeline	Performance Measure	Unit Cost	Partners
2 3 4	1,2,4 All All	capital budget restoration projects and BMPs	annual NPDES report		report		

APPENDIX B: U.S. ENVIRONMENTAL PROTECTION AGENCY A THROUGH I CRITERIA FOR WATERSHED PLANNING

U.S. Environmental Protection Agency
A Through I Criteria for Watershed Planning

Background

EPA's Section 319 Grant program was established to provide funding for efforts to reduce nonpoint source (NPS) pollution, including that which occurs though stormwater runoff. The EPA provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns.

Section 319 funds may be used to demonstrate innovative best management practices (BMPs), support education and outreach programs, establish TMDLs for a watershed, or to restore impaired streams or other water resources. 303(d) listed waters approved by the EPA are the top priority for incremental funds.

The EPA requires that nine elements (labeled "a" though "i") be included in a watershed plan for impaired waters funded using Section 319 funds. Although there is no formal requirement for EPA to approve watershed plans, the plans must address the nine elements discussed below if they are developed in support of a section 319-funded project. Below, we review how the development of the Bird Small Watershed Action Plan addresses each of the nine elements.

Addressing the Nine Elements for the Bird River Watershed

The County's progress in addressing the nine elements ("a" thru "i") required for 319 funding is described below:

a) ***Causes of Impairment:*** *Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. Sources that need to be controlled should be identified at the significant subcategory level along with estimates of the extent to which they are present in the watershed.*

   This element will usually include an accounting of the significant point and nonpoint sources in addition to the natural background levels that make up the pollutant loads causing problems in the watershed. If a TMDL exists, this element may be adequately addressed. (EPA 2008)

Impairments to Chesapeake Bay are well recognized and are being addressed by multiple agency efforts under the Chesapeake Bay TMDL for nitrogen, phosphorus, and sediment. There are no watershed-specific impairments listed for the area covered by the Bird River SWAP.

Section 1.3.1 of the SWAP contains further information on the Chesapeake Bay TMDL, a copy of which is in the Appendix I of the Characterization Report (Appendix E). Chapter 3 of the Characterization Report includes estimates of pollutant loads.

b) ***Estimate Load Reductions:*** *On the basis of the existing source loads estimated for element "a" above, you will similarly determine the reductions needed to meet the quality standards. You will then identify various management measures (see*

element "c" below) that will help to reduce the pollutant loads and estimate the load reductions expected as a result of these management measures to be implemented, recognizing the difficulty in precisely predicting the performance of management measures over time. In cases where a TMDL for affected waters has already been developed and approved or is being developed, the watershed plan should be crafted to achieve the load reductions called for in the TMDL. (EPA 2008)

Expected nitrogen and phosphorus load reductions were calculated based on Maryland Assessment Scenario Tool (MAST) load reduction criteria. These load reduction criteria are presented in Appendix D. The nitrogen, phosphorus, and sediment load reductions for the various proposed actions in the Bird River watershed were calculated and summarized in Chapter 3 of the SWAP.

Estimated load reductions needed are as follows:

- Reduce annual Total Nitrogen (TN) and Total Phosphorus (TP) loadings from urban land in the Bird River SWAP area by 32.2% and 47.0% respectively to meet the requirements of the Chesapeake Bay TMDL.

MAST (CBP-approved) BMP removal efficiencies are summarized in the tables included as Appendix D. These pollutant removal efficiencies will continue to be used to measure progress in meeting the nutrient TMDL reduction goal. Actions and associated pollutant load reductions will be reevaluated if CBP revises/updates pollutant removal efficiencies within the 10-year timeframe to ensure that the TMDL reductions are met.

c) ***Description and location of NPS management measures:*** *A description of the NPS management measures that will need to be implemented to achieve load reductions, and a description of the critical areas in which those measures will be needed to implement this plan. This description should be detailed enough to guide implementation activities and can be greatly enhanced by identifying on a map priority areas and practices.* (EPA 2008)

This Small Watershed Action Plan, by definition, identifies strategies for bringing a small watershed into compliance with water quality criteria. The strategies employed in this SWAP include a combination of government capital projects, actions in partnership with local watershed associations, citizen awareness campaigns and volunteer activities. Chapter 3 summarizes restoration strategies/NPS management measures. Specifically, information on the achievement of the phosphorus and nitrogen reduction goals is provided in Section 3.4. Chapter 4 specifies implementation locations, by subwatershed, detailing management measures recommended for each subwatershed in the SWAP study area. The management measures that will need to be implemented to achieve the goals are detailed further in Appendix A.

Note that the projected, practicable implementation of proposed restoration BMPs, shown in Table 3-17, will just barely meet the 32.2 reduction for nitrogen, and will exceed the 47.0%t reduction for phosphorus loads needed to meet water quality standards for the Bird River watershed as specified by Chesapeake Bay TMDL for nutrients (Appendix E).

Greater reductions may also be achieved through restoration actions not included in this analysis such as public education/outreach efforts (e.g., watershed trash and recycling

campaign and tours of completed projects). However, these types of actions are not included in the pollutant removal analysis because reductions efficiencies are not well known and difficult to estimate.

d) ***Estimate of the amounts of technical and financial assistance*** *needed associated costs, and/or the sources and authorities that will be relied upon to implement this plan. This includes implementation and long-term operation and maintenance of management measures, information/education activities, monitoring, and evaluation activities. You should also document which relevant authorities might play a role in implementing the plan. Plan sponsors should consider the use of federal, state, local, and private funds or resources that might be available to assist in implementing the plan. Shortfalls between needs and available resources should be identified and addressed in the plan. The estimate of financial and technical assistance should take into account the following* (EPA 2008)*:*

- *Administration and management services, including salaries, regulatory fees, and supplies, as well as in-kind services efforts, such as the work of volunteers and the donation of facility use;*
- *I/E efforts;*
- *The installation, operation, and maintenance of management measures; and*
- *Monitoring, data analysis, and data management activities.*

Appendix A details the anticipated cost for each action on an annual or unit basis and details the organizations that will be responsible for implementation of the each action. Appendix C provides a cost analysis and anticipated funding sources to implement the actions.

Baltimore County's NPDES program generally, as well the program infrastructure needed to implement this SWAP, is already well-established as demonstrated by previously completed technical Water Quality Management Plans, such as the 1995 Bird River Plan, which this effort builds upon. Additionally, Bird River watershed partners have worked together over the past year, conducting assessments, identifying restoration opportunities, and engaging the community, in order to build a successful SWAP.

A Bird Steering Committee, consisting of various watershed partners, was formed to develop the Bird River SWAP. This includes Baltimore County EPS and Department of Planning personnel, Gunpowder Valley Conservancy, staff from Maryland Department of Natural Resources, staff from University of Maryland Sea Grant Extension, Blue Water Baltimore, and various community associations and concerned citizens. The Steering Committee met regularly throughout the SWAP development and will form the basis for a similar group to carry out SWAP implementation.

e) ***An information and education component*** *used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented*. (EPA 2008)

The participation of citizens in watershed restoration is an essential part of the SWAP process. Citizen participation is critical to the implementation and long-term maintenance of restoration activities. Three citizen stakeholder meetings were held as part of the SWAP

process (see Chapter 1). Key citizen-based strategies proposed for restoring Bird River including nutrient management, lawn maintenance education, Bayscaping, downspout disconnection, tree planting, stream buffer management (see Chapter 3). This demands continued participation by citizen stakeholders. Specific strategies by subwatershed which include an information and education component are detailed in Chapter 4. Outreach and awareness components by action are detailed in Appendix A.

f) ***Schedule for implementing the NPS management measures*** *identified in this plan that is reasonably expeditious. The schedule should reflect the milestones you develop in measure "g".* (EPA 2008)

Each action strategy listed in Appendix A has a timeline and where appropriate, a temporal performance measure. It is anticipated that the restoration will require a 10-year timeframe. Some actions have a shorter time frame based on sequencing of actions, or on the urgency of the actions. However, most management measures have annual performance measures that will determine if the restoration is on pace to be completed within the time frame. The limitations on the pace of the implementation include staffing, and funding. Increases in staffing and funding will be used to accelerate the restoration timeline. Chapter 5 presents an adaptive management approach to implementation.

g) ***A description of interim measurable milestones*** *for determining whether NPS management measures or other control actions are being implemented. These milestones will measure the implementation of the management measures, such as whether they are being implemented on schedule, whereas element h (see below) will measure the effectiveness of the management measures, for example, by documenting improvements in water quality. (EPA 2008)*

Actions will be organized into two year milestones, with the first interval being July 1, 2014 - June 30, 2016, and the final interval being July 1, 2022 – June 30, 2024. Additionally, most action strategies (listed in Appendix A) have an associated time-sensitive performance measure. Additionally each will be evaluated on an annual basis and may be modified and/or new actions may be proposed based on this annual evaluation. New actions proposed will also be evaluated on an annual basis and modified as necessary to meet watershed goals and objectives and if new TMDLs are approved.

Chapter 5 provides a plan for evaluation of NPS management measures implementation. This includes formation of The Bird River SWAP Implementation Committee which will meet twice per year to assess progress in meeting watershed goals and objectives and generation of an annual progress report. A biennial report on water quality monitoring results will be produced as well.

Additionally, Baltimore County intends to track implementation of the SWAP using a Geographic Information System (GIS), which will allow the County to record and map all actions taken per the SWAP. The data generated from the GIS will be provided to the Bird River SWAP Implementation Committee to assess annual progress through a comparison between completed restoration activities and the performance measures detailed in Appendix A. Pollutant load reductions that have been achieved through implementation of various restoration projects will also be calculated and tracked.

h) ***A set of criteria that can be used to determine whether loading reductions are being achieved*** *over time and substantial progress is being made toward attaining water quality standards (WQS). The criteria in element h (not to be confused with water quality criteria in state regulations) are the benchmarks or waypoints to measure against through monitoring. These interim targets can be direct measurements (e.g., fecal coliform concentrations) or indirect indicators of load reduction (e.g., number of beach closings). You should also indicate how you'll determine whether the watershed plan needs to be revised if interim targets are not met. (EPA 2008)*

Appendix A gives a "performance measure" which describes how the success/completion of a given action will be measured. In many cases, it is the numeric basis of the performance measure divided by the proposed timeline.

Current pollutant load reduction scenarios and calculations for proposed actions are presented in Chapter 3. These are mainly based on CBP-approved, pollutant removal efficiencies for various nonpoint source BMPs used in the Maryland Assessment Scenario Tool (MAST). These pollutant removal efficiencies will continue to be used to measure progress in meeting the nutrient TMDL reduction goals. Actions and associated pollutant load reductions will be reevaluated if CBP revises/updates pollutant removal efficiencies within the 10-year timeframe to ensure that the nutrient TMDL reductions are met.

As mentioned in element "g" above, the Bird River SWAP Implementation Committee will generate a biennial report on water quality monitoring results and action strategies will be modified as required to respond to a lack of substantial progress and/or new TMDL.

i) ***A monitoring component*** *to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item h immediately above. The monitoring component should be designed to determine whether loading reductions are being achieved over time and substantial progress in meeting water quality standards is being made. (EPA 2008)*

Chapter 5 details the monitoring that will occur to evaluate the effectiveness of implementation. The monitoring results will be compared to the predicted load reductions determined under item (h), above. Baltimore County conducts chemical, biological, and illicit connection monitoring within the Bird River watershed which are appropriate for measuring changes in loading. Additional monitoring is anticipated in order to assess the effectiveness of restoration projects and progress in meeting nutrient TMDL reductions. Current applicable monitoring is described in detail in Chapter 3.4 of the Watershed Characterization Report (Appendix E) and listed below:

- County Trend Chemical Monitoring Program – 3 sampling locations (Windlass Run, Honeygo Run, and Whitemarsh Run), measuring total suspended solids (TSS), nutrients, metals, and chloride;
- County Recreational Water Sampling Program - 6 sampling locations in freshwater and tidal portions of Patapsco River to measure bacteria levels;
- County Biological Monitoring Program – Randomly selected locations in the Bird River watershed using characteristics of benthic macroinvertebrates as a water quality indicator; and

- Illicit Discharge Detection and Elimination Program – Routine outfall screening and prioritization system to track and reduce illicit connections and discharges.

Project specific monitoring will be identified as restoration progresses. It will not be possible to monitor all restoration projects due to the number of actions proposed. Project specific monitoring will target activities with limited data regarding removal efficiencies such as lawn care education. Subwatershed monitoring will measure overall improvement in water quality as a result of multiple restoration activities within a subwatershed. This will also be developed as restoration progresses.

Monitoring activities will be coordinated among SWAP participants (e.g., Baltimore County, Maryland DNR, and GVC) through participation in the Bird River SWAP Implementation Committee. There is potential to coordinate a citizen-based stream watch program since the existing water quality monitoring stations are limited in the Bird River watershed.

APPENDIX C: COST ANALYSIS AND POTENTIAL FUNDING SOURCES

Cost Analysis and Potential Funding Sources

This appendix presents cost estimates and potential funding sources for the implementation of proposed restoration BMPs in the Bird River SWAP. Each is described below. The cost analysis is based on the actions detailed in Appendix A. Cost estimates are summarized in Tables C-1 and C-2.

Table C-1 presents cost estimates based on the maximum implementation scenario described in Chapter 3. Table C-2 presents costs estimates based on the projected participation rates needed to achieve the reduction in nutrient loads and sediment from urban runoff, also described in Chapter 3.

For both scenarios, estimates provided are in current dollars and represent total cost estimates for the anticipated 10-year implementation timeframe. Unit costs are based on a combination of local information and previous SWAPs completed for other local watersheds (e.g., Upper Back River, Tidal Back River, and Lower Patapsco River). BMP costs are not annualized over the 10-year implementation timeframe and do not include costs of existing staff. Costs are also presented in dollars per pound of nitrogen, phosphorus, and TSS removal for those BMPs where pollutant removal calculations were possible (refer to Chapter 3). This provides an additional tool for the assessment and selection of BMPs.

The total cost of implementation exclusive of staffing costs is approximately **$48,226,894** for maximum implementation and **$29,888,909** based on projected participation rates. This does not include cost associated with sanitary sewer overflow prevention.

Potential Funding Sources

Funding sources for the implementation of the Bird River SWAP include local government funding for Baltimore County, monetary and time contributions to the Bird River SWAP Implementation Committee, and various grants as described below. Baltimore County uses general funds to support staff, whose responsibility is to monitor and improve water quality through implementation of various programs including capital restoration projects. Baltimore County has a Waterway Improvement Capital Program that is funded by a combination of general funds and bonds. Approximately $4 million per year is allocated for various restoration projects throughout the county. The capital budget is projected for six years, with a two-year cycle for changes. The Bird River watershed as a whole currently has $1.1 million allocated for restoration projects over the six-year period. Baltimore County provides grants to local watershed organizations through its Watershed Association Citizen Restoration Planning and Implementation Grant Program. These funds provide staffing for restoration project implementation and education and outreach programs.

In order to implement all of the actions listed in Appendix A and to meet the anticipated funding needs summarized in Table C-2, additional funding from grants will be required. Table C-3 presents potential funding sources to support the implementation of the Bird River SWAP including funding source, applicant eligibility, eligible projects, funding amount, cost share requirements, and grant cycle. The anticipated major grant funding sources include the following:

- **The Chesapeake and Atlantic Coastal Bays Trust Fund (Trust Fund):** Established during the 2008 Legislative Session by Senate Bill 213 to provide financial assistance to local governments and political subdivisions for the implementation of nonpoint source pollution control projects. These are intended to achieve the state's tributary strategy developed in accordance with the Chesapeake 2000 Agreement and to improve the health of the Atlantic Coastal Bays and their tributaries. The BayStat Program directs the administration of the Trust Fund, with multiple state agencies receiving moneys from the Trust Fund, including Maryland Department of Environment (MDE), Department of Natural Resources (DNR), Maryland Department of Agriculture (MDA), and Maryland Department of Planning (MDP).

- **319 Non-point Pollution Grants:** Approximately $1,000,000 of federal money for restoration implementation is available annually through MDE.

- **Bay Restoration Fund (MDE):** The Bay Restoration Fund offers financial assistance to local governments for voluntary stream and creek restoration projects that improve water quality and restore habitat. Funds are targeted to seriously degraded water bodies in Maryland. Types of projects funded include: stream channel reconstruction, stream bank stabilization, vegetative buffers, wetlands creation, treatment of acid mine drainage, and dredging.

- **Stormwater Pollution Control Cost Share Program (MDE):** The Maryland Stormwater Pollution Control Cost-Share Program provides grant funding for stormwater management retrofit and conversion projects in urban areas developed prior to 1984. These projects reduce nutrients, sediments and other pollutant loads entering the state's waterways through the use of infiltration basins, infiltration trenches, vegetated swales, extended detention ponds, bioretention basins, wetlands and other innovative structures.

- **Innovative Nutrient and Sediment Reduction Program (National Fish and Wildlife Foundation):** The National Fish and Wildlife Foundation (NFWF), in partnership with U.S. Environmental Protection Agency (USEPA) and the Chesapeake Bay Program, will award grants on a competitive basis of between $200,000 and $1,000,000 each to support the demonstration of innovative approaches to expand the collective knowledge about the most cost effective and sustainable approaches to dramatically reduce or eliminate nutrient and sediment pollution to the Chesapeake Bay and its tributaries.

- **Chesapeake Bay Stewardship Fund:** The goal of the Chesapeake Bay Stewardship Fund is to accelerate local implementation of the most innovative, sustainable and cost effective strategies to restore and protect water quality and vital habitats within the Chesapeake Bay watershed. The Stewardship Fund offers four grant programs: the Chesapeake Bay Small Watershed Grant Program, the Chesapeake Bay Targeted Watersheds Grant Program, the Chesapeake Bay Conservation Innovation Grant Program and the Innovative Nutrient and Sediment Reduction Program. Major funding for the Chesapeake Bay Stewardship Fund comes from the USEPA, the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the U.S. Department of Administration (NOAA).

- **MD State Highway Administration (SHA) Transportation Enhancement Program (TEP):** This is a reimbursable, federal-aid funding program for transportation-related community projects designed to strengthen the intermodal transportation system. The

TEP supports communities in developing projects that improve the quality of life for their citizens and enhance the travel experience for people traveling by all modes. Among the qualifying TEP categories is environmental mitigation to address water pollution due to highway runoff or to reduce vehicle-caused wildlife mortality while maintaining habitat connectivity.

- **Chesapeake Bay Trust:** Provides grants through a variety of grant programs that focus on environmental education, urban greening, fisheries, and remediation of water quality issues. Specifically the Targeted Watershed Grant Program provides funding for on-the ground solutions that address the most pressing nonpoint source pollution challenges facing a small watershed, and that result in measurable improvements in water quality and wildlife habitat. The program also seeks to support cost effective approaches to Chesapeake Bay restoration actions at the small watershed scale and establish a replicable model of restoration that can be transferred and used throughout the region.

Table C-1. Maximum Estimated Costs for Bird River SWAP Implementation

BMP or Action	Cost	Unit	Projected	Quantity	Proj. Total Cost	Proj. TN Load Reduction (lbs/year)	Proj. Cost/ lb of TN Removal*	Proj. TP Load Reduction (lbs/year)	Proj. Cost/lb of TP Removal*	Proj. TSS Load Reduction (lbs/year)	Proj. Cost/lb of TSS Removal*
Dry pond Conv.	$3,200	/acre	225	acres	$720,000	727	$990.37	156	$4,615.38	88,884	$8.10
Stormwater Retrofits: Bioretention	$3,200	/acre	20.9	acres	$66,880	86.4	$774.07	16.9	$3,957.40	8,052	$8.31
Stream Buffer Reforestation (pervious areas)	$15,000	/acre	613	acres	$9,195,000	3,676	$2,501.36	296	$31,064.19	98,523	$93.33
Pervious Area Reforestation	$6,000	/acre	63	acres	$378,000	274	$1,379.56	13	$29,076.92	3,501	$107.97
Stream Corridor Restoration	$350	/Linear foot	31,074	ft	$10,875,900	6,215	$1,749.94	2,113	$5,147.14	1,685,765	$6.45
Downspout Disconnection	$152,374	/acre	177	acres	$26,970,198	819	$32,930.64	148	$182,231.07	90,217	$298.95
Neighborhood Tree Plantings	$175	/tree	76	acres	$13,300	329	$40.43	16	$831.25	4,203	$3.16
Institution Tree Plantings	$175	/tree	0.66	acres	$116	29	$3.98	1.41	$81.91	370	$0.31
Bayscaping Education	$500	/event	15	Events	$7,500	**	**	**	**	**	**
Street Sweeping	***	/mile	95	Miles	***	132	***	53	***	52,728	***
				Total:	**$48,226,894**						

* This projected cost is for the first year. Cost per pound removed decreases for every subsequent year the device is functioning.

** Removal efficiencies for BayScaping have not been set and incorporated into MAST at this time, so estimated load reductions could not be calculated.

*** Street sweeping does not add to the cost of the SWAP Implementation. It is assumed that existing Baltimore County staff would be responsible for the action, and therefore not additional cost would be incurred.

Table C-2. Projected Estimated Costs for Bird River SWAP Implementation

BMP or Action	Cost	Unit	Projected	Quantity	Proj. Total Cost	Proj. TN Load Reduction (lbs/year)	Proj. Cost / lb of TN Removal*	Proj. TP Load Reduction (lbs/year)	Proj. Cost/lb of TP Removal*	Proj. TSS Load Reduction (lbs/year)	Proj. Cost/lb of TSS Removal*
Dry pond Conv.	$3,200	/acre	225	acres	$720,000	727	$990.37	156	$4,615.38	88,884	$8.10
Stormwater Retrofits: Bioretention	$3,200	/acre	10.45	acres	$33,440	43.2	$774.07	8.46	$3,952.72	4,026	$8.31
Stream Buffer Reforestation (pervious areas)	$15,000	/acre	490	acres	$7,350,000	2,941	$2,499.15	237	$31,012.66	78,819	$93.25
Pervious Area Reforestation	$6,000	/acre	31.5	acres	$189,000	137	$1,379.56	6.68	$28,293.41	1,750	$108.00
Stream Corridor Restoration	$350	/Linear foot	36,413	ft	$12,744,550	5,283	$2,412.37	1,796	$7,096.07	1,432,900	$8.89
Downspout Disconnection	$152,374	/acre	58	acres	$8,837,692	270	$32,732.19	49	$180,361.06	29,772	$296.85
Neighborhood Tree Plantings	$175	/tree	38	acres	$6,650	165	$40.30	8	$831.25	2,102	$3.16
Institution Tree Plantings	$175	/tree	0.44	acres	$77	19	$4.05	0.93	$82.80	244	$0.32
Bayscaping Education	$500	/event	15	Events	$7,500	**	**	**	**	**	**
Street Sweeping	***	/mile	95	Miles	***	132	***	53	***	52,728	***
				Total:	**$29,888,909**						

* This projected cost is for the first year. Cost per pound removed decreases for every subsequent year the device is functioning.

** Removal efficiencies for BayScaping have not been set and incorporated into MAST at this time, so estimated load reductions could not be calculated.

*** Street sweeping does not add to the cost of the SWAP Implementation. It is assumed that existing Baltimore County staff would be responsible for the action, and therefore not additional cost would be incurred.

Table C-3: Bird River SWAP Potential Funding Sources

Managing Agency	Funding Source	Application Eligibility	Eligible Projects	Funding Amount	Cost Share / In-Kind	Project Period
American Forests	Global ReLeaf Program (American Forests)	All public lands or public accessible lands Local government State government	Public Lands Restoration Projects which include local organizations; use innovative restorative practices with potential for general application; minimum 20 acre project area	$1 per tree planted	Covers tree planting costs / YES	1 Year
Chesapeake Bay Trust	Targeted Watershed Initiative Grant Program	Non-profits 501(c) Institutions Soil/-Water Conservation Districts Local government	Involve local organizations; address non-point source pollution; projects related to water quality and habitat restoration	$50 to $200,000	0% / YES	1-2 years
Chesapeake Bay Trust	Capacity Building Initiative Grant Program	Non-profit 501(c) with a board on which half the members participate meaningfully and at least one paid staff (or a part-time paid volunteer)	Strengthen an organization through management operations, technology, governance, fundraising and communications	$15,000 per year	0% / YES	3 years
Chesapeake Bay Trust	Stewardship Grant Program	Non-profits 501(c) Schools/universities Soil/Water Conservation Districts Local government State government	Raise awareness about watershed restoration; design plans which educate citizens on things they can do to aid watershed restoration; educate students about local watersheds, projects geared towards watershed restoration and protection	$5,000 to $25,000	0% / YES	1 year

Table C-3: Bird River SWAP Potential Funding Sources (Cont.)

Managing Agency	Funding Source	Application Eligibility	Eligible Projects	Funding Amount	Cost Share / In-Kind	Project Period
DNR	Clean Water Action Plan Nonpoint Source Program 319 Grant	Non-profits 501(c) Universities Soil/Water Conservation Districts Local government State government	Located in a Category I and Category III watershed as outlined in the MD unified watershed assessment; establish cover crops; address stream restoration and riparian buffers	$5,000 to $40,000	40%	Annual
MDE	Bay Restoration Fund	Local Government	Green restoration projects	None specified	50% / YES	None specified
MDE/DNR	Chesapeake and Atlantic Coastal Bays Trust Fund	Non-profits 501(c) Local government	Non-point source best manage-ment practices reducing nitro-gen, phosphorous and sediment	None specified	Unknown	Annual
NFWF	Chesapeake Bay Small Watersheds Grant Program	Non-profits 501(c) Local government	Community-based projects that improve the condition of local watersheds while building stewardship among citizens; watershed restoration, conservation, and planning	$20,000 to $200,000	25%	1-5 years
NFWF	Chesapeake Bay Targeted Watersheds Grant Program	Non-profits 501(c) Universities Local government State government	Innovative demonstration type restoration projects	$ 400,000 to $1,000,000	25% / YES	2-3 years
NRCS	Watersheds Operations Program	Local government State government Tribes	Address watershed protection, flood mitigation, water quality, soil erosion, sediment control, habitat enhancement, and wetland creation and restoration	None specified	Unknown	None specified
USEPA	Targeted Watersheds Grant Program – Capacity Building Grant Program	Non-profits 501(c) Institutions Local government State government	Promote organizational development of local watershed partnerships; provide training and assistance to local watershed groups	$400,000 to $800,000	25% / YES	2 years

Table C-3: Bird River SWAP Potential Funding Sources (Cont.)

Managing Agency	Funding Source	Application Eligibility	Eligible Projects	Funding Amount	Cost Share / In-Kind	Project Period
USEPA	Targeted	Non-profits 501(c)	Watershed restoration and/or	$600,000	25% /	3-5 years

	Watersheds Grant Program – Implementation Grant Program	Universities Local government State government	protection projects (must include a monitoring component)	to $900,000	YES	

APPENDIX D: POLLUTANT REMOVAL EFFICIENCIES FROM THE MARYLAND ASSESSMENT SCENARIO TOOL (MAST)

(Approved by the Chesapeake Bay Program)

Table D-1: Pollutant Removal Efficiencies from MAST*

BMP	Nitrogen Effectiveness (%)	Phosphorus Effectiveness (%)	Sediment Effectiveness (%)
Bioretention/rain gardens - A/B soils, no underdrain	80	85	90
Bioretention/rain gardens - A/B soils, underdrain	70	75	80
Bioretention/rain gardens - C/D soils, underdrain	25	45	55
Bioswale	70	75	80
Dry Detention Ponds and Hydrodynamic Structures	5	10	10
Dry Extended Detention Ponds	20	20	60
MS4 Permit-Required Stormwater Retrofit	25	35	65
Permeable Pavement w/ Sand, Veg. - A/B soils, no underdrain	80	80	85
Permeable Pavement w/ Sand, Veg. - A/B soils, underdrain	50	50	70
Permeable Pavement w/ Sand, Veg. - C/D soils, underdrain	20	20	55
Permeable Pavement w/o Sand, Veg. - A/B soils, no underdrain	75	80	85
Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain	45	50	70
Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	10	20	55
Stormwater Management by Era 1985 to 2002 MD	17	30	40
Stormwater Management by Era 2002 to 2010 MD	30	40	80
Stormwater to the Maximum Extent Practicable (SW to the MEP)	50	60	90
Street Sweeping 25 times a year-acres (formerly called Street Sweeping Mechanical Monthly)	3	3	9
Urban Filtering Practices	40	60	80
Urban Forest Buffers	25	50	50
Urban Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	85	85	95
Urban Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	80	85	95
Vegetated Open Channels - A/B soils, no underdrain	45	45	70
Vegetated Open Channels - C/D soils, no underdrain	10	10	50
Wet Ponds and Wetlands	20	45	60

*For additional information on MAST, visit http://www.mastonline.org/ .