BIRD RIVER WATERSHED CHARACTERIZATION

Volume II

April 2014

Prepared for

Baltimore County Department of Environmental Protection and Sustainability

Prepared by

VERSAR

with

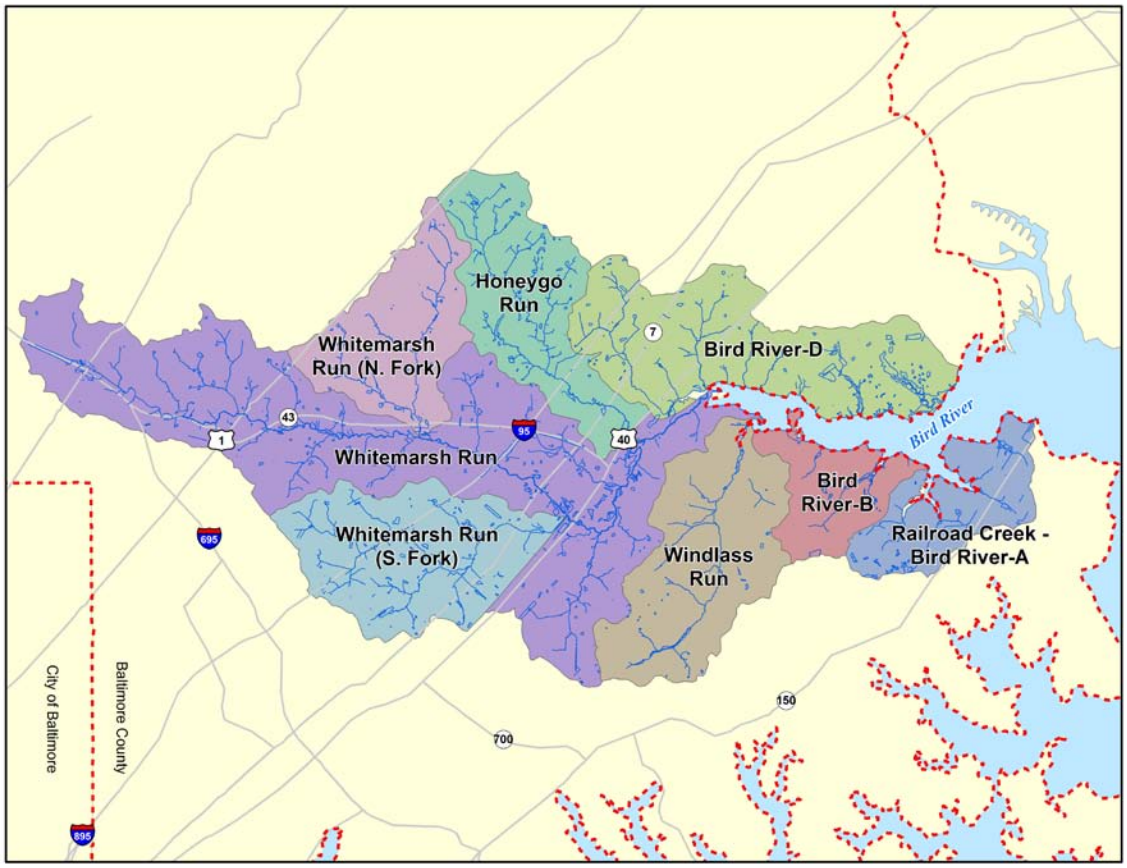
Coastal Resources, Inc.

McCormick Taylor

APPENDIX E:

BIRD RIVER WATERSHED CHARACTERIZATION REPORT

BIRD RIVER
WATERSHED CHARACTERIZATION



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CHAPTER 1: INTRODUCTION

1.1 Purpose

The purpose of the Bird River Watershed Characterization Report is to:

1. Summarize the factors that may affect the water quality of Bird River such as landscape, geomorphology, hydrology, and biological characteristics; and
2. Explain the current conditions of the watershed and its natural resources.

This report also describes human-induced effects on the watershed and identifies restoration and preservation strategies appropriate for accomplishing watershed goals. A Small Watershed Action Plan (SWAP) for the Bird River will be developed based on the information provided in this watershed characterization report.

1.2 Watershed Location and Scale

The Bird River watershed is within the Eastern Piedmont and Coastal Plain regions of Maryland, located north and east of the City of Baltimore (Figure 1-1). It drains to the tidal Gunpowder River just north of where the Gunpowder enters the Chesapeake Bay. The Bird River SWAP area includes several towns (Fullerton, Perry Hall, White Marsh and Chase) and is approximately 16,408 acres (26 square miles) or 5 percent of the overall Gunpowder River watershed.

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. Subwatersheds and corresponding acreages are listed in Table 1-1. Watershed and subwatershed delineation is explained further in Chapter 2.

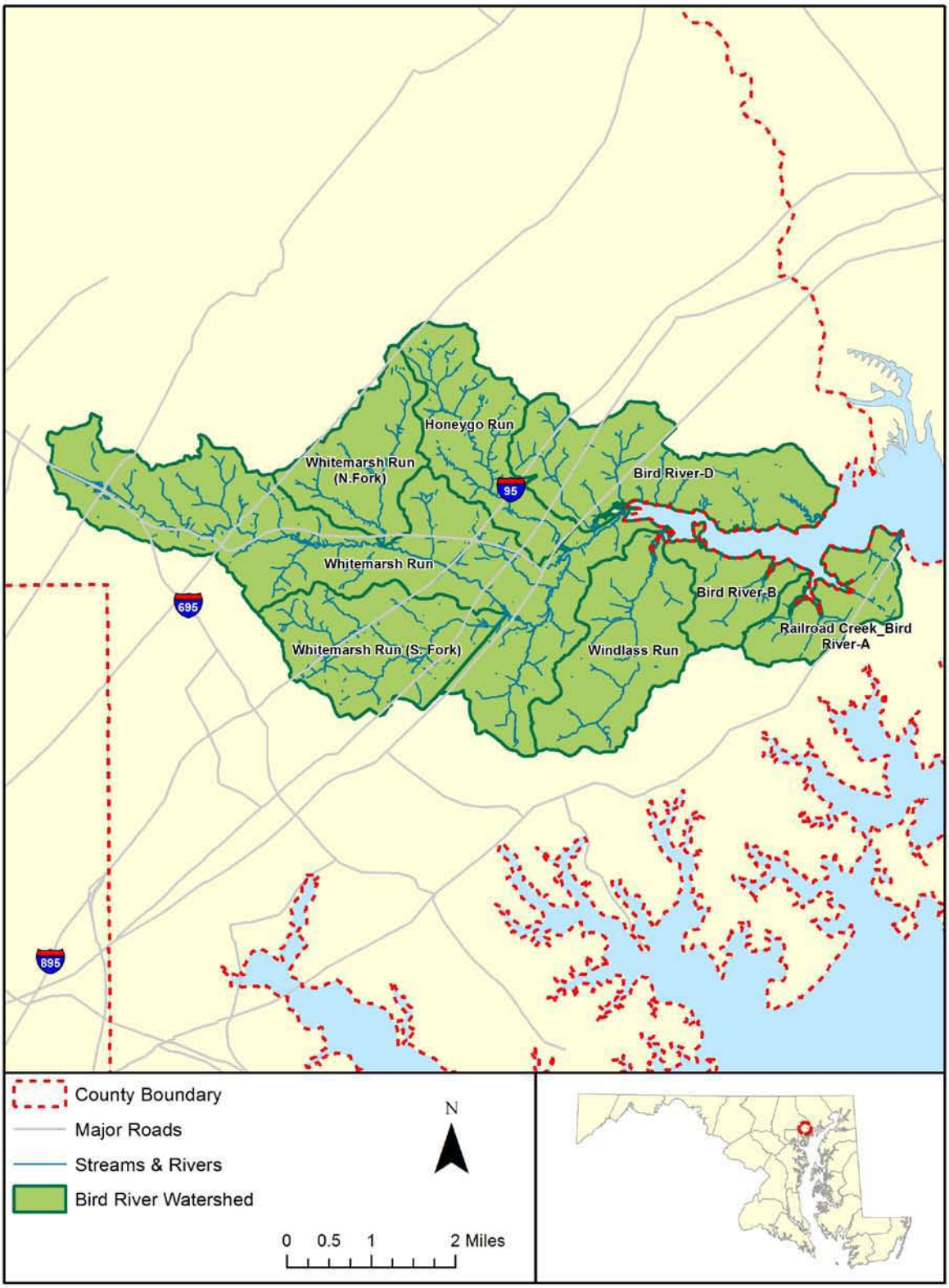


Figure 1-1: Bird River Watershed Location

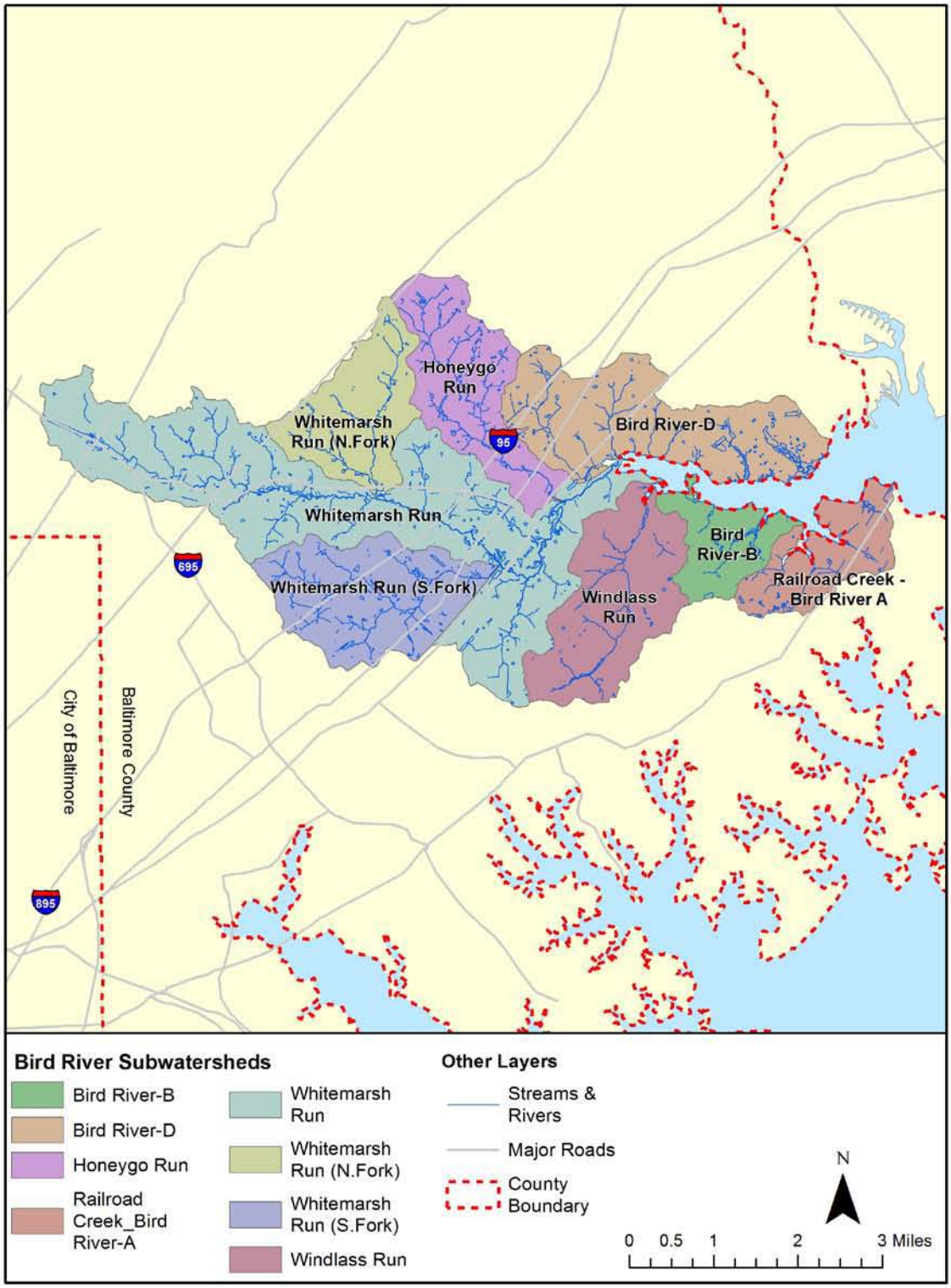


Figure 1-2: Bird River Subwatersheds

Table 1-1: Bird River Subwatershed Areas

Subwatershed	Area (Acres)	Area (Sq. Miles)
Bird River-B	770.41	1.20
Bird River-D	2,360.10	3.69
Honeygo Run	1,644.93	2.57
Railroad Creek_Bird River-A	991.90	1.55
Whitemarsh Run	5,454.42	8.52
Whitemarsh Run (N. Fork)	1,374.42	2.15
Whitemarsh Run (S. Fork)	1,884.09	2.94
Windlass Run	1,927.90	3.01
Total	16,408.18	25.64

1.3 Report Organization

This report is organized into the following six major chapters:

Chapter 1 explains the purpose of this report, the watershed location, and the scope of the watershed characterization.

Chapter 2 summarizes watershed characteristics related to landscape and land use that may affect natural resources and water quality. This chapter contains landscape information related to natural features such as geology, soils, forest cover, and streams, as well as information pertaining to human influence such as land use, population, impervious cover, water distribution, and stormwater infrastructure.

Chapter 3 includes an analysis of pollutant loads, as calculated through modeling efforts, and discusses water quality and quantity conditions based on available monitoring and stream assessment data. This chapter also includes results of stormwater management facility evaluations and ranks facilities by conversion potential. Additional details are presented for top-rated facilities.

Chapter 4 describes the uplands assessment conducted to identify pollutant sources and restoration opportunities for neighborhoods, institutions, pervious areas, and hotspots.

Chapter 5 presents an overview of the key best management practice (BMP) recommendations appropriate for accomplishing watershed goals developed by the community and the Bird River Steering Committee.

Chapter 6 contains a list of references consulted during the development of this report.

CHAPTER 2: LANDSCAPE AND LAND USE

2.1 Introduction

This chapter describes land cover and land use in the Bird River watershed, including natural land surface characteristics and development activities. Characteristics such as soil type and impervious cover strongly influence the quantity and quality of stormwater runoff in the watershed. For example, the amount and rate at which precipitation will be absorbed by the ground surface depends on the infiltration capacity of a soil for pervious areas; impervious (e.g., paved) surfaces impede rainfall infiltration which can result in flooding, erosion, and a decrease in groundwater supply. In addition, the type and extent of pollutants carried by stormwater is affected by land use characteristics. For example, residential or agricultural areas may contribute fertilizers and pesticides to stormwater runoff. Developed areas may transmit various types of pollutants directly to receiving water bodies such as trash, bacteria (livestock and pet waste), and chemicals, depending on specific land use activities, since there is often inadequate buffer or vegetation to filter pollutants. The information presented in this chapter provides the physical setting and background necessary to evaluate other watershed components including water quality, natural resources, restoration, and management.

2.2 Natural Landscape

Natural climate and land surface characteristics relevant to watershed properties and processes are described in the following sections.

2.2.1 Climate

Climate is an important consideration since it can influence soil and erosion processes, stream flow patterns, and topography. In addition, climate affects vegetative growth and determines the species composition of the terrestrial and aquatic life of a region.

This region can be described as a humid continental climate with four distinct seasons (DEPRM 2008). It has a relatively temperate climate due to the combined effects of the Appalachian Mountains to the west and the Chesapeake Bay and the Atlantic Ocean to the east. According to the National Climatic Data Center (NCDC), it is also in the path of the low pressure systems that move across the country, which results in frequent changes in wind direction and weather (NCDC 2013). Average annual rainfall in Baltimore, Maryland is 41.94 inches based on 30 years of data (1971-2000) collected by the Northeast Regional Climate Center (NRCC 2013). Monthly average rainfall is 3.5 inches based on the same data set. Rainfall is uniformly distributed through the year, with monthly averages ranging from 3.00 inches in April to 3.98 inches in September. Most snowfall occurs in December, January, February, and March; an average annual snowfall of 21.4 inches is based on 58 years of data (1950-2008).

2.2.2 Watershed Delineation

A watershed-based approach for evaluating water quality conditions and improvement potential involves determining the drainage area that contributes runoff and groundwater to a specific water body. Drainage areas vary greatly depending on the scale of the stream system of interest. Drainage areas for large river, estuary and lake systems are typically on the order of several thousand square miles, and usually referred to as basins. For example, the Chesapeake

Bay basin covers over 64,000 square miles, including over 100,000 tributaries (i.e., rivers and streams) and includes portions of six different states (CBP 2011). Basins consist of sub-basins, which are on the order of several hundred square miles and may consist of one or more major stream networks. Maryland has 13 sub-basins, including the Upper Western Shore sub-basin, of which Bird River is a part (CWP 2005). These units are then further subdivided into watersheds and subwatersheds, which are a practical size for watershed assessment, management, and restoration planning.

The Bird River watershed covers 26 square miles in southeastern Baltimore County. For the purposes of the Bird River Small Watershed Action Plan, Baltimore County used stream maps and topography to divide the Bird River watershed into eight subwatersheds, ranging in size from 770 acres to 5,454 acres (Figure 1-2; Table 1-1).

2.2.3 Topography

The topography of a region describes the relative elevations of surface features, such as ridges and valleys. Land surface shape, including degree of slope and concavity, is important as it affects the flow of surface water, soil erosion patterns, and suitability for development. For example, steep slopes are more prone to overland flow and soil erosion than flatter slopes, and thus have a greater potential for generating pollutants. Slopes were determined based on Baltimore County's Geographic Information System (GIS) soils data and divided into the following six categories, derived from slope class definitions provided in the U.S. Department of Agriculture (USDA) *Soil Survey Manual* (USDA 1993):

- Nearly level (0-3% slope);
- Gently sloping, undulating (1-8% slopes);
- Strongly sloping, rolling (4-16% slopes);
- Mod.ly steep, hilly (10-30% slopes);
- Steep (20-60% slopes); and
- Very steep (> 45% slope).

Table 2-1 summarizes the percent breakdown of each soil slope category by subwatershed. The distribution of these slope categories within the Bird River watershed is depicted in Figure 2-1. Most of the watershed is categorized as "Nearly level" to "Strongly sloping." Only a few small blocks of land are categorized as "Steep," and would be more prone to erosion, depending on development and land use.

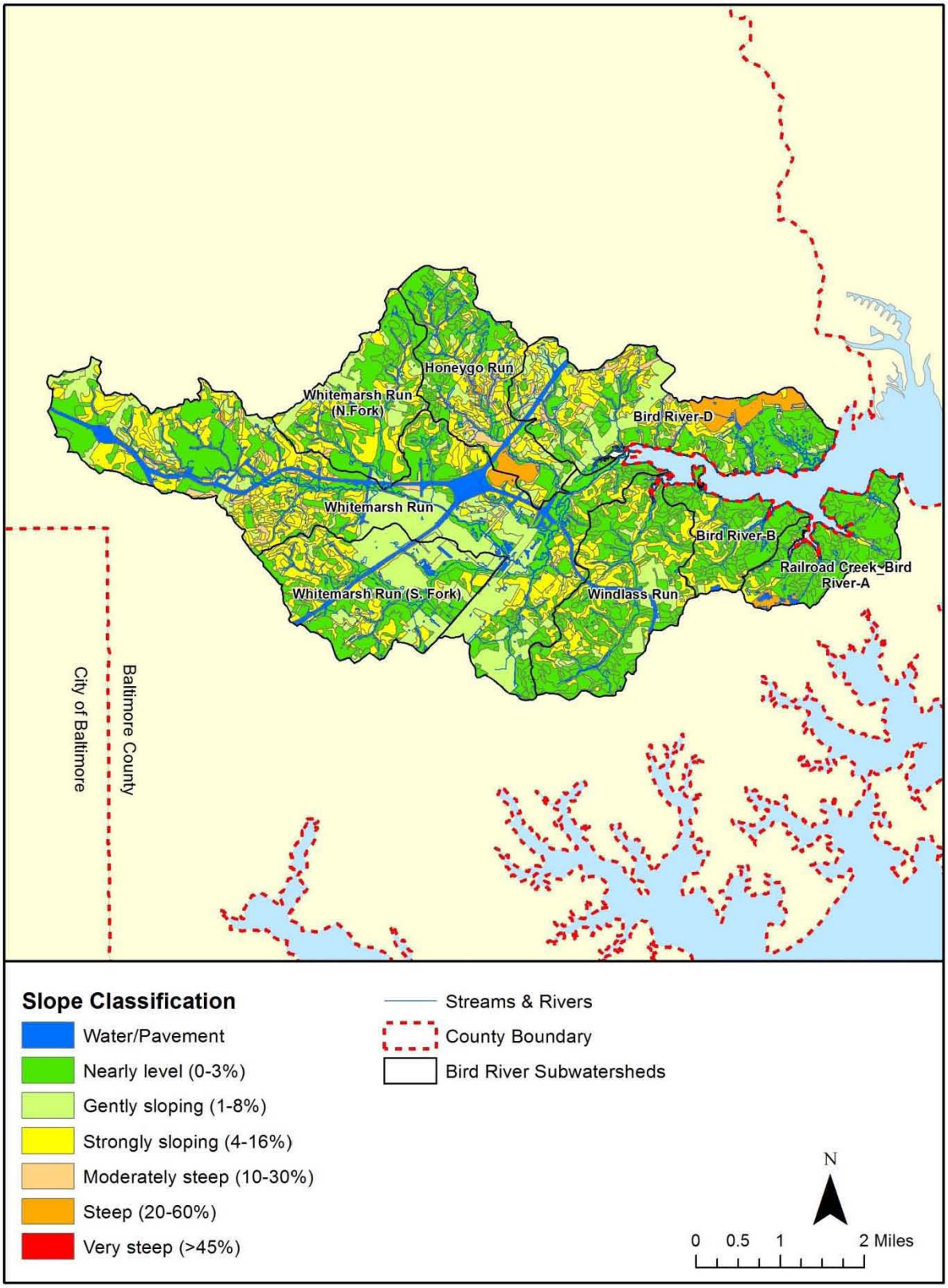


Figure 2-1: Bird River Watershed Topography Based on Soil Slopes

Table 2-1: Bird River Subwatershed Slope Categorization

Subwatershed	Slope Category (% of Subwatershed)						
	Water/ Pavement	Nearly Level (0-3%)	Gently Sloping (1-8%)	Strongly Sloping (4-16%)	Mod.ly-Steep (10-30%)	Steep (20-60%)	Very Steep (> 45%)
Bird River-B	0.5	74.2	2.9	22.0	0.5	0.0	0.0
Bird River-D	1.4	39.8	20.0	26.0	3.6	9.1	0.0
Honeygo Run	1.4	48.4	12.6	27.2	5.1	5.3	0.0
Railroad Creek_Bird River-A	1.1	87.7	0.0	7.6	0.0	3.6	0.0
Whitemarsh Run	7.0	37.6	24.4	28.3	1.9	0.8	0.0
Whitemarsh Run (N. Fork)	0.4	53.8	16.0	29.4	0.2	0.1	0.0
Whitemarsh Run (S. Fork)	3.2	38.6	31.8	26.4	0.0	0.0	0.0
Windlass Run	1.6	61.4	10.8	26.1	0.0	0.0	0.0
Total	2.1	55.2	14.8	24.1	1.4	2.4	0.0

2.2.4 Geology

The Bird River watershed is divided fairly evenly between two distinct physiographic provinces. The northwestern half of the watershed lies within the Piedmont region, while the southeastern portion of the watershed lies within the Coastal Plain region (Figure 2-2). Table 2-2 displays the geology of the subwatersheds, showing both the percent distribution and the geological type. This area of the Piedmont is characterized by hard igneous and metamorphic rocks, with areas of gneiss, quartzite, marble and schist (MGS 2009). These varying rock types have different erosion potentials, and are a big factor in the unusual topography in this part of the Piedmont. The Coastal Plain of this area is underlain with unconsolidated rocks, including gravel, sand, silt, and clay.

The geological formations of the Bird River watershed are shown in Figure 2-3. Geology effects the chemical composition of surface and groundwater, as well as the recharge rate to groundwater and wells. It is also key in soil formation and influences the buffering of pollution to water bodies in developed areas. Consequently, geology is closely related to water quality.

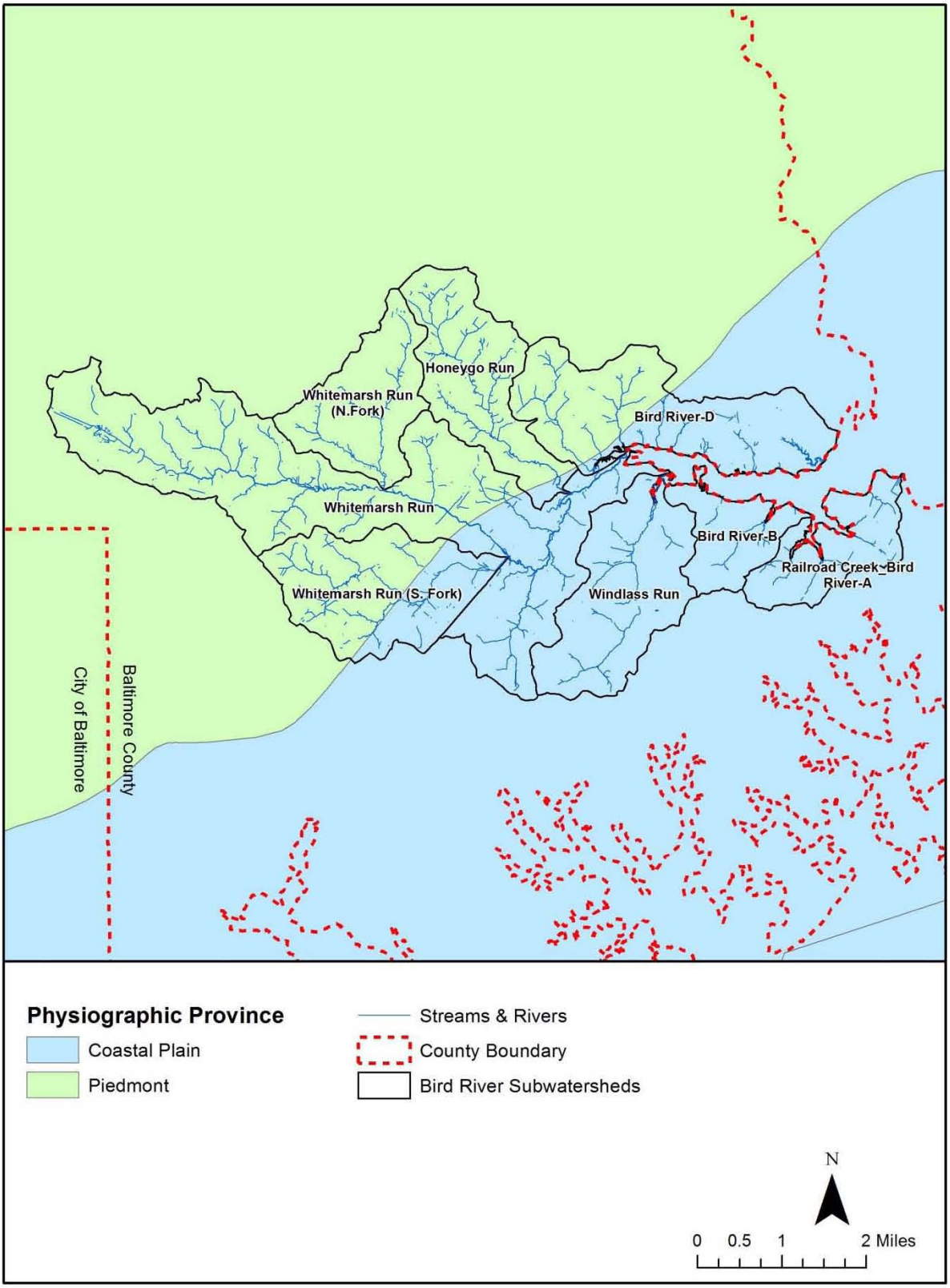


Figure 2-2: Bird River Watershed Physiographic Provinces

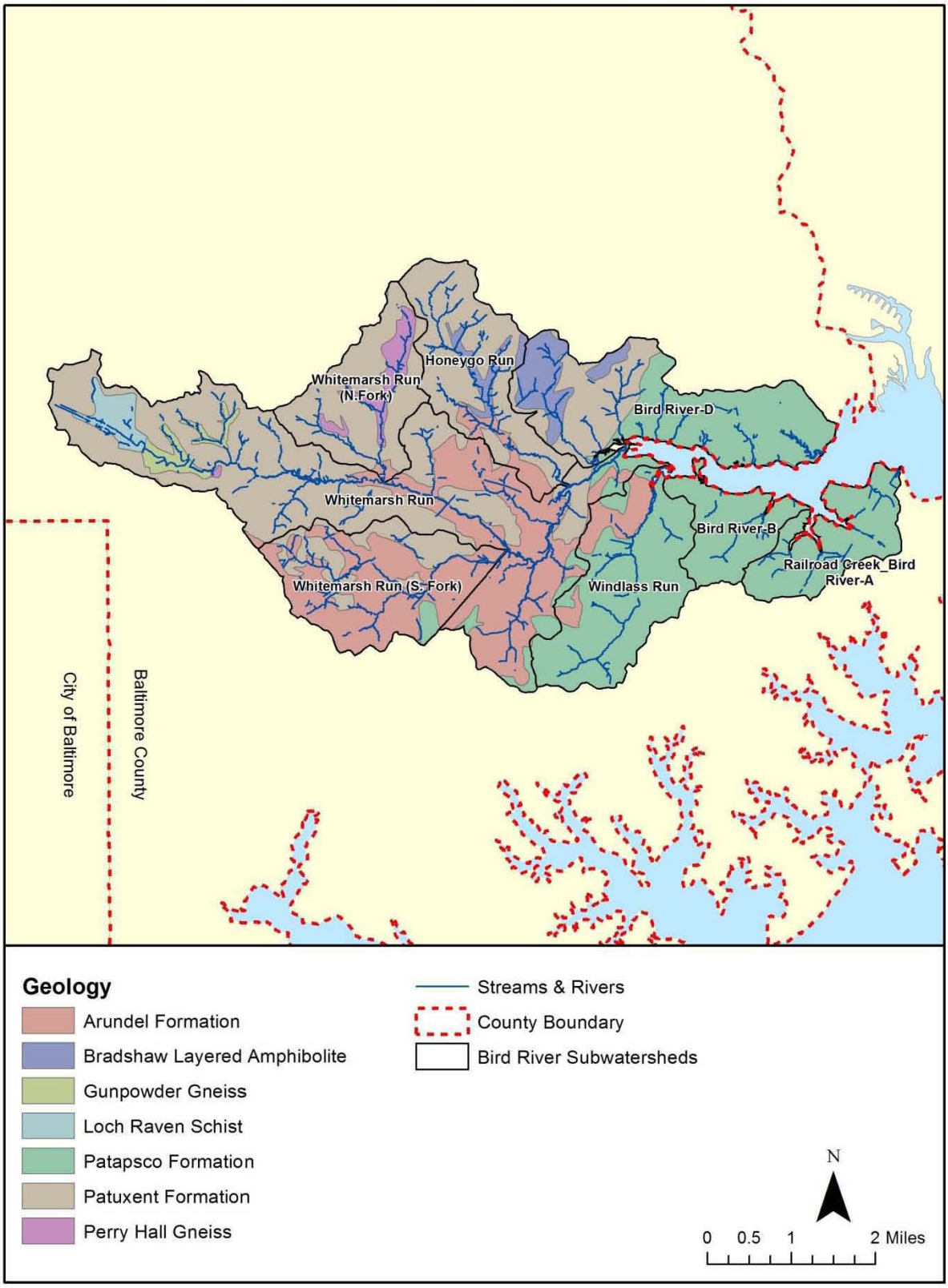


Figure 2-3: Bird River Watershed Geology

Table 2-2: Geological Composition by Subwatershed (%)

Geology	Type	Bird River-B	Bird River-D	Honeygo Run	Railroad Creek_ Bird River-A	Whitemarsh Run	Whitemarsh Run (N. Fork)	Whitemarsh Run (S. Fork)	Windlass Run
Arundel Formation	Sedimentary	0.0	0.0	11.0	0.0	31.5	2.1	70.7	14.5
Bradshaw Layered Amphibolite	Metamorphic	0.0	17.0	9.2	0.0	0.0	0.0	0.0	0.0
Gunpowder Gneiss	Metamorphic	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0
Loch Raven Schist	Sedimentary	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0
Patapsco Formation	Sedimentary	100.0	53.7	0.0	100.0	5.4	0.0	3.2	85.5
Patuxent Formation	Sedimentary	0.0	29.3	79.8	0.0	55.7	79.8	26.1	0.0
Perry Hall Gneiss	Metamorphic	0.0	0.0	0.0	0.0	0.1	18.1	0.0	0.0

2.2.5 Soils

Soil conditions are important when evaluating water quantity and quality in streams and rivers. Soil type and moisture conditions, for example, affect how land may be used and its potential for vegetation and habitat. Soils are an important consideration for projects aimed at improving water quality and/or habitat. Baltimore County's GIS soils layer was used for the soils data analysis and is a representation of the Baltimore County Soil Survey, published by USDA/ Natural Resources Conservation Service (NRCS) in 1976.

2.2.5.1 Hydrologic Soil Groups

The Natural Resource Conservation Service (NRCS) classifies soils into four hydrologic soil groups (HSG) based on runoff potential. Runoff potential is the opposite of infiltration capacity (ability for the soil to absorb precipitation). Soils with high infiltration capacity will have low runoff potential, and vice versa. Infiltration rates are highly variable among soil types and are also influenced by disturbances to the soil profile (e.g., land development activities). For example, urbanization in watersheds with high infiltration rates (e.g., sands and gravels) will have a greater impact than urbanization in watersheds consisting mostly of silts and clays, which have low infiltration rates. The four hydrologic soil groups are A, B, C, and D, where group A soils generally have the lowest runoff potential and Group D soils have the greatest.

Brief descriptions of each hydrologic soil group are provided below. Further explanation of each can be found in the USDA/NRCS publication, *Urban Hydrology for Small Watersheds*, also called Technical Release 55 (USDA 1986).

- **Group A** soils include sand, loamy sand, or sandy loam types. These soils have a high infiltration rate and low runoff potential even when thoroughly wet. These consist mainly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission.

- **Group B** soils include silt loam or loam types. They have a Mod. infiltration rate when thoroughly wet. These soils mainly consist of somewhat deep to deep, Mod.ly well to well drained soils with Mod.ly fine texture to Mod.ly coarse texture. These soils have a Mod. rate of water transmission.
- **Group C** soils are sandy clay loam. These soils have a low infiltration rate when thoroughly wet. These types of soils typically have a layer that hinders downward movement of water and soils with Mod.ly fine or fine texture. These soils have a low rate of water transmission.
- **Group D** soils include clay loam, silty clay loam, sandy clay, silty clay, or clay types. These soils have a very low infiltration rate and high runoff potential when thoroughly wet. These consist mainly of clays with high swell potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission.

Table 2-3 and Figure 2-4, the soils in the Bird River watershed are mostly divided between soil groups B and C (those with Mod. and low infiltration rates, respectively). The distribution of hydrologic soil groups is patchy, with a few solid blocks of soils in groups A and D, the very well drained soils and very low infiltration rate soils. The large blocks of Group D correspond to areas of dense urbanization and large areas of impervious surface.

Table 2-3: Bird River Subwatershed Hydrologic Soil Group Categorization

Subwatershed	Hydrologic Soil Group (% of Subwatershed)			
	A	B	C	D
Bird River-B	20.57	36.13	38.63	4.67
Bird River-D	2.95	22.19	55.03	19.83
Honeygo Run	13.60	34.80	48.34	3.26
Railroad Creek_Bird River-A	4.47	39.46	50.81	5.26
Whitemarsh Run	10.28	23.09	40.53	26.10
Whitemarsh Run (N. Fork)	14.33	25.11	50.74	9.83
Whitemarsh Run (S. Fork)	11.95	12.51	50.73	24.81
Windlass Run	8.97	35.92	53.29	1.83
Total	10.89	28.65	48.51	11.95

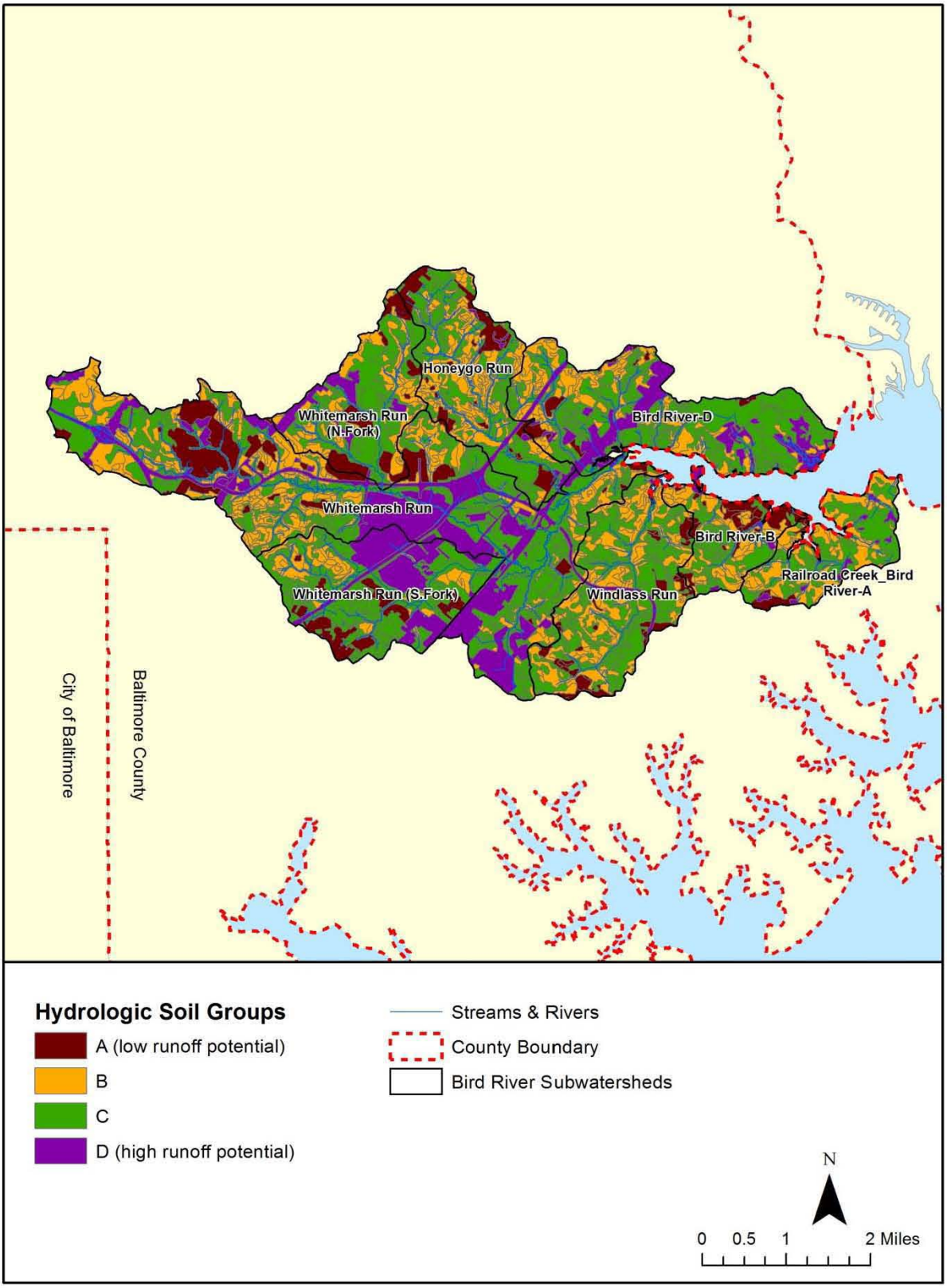


Figure 2-4: Bird River Watershed Hydrologic Soil Groups

2.2.5.2 Erodibility

Erodibility is the susceptibility of soil to erosion. It is quantified by the K factor, which is part of the Universal Soil Loss Equation (USLE) developed by USDA's Agricultural Research Service to estimate rate of erosion and soil loss for a particular site. Low K factor values indicate low erodibility or high resistance to detachment and high K factors represent high erodibility potential. Erodibility is based on the physical and chemical properties of the soil, which determine how strongly soil particles cohere with one another. For example, clay soils are cohesive or resistant to detachment and have low K values on the order of 0.05 to 0.15 (Ouyang 2002).

Soil erodibility was divided into the following three categories, based on the soils data obtained from Baltimore County's Office of Information Technology (OIT) for Bird River:

- Low Erodibility (K factor < 0.24);
- Medium Erodibility (0.24 ≤ K factor ≤ 0.32); and
- High Erodibility (K factor > 0.32).

Figure 2-5 shows the distribution of soil erodibility in the Bird River watershed based on these categories and a summary by subwatershed is shown in Table 2-4. Subwatersheds with the largest fractions of highly erodible soils present the greatest potential for addressing soil conservation issues via best management practices (BMPs) such as minimizing bare soil and keeping topsoil in place. Soil erodibility data are also useful in combination with other information such as location of cropland, slope steepness, and distance to streams to determine where retirement of highly erodible land, another BMP, is appropriate. High K factor values can also serve as a warning for urban activities planned near streams such as road construction or utility placements.

As shown in Table 2-4 and Figure 2-5, medium and high erodibility categories represent over 70 percent of the soil erodibility distribution in the Bird River watershed. This indicates that most of the watershed's soils are prone to Mod. or high erosion. Significant portions (> 40%) of the Bird River-D, Whitemarsh Run (N. Fork) and Whitemarsh Run (S. Fork) subwatersheds consist of highly erodible soils. These subwatersheds should rank as a priority for maintaining protective land cover such as forested area.

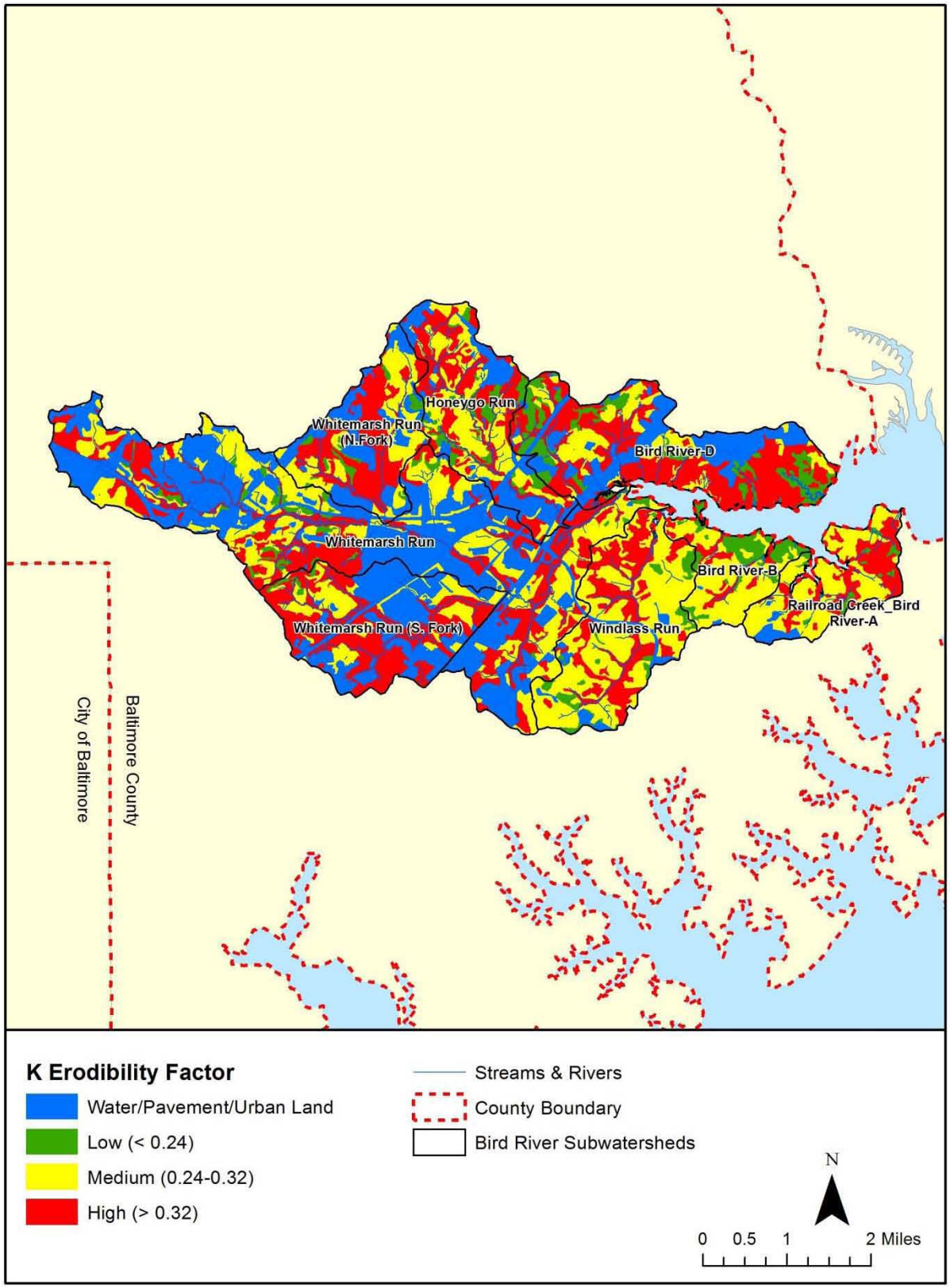


Figure 2-5: Bird River Watershed Soil Erodibility (based on the K factor)

Table 2-4: Bird River Subwatershed Soil Erodibility Categorization

Subwatershed	Water/ Pavement/ Urban Land	Soil Erodibility Category (K Factor) (% of Subwatershed) Low (< 0.24)	Medium (0.24-0.32)	High (> 0.32)
Bird River-B	0.67	26.32	59.94	13.07
Bird River-D	25.21	14.82	16.29	43.69
Honeygo Run	22.11	8.76	32.55	36.58
Railroad Creek_Bird River-A	5.64	5.10	58.89	30.37
Whitemarsh Run	43.12	3.00	28.22	25.66
Whitemarsh Run (N. Fork)	27.97	5.10	26.34	40.59
Whitemarsh Run (S. Fork)	37.19	1.15	18.56	43.11
Windlass Run	5.55	6.40	58.49	29.55
Total	20.93	8.83	37.41	32.83

2.2.6 Forest Cover

Forest provides the greatest protection among land cover types for water and soil quality. In pristine systems, forest and soils co-evolve, shaping the hydrologic cycle; these systems operate within a natural range of variability, assuring healthy habitat and water quality. The entire Chesapeake Bay basin, including the Bird River watershed, consisted overwhelmingly of old-growth forest at the time of European settlement. In human-impacted systems, forest cover can still provide many benefits and protect water quality if judiciously planned and conserved.

While the forested area has been greatly reduced in the Bird River watershed since European settlement, some subwatersheds have maintained a relatively high percentage of forest cover (e.g., Bird River-B, Bird River-D and Windlass Run) compared to the other more densely urbanized watersheds in this area. This is partly due to the fact that the northeastern section of the watershed (subwatershed Bird River-D) is part of the Gunpowder Falls State Park and contains Days Cove Park. Table 2-5 summarizes forested acres and percent forested area by subwatershed and Figure 2-6 shows the distribution of forest cover within the Bird River watershed based on Baltimore County's wooded GIS layer. Data used to calculate and display forest cover were developed by the University of Vermont (UVM) Spatial Analysis Laboratory in 2008. LiDAR images from 2005 and National Agricultural Imagery Program (NAIP) data from 2007 were used to create this high resolution land cover dataset.

Table 2-5 shows that the Bird River watershed has approximately 6,800 acres of forested area, which is 41% of the total watershed area. This is higher than the Maryland Department of Planning's (MDP) 2010 land use/land cover classification scheme, which estimates that just under 29% of forest cover remains in the Bird River watershed. (Slight variations between the UVM land cover/canopy cover dataset and MDP land use/land cover scheme result from different scales and photo sources used.)

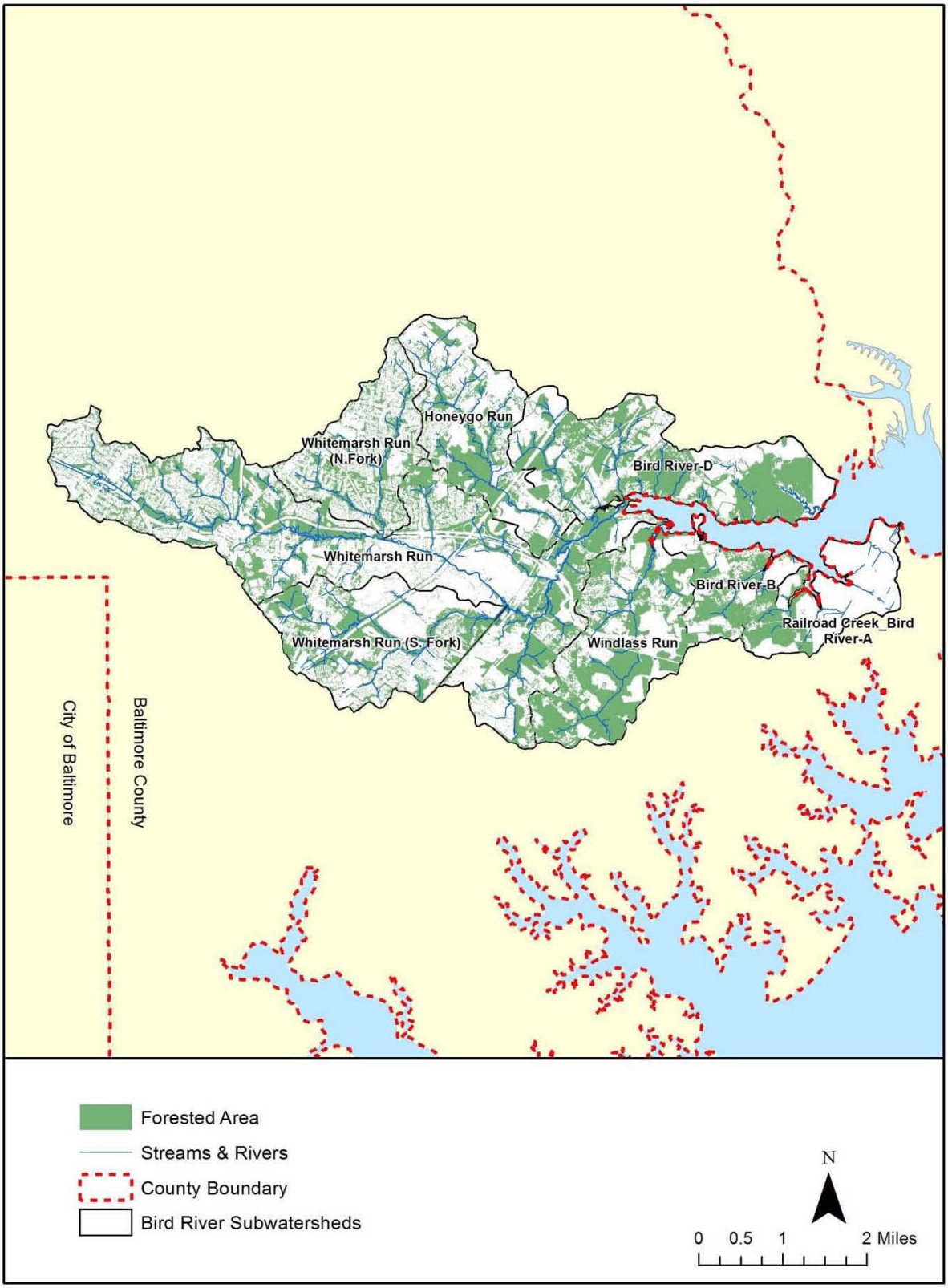


Figure 2-6: Bird River Watershed Forest Cover

Table 2-5: Bird River Subwatershed Forest Cover

Subwatershed	Total Acres	Forested Acres	% Forested
Bird River-B	770	379	49
Bird River-D	2,360	1,239	53
Honeygo Run	1,645	641	39
Railroad Creek_Bird River-A	992	201	20
Whitemarsh Run	5,454	2,060	38
Whitemarsh Run (N. Fork)	1,374	488	36
Whitemarsh Run (S. Fork)	1,884	683	36
Windlass Run	1,928	1,079	56
Total	16,408	6,771	41

2.2.7 Stream Systems

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

2.2.7.1 Stream System Characteristics

The entire Bird River watershed is a state-defined 8-digit watershed and, as discussed in Section 2.2.2, is part of the Chesapeake Bay basin. This watershed is subdivided into eight subwatersheds and contains approximately 90 miles of stream. These streams all drain to the Bird River, which drains to the Gunpowder River and then ultimately to the Chesapeake Bay. A summary of stream mileage and density by subwatershed is included in Table 2-6. Figure 2-7 shows the streams and the eight subwatersheds that make up the Bird River watershed. The Whitemarsh Run subwatershed has the largest number of stream miles, with almost three times as many miles as any other watershed. This area may represent a priority for stream restoration opportunities. Portions of Whitemarsh Run, Honeygo Run, and Bird River-D were evaluated for stream condition and stream restoration potential.

Figure 2-7: Bird River Watershed Stream System and Subwatersheds

Table 2-6: Bird River Watershed Stream Mileage and Density

Subwatershed	Area (square miles)	Stream Miles	Stream Density (miles/square mile)
Bird River-B	1.20	2.13	1.77
Bird River-D	3.69	12.74	3.45
Honeygo Run	2.57	11.73	4.57
Railroad Creek_Bird River-A	1.55	4.19	2.71
Whitemarsh Run	8.52	32.44	3.81
Whitemarsh Run (N. Fork)	2.15	6.42	2.99
Whitemarsh Run (S. Fork)	2.94	12.21	4.15
Windlass Run	3.01	7.97	2.64
Total	25.64	89.84	3.50

2.2.7.2 Stream Riparian Buffers

Riparian buffers are the vegetated areas adjacent to streams that protect water bodies from toxins and excessive nutrients, while also providing bank stabilization and habitat. Forested buffer areas along streams play a crucial role in improving water quality and flood mitigation since they can reduce surface runoff, stabilize stream banks, trap sediment, and provide habitat for various types of terrestrial and aquatic life including fish. Tree roots, for example, capture and remove pollutants including excess nutrients (e.g., nitrogen) from shallow flowing water; the tree root structure also impedes erosion and water flow, which in turn reduces sediment load and the risk of flooding. Tree canopy provides shading and results in cooler water temperatures required by a variety of stream biota, particularly cold-water species like trout. In smaller streams such as the ones surveyed, terrestrial plant material falling into the stream is the primary source of food for stream fauna. Trees provide seasonal food in the form of leaves and plant parts for stream life at the base of the food chain, while fallen tree branches and trunks provide a more consistent, slow-release food source throughout the year. Tree roots and snags offer habitat for fish and other aquatic species. Maintaining healthy, forested buffers is important for reducing nutrient and sediment loadings to the Bird River and to the Chesapeake Bay. When stream riparian buffers are converted from forest to agriculture or urban land uses (e.g., residential), many of these benefits are lost and stream health declines. Riparian buffer zones can be re-established or preserved as a BMP to reduce land use impacts by intercepting and controlling the pollutants entering a water body.

The vegetative condition of the riparian buffer was analyzed based on a 100-ft buffer on either side of the stream system. Three conditions were used to classify stream buffer conditions: impervious, open pervious, or forested. Impervious areas were determined by overlaying the roads and buildings data layers over the 100-ft stream buffer layer. Similarly, the forested areas were determined using the UVM land cover layer and removing any impervious area footprint. Remaining areas were classified as open pervious areas. Stream buffer conditions are summarized by subwatershed in terms of acres and percentages in Table 2-7. The distribution of land cover classes within the 100-ft stream buffer is shown in Figure 2-8. As expected, streams in the highly urbanized Whitemarsh Run, Whitemarsh Run (N. Fork) and Whitemarsh Run (S. Fork) subwatersheds have the highest percentage of impervious surface within the 100-ft buffer corridor. The Bird River-B and Windlass Run subwatersheds have the highest proportion of forested stream buffer.

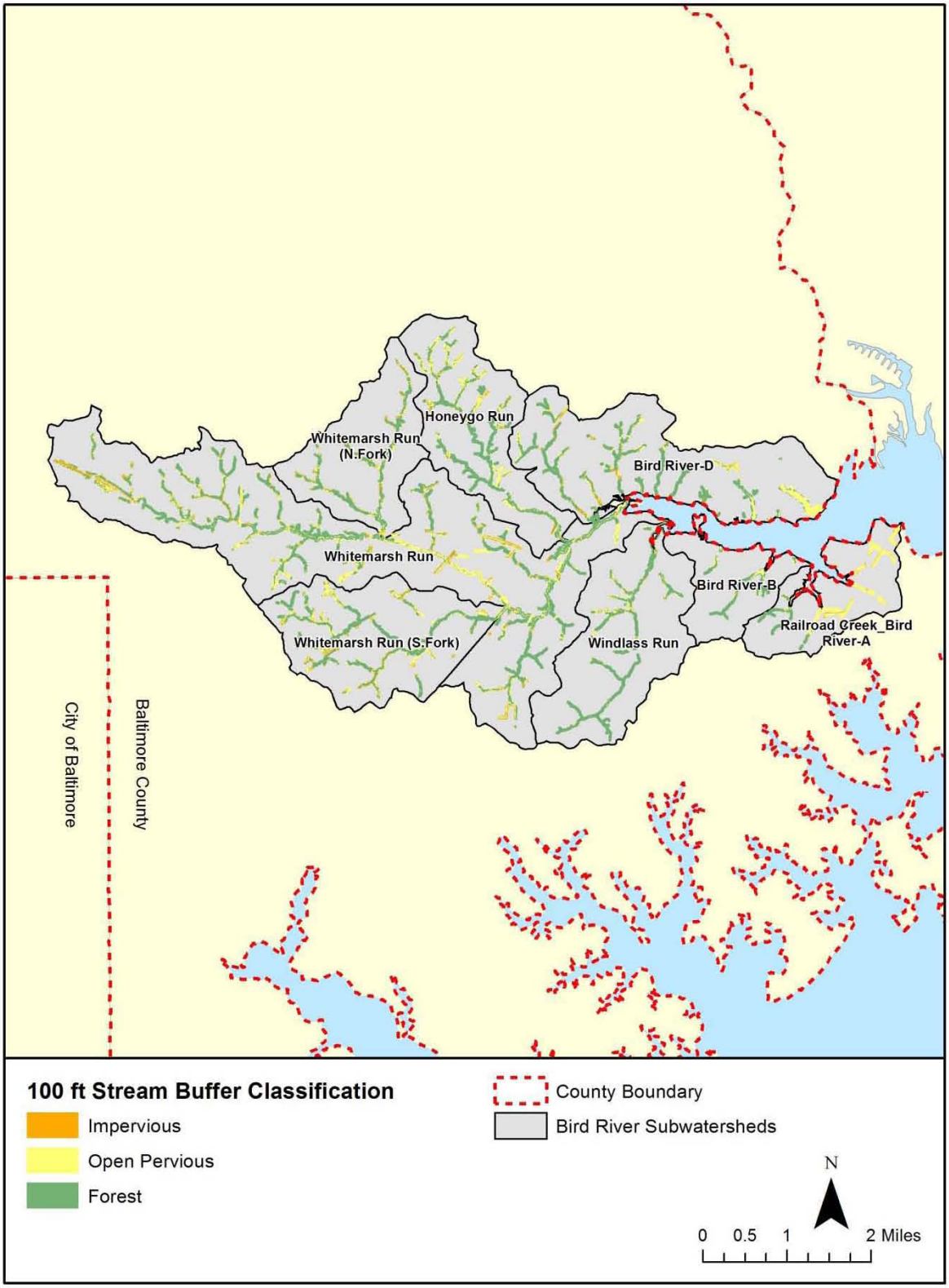


Figure 2-8: Bird River Watershed 100-ft Stream Buffer Condition

Table 2-7: Bird River Subwatershed Land Use in the 100-ft Stream Buffer

Subwatershed	Forest		Open Pervious		Impervious	
	Acres	%	Acres	%	Acres	%
Bird River-B	40.5	78.5	10.8	21.0	0.3	0.5
Bird River-D	208.5	67.9	82.4	26.9	16.0	5.2
Honeygo Run	184.1	67.3	79.0	28.9	10.3	3.8
Railroad Creek_Bird River-A	30.1	27.8	70.8	65.5	7.2	6.7
Whitemarsh Run	503.3	61.9	238.2	29.3	72.0	8.8
Whitemarsh Run (N. Fork)	106.9	70.9	31.5	20.9	12.3	8.1
Whitemarsh Run (S. Fork)	188.0	65.8	74.6	26.1	23.2	8.1
Windlass Run	157.5	84.4	25.5	13.7	3.6	1.9
Totals	1,418.8	65.6	612.9	29.0	144.8	5.4

2.2.8 Tidal Waters

The tidal waters of Bird River encompass approximately 828 acres. This area is primarily open tidal water, though a small portion is made up of embayments (e.g., coves, bays. The tidal waters of Bird River are oligohaline which denotes low salinity/brackish waters (0.5 to 5 parts per thousand [ppt]). In 1996, the tidal portion of the Bird River was identified on Maryland's 1996 list of water quality limited segments as being impaired for nutrients and sediment (MDE 2012). Additional monitoring data indicated that the dissolved oxygen criterion and designated uses associated with nutrients are being met in Bird River. Water quality issues and current conditions are discussed further in Chapter 3.

The Bird River watershed contains approximately 16 miles of coastline. Three of the eight subwatersheds are landlocked and have no coastline. A summary of coastline mileage and density by subwatershed is included in Table 2-8.

Table 2-8: Bird River Coastline Mileage and Density

Subwatershed	Acres (sq. mi.)	Coastline Miles	Coastline Density (mi./sq. mi.)
Bird River-B	1.2	3.67	3.06
Bird River-D	3.69	5.01	1.36
Honeygo Run	2.57	0.00	0.00
Railroad Creek_Bird River-A	1.55	4.81	3.10
Whitemarsh Run	8.52	1.40	0.16
Whitemarsh Run (N. Fork)	2.15	0.00	0.00
Whitemarsh Run (S. Fork)	2.94	0.00	0.00
Windlass Run	3.01	1.22	0.41
Totals	25.63	16.12	0.63

Bird River-D and Railroad Creek_Bird River-A are the subwatersheds with the greatest lengths of coastline. These areas represent a priority for shoreline restoration opportunities; however, restoration potential is often influenced by property ownership.

The vegetative condition of the riparian buffer along the shoreline was analyzed based on a 100-ft buffer from the tidal waters. Three conditions were used to classify shoreline buffer conditions: impervious, open pervious, or forested. Impervious areas were determined by overlaying the roads and buildings data layers over the 100-ft shoreline buffer layer. Similarly, the forested areas were determined using the wooded GIS layer and removing any impervious area footprint. Remaining areas were classified as open pervious areas. Shoreline buffer conditions are summarized by subwatershed in terms of acres and percentages in Table 2-9. The distribution of land cover classes within the 100-ft shoreline buffer is shown in Figure 2-9.

Table 2-9: Bird River Land Use in the 100-ft Shoreline Buffer

Subwatershed	Forest		Open Pervious		Impervious	
	Acres	%	Acres	%	Acres	%
Bird River-B	15.3	38.2	2.9	7.2	21.8	54.6
Bird River-D	30.7	56.5	2.7	4.9	21.0	38.6
Honeygo Run	0.0	0.0	0.0	0.0	0.0	0.0
Railroad Creek_Bird River-A	11.9	21.6	3.7	6.6	39.7	71.8
Whitemarsh Run	6.2	44.6	2.0	14.1	5.8	41.3
Whitemarsh Run (N. Fork)	0.0	0.0	0.0	0.0	0.0	0.0
Whitemarsh Run (S. Fork)	0.0	0.0	0.0	0.0	0.0	0.0
Windlass Run	10.7	79.5	0.5	3.9	2.2	16.6
Totals	74.8	42.3	11.7	6.6	90.5	51.1

Bird River-B and Railroad Creek_Bird River-A subwatersheds have the smallest percentages of forested buffer, while the shoreline along the Windlass Run subwatershed has a buffer that is close to 80% forested. Open pervious areas represent only 7% of the 100-ft shoreline buffer in the Bird River watershed, meaning there are limited opportunities for reforestation of the shoreline riparian buffer. While riparian buffer covered by impervious areas have less potential for remediation and makes up over 50% of the total area, there may be an opportunity for impervious cover removal and buffer reforestation.

Baltimore County encompasses approximately 219 miles of tidal shoreline on several tributaries to the Chesapeake Bay. The county monitors and manages the conditions of its shorelines for the overall benefit of the public. Baltimore County Department of Environmental Protection and Sustainability, EPS (formerly the Department of Environmental Protection and Resource Management, DEPRM), in particular, has a well-established program for waterway improvement and coastal management to protect these resources and meet public demands for access and recreation. A Shoreline Enhancement Feasibility Study was performed by DEPRM (DEPRM 1998). The purpose of the feasibility study was to establish baseline shoreline conditions and to identify areas with the potential for shoreline enhancement.

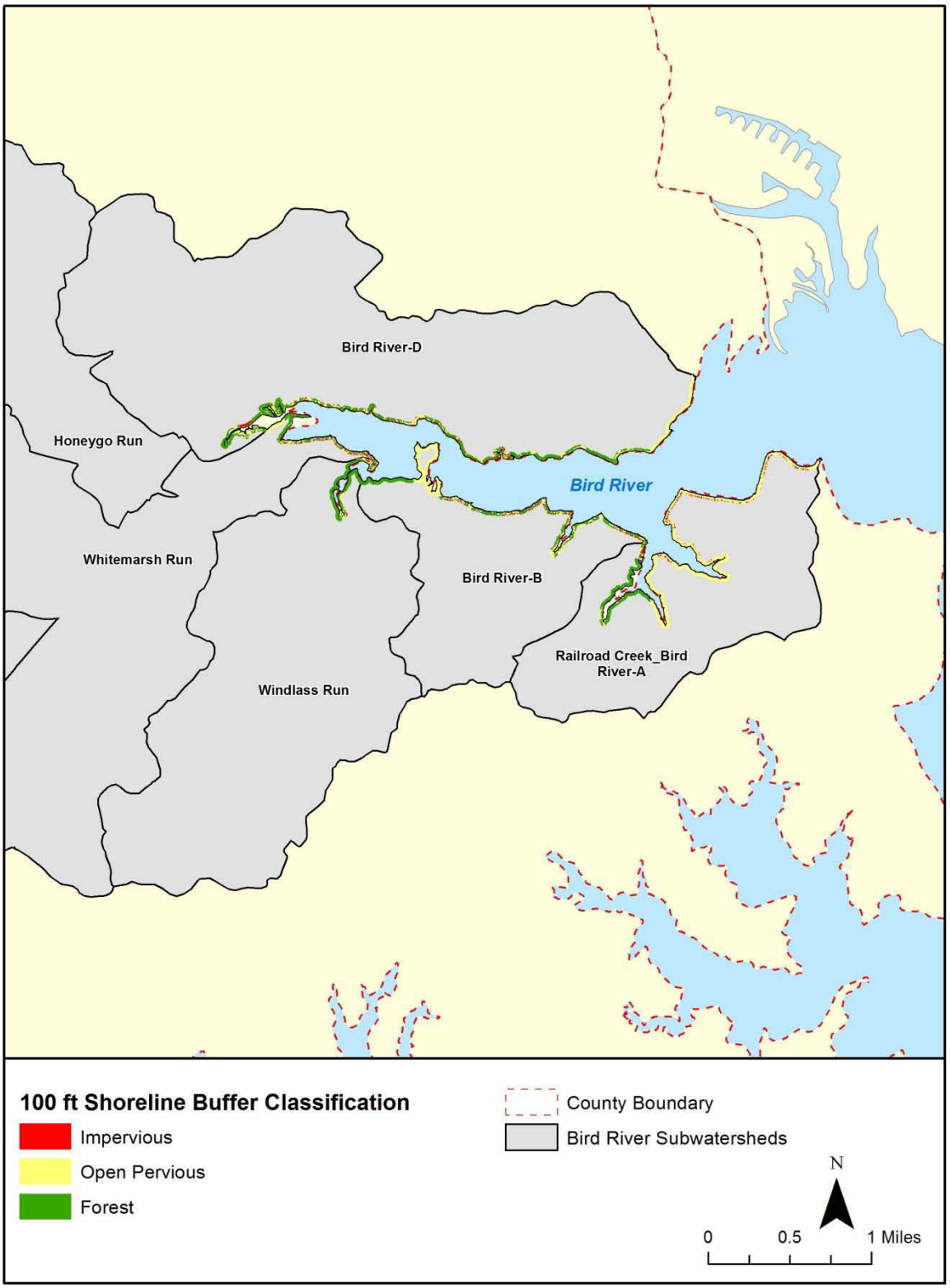


Figure 2-9: Bird River 100 ft. Shoreline Buffer Condition

After baseline conditions were established and reviewed, DEPRM rated enhancement potential for the reaches studied. For each reach, a rating was assigned to describe the feasibility of implementing the following five categories of enhancement projects:

- Erosion Control
- Habitat Enhancement
- Existing Project – Expansion/Protection/Enhancement
- Existing Project – Enhancement/Retrofit
- Beneficial Use

Enhancement potential and feasibility for each category was rated as high, medium or low based on accepted practice and professional judgment/experience of the study team. In general, reaches with serious erosion or degraded habitat were designated as high enhancement potential. A low enhancement potential rating was assigned where a low probability of success was anticipated such as reaches that were relatively stable with a balanced habitat or where development would have measurable impacts. Reaches where the shorelines were stable or where previous enhancement projects were successful were classified as complete/stable and not prioritized for shoreline enhancement.

Two locations in the Bird River watershed were investigated: Days Cover Natural Area and Gunpowder State Park (DEPRM 1998). Neither site visited was considered a good candidate for enhancement; the Days Cove site was noted as being “Complete/Stable” and Gunpowder was thought to have “Low Potential” for habitat enhancement.

2.3 The Human Modified Landscape

The natural landscape has been modified for human use over time. The intensity of development activities has increased, starting with the colonization of Maryland in the 1600s. This modification has resulted in environmental impacts to both terrestrial and aquatic ecosystems. This section describes the characteristics of the human modified landscape and how it is associated with impacts to the natural ecosystem. This includes a general description of land use and land cover and more specific issues such as population, impervious cover, drinking water and wastewater, storm water systems, discharge permits, zoning, and build-out analysis.

This section also demonstrates how pollutants may enter waterways from both point and non-point sources. Point sources of pollution are those that may be easily traced to a single, easily-defined origin, for example a wastewater treatment plant or a leaking barrel. Non-point sources (NPS) are those that originate from a diffuse area and are typically carried by precipitation or snowmelt into storm drain systems and/or waterways. NPS pollutants may include chemicals that wash off of roadways, including oils, salt and other de-icing agents that are used to treat roadways during winter storms. Other common NPS pollutants are the fertilizers and pesticides used on residential lawns, commercial landscaping, and cropfields; improper or excessive application of these chemicals often results in increased NPS pollution.

2.3.1 Land Use and Land Cover

Land use has pronounced impacts on water quality and habitat. Different land uses generate different types and amounts of pollutants. As discussed in the previous section, a forested watershed has the capacity to absorb pollutants such as sediment and nutrients and reduce the

flow rate of water into streams. Developed areas with impervious surfaces, such as roads, parking lots, and roofs, block the natural seepage of precipitation into the ground. Unlike most natural surfaces, impervious surfaces tend to concentrate stormwater runoff, accelerate flow rates, and direct stormwater to the nearest stream. This can cause bank erosion and destruction of in-stream and riparian habitat. Undeveloped watersheds and those with small amounts of impervious surfaces tend to have better water quality in local streams than developed watersheds with larger amounts of impervious surfaces. In addition, agricultural land uses can contribute to increases in nutrients and coliform bacteria in streams, if not properly managed.

MDP develops a statewide land use/land cover GIS layer every five years to provide a general overview of predominant land cover/usage (interpreted from aerial photography and satellite imagery) and to monitor development activities throughout the state. The most recent update available and used for this characterization report is the 2010 MDP land use/land cover scheme. This was a revision of the 2002 land use/land cover GIS layer, updated using a combination of aerial imagery and parcel information. These data are for use by government agencies and other stakeholders to assess trends in land development and consumption of undeveloped/natural resources over time. Two new land use/land cover categories were introduced in the draft 2007 GIS layer and are were also included in the 2010 dataset: very low density residential (large lot subdivision, 5 to 20 acres) and transportation (major highways and miscellaneous transportation features not classified elsewhere). A summary of land use/land cover percentages by subwatershed is included in Table 2-10. A map and pie chart of land use/land cover according to MDP's 2010 scheme is shown in Figure 2-10.

The Bird River watershed encompasses approximately 16,408 acres (25.6 square miles) of land. The primary land uses in the watershed are Deciduous Forest (25%) and Medium Density Residential (21%), which occur in large patches that are spread throughout the watershed. The largest area of commercial and industrial land uses is concentrated around White Marsh Mall and the Avenue at White Marsh near the center of the watershed. When all residential and commercial land uses are combined, urban development covers close to 50% of the watershed.

Table 2-10 shows that the MDP dataset estimates the Bird River watershed is 29% forested. This is lower than the 41% forest cover presented in Section 2.2.6, Table 2-5, which was calculated using the UVM land cover dataset. Variations between the UVM land cover dataset and MDP land use/land cover scheme result from different scales and photo sources used during their development.

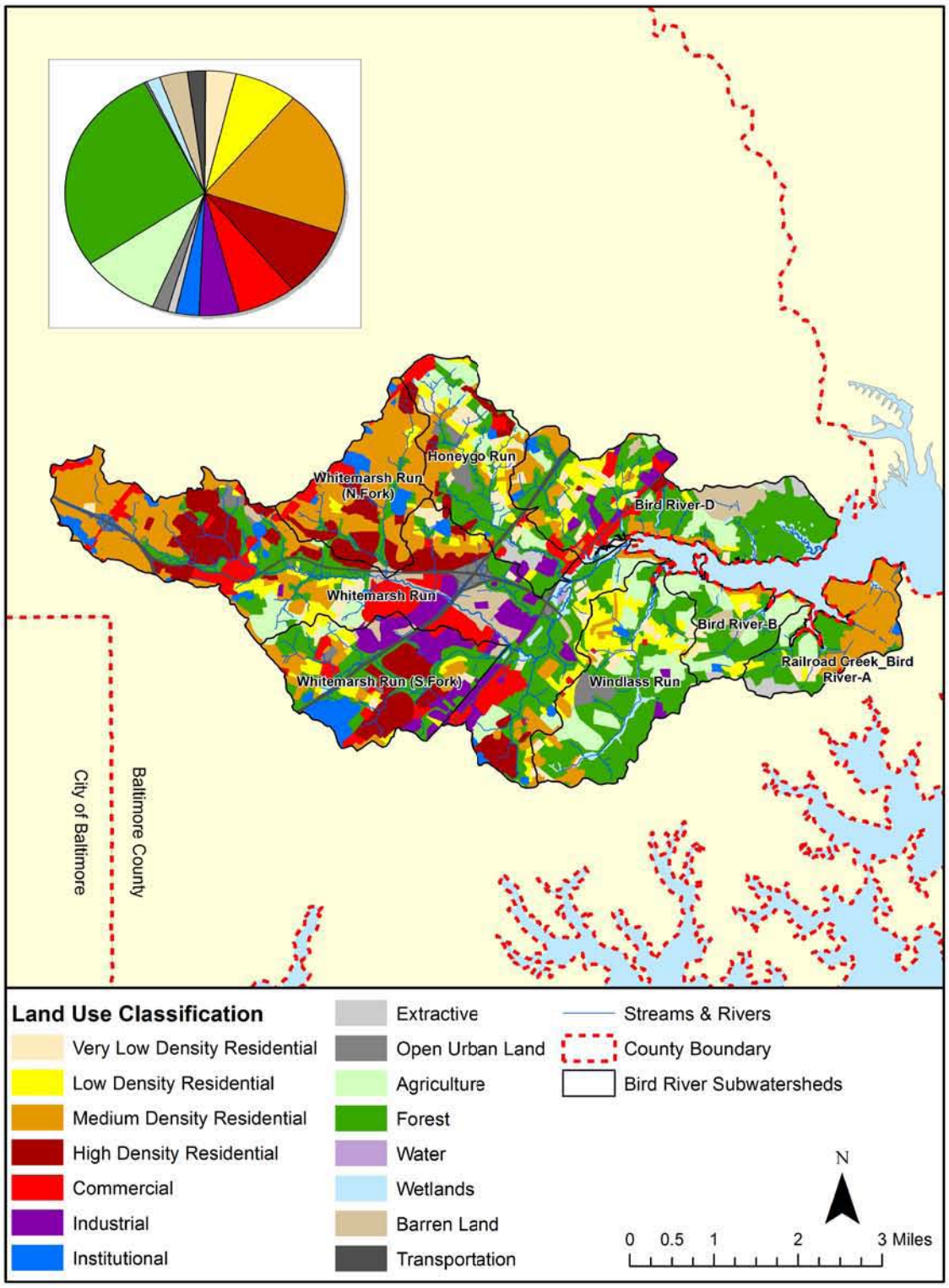


Figure 2-10: Map and Pie Chart of Bird River Watershed Land Use/Land Cover

Table 2-10: Bird River Land Use/Land Cover Classification (%)

Land Use	Subwatershed								
	Bird River-B	Bird River-D	Honeygo Run	Railroad Creek_Bird River-A	Whitemarsh Run	Whitemarsh Run (N. Fork)	Whitemarsh Run (S. Fork)	Windlass Run	Total
Very Low Density Residential	4.5	4.6	8.3	3.5	2.7	0.0	1.7	4.7	3.7
Low Density Residential	8.6	7.7	10.9	3.8	4.9	2.4	7.4	14.5	7.5
Medium Density Residential	5.3	10.6	14.3	48.8	21.2	53.4	10.0	6.4	21.2
High Density Residential	0.0	0.7	6.3	0.2	13.1	22.0	17.7	0.0	7.5
Commercial	0.0	6.1	6.4	0.3	11.9	6.5	6.4	0.3	4.7
Industrial	0.0	3.6	2.6	0.0	5.8	0.0	16.0	1.1	3.6
Institutional	1.1	1.0	0.8	0.8	2.7	6.9	6.9	0.6	2.6
Extractive	1.4	1.7	3.2	5.7	0.0	0.0	0.0	0.0	1.5
Open Urban Land	0.0	0.0	4.3	0.0	2.0	0.0	2.1	4.1	1.6
Cropland	31.8	5.7	15.7	9.2	5.9	0.1	2.3	20.2	11.4
Orchards/Vineyards/Horticulture	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeding Operations	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	37.4	43.8	5.3	25.9	16.4	7.6	22.0	39.3	24.7
Evergreen Forest	0.0	0.6	2.0	0.0	0.0	0.0	0.0	0.0	0.3
Mixed Forest	0.0	0.0	18.7	0.0	3.3	0.0	2.8	5.6	3.8
Brush	6.1	0.0	0.0	0.0	2.9	0.9	2.0	0.0	1.5
Bare Ground	0.0	7.4	0.0	0.0	1.8	0.0	0.0	0.0	1.1
Water	0.2	0.6	0.0	0.3	0.2	0.0	0.0	0.1	0.2
Wetlands	3.8	3.7	0.1	1.4	1.4	0.0	0.0	3.2	1.7
Transportation	0.0	1.8	1.2	0.0	4.0	0.2	2.5	0.0	1.2

A total of 939 acres of the Bird River watershed are contained within state and county parks (Figure 2-11). State parks account for 583 acres of the total, while County parks account for 356 acres of the total. Parks are 5.7% of the total watershed area; over half of the total parkland in the watershed is located within the Bird River-D subwatershed.

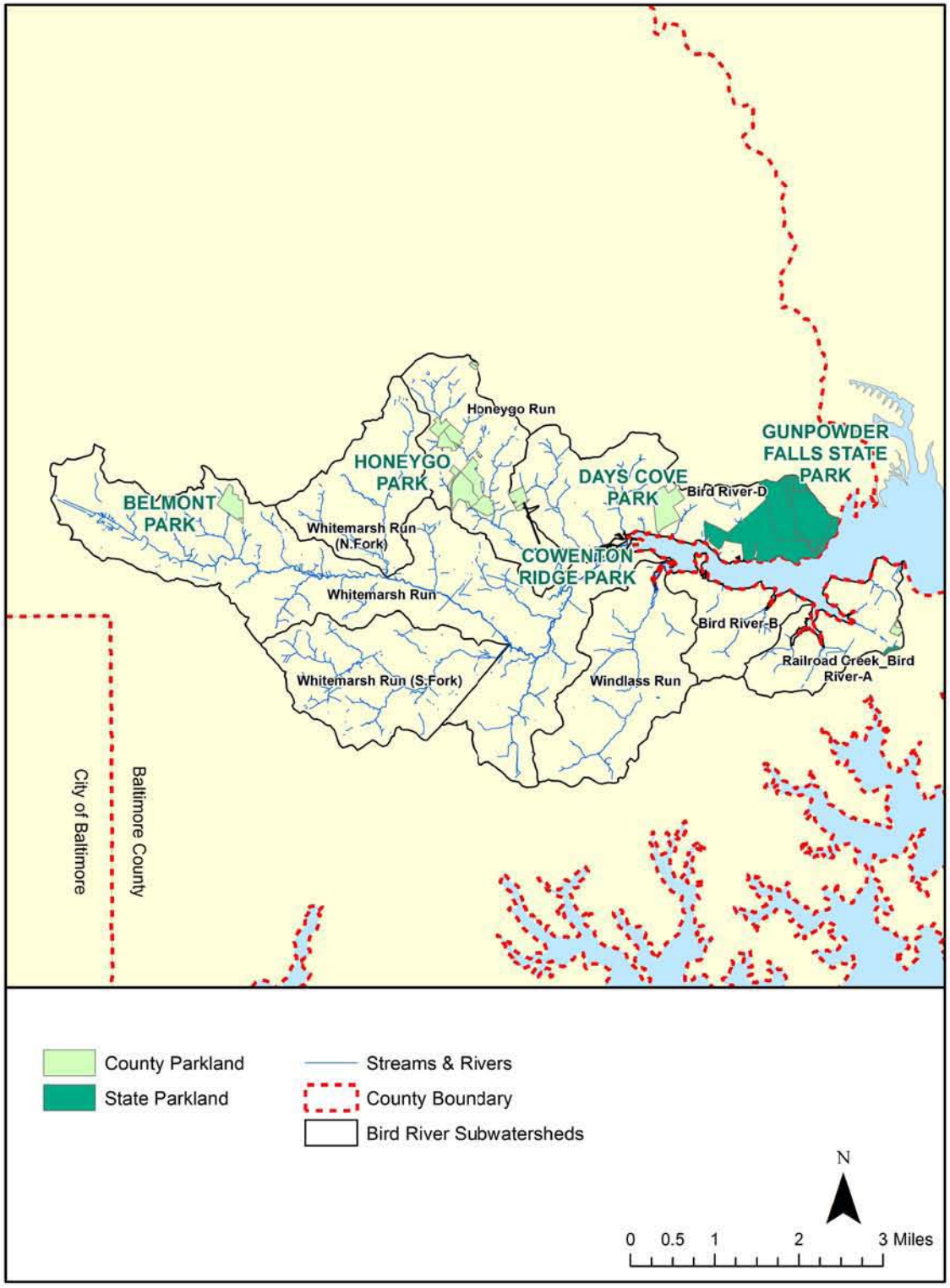


Figure 2-11: Bird River Watershed Parklands

2.3.2 Population

Population data provides another way to evaluate the intensity of land use. As previously mentioned, much of the degradation from urban/suburban land uses (where population is mainly concentrated) is related to the extent of impervious cover and also conversion of land uses that protect water resources such as forest. A higher population density (persons per acre) represents a more intense use of the land and potential for environmental degradation. On the other hand, urban planning and smart growth initiatives, which concentrate development and maximize land use in some areas, are ways of preserving open spaces and protecting areas outside of the growth zone, leaving them undisturbed and undeveloped. Much of the development in the watershed pre-dates the recent push for smart growth, but the principles may still be of use. Smart growth principles are aimed at directing future growth to areas of existing services and where development has already occurred. This will result in less land conversion to residential and supporting urban development such as commercial areas and therefore, conservation of land uses with less environmental impacts such as forest and agriculture. Population density in the Bird River watershed was estimated based on the 2010 U.S. Census. Table 2-11 summarizes population density by subwatershed with respect to total area and impervious area. Population density distribution for the watershed is shown in Figure 2-12. In general, higher population densities correspond to the areas designated as medium and high density residential land use discussed in the last section. Population density is greatest along the western half of the watershed, which includes the Whitemarsh Run, Whitemarsh Run (N. Fork) and Whitemarsh Run (S. Fork) subwatersheds.

Table 2-11: Bird River Watershed Population Data

Subwatershed	Total Population (2010 census)	Total Area (acres)	Population Density (per acre)	Impervious Area (acres)	Population Density (per impervious acre)
Bird River-B	354.4	770.4	0.5	30.4	11.7
Bird River-D	2,724.8	2,360.1	1.2	297.3	9.2
Honeygo Run	4,533.3	1,644.9	2.8	255.8	17.7
Railroad Creek_Bird River-A	2,397.4	991.9	2.4	126.2	19.0
Whitemarsh Run	30,181.6	5,454.4	5.5	1340.1	22.5
Whitemarsh Run (N. Fork)	11,604.8	1,374.4	8.4	372.0	31.2
Whitemarsh Run (S. Fork)	7,862.8	1,884.1	4.2	497.6	15.8
Windlass Run	1,236.0	1,927.9	0.6	138.8	8.9
Total	60,895.3	16,408.2	3.7	3,058.2	19.9

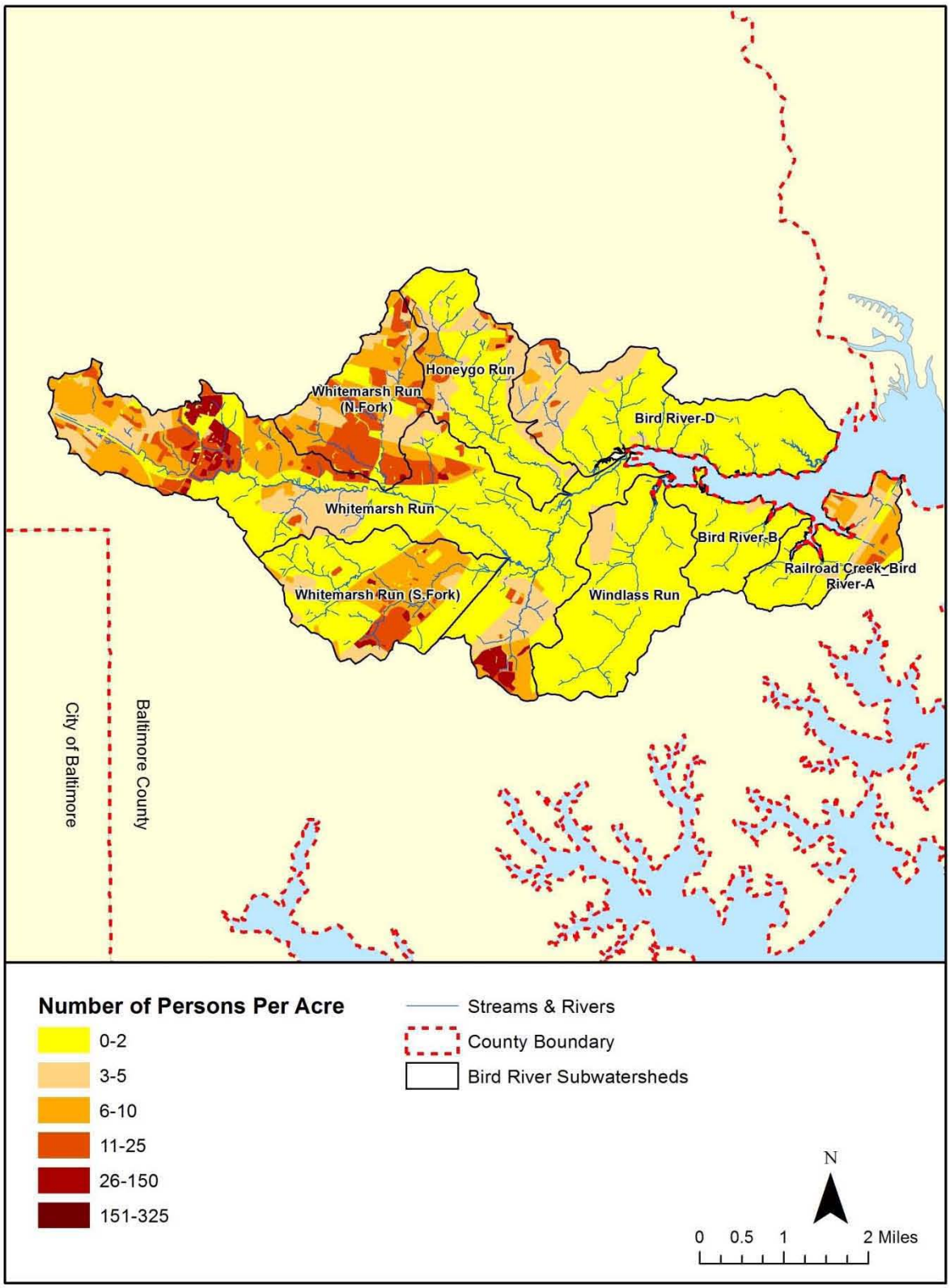


Figure 2-12: Bird River Watershed Population Distribution

2.3.3 Impervious Surfaces

Impervious surfaces prevent precipitation from naturally infiltrating into the ground; these types of surfaces include roads, parking areas, roofs, and other paved surfaces. When precipitation cannot infiltrate, it is typically concentrated, accelerated and conveyed directly to the nearest stream. Consequently, stormwater and snowmelt 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 likely to have better water quality in local streams than urbanized watersheds with greater amounts of impervious cover. Impervious cover is a primary factor when determining pollutant characteristics and amounts in stormwater runoff. Research has been conducted to link the degree of urbanization (typically measured by amount of impervious cover) with various watershed-based indicators of water quality such as the diversity and abundance of aquatic and terrestrial life. The Center for Watershed Protection (CWP) compiled stream research conducted in various parts of the country and developed a simple model that relates stream quality to percentage of impervious cover in a watershed. Studies used to develop the impervious cover model measured stream quality based on a variety of indicators such as number of aquatic insect species, stream temperature, channel stability, aquatic habitat, wetland plant density, and fish communities. CWP's impervious cover model is illustrated in Figure 2-13.

Based on the research compiled, CWP determined three general categories to classify and predict stream quality in terms of impervious cover. Watersheds with less than 10 percent impervious cover are referred to as sensitive and typically have high quality streams with stable channels, good habitat conditions, and good to high water quality; sensitive watersheds are susceptible to environmental degradation with urbanization and increases in impervious cover. The model predicts that between 10 and 25 percent impervious cover, watersheds become impacted and would show clear signs of degradation such as erosion, channel widening, and a decline in stream habitat. There is a possibility to restore streams to a somewhat natural functioning system within this category. When a watershed has more than 25 percent impervious cover, streams are classified as damaged which are characterized by fair to poor water quality, unstable channels, severe erosion, and inability to support aquatic life and provide habitat; many streams in this category are typically piped or channelized.

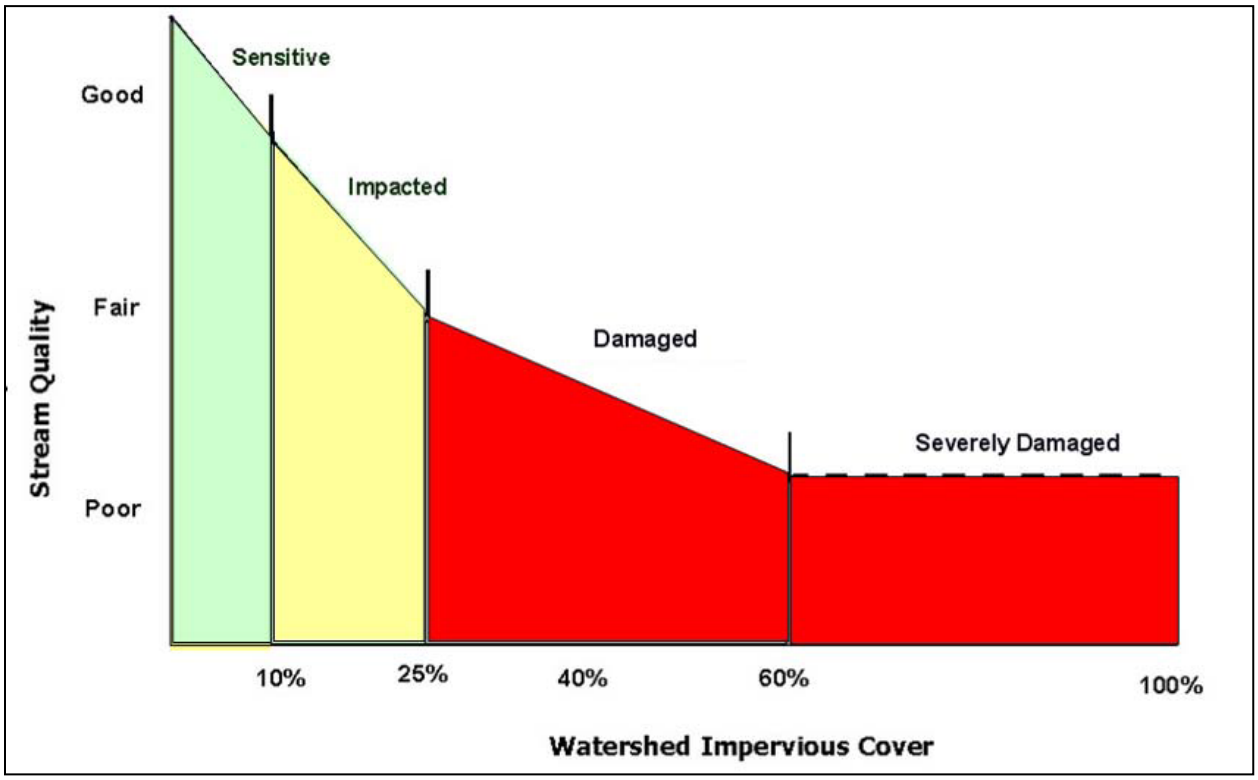


Figure 2-13: Impervious Cover Model (adapted from CWP 2003)

Figure 2-13 shows that when impervious cover exceeds 60 percent, a watershed is classified as severely damaged and means that most of the natural stream system is gone. Management of damaged and severely damaged streams may focus on decreasing pollutant loads to downstream receiving waters (e.g., installing BMPs) but the ability to restore natural functions, such as habitat, is unlikely. Restoration efforts may also focus on making the remaining stream systems stable, aesthetically pleasing and an amenity to the community. It should be noted that the impervious cover model is a simplified approach for classifying the quality of urban streams. Although it is based on research, there are inherent model assumptions and limitations that should be considered such as regional variations and scale effects. In addition, while impervious cover is a relevant and significant indicator for watershed health, it is only one of many different factors affecting stream health and contributing to the cumulative impacts of development on water quality. For example, agricultural land uses contribute sediment and nutrient loads to receiving waters depending on management practices. Also, the ability of BMPs to offset adverse impacts from urbanized areas is not specifically accounted for in this model.

The roads and buildings (including parking lots) GIS data layers from Baltimore County were used to derive impervious surface areas within the Bird River watershed (Figure 2-14). Data for sidewalks was unavailable so they are not accounted for in this analysis. The area for each layer was determined and then combined to obtain estimates of impervious cover areas on a subwatershed scale. Table 2-12 summarizes the area of roads and buildings, total impervious area, and percent impervious area for each subwatershed. Impervious cover represents about 20 percent of the watershed or 3,058 acres. Subwatershed ratings according to the CWP impervious cover model and these impervious area estimates are shown in Figure 2-15.

Table 2-12: Bird River Subwatershed Impervious Area Estimates

Subwatershed	Total Area (acres)	Buildings (acres)	Parking Lots (acres)	Roads (acres)	Impervious Area (acres)	% Imper-vious
Bird River-B	770.4	8.9	1.6	19.9	30.4	3.9
Bird River-D	2,360.1	63.2	122.9	111.2	297.3	12.6
Honeygo Run	1,644.9	71.7	65.1	119.0	255.8	15.6
Railroad Creek_Bird River-A	991.9	50.0	10.5	65.8	126.2	12.7
Whitemarsh Run	5,454.4	399.5	364.4	576.2	1340.1	24.6
Whitemarsh Run (N. Fork)	1,374.4	154.6	48.5	168.9	372.0	27.1
Whitemarsh Run (S. Fork)	1,884.1	143.1	177.9	176.6	497.6	26.4
Windlass Run	1,927.9	43.3	33.4	62.1	138.8	7.2
Total	16,408.2	934.1	824.3	1,299.8	3,058.2	18.6

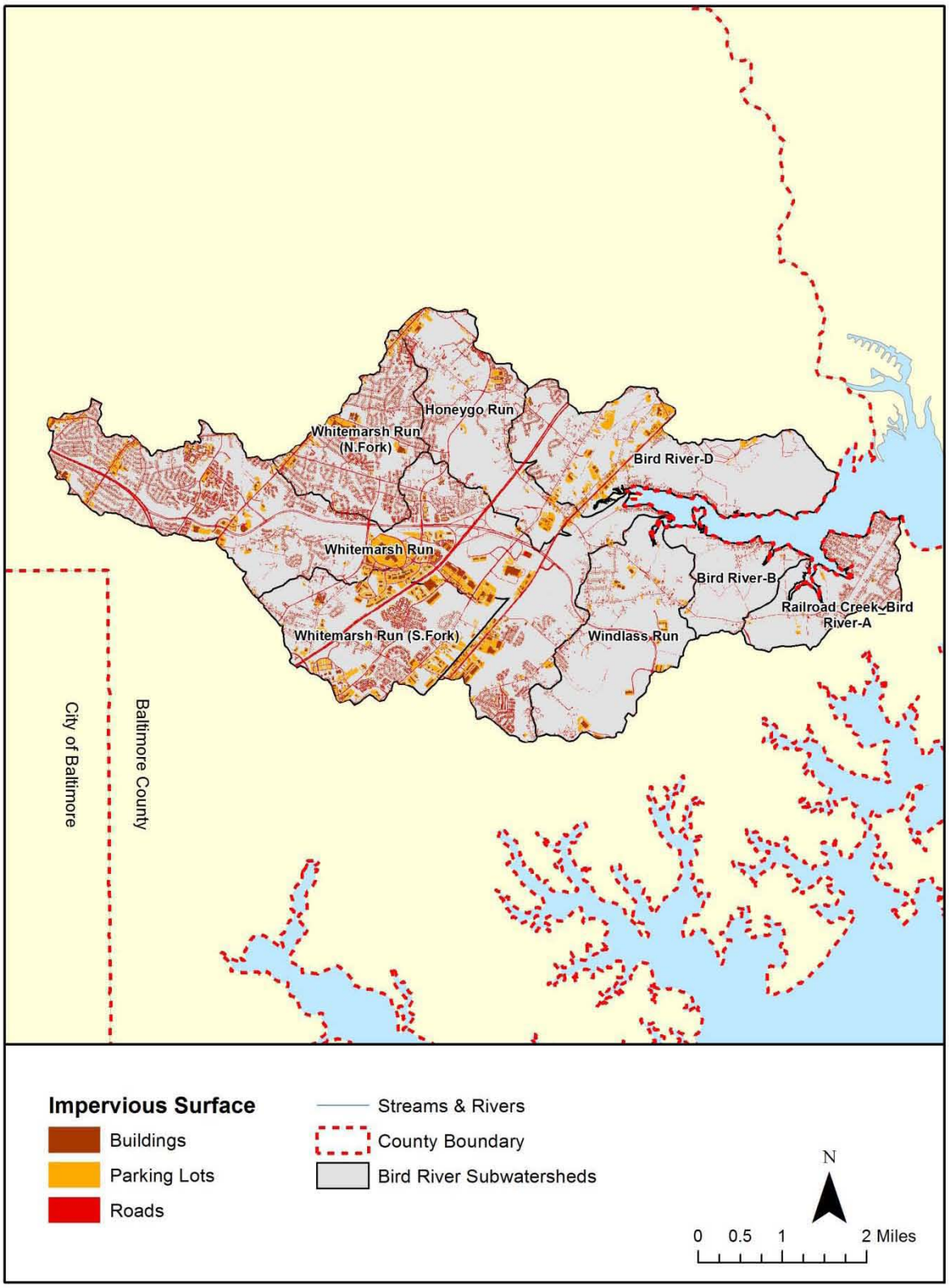


Figure 2-14: Bird River Watershed Impervious Surface

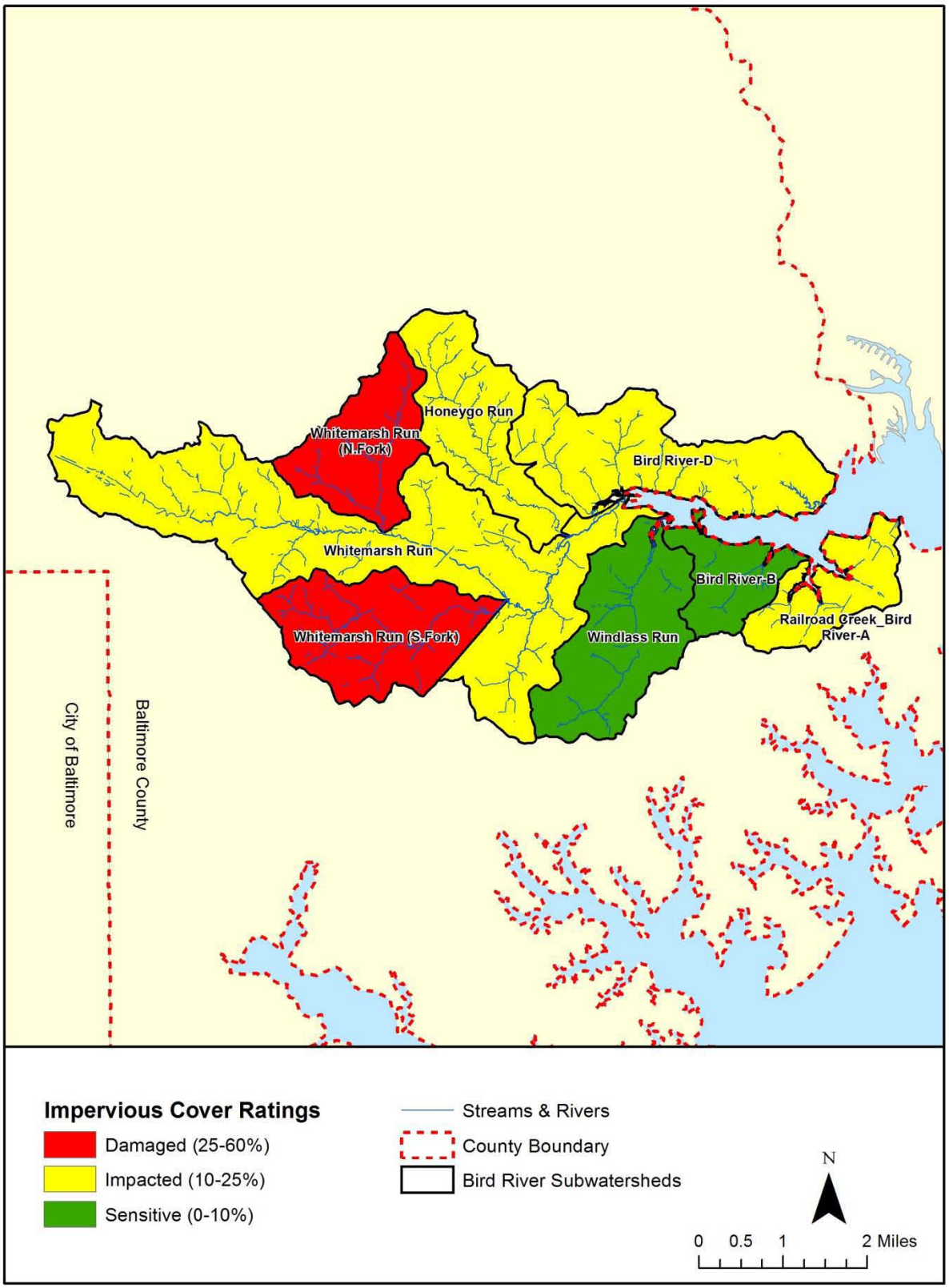


Figure 2-15: Bird River Watershed Impervious Cover Ratings

2.3.4 Stormwater

Stormwater is water generated during and immediately after storm events. Stormwater that does not seep into the ground becomes stormwater runoff and goes directly to receiving water bodies. The amount and characteristics of stormwater runoff is affected by rainfall amount and intensity, soil properties, slope, and land use/land cover. Concerns associated with stormwater include rate and volume of runoff and water pollution. For example, more runoff is generated from impervious cover and agricultural land than from forested land. As previously mentioned, impervious surfaces do not allow any water to infiltrate into the ground and runoff is conveyed more rapidly into the stream system. The increase in runoff rate and volume can cause flooding and stream erosion which in turn, results in the destruction of habitat and natural stream functions such as nutrient reduction. In addition, there is less potential for groundwater recharge when there is little or no infiltration of stormwater.

Stormwater runoff can also carry various contaminants depending on land use characteristics and human activities. Pollutants deposited on impervious surfaces and other developed lands from daily human activities are often carried by stormwater to stream systems. For example, common constituents in impervious surface runoff (e.g., highways, parking lots) include sediment, metals, bacteria, nutrients, and petroleum; pollutants such as these build up over time from various sources such as maintenance activities (de-icing, roadside fertilizer use), vehicles (exhaust, leaks), and accidents/spills and are washed off during storm events. While the runoff from other developed areas, agriculture operations and residential areas for example, may be Mod. compared to highly impervious areas, it can still carry pollutants such as nutrients, bacteria, and chemicals to receiving water bodies.

2.3.4.1 Storm Drainage System

The storm drainage system consists of either drainage swales (roadside ditches) or a curb and gutter system including inlets, piping, and outfalls. Both methods are intended to prevent flooding and potentially hazardous situations by removing water quickly from roadways. However, the efficiency and environmental impacts associated with each method are different. The curb and gutter system removes stormwater from impervious surfaces quickly and typically conveys water directly to the stream system. While the curb and gutter system removes stormwater quickly from roadways, it delivers increased runoff volumes and untreated pollutants to receiving water bodies. Drainage swales do not convey water as quickly as the curb and gutter system and the stormwater flow is somewhat reduced before entering the stream system. Drainage swales also allow some infiltration into the ground unlike the curb and gutter system; this reduces the amount of water delivered and provides some filtering of pollutants.

Curb and gutter system components in the Bird River watershed are summarized in Table 2-13 by subwatershed. This includes an estimate of the number of major (> 3 feet in diameter) and minor (< 3 feet in diameter) storm drain outfalls and corresponding number of inlets and length of storm drain pipe. Storm drain system databases used to compile this table were created in 1992 with periodic updates according to county storm drain plans. This data provides a reasonable approximation of storm drain pipe data for this analysis and the numbers presented in Table 2-13 where pipe lengths were rounded to the nearest tens of feet. Table 2-14 provides a summary of the proportion of subwatershed area covered by the storm drain system (stormwater drainage area within subwatershed divided by total subwatershed area) and the number of inlets per square mile for each subwatershed. Figure 2-16 shows the location of major (> 3 feet) and minor (< 3 feet) outfalls within the watershed. The subwatershed with the

most storm drain system coverage is Whitemarsh Run (N. Fork). This coincides with the high concentration of residential and commercial development that is present in this area. Whitemarsh Run and Whitemarsh Run (N. Fork) have the highest number of major outfalls with 18 and 15, respectively. In all, 73% of the major outfalls in the entire watershed are concentrated in these two subwatersheds. This is also where there is the most commercial/industrial development present.

Table 2-13: Bird River Subwatershed Storm Drain System Components

Subwatershed	Major Outfalls (> 3 ft diameter)			Minor Outfalls (< 3 ft diameter)			All Outfalls		
	Out-falls (#)	Inlets (#)	Pipes (ft)	Out-falls (#)	Inlets (#)	Pipes (ft)	Total Out-falls (#)	Total Inlets (#)	Total Pipes (#)
Bird River-B	0	0	0	1	2.	290	1	2	290
Bird River-D	0	0	0	0	0	0	0	0	0
Honeygo Run	3	24	2,700	13	37	3,580	16	61	6,280
Railroad Creek_Bird River-A	2	13	2,270	7	29	4,050	9	42	6,320
Whitemarsh Run	18	134	23,967	96	403	46,929	114	537	70,896
Whitemarsh Run (N. Fork)	15	195	18,923	86	357	54,652	101	552	73,575
Whitemarsh Run (S. Fork)	6	20	2,930	21	61	7,548	27	81	10,478
Windlass Run	1	11	1,600	1	5	1,295	2	16	2,895
Total	45	397	52,390	225	894	118,344	270	1,291	170,734

Note: Baltimore County is currently updating their storm drain data and although this current dataset is incomplete and in draft form, it is more accurate and complete than the County's historic storm drain data.

Table 2-14: Bird River Subwatershed Stormwater System Coverage

Subwatershed	Stormwater System Drainage Area (acres)	% of Watershed Covered by Stormwater System	Total Inlets (#)	Inlet Density (#/sq. mi.)
Bird River-B	8.8	1	2	1.7
Bird River-D	0	0	0	0.0
Honeygo Run	149.7	9	61	23.7
Railroad Creek_Bird River-A	91.4	9	42	27.1
Whitemarsh Run	1,093.4	20	537	63.0
Whitemarsh Run (N. Fork)	1,081.4	79	552	256.7
Whitemarsh Run (S. Fork)	508.6	27	81	27.6
Windlass Run	71.8	4	16	5.3
Total	3,005.1	2	1291	50.4

Note: Baltimore County is currently updating their storm drain data and although this current dataset is incomplete and in draft form, it is more accurate and complete than the County's historic storm drain data.

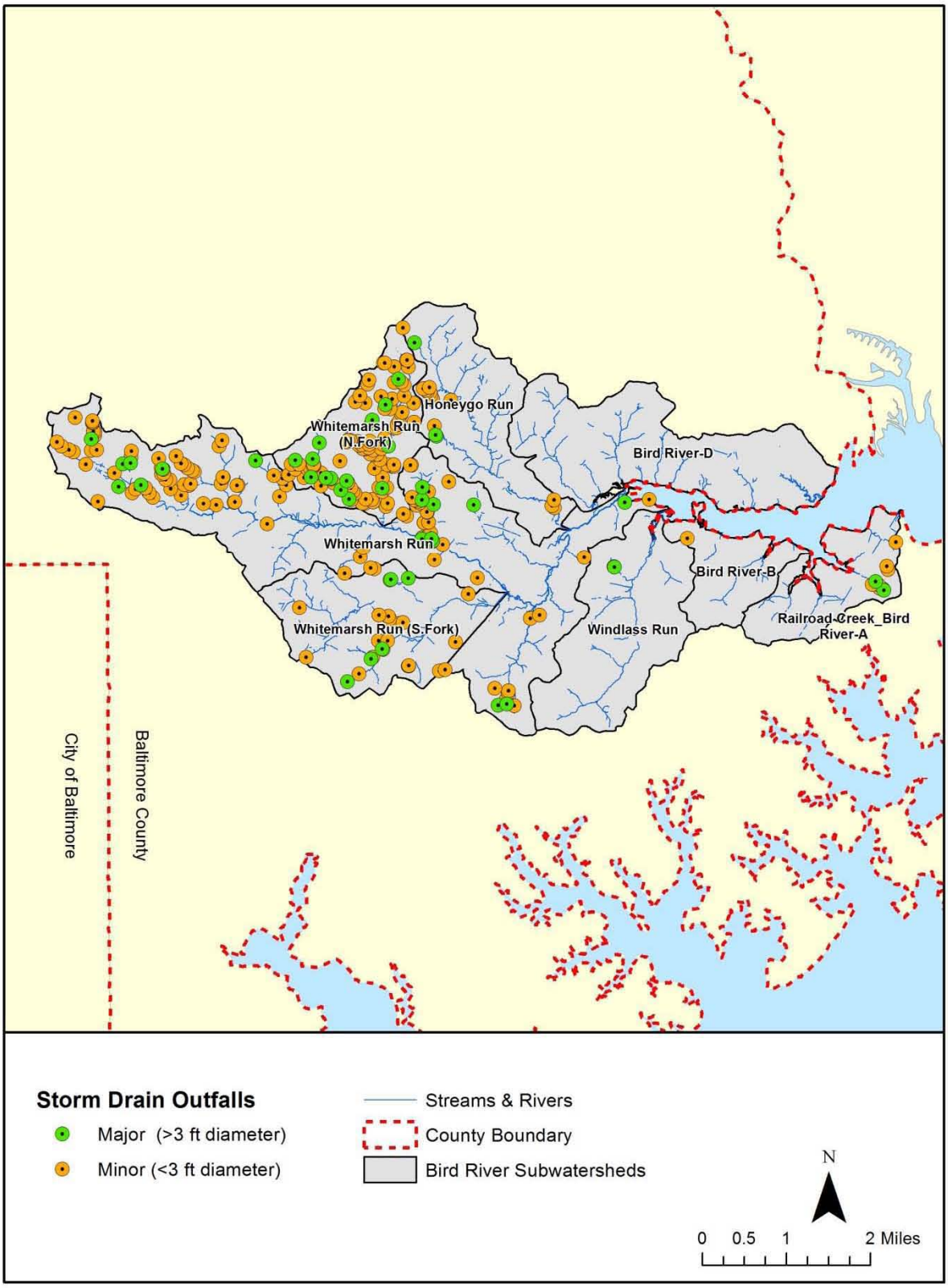


Figure 2-16: Bird River Watershed Storm Drain Outfalls

2.3.4.2 Stormwater Management Facilities

Maryland was the first state to adopt stormwater quality regulations more than 20 years ago. Stormwater management (SWM) practices evolve as technology and research advance. It continues to be a significant consideration for new and re-development within the state. Management of stormwater runoff is required to reduce erosion, sedimentation, pollution, and flooding per Title 4, Subtitle 2 of the Environment Article of The Annotated Code of Maryland. Increased importance of water quality and water resource protection led to the development of the Maryland Stormwater Design Manual to provide BMP design standards and environmental incentives (MDE 2000) and a general shift toward adopting practices that mimic natural hydrologic processes, are low impact, and achieve pre-development conditions. The latter is evident in the Maryland "Stormwater Management Act of 2007," which requires that environmental site design (ESD) be implemented to the maximum extent practicable via nonstructural BMPs and/or other better site design techniques. Maryland Department of the Environment (s responsible for implementing this regulation and issued an update to the Design Manual in May 2009.

There are many types of BMPs available for managing stormwater runoff and providing stormwater quality treatment. SWM can target specific objectives depending on the BMP type such as stormwater quality, soil stabilization, stormwater flow control, and stream restoration. In addition, different SWM facilities have different pollutant removal capabilities. For example, initial dry pond designs for SWM typically have low pollutant removal efficiency compared to practices that filter the stormwater or allow it to infiltrate into the ground or through plant roots. Several considerations are taken into account when selecting appropriate stormwater treatment measures such as space requirements, maintenance, cost, and community acceptance. Table 2-15 provides a summary of the different SWM facilities located within the Bird River watershed by subwatershed including dry and wet ponds, wetlands, infiltration/filtration practices, extended detention, and proprietary BMPs. The distribution of SWM facilities throughout the watershed is illustrated in Figure 2-17.

Extended detention facilities and filtration/infiltration practices are the most common types of SWM within the SWAP area. However, more acreage drains to dry ponds than any other type of SWM facility. The dry pond facilities represent the best opportunity for conversion to BMPs with higher pollutant removal capabilities. Every subwatershed has some form of SWM, though the Bird River-B subwatershed contains only one infiltration/filtration facility. This is likely due to the fact that this subwatersheds land use/land cover is mostly agriculture and forest. The proprietary BMPs in the watershed are Stormceptor devices, which remove sediment, oil and grease through hydrodynamic separation. Sediment particles and oil and grease settle out as flow circulates in a swirling path; floatable and settled debris collected in the treatment chamber are typically removed by a vacuum truck at regular intervals.

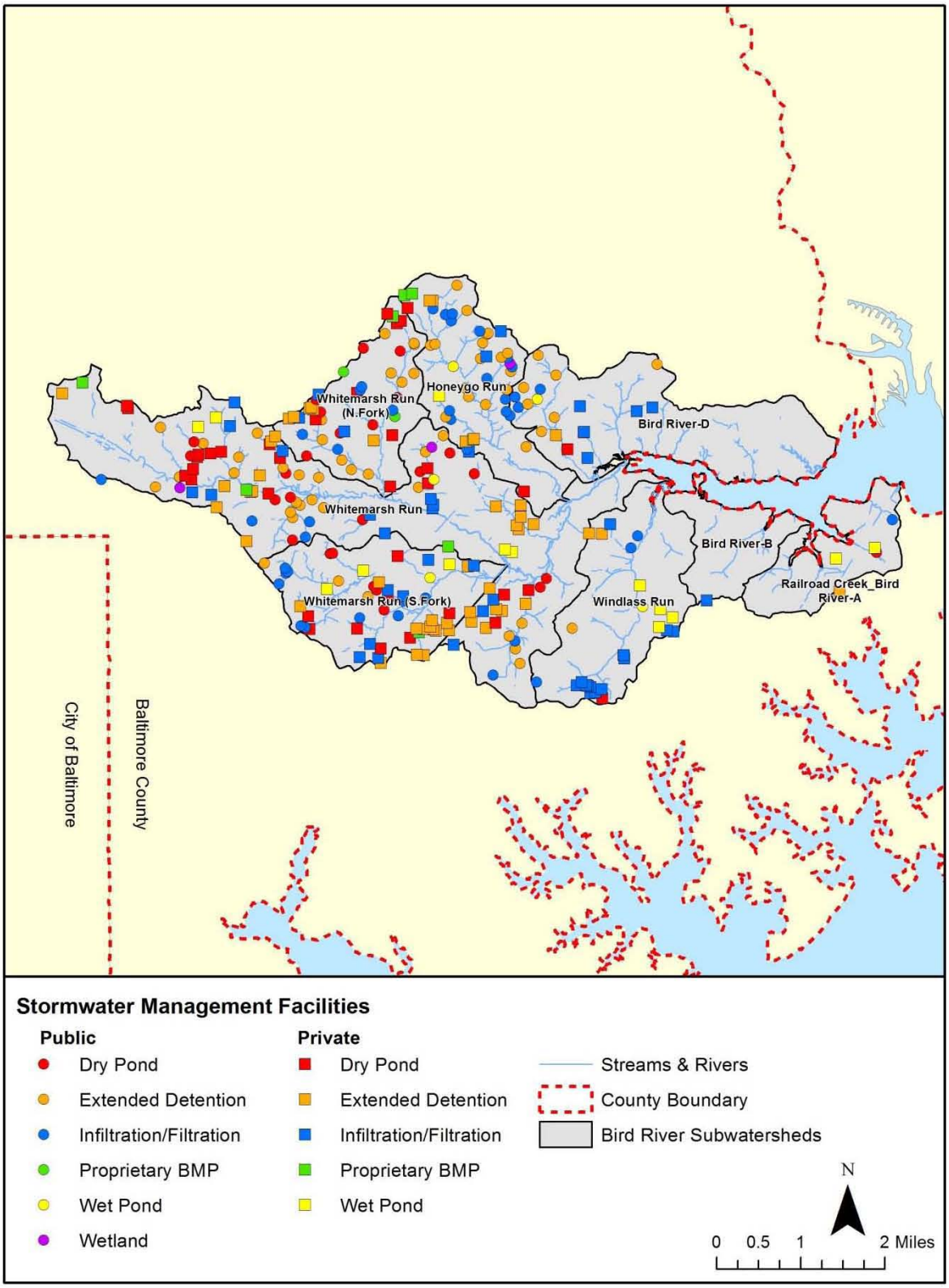


Figure 2-17: Stormwater Management Facilities in Bird River Watershed

Table 2-15: Bird River Stormwater Management Facilities by Subwatershed

SWMF Facility Type	Subwatersheds								
	Bird River-B	Bird River-D	Honeygo Run	Railroad Creek_Bird River-A	Whitemarsh Run	Whitemarsh Run (N. Fork)	Whitemarsh Run (S. Fork)	Windlass Run	Total
Dry Pond (#)	0	1	2	1	29	15	13	1	62
Dry Pond Drainage Area (acres)	0.00	10.53	11.92	87.70	664.76	243.48	202.77	8.72	1229.88
Extended Detention (#)	0	8	21	1	46	17	17	3	113
Extended Detention Drainage Area (acres)	0.00	130.03	184.30	0.75	345.76	137.01	107.43	28.40	933.68
Infiltration/Filtration (#)	1	10	16	1	19	8	17	16	88
Infiltration/Filtration Drainage Area (acres)	8.19	23.33	64.09	1.87	80.70	22.63	48.15	62.00	310.96
Proprietary BMP (#)	0	0	3	0	3	3	1	0	10
Proprietary BMP Drainage Area (acres)	0.00	0.00	1.14	0.00	0.86	1.65	0.82	0.00	4.47
Wet Pond (#)	0	1	2	2	5	0	4	5	19
Wet Pond Drainage Area (acres)	0.00	10.78	12.58	16.95	171.84	0.00	350.67	183.66	746.48
Wetland (#)	0	2	1	1	3	0	0	1	8
Wetland Drainage Area (acres)	0.00	6.31	9.58	1.30	108.50	0.00	0.00	30.81	156.5
Total (#)	1	22	45	6	105	43	52	26	300
Total Drainage Area (acres)	8.19	180.98	283.61	108.57	1372.42	404.77	709.84	313.59	3381.97

The total area treated by SWM and the proportion of urban area treated by SWM is summarized in Table 2-16 by subwatershed. Note that for this analysis urban land use includes the following MDP land use categories: low, medium and high residential, commercial, industrial, institutional, open urban, and transportation. Table 2-16 shows that urban land use encompasses about 45 percent of the Bird River watershed and only 46% of that is treated by SWM practices. This indicates an opportunity to implement SWM (BMPs or treatment devices) in existing developed areas where no practices are currently in place or to retrofit facilities that are not providing adequate treatment before stormwater reaches the stream system. Refer to Section 3.7 for more details on assessed SWM facilities within the watershed.

Table 2-16: Bird River Stormwater Management by Subwatershed

Subwatershed	Area (acres)	Urban Land Use (acres)	Area Treated by SWM (acres)	Urban Land Use Treated by SWM (%)
Bird River-B	770	116	8	7%
Bird River-D	2,360	729	181	25%
Honeygo Run	1,645	664	284	43%
Railroad Creek_Bird River-A	992	533	109	20%
Whitemarsh Run	5,454	2,858	1,372	48%
Whitemarsh Run (N. Fork)	1,374	953	405	42%
Whitemarsh Run (S. Fork)	1,884	970	710	73%
Windlass Run	1,928	520	314	60%
Total	16,407	7,342	3,383	46%

2.3.5 NPDES Discharge Permits

Facilities that discharge municipal or industrial wastewater or conduct activities that can contribute pollutants to a waterway are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit. The number and type of NPDES-permitted facilities within each subwatershed is summarized in Table 2-17.

As of 2012, there are currently 21 NPDES-permitted facilities within the Bird River watershed (Figure 2-18). These permitted facilities include the Days Cove and the Honeygo Rubble Landfills, various apartment complexes, several swimming pool facilities, and more. Industrial surface water discharge permits are issued for industrial facilities that discharge process water to State surface waters which must meet applicable federal effluent guidelines and/or State water quality standards. The only facility with an individual surface water industrial discharge permit is Cargill Inc. - Salt Division.

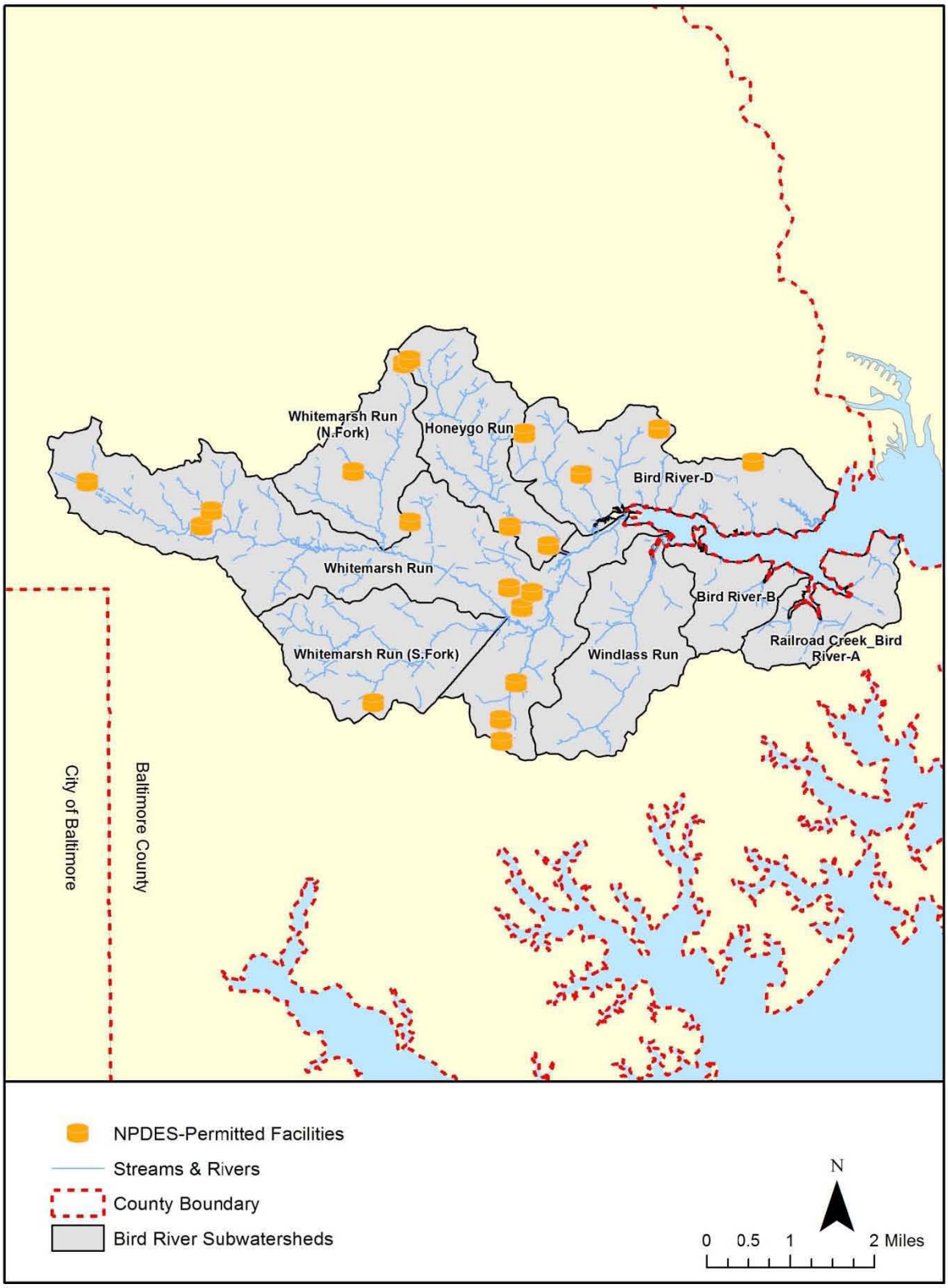


Figure 2-18: Location of NPDES-Permitted Facilities in Bird River Watershed

Table 2-17: NPDES-Permitted Facilities in Bird River Subwatersheds

Subwatershed	# General Permits	# General Industrial Stormwater Permits	# Surface Industrial Discharge Permits	Total # of Permits
Bird River-B	0	0	0	0
Bird River-D	3	0	1	4
Honeygo Run	2	1	0	3
Railroad Creek_Bird River-A	0	0	0	0
Whitemarsh Run	9	2	0	11
Whitemarsh Run (N. Fork)	2	0	0	2
Whitemarsh Run (S. Fork)	1	0	0	1
Windlass Run	0	0	0	0
Total	17	3	1	21

2.3.6 Wastewater

Wastewater created through human use must be treated and disposed. This is accomplished either through public conveyance to a treatment facility or through individual wastewater treatment systems (septic systems). Residential wastewater consists of all water typically used by residents including wash water, bathing water, human waste disposal water, and any other rinse water (paint brush, floor washing, etc.). Industrial wastewater depends on the operation and could contain various contaminants such as metals, organic compounds, detergents, or synthetic compounds. All of these types of wastewater have the potential to adversely impact the natural environment.

2.3.6.1 Septic Systems

Properly functioning septic systems provide treatment for nearly all of the phosphorus present in wastewater, but can leak nitrogen in the form of nitrate. Depending on the location of the system, nitrate may be reduced or eliminated through de-nitrification as the treated water passes through riparian buffers, particularly forested riparian buffers. Failing systems can release nitrogen, phosphorus, and other chemicals and in turn, contaminate the aquatic environment. They can also result in increased bacterial contamination of nearby streams and therefore, potential for human health concerns. Table 2-18 summarizes the approximate number of septic systems by subwatershed.

Table 2-18: Bird River Septic Systems by Subwatershed

Subwatershed	No. of Septic Systems
Bird River-B	159
Bird River-D	108
Honeygo Run	225
Railroad Creek_Bird River-A	40
Whitemarsh Run	154
Whitemarsh Run (N. Fork)	3
Whitemarsh Run (S. Fork)	74
Windlass Run	339
Total	1,102

2.3.6.2 Public Sewer

A public sewer system conveys wastewater from individual households or businesses to a facility that treats the wastewater prior to discharge. It consists of the piping system within the public right-of-way and cleanouts on individual properties. Property owners are responsible for the maintenance of the latter part of the system, their individual cleanouts. The portion of the system within the public right-of-way is owned and maintained by the local government. This includes gravity piping system, access manholes, pumping stations, and force mains. Table 2-19 summarizes the types and lengths of public sewer piping by subwatershed in the Bird River watershed. This includes force (pressure) and gravity main lines and portions of the gravity main that have been abandoned or removed. Table 2-20 includes sewer piping density, or length per square mile, for each subwatershed.

Table 2-19: Public Sewer Piping in Bird River Subwatersheds

Subwatershed	Pressurized Main (ft)	Gravity Main (ft)	Gravity Main Abandoned (ft)	Total (ft)
Bird River-B	0	0	0	0
Bird River-D	22,575	76,214	192	98,981
Honeygo Run	3,715	98,324	11	102,049
Railroad Creek_Bird River-A	6,862	54,926	0	61,788
Whitemarsh Run	37,026	359,805	8,546	405,377
Whitemarsh Run (N. Fork)	244	184,300	341	184,884
Whitemarsh Run (S. Fork)	1,417	103,002	215	104,634
Windlass Run	13,243	47,328	0	60,571
Total	85,081	923,899	9,305	1,018,285

Table 2-20: Public Sewer Piping Density in Bird River Subwatersheds

Subwatershed	Area (sq. miles)	Gravity Main (ft/sq. mi.)	Pressurized Main (ft/sq. mi.)
Bird River-B	1.2	0	0
Bird River-D	3.69	20,706	6,118
Honeygo Run	2.57	38,263	1,446
Railroad Creek_Bird River-A	1.55	35,436	4,427
Whitemarsh Run	8.52	43,234	4,346
Whitemarsh Run (N. Fork)	2.15	85,880	113
Whitemarsh Run (S. Fork)	2.94	35,108	482
Windlass Run	3.01	15,724	4,400
Total	25.63	36,411	3,320

Environmental impacts associated with public sewer are usually the result of sewage overflows. Overflows typically result from blockages within the sewage system, pumping station failure, or rainwater inflows exceeding pipe capacity. Dry weather flows can also have potential impacts due to leaks in the sewer system. Environmental concerns related to sewer overflows and leaks include high bacteria concentrations, release of nutrients, elevated turbidity (cloudiness), and low dissolved oxygen.

2.3.7 Drinking Water

Drinking water is a fundamental need for human development. It can be supplied either by public distribution systems or by wells associated with individual developed properties. Having an adequate supply of drinking water is essential to maintaining the human population in a region.

2.3.7.1 Public Water Supply

Environmental impacts associated with public supply of water include the potential for increased residential development with the associated impervious cover effects discussed in the previous section and the potential for leaks from the system. Leaks from public water supply systems introduce chlorine into the aquatic system which can result in the death of aquatic organisms. In addition, major leaks can cause erosion which contributes to the sediment load in stream channels; this can bury aquatic benthic communities and degrade habitat.

2.3.8 Zoning

According to the Baltimore County Office of Planning (2011), zoning is defined as “a system of land use regulation that controls the physical development of land and a legal mechanism by which local government is able to regulate an owner’s right to use privately owned land for the sake of protecting the public health, safety, and/or general welfare.” In other words, zoning manages development patterns over time throughout the county. The current zoning for the Bird River watershed is shown in Figure 2-19. A summary of zoning category acreages and proportions within the Bird River watershed is included in Table 2-21. As shown in the table, a variety of zoning categories are represented in the watershed however, the dominant categories are residential (‘DR’ categories) and light manufacturing (‘ML’ categories).

Most of the land directly adjacent to the tidal Bird River is zoned as Resource Conservation - Critical Area or Agricultural, as shown in Figure 2-19. Commercial and industrial zoning dominate the central portion of the watershed, while the remaining areas of the watershed, including most of the lands surrounding stream headwaters, are zoned residential.

Table 2-21: County Zoning in Bird River Watershed

Zoning Description	Zoning Codes	Acres	% of Watershed Area
Business Local	BL,BLR	278	1.7
Business Major	BM	418	2.5
Business Roadside	BR	321	2.0
Community Business	CB	14	0.1
Low Density Residential	DR 1	4,383	26.6
Medium Density Residential	DR 5.5	3,751	22.8
High Density Residential	DR 10.5	1,160	7.0
Residential Apartment - Mid-rise	RAE 1	50	0.3
Manufacturing Heavy	MH	440	2.7
Manufacturing Light	ML	2,213	13.5
Manufacturing Light Restricted	MLR	272	1.7
Office Park	O 3	11	0.1
Office/Residential - High Density	OR 1	-	0.0
Office/Residential - Medium Density	OR 2	30	0.2
Office and Technology	OT	-	0.0
Resource Conservation - Agricultural	RC 2	1,447	8.8
Resource Conservation - Deferral of Pl. and Devel.	RC 3	399	2.4
Resource Conservation - Rural Residential	RC 5	43	0.3
Resource Conservation - Rural Cons. & Reside.	RC 6	43	0.3
Resource Conservation - Critical Area	RC 20, RC 50	1,131	6.9
Residential Office	RO	48	0.3
Total		16,451	100.0

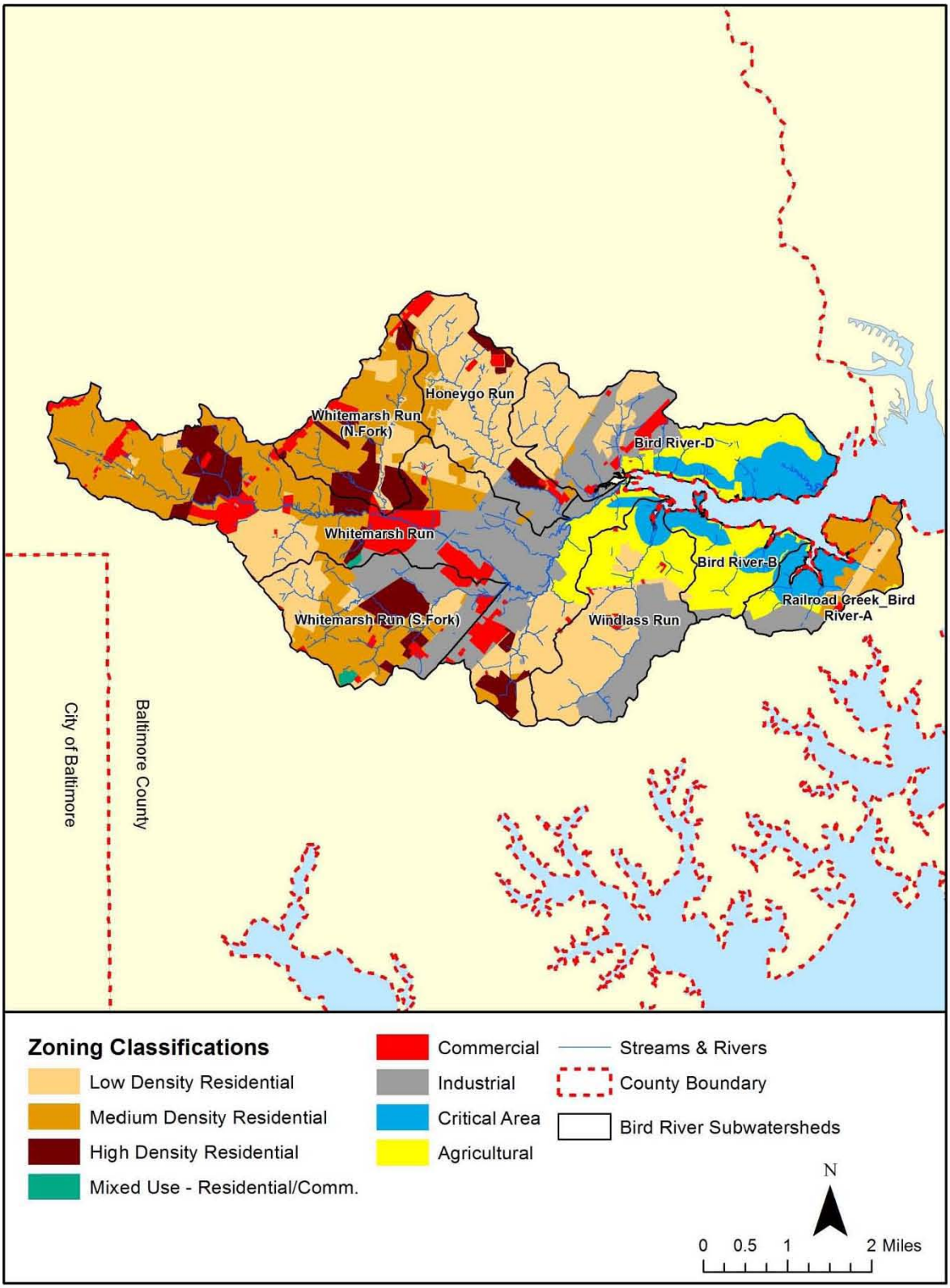


Figure 2-19: Bird River Watershed Zoning

2.3.9 Coastal Rural Legacy

Baltimore County, in partnership with the Gunpowder Valley Conservancy (GVC), a watershed and local land trust organization, participates in the State's Rural Legacy Program. This program was developed in 1997 to protect large, continuous tracts of valuable cultural and natural resource lands through state grants made to local land trusts. The Coastal Rural Legacy (CRL) area, one of five state-approved rural legacy areas in Baltimore County, is among the richest in resources within the County and is the most threatened by development. The area encompasses 14,103 acres of vital wetlands, forests, marshes, farmland, and habitat along the shoreline of the Upper Western Shore of the Chesapeake Bay. 2,834 acres of CRL lie in the Bird River SWAP area (Table 2-22), of which 130 acres have been preserved under the Rural Legacy program. Figure 2-20 shows the Coastal Rural Legacy area in Bird River and land preserved under the program. An additional 105 acres in the Bird River CRL area have been preserved under the Maryland Agricultural Land Preservation Foundation (MALPF).

The preservation of large blocks of forest and wetland areas creates a system of environmental reserves, which is important in the protection and restoration of the Chesapeake Bay watershed. The 16 miles of coastal area shoreline in Bird River serve as an essential buffer area between urbanized portions of watershed and the Bay. Significant progress has been made in protecting these coastal areas and if support continues, the long-term goal of protecting 11,700 acres county-wide can be achieved.

For more information, or to apply for this program, visit Baltimore County's Coastal Rural Legacy website, http://www.baltimorecountymd.gov/Agencies/environment/landpreservation/coastalrurallegacy.html or contact the land preservation office at 410-887-3854.

Table 2-22: Coastal Rural Legacy (CRL) Area in Bird River Subwatersheds

Subwatershed	CRL Area (Acres)	% of Subwatershed
Bird River-B	757.21	98
Bird River-D	1,222.35	52
Honeygo Run	0.00	0
Railroad Creek_Bird River-A	324.19	41
Whitemarsh Run	186.20	3
Whitemarsh Run (N. Fork)	0.00	0
Whitemarsh Run (S. Fork)	0.00	0
Windlass Run	344.19	18
Total	2,834.15	17

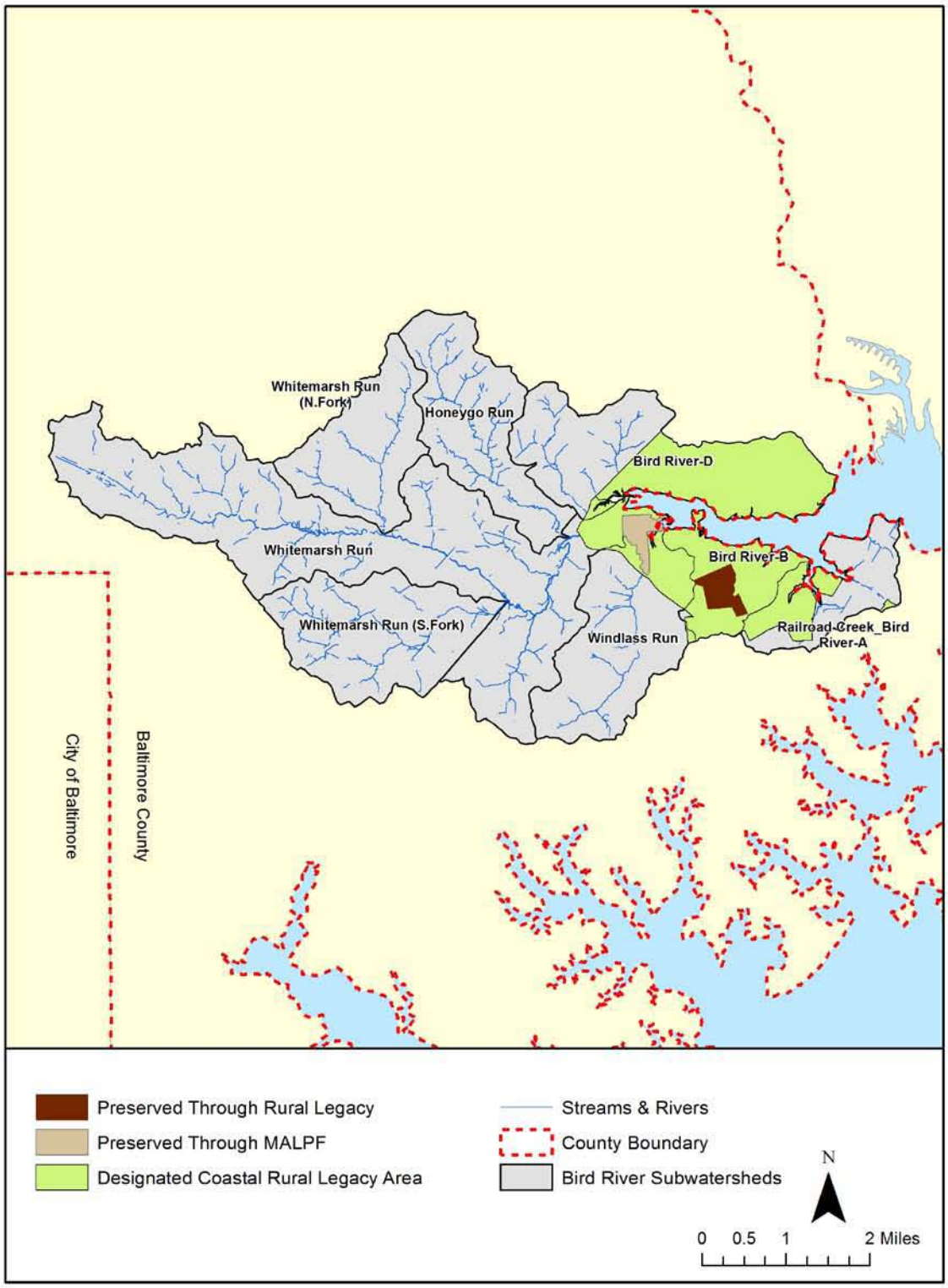


Figure 2-20: Bird River Watershed Coastal Rural Legacy Area

2.3.10 Agriculture

The Bird River watershed contains approximately 1,700 acres of agricultural land representing about 11% of the SWAP area. Figure 2-10 shows the locations, shaded in light green, of agricultural areas in Bird River. As described in Section 1.3 of the SWAP Report, Baltimore County is under environmental mandate to reduce pollution entering the Chesapeake Bay. Section 3.4.1 of the SWAP report quantifies the amount of pollution that needs to be reduced by Baltimore County from what's referred to as the "urban sector" to meet these mandates. The agricultural community is also under mandate to reduce pollution from the "agricultural sector". These pollution reduction efforts for agricultural properties are coordinated between the Maryland Department of Agriculture, Baltimore County Soil Conservation District (SCD), and local farmers. Data for these efforts is available from the SCD at the 12-digit watershed scale only; information on specific agricultural practices at specific properties is protected by privacy laws. Table 2-23 shows the available information on agricultural BMPs in the Bird River SWAP area.

Table 2-23: Agricultural BMPs in the Bird River Watershed

Best Management Practice (BMP)	Acres	Date Installed
Nutrient Management	4.0	9/03/08
Integrated Pest Management	4.0	9/03/08
Residue and Tillage Management	4.0	9/03/08
Conservation Crop Rotation	4.0	9/03/08
Stripcropping	5.7	7/31/00
Conservation Crop Rotation	5.7	7/31/00
Residue and Tillage Management	5.7	7/31/00
Conservation Crop Rotation	20.3	4/07/00
Residue and Tillage Management	20.3	4/07/00
Stripcropping	20.3	4/07/00
Stripcropping	10.3	4/07/00
Residue and Tillage Management	10.3	4/07/00
Conservation Crop Rotation	10.3	4/07/00
Cover Crop	9.0	12/06/99
Residue and Tillage Management	9.0	12/06/99
Conservation Crop Rotation	9.0	12/06/99
Residue and Tillage Management	12.5	12/06/99
Stripcropping	12.5	12/06/99
Cover Crop	12.5	12/06/99
Conservation Crop Rotation	12.5	12/06/99

Soil Conservation and Water Quality Plans (SCWQPs) are described in Section 5.3.1 of this Characterization Report. Table 2-24 shows the data available for these plans for farms in Bird River.

Table 2-24: Soil Conservation and Water Quality Plans in the Bird River Watershed

Plan Type	Plan Date	Acres					
		Crop	Pasture	Wood-land	Head-quarters	Other	Total
New	5/02/11	0.0	0.0	54.5	4.5	0.0	59.0
New	2/28/11	50.6	0.0	0.0	0.0	0.0	50.6
New	2/22/11	21.6	0.0	0.0	0.0	0.0	21.6
New	2/08/11	20.7	0.0	0.0	12.1	1.5	34.3
New	2/03/11	42.9	0.0	27.1	1.4	0.0	71.4
New	2/01/11	100.8	0.0	34.0	9.9	14.4	159.1
New	7/29/10	0.0	7.4	5.3	2.7	0.0	15.4
New	9/19/08	0.0	9.6	43.0	0.0	24.8	77.4
New	9/01/08	0.0	27.8	23.5	2.6	0.0	53.9
Revised	3/13/08	3.9	0.0	0.0	0.0	0.0	3.9
New	7/31/00	5.7	0.0	0.0	0.0	0.0	5.7
New	4/14/00	10.3	0.0	1.2	0.0	0.0	11.5
New	4/10/00	20.3	0.0	3.9	0.0	0.0	24.2
Revised	12/16/99	9.0	0.0	0.0	0.0	0.0	9.0
Revised	12/15/99	19.0	3.0	8.0	5.0	0.0	35.0
Totals		304.8	47.8	200.5	38.2	40.7	632.0

More information on these agricultural BMPs and Soil Conservation and Water Quality Plans is available in Section 5.3 of this Characterization Report.

CHAPTER 3: WATER QUALITY AND LIVING RESOURCES

3.1 Introduction

This chapter describes the water quality, living resources, and habitat for the Bird River watershed based on existing conditions. In addition to water quality maintenance and improvement, the SWAP aims to provide for plants, animals, and their habitat. Natural communities require many habitat characteristics for survival. This includes land, water, and biological conditions that provide their needs for food, water, shelter, and reproduction. Water is an integral part of the habitat of all species. Living resources, including all animals and plants, require water to survive. Living resources and their habitat are intimately connected to water quality and availability. They respond to changes in water quality and habitat conditions in ways that indicate the status of water bodies and the effects of watershed characteristics and activities. In some cases, water quality is measured in terms of its ability to support living resources such as trout or shellfish. Information on living resources is presented in this chapter to indicate water quality status and to evaluate habitat conditions in the watershed. This information can help to determine if current watershed management practices are adequately providing for the needs of natural communities.

The following sections include descriptions of the following with respect to the Bird River watershed: impairments per Maryland's 303(d) listing, water quality monitoring data available to date, pollutant loadings analysis for total nitrogen and total phosphorus, sewer overflow occurrences and impacts, stream corridor assessments, and stormwater management facility assessments.

3.2 303(d) Listings and Total Maximum Daily Loads (TMDLs)

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 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 (tidal portion) has been listed as impaired in the Maryland 303(d) list of impaired waters for the following pollutants of concern: Polychlorinated Biphenyls (PCBs) in fish tissue, nutrients, sediment and unknown.

The Whitemarsh Run streams in the Bird River watershed are designated as *Use IV: Recreational Trout Waters;* the remaining non-tidal streams in the watershed are designated as *Use I: Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life.* The tidal portion of Bird River is designated as *Use II: Support of Estuarine and Marine Aquatic Life,* according to Maryland water quality standards.

Impairment listings reflect the potential 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. A Water Quality Analysis (WQA) is performed 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 report documenting the findings is submitted to USEPA for concurrence. Table 3-1 summarizes the status of the various impairment listings for the Bird River.

Table 3-1: **Bird River Water Quality Impairment Listings and Status**

Impairment	Applicable Segment	Status	Approval Date
PCB* 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; cause is fish and benthic Indices of Biotic Integrity (IBIs)	
Nutrients	Tidal Bird River	WQA	May 2005

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

As shown in the table above, the Bird River watershed has three impairment listings and one WQA has been completed. TMDLs or WQA will be developed at some point in the future for the PCB and other impairment listings. The one WQA report that has been completed is included in Appendix I. This report stated that "An analysis of recent monitoring data shows that the dissolved oxygen criterion and designated uses associated with nutrients are being met in Bird River. This analysis supports the conclusion that a TMDL for nutrients is not necessary to achieve water quality in this case." In EPA's letter concurring with this finding, EPA stated "Based upon the information contained in MDE's report, EPA concurs that a TMDL for nutrients on Bird River is not necessary. A sediment TMDL on Bird River would still be required." This listing has since been superceded by the Chesapeake Bay TMDL, including the tidal Gunpowder River and Bird River (see MDE's Integrated Report Water Quality Map: Sediment Assessments at http://www.mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/SedimentAssessmentMap.aspx).

While there are no local TMDLs for Bird River, the entire watershed is subject to the Chesapeake Bay TMDL for nutrients and sediment. EPA established the Chesapeake Bay TMDL in 2010, 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 watershed implementation plans (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 II WIP provided a series of proposed strategies that will collectively meet the 2020 (previously 2017) target (70% of the total nutrient

and sediment reductions needed to meet final 2025 (previously 2020) goals). Baltimore County's Phase I plan required reductions equivalent to retrofit of 30% of pre-1985 developed land. Phase II WIP reduction targets for the Baltimore County watershed urban areas are: 32.2% for nitrogen and 47.0% for phosphorus.

3.3 Pollutant Loading Analysis

Pollutant loading analyses are underway for each of the Maryland-designated 8-digit watersheds located entirely or in part within Baltimore County. Analyses are intended to assess the impacts of current and future development on water quality. To support these analyses, watershed-specific pollutant loading rates were derived for nitrogen, phosphorus, and sediment based on the Chesapeake Bay Program (CBP; USEPA 2010) – Watershed Model Phase 5.3.2, July 2011 model run, using specific rates from Bird River HUC8 number 02130803. The Maryland Assessment Scenario Tool (MAST) based on the CBP's model was used to develop loadings rates for all land uses except for wetlands, the rate for which was set the same as forest land cover. Pollutant loading rates for different land cover types in the Bird River and used to estimate pollutant loadings from the Bird River watershed are summarized in the Table 3-2 below.

Table 3-2: Annual Pollutant Loadings Rates for the Bird River (lbs/acre/year)

Land Use	Nitrogen	Phosphorus	Sediment
Urban Impervious	9.24	1.39	565.4
Urban Pervious	5.85	0.25	76.9
Crop	20.74	1.31	373.4
Pasture	4.06	0.36	42.3
AFO/CAFO	62.25	10.88	972.1
Forest	1.49	0.04	21.3
Water	10.26	0.60	0.0
Wetlands	1.49	0.04	0.0
Bare Ground	12.36	2.95	2,090.3

As discussed in Chapter 2.3.1, land use information for the Bird River watershed was obtained from MDP's 2010 Land Use/Land Cover (LU/LC) GIS layer. For the purposes of watershed-scale pollutant loading analyses, Baltimore County uses a consolidated version of MDP's 2010 land use classifications since loading rates do not differ significantly among certain land use classes (e.g., various forest types). The MDP LU/LC categories present in the Bird River and the corresponding Bay Model/MAST land cover classes used for the pollutant loading analyses are summarized in Table 3-3.

Consolidated land uses were used to determine the total acreage for each MAST land cover category. These were multiplied by the corresponding loading rates presented in Table 3-2. Resulting annual pollutant loads for total nitrogen, total phosphorus, and sediment from the Bird River SWAP watershed are summarized by land use in Table 3-4 and Table 3-5, and for the entire watershed in Table 3-6.

Table 3-3: Reclassification of MDP 2010 LU/LC to MAST Land Cover for Bird River Watershed

MDP LU/LC Classification	MAST Land Cover Type
191 Very Low Density Residential (agriculture)	Urban*
192 Very Low Density Residential (forest)	Urban*
11 Low Density Residential	Urban*
12 Medium Density Residential	Urban*
13 High Density Residential	Urban*
14 Commercial	Urban*
15 Industrial	Urban*
16 Institutional	Urban*
17 Extractive	Urban*
18 Open Urban Land	Urban*
21 Cropland	Cropland
22 Pasture	Pasture
41 Deciduous Forest	Forest and Wetlands
43 Mixed Forest	Forest and Wetlands
44 Brush	Forest and Wetlands
50 Water	Water
60 Wetlands	Forest and Wetlands
73 Bare Ground	Bare Ground
80 Transportation	Urban*

* These categories were split into pervious urban and impervious urban areas using Baltimore County's roads and buildings GIS layers.

Table 3-4: Total Annual Nutrient and Sediment (Edge of stream) Loads by Land Use from the Bird River (SWAP K) Watershed

		Nitrogen		Phosphorus		Sediment	
Land Use	Area (acres)	Rate (lbs/ac/yr)	Load (lbs/yr)	Rate (lbs/ac/yr)	Load (lbs/yr)	Rate (lbs/ac/yr)	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. Bldgs.	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	0	0
Wetlands	271	1.49	404	0.04	9	0	0
Bare Ground	270	12.36	3,340	2.95	796	2,090.3	564,789
Totals	16,408		108,006		8,892		3,452,504

Table 3-5: Total Annual Nutrient and Sediment Loads (Edge of stream and Delivered)

and Ratios for Agricultural

Delivery Urban, and

Land Use	Total Nitrogen			Total Phosphorus			Total Sediment		
	EOS Load (lbs/yr)	Delivered Load (lbs/yr)	Delivery Ratio	EOS Load (lbs/yr)	Delivered Load (lbs/yr)	Delivery Ratio	EOS Load (lbs/yr)	Delivered Load (lbs/yr)	Delivery Ratio
Urban	66,636	55,822	0.8377	6,536	6,151	0.9411	2,754,420	3,857,223	1.4004
Agricultural	33,069	30,432	0.9203	2,150	2,002	0.9312	589,664	596,299	1.0113
Forest/Wet-lands/Water	8,302	7,379	0.8888	206	191	0.9272	108,421	117,754	1.0861
Totals	108,006	93,633	0.8669	8,892	8,344	0.9384	3,452,504	4,571,277	1.3240

Undeveloped Land Uses

Table 3-6: Estimated Nutrient and Sediment Loads (sum of all land uses) from the Bird River (SWAP K) Watershed

	Total Nitrogen	Total Phosphorus	Total Sediment
Edge of Stream Load (lbs/yr)	107,702	8,874	3,452,504
Edge of Stream Load (lbs/acre/yr)	6.56	0.54	210
Delivered Loads (lbs/yr)	93,339	8,326	4,571,277
Delivered Loads (lbs/acre/yr)	5.87	0.52	287

Note: Load from "Water" category is not included in edge of stream or delivered load totals.

For Bird River, loads delivered to the Chesapeake Bay from urban land uses for average annual flow totaled 55,822 lbs/year for total nitrogen, 6,151 lbs/year for total phosphorus, and 3,857,223 lbs/year for total sediment. These loads represent 84 percent of urban nitrogen edge of stream (EOS) loads, 94 percent of urban phosphorus EOS loads, and 140 percent of urban sediment EOS loads (sediment delivery to the Bay is higher than at the edge of stream loading due to stream bank erosion). Nutrient loadings were also calculated on a subwatershed basis using the same loading rates and land cover designations. These estimates will provide baseline nutrient loads before implementation of restoration projects and will allow a better assessment of both progress made to date and further progress needed to meet TMDL goals for urban nonpoint source reduction. Table 3-7 summarizes acreages of land cover categories by subwatershed.

The resulting annual nutrient loads (lbs/yr) for the eight subwatersheds in the Bird River area are summarized in the tables below. These tables also include nitrogen, phosphorus, and sediment loading rates (lbs/ac/yr) for each subwatershed.

Table 3-8 through Table 3-10 show that the subwatersheds generating the greatest annual nutrient and sediment loads per unit area are Bird River-B, Bird River-D, Honeygo Run and Whitemarsh Run. Subwatersheds with the greatest delivered phosphorus and sediment load per unit area are Bird River-D and Whitemarsh Run, while Bird River-B and Honeygo Run are the subwatersheds that generate the highest amount of nitrogen per acre. Subwatershed pollutant loadings and rates will be used to prioritize restoration efforts. The total planning level pollutant load estimate will be used to determine necessary reductions to meet the Chesapeake Bay TMDL reductions.

Table 3-7: Bird River SWAP Area K Land Use (acres) by Subwatershed

Land Use	Bird River-B	Bird River-D	Honeygo Run	Railroad Creek Bird River A	Whitemarsh Run	Whitemarsh Run (N Fork)	Whitemarsh Run (S Fork)	Windlass Run	Total
Urban Pervious	101	501	583	469	2,252	884	810	393	5,993
Urban Impervious	30	297	256	126	1,340	372	498	139	3,058
Crop	248	147	272	95	336	2	45	397	1,543
Pasture/Orchards/Ag Build.	9	32	36	9	36	0	7	20	149
Livestock	0	7	0	0	0	0	0	0	7
Forest	352	1,098	496	275	1,309	117	524	917	5,087
Water	1	15	0	3	9	0	0	1	30
Wetlands	29	88	2	14	76	0	0	61	271
Bare Ground	0	174	0	0	96	0	0	0	270
Totals	770	2,360	1,645	992	5,454	1,374	1,884	1,928	16,408

Table 3-8: Bird River SWAP Area K Annual Nitrogen Loads by Subwatershed

		Annual Nitrogen Loads by Land Cover (lbs/yr)									Edge of stream		Delivered	
Subwatershed	Total Area (acres)	Imper-vious Urban	Per-vious Urban	Crop-land	Pasture/ Orchards/ Ag Buildings	Live-stock	Forest	Water*	Wet-lands	Bare Ground	Total (lbs/yr	Total (lbs/acre/ yr)	Total (lbs/yr)	Total (lbs/acre/ yr)
Bird River-B	770	281	588	5,149	36	0	525	13	43	0	6,622	8.60	6,180	8.34
Bird River-D	2,360	2,748	2,931	3,047	129	461	1,639	155	132	2,148	13,234	5.61	11,331	5.00
Honeygo Run	1,645	2,365	3,406	5,649	147	0	740	0	3	0	12,310	7.48	10,655	6.98
Railroad Creek_ Bird River-A	992	1,167	2,744	1,974	38	0	410	33	21	0	6,353	6.40	5,510	5.73
Whitemarsh Run	5,454	12,387	13,163	6,973	146	0	1,953	89	114	1,192	35,930	6.59	30,726	5.77
Whitemarsh Run (N. Fork)	1,374	3,439	5,165	34	0	0	175	0	0	0	8,813	6.41	7,409	5.39
Whitemarsh Run (S. Fork)	1,884	4,600	4,736	941	28	0	782	0	0	0	11,086	5.88	9,382	5.05
Windlass Run	1,928	1,283	2,294	8,236	82	0	1,368	15	91	0	13,355	6.93	12,146	6.57
Total	16,408	28,269	35,027	32,002	606	461	7,593	304	404	3,340	107,702	6.56	93,339	5.87

* Load from "Water" category is not included in edge of stream or delivered load totals.

Table 3-9: Bird River SWAP Area K Annual Phosphorus Loads by Subwatershed

		Annual Phosphorus Loads by Land Cover (lbs/yr)									Edge of stream		Delivered	
Subwatershed	Total Area (acres)	Impervious Urban	Pervious Urban	Crop-land	Pasture/ Orchards/ Ag. Buildings	Live-stock	Forest	Water*	Wet-lands	Bare Ground	Total (lbs/yr	Total (lbs/acre/ yr)	Total (lbs/yr)	Total (lbs/acre/ /yr)
Bird River-B	770	42	25	324	3	0	12	1	1	0	408	0.53	393	0.53
Bird River-D	2,360	414	124	192	11	80	38	9	3	512	1,375	0.58	1,283	0.57
Honeygo Run	1,645	356	144	356	13	0	17	0	0	0	886	0.54	820	0.54
Railroad Creek_ Bird River-A	992	176	116	124	3	0	10	2	0	0	429	0.43	402	0.42
Whitemarsh Run	5,454	1,867	556	439	13	0	46	5	3	284	3,208	0.59	3,009	0.56
Whitemarsh Run (N. Fork)	1,374	518	218	2	0	0	4	0	0	0	743	0.54	699	0.51
Whitemarsh Run (S. Fork)	1,884	693	200	59	2	0	18	0	0	0	973	0.52	913	0.49
Windlass Run	1,928	193	97	519	7	0	32	1	2	0	851	0.44	808	0.44
Total	16,408	4,260	1,480	2,016	54	80	178	18	9	796	8,874	0.54	8,326	0.52

* Load from "Water" category is not included in edge of stream or delivered load totals.

Table 3-10: Bird River SWAP Area K Annual Sediment Loads by Subwatershed

		Annual Sediment Loads by Land Cover (lbs/yr)							Edge of Stream		Delivered	
Subwatershed	Total Area (acres)	Impervious Urban	Pervious Urban	Cropland	Pasture/ Orchards/ Ag Buildings	Live-stock	Forest	Bare Ground	Total (lbs/yr)	Total (lbs/acre/ yr)	Total (lbs/yr)	Total (lbs/acre/yr)
Bird River-B	770	17,187	7,731	92,699	376	0	7,503	0	125,497	163	140,141	189
Bird River-D	2,360	168,086	38,537	54,852	1,340	7,192	23,407	363,164	656,579	278	883,011	390
Honeygo Run	1,645	144,623	44,792	101,705	1,529	0	10,562	0	303,211	184	378,385	248
Railroad Creek_ Bird River-A	992	71,350	36,081	35,534	395	0	5,854	0	149,214	150	192,881	201
Whitemarsh Run	5,454	757,658	173,096	125,548	1,520	0	27,893	201,625	1,287,340	236	1,744,587	327
Whitemarsh Run (N. Fork)	1,374	210,319	67,922	617	1	0	2,495	0	281,354	205	393,413	286
Whitemarsh Run (S. Fork)	1,884	281,330	62,273	16,935	290	0	11,170	0	371,997	197	511,340	275
Windlass Run	1,928	78,474	30,171	148,277	853	0	19,537	0	277,313	144	327,519	177
Total	16,408	1,729,028	460,602	576,168	6,304	7,192	108,421	564,789	3,452,504	210	4,571,277	287

3.4 Water Quality Monitoring Data

Baltimore County conducts chemical, biological, and illicit connection monitoring within the Bird River watershed. Section 3.4.1 summarizes the chemical data available for Bird River and Section 3.4.2 summarizes the biological monitoring program. Section 3.4.3 discusses the illicit connection program.

3.4.1 Chemical Data

Various chemical monitoring data are available for the Bird River including two programs administered by Baltimore County. Chemical water quality data available to date in the watershed are summarized in the following sections.

3.4.1.1 County Recreational Water Sampling Program

Baltimore County has almost 200 miles of tidal coastline as well as public and privately owned and operated tidal and fresh water recreational bathing beaches. In addition, the availability of these recreational water resources supports a significant number of related activities such as commercial and recreational fishing, water skiing, camping, and boating. Environmental Health Services (EHS) conducts recreational water sampling, provides water sampling in support of sewer overflow investigations, and regulates bathing beaches and public swimming pools for the health and safety of the public. Baltimore County regularly conducts bacteriological sampling of many of these areas to provide water quality information to the public and encourage safe use of these resources. The sampling program uses the indicator organism, enterococcus, which is found in the intestines of all warm-blooded animals. If enterococci are found in high concentrations in association with a known or suspected source of sewage contamination, it indicates the probable presence of pathogenic (disease causing) organisms in the water samples. Sampling for tidal waters is generally performed April through November as weather permits. Additional sampling may be conducted in response to unusual conditions suspected of adversely impacting water quality.

There are currently 6 sampling locations on the Bird River as shown in Figure 3-1. The most recent sampling data results for these sampling locations (2008-2013) are summarized in Table 3-11. The USEPA/MDE bacteriological standard for consideration of beach closure at tidal beaches is a geometric mean of 35 MPN enterococci. MPN stands for most probable number. Measurements are typically denoted as MPN/100 mL which stands for the most probable number of bacteria colonies expected to be found in a 100-mL sample of water (EHS 2012; see also Code of Maryland Regulations (COMAR) 26.08.02.03).

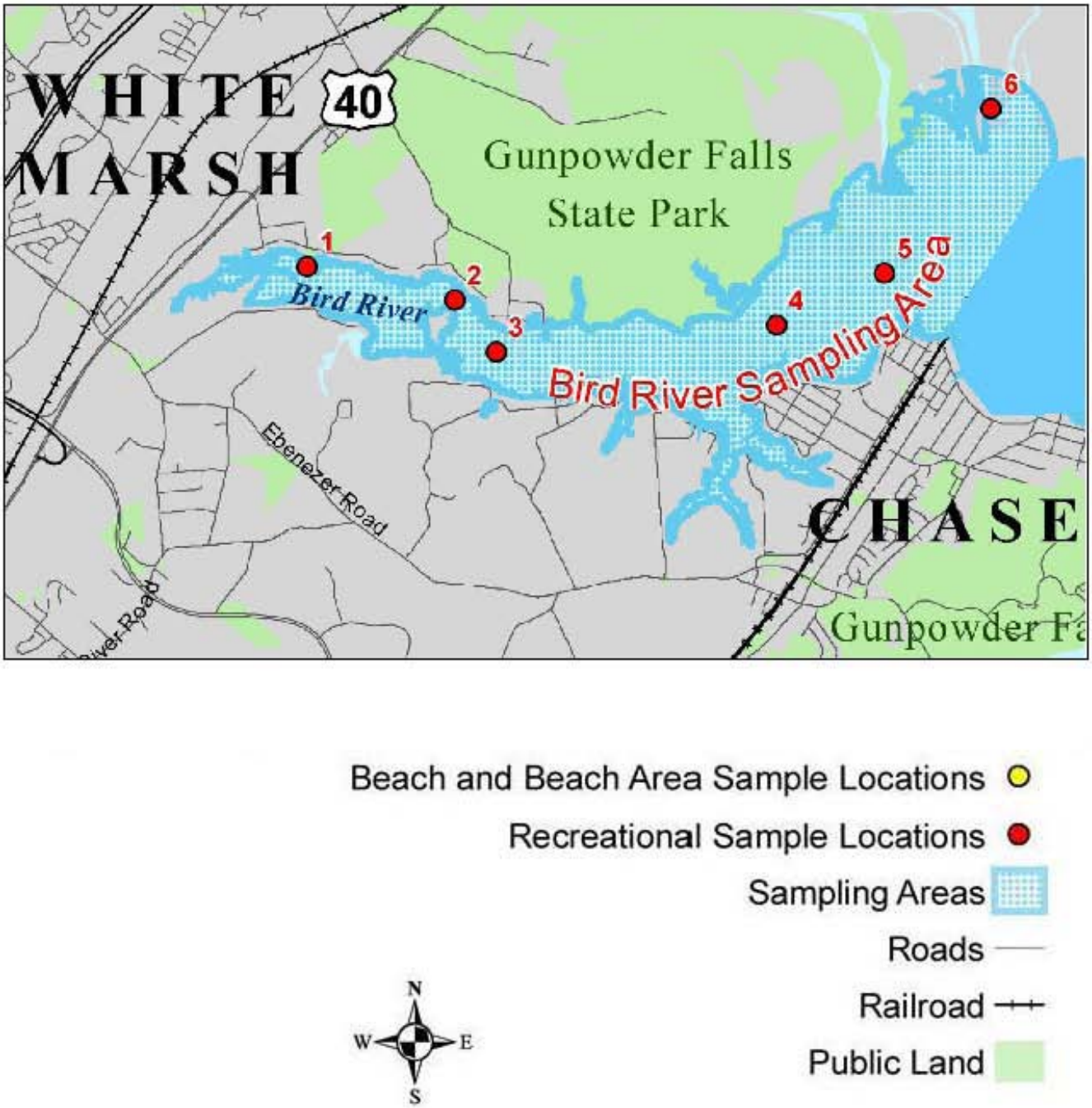


Figure 3-1: Baltimore County Recreational Water Sample Locations in Bird River (Excerpt from EHS 2012)

Table 3-11: Bird River Recreational Waters Sampling Results (MPN Enterococci/100 ml)

Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
9/30/2013	20	<10	20	20	90	<10
9/16/2013	1300	30	20	<10	50	90
9/3/2013	90	10	<10	<10	10	20
8/19/2013	110	50	50	<10	<10	20
8/5/2013	10	10	<10	<10	<10	20
7/8/2013	40	10	<10	<10	<10	20
6/24/2013	120	30	<10	<10	<10	<10
5/28/2013	<10	<10	20	10	20	50
10/15/2012	190	120	160	40	20	80
10/3/2012	>2010	1300	560	1300	1650	310
9/19/2012	>2010	>2010	>2010	430	>2010	930
11/9/2009	30	60	50	50	10	20
11/2/2009	780	180	250	20	80	30
10/26/2009	>2010	2010	2010	210	110	220
10/13/2009	110	50	20	10	30	20
10/1/2009	110	30	50	20	<10	30
9/28/2009	>2010	>2010	2010	80	>2010	250
9/21/2009	10	40	<10	<10	10	20
9/14/2009	430	410	310	250	80	120
9/1/2009	270	190	150	20	<10	30
8/17/2009	110	10	20	<10	10	10
8/3/2009	250	40	10	<10	60	30
7/20/2009	150	20	30	<10	<10	10
7/13/2009	10	10	<10	<10	<10	10
6/24/2009	10	20	10	10	<10	<10
6/8/2009	50	30	30	30	<10	<10
5/28/2009	220	60	<10	<10	<10	<10
5/11/2009	90	10	10	<10	<10	<10
4/27/2009	30	<10	<10	<10	<10	<10
4/13/2009	40	40	<10	10	10	<10
4/1/2009	60	<10	10	<10	20	10
10/21/2008	140	90	20	<10	100	50
10/7/2008	40	10	30	<10	<10	10
9/23/2008	290	40	30	<10	10	<10
9/8/2008	200	40	30	20	20	20
8/27/2008	>2010	110	50	10	220	20
8/12/2008	40	210	40	10	<10	20
7/29/2008	220	<10	<10	10	30	20
7/15/2008	240	40	60	10	10	10
7/2/2008	340	<10	10	<10	<10	10

Date	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
6/24/2008	20	10	40	20	<10	<10
6/10/2008	<10	20	<10	<10	<10	<10
5/27/2008	50	10	<10	<10	<10	<10
5/14/2008	1450	>2010	2010	100	60	110
5/1/2008	220	100	100	<10	10	10
4/22/2008	1300	310	60	<10	10	<10
4/8/2008	50	30	<10	<10	<10	10

Note: Monitoring did not occur from December 2009 through August 2012 due to budgetary constraints. Bird River sampling results are also available for 2002- 2007 in the archives maintained by Baltimore Co: http://www.baltimorecountymd.gov/Agencies/health/environmentalhealth/watersampling/samplingresults/birdriverarchive.html.

3.4.1.2 County Trend Chemical Monitoring Program

From 1999-2010 Baltimore County maintained a baseflow monitoring program that evolved several times over the years (EPS 2013). In 1999, sampling targeted the Lower Gunpowder, Little Gunpowder, Middle River, and Baltimore Harbor watersheds, as these areas had Water Quality Management plans under development at that time. In the fall of 2000, baseflow monitoring shifted to the Back River, Jones Falls, and Gwynns Falls watersheds. The program was re-designed in 2003, and through 2010, baseflows were monitored in the Patapsco/Back River Basin in odd-numbered years and in the Gunpowder/Deer Creek Basin in even-numbered years.

In January 2011, Baltimore County's baseflow monitoring program was replaced with a water quality trend monitoring program. The trend monitoring program observes ambient chemical conditions and determines trends in chemical concentrations and pollutant loads over time. This data is used to determine areas to target restoration, assess the impact of implemented restoration activities, and determine the amount of progress made towards meeting TMDLs and other restoration goals. Forty monitoring sites are visited on the same day, once per month. Three of those trend sites were within the Bird River watershed (Figure 3-2):

1. BI01 which is located on Windlass Run, at White Marsh Boulevard;
2. BI02 which is located on Honeygo Run, at Philadelphia Road; and
3. BI03 which is located on the Whitemarsh Run, at Philadelphia Road.

Trend chemical monitoring results collected for these sites are summarized in Table 3-12, Table 3-13, and Table 3-14.

Water quality parameters measured as part of the County's trend monitoring program include total suspended solids (TSS), nutrients, metals, and chloride. The importance of each of these parameters is briefly described below.

- Suspended Solids: Excessive suspended solids in water bodies can adversely impact aquatic life as it affects the light available for photosynthesis by plants and visual capacity of aquatic life. Decreased light can lead to an increase in algae communities and resulting decrease in abundance and diversity of invertebrate and fish communities.

Excessive sediment can also negatively affect habitat structure, by filling in the niche spaces used by organisms for feeding and protection from predators.

- Nutrients: As discussed previously, over-enrichment of water bodies by excessive nutrient input can cause excessive algal growth and bacterial consumption of dissolved oxygen when the algae decompose. This can lead to significant reductions in water quality, as well as abundance and diversity of aquatic life communities.

- Metals: Metals are a concern because they dissolve in water and are easily absorbed by aquatic organisms such as fish. Even low concentrations of metals in water bodies can be toxic to aquatic life and human health. While metals may not directly kill organisms, they may adversely affect an organism's health and interfere with growth and reproduction.

- Chloride: Chlorides come from various sources such as agricultural runoff, waste water, and road salting. High levels of chlorides can be toxic to aquatic communities including fish.

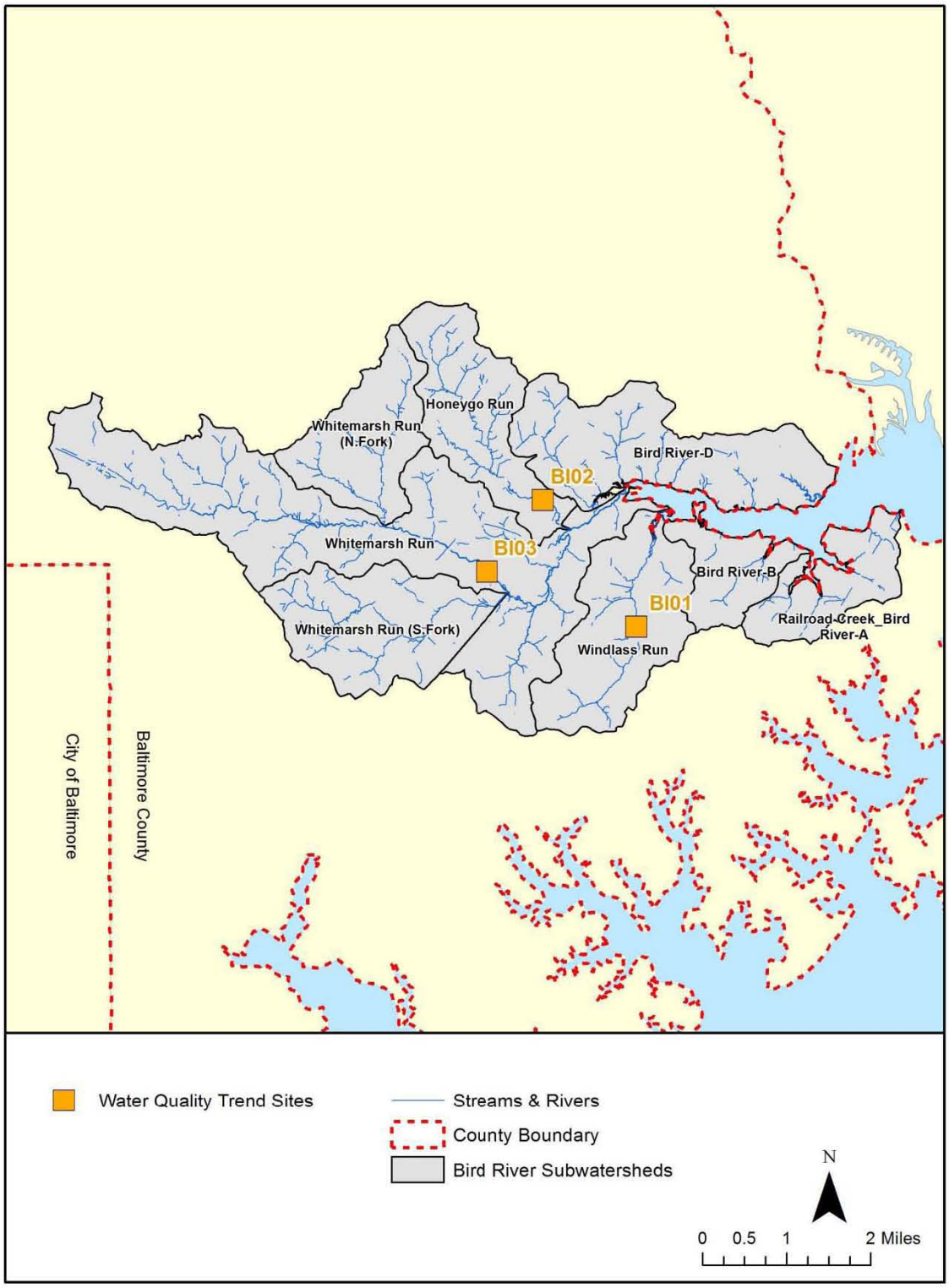


Figure 3-2: Baltimore County Trend Monitoring Locations in Bird River Watershed

Table 3-12: Bird River Trend Monitoring Results at Site BI01 (mg/l)

Date	TKN	TSS	NO_2	NO_3	NO_2-NO_3	TP	CD	CU	PB	ZN	CL
3/26/2013	0.78	6.0	0.39	0.15	0.54		<0.0010	<0.0010	0.0010	0.0210	
2/19/2013		<1.0	0.45	0.43	0.88		<0.0010	<0.0010	<0.0010	0.0210	36.1
1/22/2013	0.46	<1.0	<0.06	0.41	0.44	<0.050	<0.0010	0.0110	0.0010	0.0210	25.69
12/18/2012		<1.0	<0.06	0.18	0.21		<0.0010	<0.0010	<0.0010	0.0260	28.02
11/28/2012	0.47	<1.0	<0.06	0.22	0.25	<0.050	<0.0010	0.0030	<0.0010	0.0180	28.87
10/23/2012	0.43	2.0	<0.06	0.28	0.31	<0.050	<0.0010	0.0080	0.0010	0.0120	36.63
9/18/2012	0.52	<1.0	<0.06	0.53	0.56	<0.050	<0.0010	<0.0010	<0.0010	0.0110	46.3
8/21/2012	1.03	22.0				<0.050	<0.0010	0.0020	0.0010	0.0190	
7/24/2012	0.66	<1.0	<0.06	0.28	0.31	<0.050	0.3310	0.0300	0.0310	0.0470	28.49
6/19/2012	0.38	2.0	<0.06	0.49	0.52	<0.050	<0.0010	<0.0010	<0.0010	0.0110	35.01
5/15/2012	1.54	14.0	<0.06	0.13	0.16	0.18	<0.0010	0.0110	0.0070	0.0350	21.95
4/24/2012	0.75	30.0	<0.06	0.15	0.18	0.11	0.0010	<0.0010	0.0040	0.0280	22.87
3/20/2012	0.56	0.0	<0.06	0.31	0.34	<0.050	<0.0010	0.0030	0.0010	0.0230	27.4
2/21/2012	0.26	<1.0	<0.06	0.28	0.31	<0.050					21.85
1/24/2012	0.41	<1.0				<0.050	0.0010	0.0080	0.0020	0.0250	
12/28/2011	0.51	6.0				<0.050	<0.0010	0.0100	0.0030	0.0260	
11/22/2011	0.66	236.0				<0.050	<0.0010	0.0030	<0.0010	0.0120	
10/25/2011	0.97	8.0				<0.050	<0.0010	0.0060	<0.0010	0.0140	
9/27/2011	0.90	8.0				<0.050	<0.0010	0.0080	<0.0010	0.0220	
8/16/2011	0.70	30.0				0.1	<0.0010	0.0020	<0.0010	0.0080	
7/19/2011	0.54	12.0				<0.050	<0.0010	<0.0010	<0.0010	<0.0010	
6/21/2011	0.59	<1.0	<0.06	0.47	0.50	<0.050	<0.0010	<0.0010	<0.0010	0.0010	32.49
5/31/2011	1.19	4.0	<0.06	0.58	0.61	0.08	<0.0010	0.0030	<0.0010	0.0060	34.24
4/20/2011	0.63	<1.0	<0.06	0.17	0.20	0.03	<0.0010	0.0010	<0.0010	<0.0010	25.73
3/22/2011	0.30	8.0	<0.06	0.13	0.16	<0.050	<0.0010	0.0080	0.0010	0.0330	42.71
2/16/2011	0.33	<1.0	<0.06	0.36	0.39	<0.050	<0.0010	0.0010	<0.0010	0.0010	41.97
1/19/2011	0.40	<1.0	<0.06	0.22	0.25	<0.050	<0.0010	0.0020	<0.0010	0.0220	97.53
Min	0.26	<1.0	<0.06	0.13	0.16	<0.050	<0.0010	<0.0010	<0.0010	<0.0010	21.85
Max	1.54	236.0	0.45	0.58	0.88	0.180	0.3310	0.0300	0.0310	0.0470	97.53
Median	0.56	2.0	<0.06	0.28	0.31	<0.050	<0.0010	0.0025	<0.0010	0.0200	30.68

Table 3-13: Bird River Trend Monitoring Results at Site BI02 (mg/l)

Date	TKN	TSS	NO_2	NO_3	NO_2-NO_3	TP	CD	CU	PB	ZN	CL
3/26/2013	0.29	<1.0	0.75	0.62	1.37		<0.0010	<0.0010	<0.0010	0.0140	241.53
2/19/2013		<1.0	0.79	1.19	1.98		<0.0010	<0.0010	<0.0010	0.0120	123.42
1/22/2013	0.20	4.0	<0.06	0.90	0.93	<0.050	<0.0010	0.0010	<0.0010	0.0100	69.77
12/18/2012		<1.0	<0.06	0.92	0.95		<0.0010	<0.0010	<0.0010	0.0220	70.49
11/28/2012	0.36	<1.0	<0.06	1.07	1.10	<0.050	<0.0010	0.0020	<0.0010	0.0100	77.29
10/23/2012	0.28	6.0	<0.06	0.30	0.33	<0.050	<0.0010	0.0110	<0.0010	0.0090	64.91
9/18/2012	0.33	<1.0	<0.06	0.94	0.97	<0.050	<0.0010	0.0030	<0.0010	0.0170	95.09
8/21/2012	0.55	14.0				<0.050	<0.0010	0.0040	<0.0010	0.0140	
7/24/2012	0.39	<1.0	<0.06	0.37	0.40	<0.050	0.0050	0.0070	0.0040	0.0160	68.29
6/19/2012	0.23	<1.0	<0.06	0.56	0.59	<0.050	<0.0010	<0.0010	<0.0010	0.0060	88.76
5/15/2012	0.70	<1.0	<0.06	0.46	0.49	<0.050	<0.0010	0.0070	<0.0010	0.0140	51.02
4/24/2012	0.25	6.0	<0.06	0.36	0.39	<0.050	<0.0010	<0.0010	<0.0010	0.0140	52.86
3/20/2012	<0.20	<1.0	<0.06	0.76	0.79	<0.050	<0.0010	0.0020	<0.0010	0.0130	97.06
2/21/2012	<0.20	<1.0	<0.06	0.89	0.92	<0.050					134.71
1/24/2012	0.47	<1.0				<0.050	0.0010	0.0080	0.0020	0.0210	
12/28/2011	0.23	<1.0				<0.050	<0.0010	0.0100	0.0020	0.0330	
11/22/2011	0.43	58.0				<0.050	<0.0010	0.0040	<0.0010	0.0140	
10/25/2011	0.23	<1.0				<0.050	<0.0010	0.0030	<0.0010	0.0070	
9/27/2011	0.35	14.0				<0.050	<0.0010	0.0050	<0.0010	0.0100	
8/16/2011	0.65	56.0				0.190	<0.0010	<0.0010	<0.0010	0.0040	
7/19/2011	0.42	2.0				<0.050	<0.0010	0.0010	<0.0010	0.0030	
6/21/2011	0.27	2.0	<0.06	0.62	0.65	<0.050	<0.0010	<0.0010	<0.0010	0.0010	103.01
5/31/2011	0.37	<1.0	<0.06	0.91	0.94	<0.050	<0.0010	0.0030	<0.0010	0.0090	105.23
4/20/2011	0.39	<1.0	<0.06	0.51	0.54	0.030	<0.0010	0.0010	<0.0010	0.0030	75.44
3/22/2011	0.24	<1.0	<0.06	0.70	0.73	<0.050	<0.0010	<0.0010	<0.0010	0.0160	90.68
2/16/2011	0.27	2.0	<0.06	0.83	0.86	<0.050	<0.0010	<0.0010	<0.0010	<0.0010	171.72
1/19/2011	0.66	6.0	<0.06	0.78	0.81	<0.050	<0.0010	0.0030	<0.0010	0.0270	1,225.68
Min	<0.20	<1.0	<0.06	0.30	0.33	<0.050	<0.0010	<0.0010	<0.0010	<0.0010	51.02
Max	0.70	58.0	0.79	1.19	1.98	0.190	0.0050	0.0110	0.0040	0.0330	1,225.68
Median	0.33	<1.0	<0.06	0.76	0.81	<0.050	<0.0010	0.0020	<0.0010	0.0125	90.68

Table 3-14: Bird River Trend Monitoring Results at Site BI03 (mg/l)

Date	TKN	TSS	NO_2	NO_3	NO_2-NO_3	TP	CD	CU	PB	ZN	CL
3/26/2013	0.39	10.0	0.87	0.51	1.38		<0.0010	<0.0010	<0.0010	0.0180	458.74
2/19/2013		18.0	0.94	0.94	1.88		<0.0010	<0.0010	<0.0010	0.0650	311.1
1/22/2013	0.27	2.0	<0.06	0.81	0.84	<0.050	<0.0010	<0.0010	<0.0010	0.0080	116.44
12/18/2012		<1.0	<0.06	0.65	0.68		<0.0010	<0.0010	<0.0010	0.0100	71.29
11/28/2012	0.46	2.0	<0.06	0.84	0.87	<0.050	<0.0010	0.0020	<0.0010	0.0150	89.53
10/23/2012	0.41	<1.0	<0.06	0.17	0.20	<0.050	<0.0010	0.0030	<0.0010	0.0100	51.47
9/18/2012	0.43	<1.0	<0.06	0.62	0.65	<0.050	<0.0010	0.0030	<0.0010	0.0140	89.11
8/21/2012	0.59	<1.0				<0.050	<0.0010	0.0030	<0.0010	0.0130	
7/24/2012	0.40	<1.0	<0.06	0.26	0.29	<0.050	0.0020	0.0020	0.0010	0.0120	66.56
6/19/2012	<0.20	12.0	<0.06	0.30	0.33	<0.050	<0.0010	0.0020	<0.0010	0.0090	98.95
5/15/2012	0.90	<1.0	<0.06	0.31	0.34	0.050	<0.0010	0.0110	0.0010	0.0230	38.03
4/24/2012	0.23	<1.0	<0.06	0.35	0.38	<0.050	0.0010	<0.0010	<0.0010	0.0110	82.32
3/20/2012	<0.20	<1.0	<0.06	0.53	0.56	<0.050	<0.0010	<0.0010	<0.0010	0.0180	117.41
2/21/2012	<0.20	<1.0	<0.06	0.70	0.73	<0.050	<0.0010		<0.0010		150.39
1/24/2012	0.63	6.0				<0.050	<0.0010	0.0050	0.0010	0.0280	
12/28/2011	0.88	<1.0				0.100	<0.0010	0.0100	0.0010	0.0360	
11/22/2011	0.57	14.0				<0.050	<0.0010	0.0070	<0.0010	0.0180	
10/25/2011	0.32	<1.0				<0.050	<0.0010	0.0030	<0.0010	0.0110	
9/27/2011	3.06	<1.0				0.060	<0.0010	0.0050	<0.0010	0.0150	
8/16/2011	0.33	<1.0				<0.050	<0.0010	0.0010	<0.0010	0.0050	
7/19/2011	0.55	4.0				<0.050	<0.0010	0.0010	<0.0010	0.0030	
6/21/2011	0.25	<1.0	<0.06	0.28	0.31	<0.050	<0.0010	<0.0010	<0.0010	0.0020	159.57
5/31/2011	0.35	<1.0	<0.06	0.53	0.56	<0.050	<0.0010	0.0010	<0.0010	0.0040	190.28
4/20/2011	0.50	<1.0	<0.06	0.55	0.58	0.030	<0.0010	0.0080	<0.0010	0.0040	112.58
3/22/2011	0.29	2.0	<0.06	0.57	0.60	<0.050	<0.0010	<0.0010	<0.0010	0.0130	160.8
2/16/2011	0.38	4.0	<0.06	0.68	0.71	<0.050	<0.0010	<0.0010	<0.0010	0.0010	402.2
1/19/2011	0.89	18.0	<0.06	0.58	0.61	<0.050	<0.0010	0.0020	<0.0010	0.0230	2,059.52
Min	<0.20	<1.0	<0.06	0.17	0.20	<0.050	<0.0010	<0.0010	<0.0010	0.0010	51.47
Max	3.06	18.0	0.94	0.94	1.88	0.100	0.0020	0.0110	0.0010	0.0650	2,059.52
Median	0.40	<1.0	<0.06	0.55	0.60	<0.050	<0.0010	0.0020	<0.0010	0.0125	116.44

Most of the Bird River watershed is defined as a fresh water body and designated for water contact recreation, fishing, and protection of aquatic life and wildlife. Per COMAR, it is subject to toxic substance criteria established for ambient surface waters, pertaining to aquatic life in fresh water. EPA National Recommended Water Quality Criteria (USEPA 2014) and reporting limits for measured water quality parameters in Bird River are summarized in Table 3-15.

Table 3-15: Numeric Water Quality Criteria and Report Limits (mg/l)

Parameter	CMC (acute)	CCC (chronic)	Reporting Limit
Suspended Solids	N/A	N/A	1
Total Phosphorus	N/A	N/A	0.02
Total Nitrogen	N/A	N/A	0.2
Cadmium	0.002	0.0025	0.0001
Copper	0.013	0.009	0.001
Lead	0.065	0.0025	0.001
Zinc	0.12	0.12	0.001
Chloride	860	230	-

CMC: Criteria Maximum Concentration is an estimate of the highest concentration to which an aquatic community can be exposed briefly without resulting in an unacceptable effect.
CCC: Criterion Continuous Concentration is an estimate of the highest concentration to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

Table 3-12, Table 3-13, and Table 3-14 show that measured concentrations of cadmium, lead, and zinc are well below water quality criteria recommended by USEPA (Table 3-15). Copper concentrations exceeded the acute threshold of 0.013 mg/l once each at BI01 and BI03 in July 2012. Chloride concentrations were well below the acute criterion. Water criteria for suspended solids and nutrients are currently not available. However, the data shows that a spike in TSS was recorded at BI01 in November 2011.

Additional synoptic water quality sampling was performed at 20 locations within the Bird watershed, in April and May 2013, in support of the SWAP (Figure 3-3, Table 3-16). E. coli concentrations exceeded the threshold (235 MPN/100 mL) for Use I Waters supporting Frequent Full-Body Contact Recreation (COMAR 26.08.02.03-3) at six locations. All sites were below the EPA recommended acute criterion for chloride (Table 3-15), though site K-20 was elevated and neared the acute threshold criterion. Numeric criteria for nutrient concentrations have not yet been established by the state of Maryland. Baltimore County uses the nutrient ratings in Table 3-17, which are based on data from the Maryland Department of Natural Resources (DNR) Watershed Restoration Actions Strategy (WRAS) program (EPS 2013 - Section 10; Figures 10-23 and 10-24).

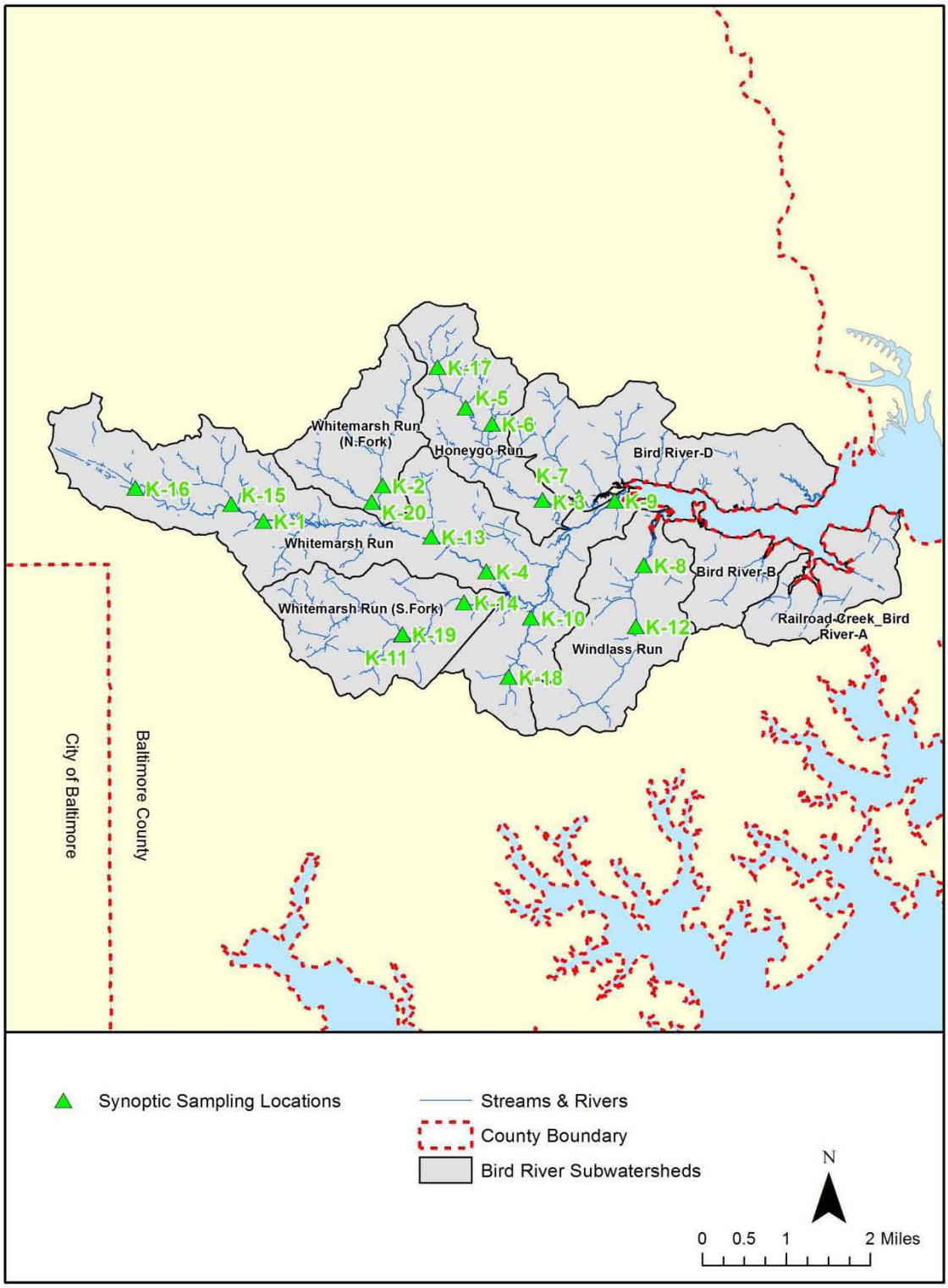


Figure 3-3: Baltimore County Synoptic Water Quality Sampling Locations in Bird River Watershed

Table 3-16: Synoptic Baseflow Monitoring Water Quality Results* for Bird River Watershed (mg/l), April and May 2013

Site ID	E. Coli MPN	Nitrate	TKN	TN	CL
K01	53.8	0.27			124.95
K02	95.9	0.67			84.09
K03	<1	0.46			80.98
K04	27.5	0.29			137.76
K05	78.9	0.58			83.18
K06	3.1	1.33			95.68
K07	325.5	0.57			86.40
K08	198.9	0.83			47.29
K10	22.8	0.03			32.05
K11	249.5	0.03			121.04
K12	93.4	0.42			31.83
K13	238.9	0.42			105.39
K14	159.7	0.12			81.44
K15	41.0	0.87			107.85
K16	<1	0.88			213.79
K17	648.8	1.71			128.12
K18	235.9	0.03			25.29
K19	285.1	0.15			143.37
K20	53.0	0.49			715.85

* Note that instrument failure resulted in missing results for TKN and TN. Data not collected at Site K09; site was too deep to sample.

Table 3-17: Nutrient Ratings Used by Baltimore County, Based on Maryland DNR WRAS Program

Rating	TN (mg/l)	TP (mg/l)
Low	0.0-1.0	<0.01
Slightly elevated	1.0-2.0	0.01-0.02
Mod.	2.0-3.0	0.02-0.03
High	3.0-4.0	0.03-0.04

3.4.1.3 Upper Western Shore Tributary Strategy Data

To help achieve Maryland's portion of the reductions in nitrogen, phosphorus and sediment to the Chesapeake Bay, a Tributary Strategy Team was created in 1995 for each of the 10 basins that make up the Chesapeake Bay, including the Upper Western Shore Basin, of which Bird River is a part. Each Team consists of local citizens, farmers, business leaders, and state and local government officials appointed by the Governor. The Teams help implement pollution prevention measures and to support local water quality programs including water quality monitoring. To assist the Tributary Team, Maryland DNR documented Upper Western Shore basin characteristics including available water quality monitoring results in their report, Maryland

Tributary Strategy Upper Western Shore Basin Summary Report for 1985-2005 Data (DNR 2007).

Water quality parameters including nitrogen, phosphorus, chlorophyll-a (algal abundance), total suspended solids, water clarity and dissolved oxygen are measured at three long-term tidal monitoring stations in the Upper Western Shore Basin, one of which (Station WT2.1) is located on the Gunpowder River, near the mouth of Bird River (Figure 3-4). Results are assigned a current status of good, fair or poor relative to baseline data or scientifically based benchmarks (e.g., applicable state thresholds) depending on the parameter. For example, concentrations of dissolved oxygen (DO) are compared to ecologically meaningful thresholds available: good (DO > 5 mg/L); fair (DO = 2-5 mg/L); and poor (DO < 2 mg/L). Since scientific benchmarks are not available for the remaining parameters, a Chesapeake Bay-wide scale was developed for each parameter based on salinity zone. All data available for the Chesapeake Bay between 1985 and 1990 were used to establish a baseline for rating water quality at each station. Three cutoff points were derived to define good, fair, and poor ratings from a cumulative logistic function for the monthly medians of the baseline data. Monthly medians from the most recent data set (2003-2005) at a given station are compared to these cutoff points to establish water quality status ratings. Water quality ratings are indicators relative to similar stations in the Chesapeake Bay during the baseline time period (1985-1990); therefore, a good rating does not necessarily reflect levels needed to sustain healthy living resource populations. Refer to the following link for more details regarding water quality analysis: http://www.dnr.state.md.us/Bay/tribstrat/status_trends_methods.html

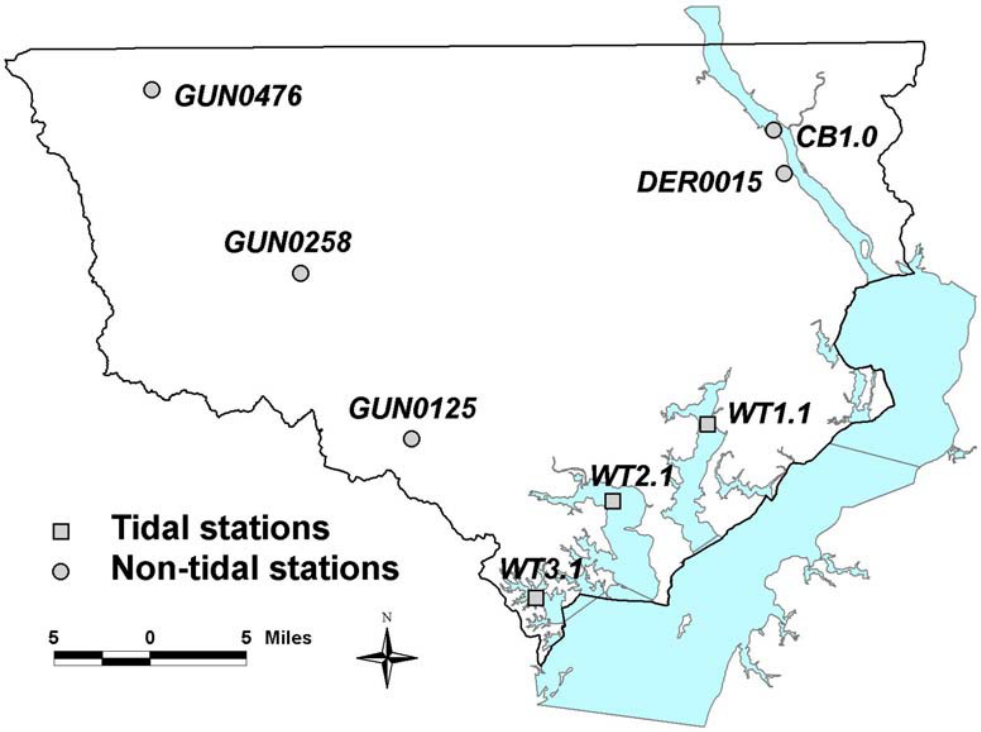


Figure 3-4: Location of Maryland DNR's Long-Term Fixed Monitoring Stations (figure from DNR 2007)

Figure 3-5, Figure 3-6, and Figure 3-7 show the water quality monitoring results reported by Maryland DNR for Gunpowder River (Station WT2.1 in Figure 3-4) during the period 1985-2005. Note that the black lines on each graph denote concentrations for each sampling date; annual medians of these values are shown as red bars. Total nitrogen concentrations ranged from as high as 4 mg/l in 2003 to as low as 0.5 mg/l in 1992. Total phosphorus concentrations ranged from approximately 0.01 mg/l to 0.28 mg/l with a general decreasing trend in more recent years, and fewer high spikes. Chlorophyll concentrations were as high as 125 µg/l in 1990, and continued to spike periodically through the years, though concentrations overall are decreasing and have been less extreme since the mid-1990's. Total suspended solids concentrations have frequently spiked to above 50 mg/l at this location. While spikes in TSS continued to be a pattern at this location, their frequency has decreased since 1995. Water clarity was measured in terms of Secchi depth or the depth of water transparency. Water clarity was generally consistent from 1985 to 2005, while the Secchi depth varied from 0.5-1.0 meters, seasonally. Dissolved oxygen was not generally a problem at this location with values rarely sinking below 5 mg/l, the concentration known to be necessary for many aquatic organisms. For more information, please refer to the Maryland Tributary Strategy Upper Western Shore Basin Summary Report for 1985-2005 Data (DNR 2007).

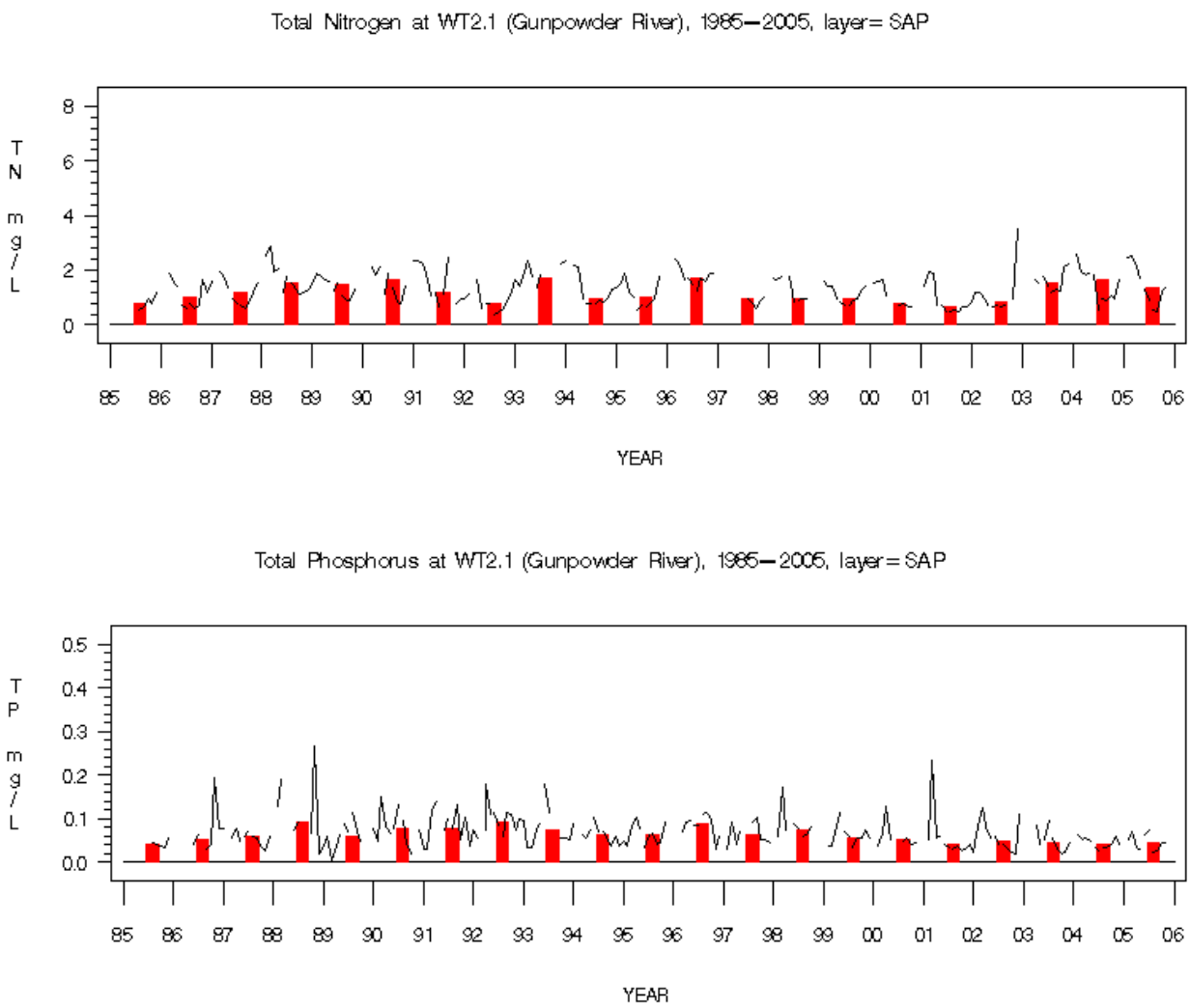
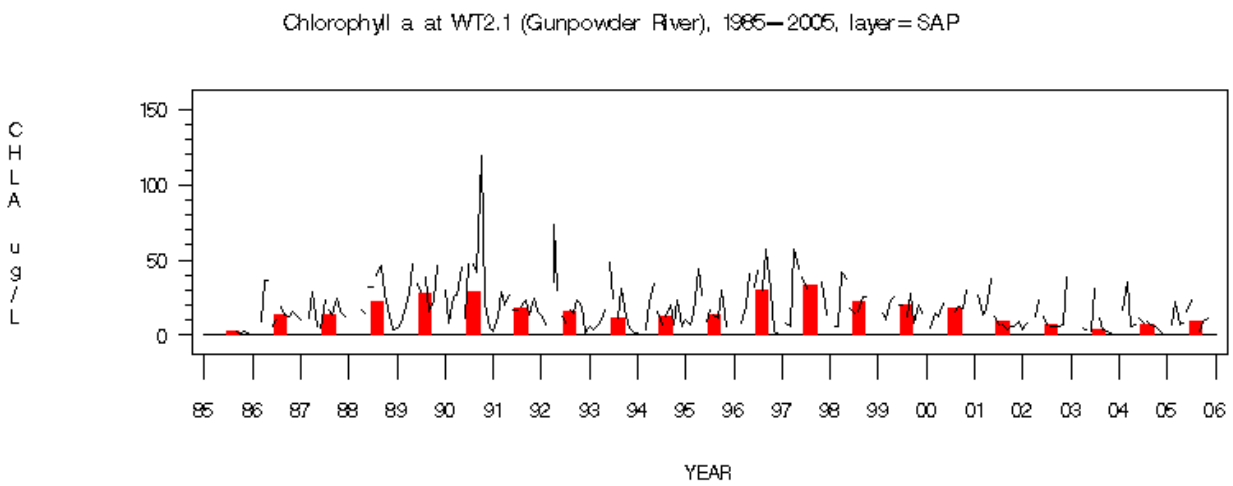


Figure 3-5: Total Nitrogen and Phosphorus Tidal Monitoring Results in Gunpowder River



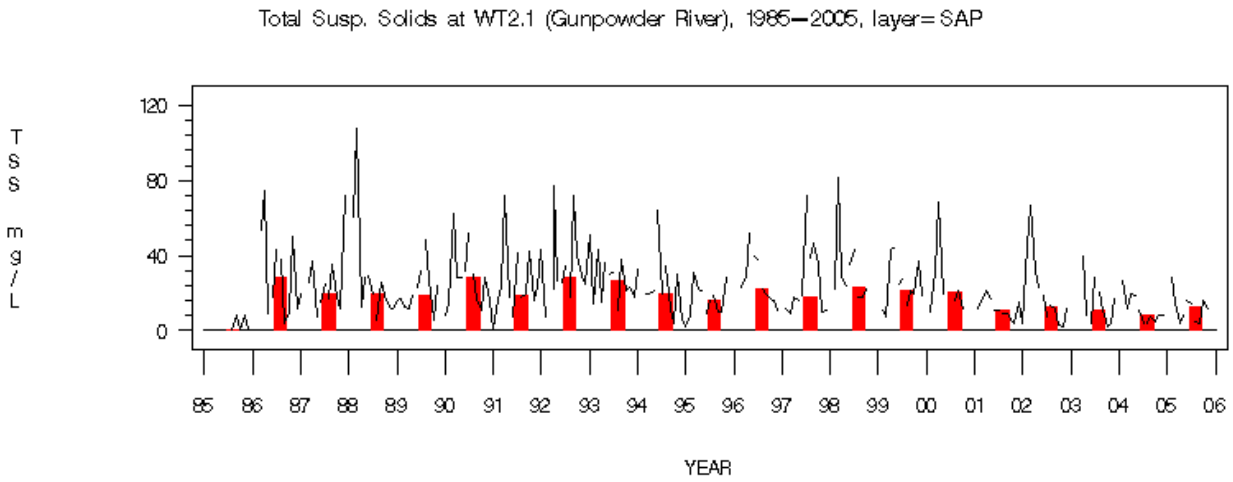


Figure 3-6: Chlorophyll-a and Total Suspended Solids Tidal Monitoring Results in Gunpowder River

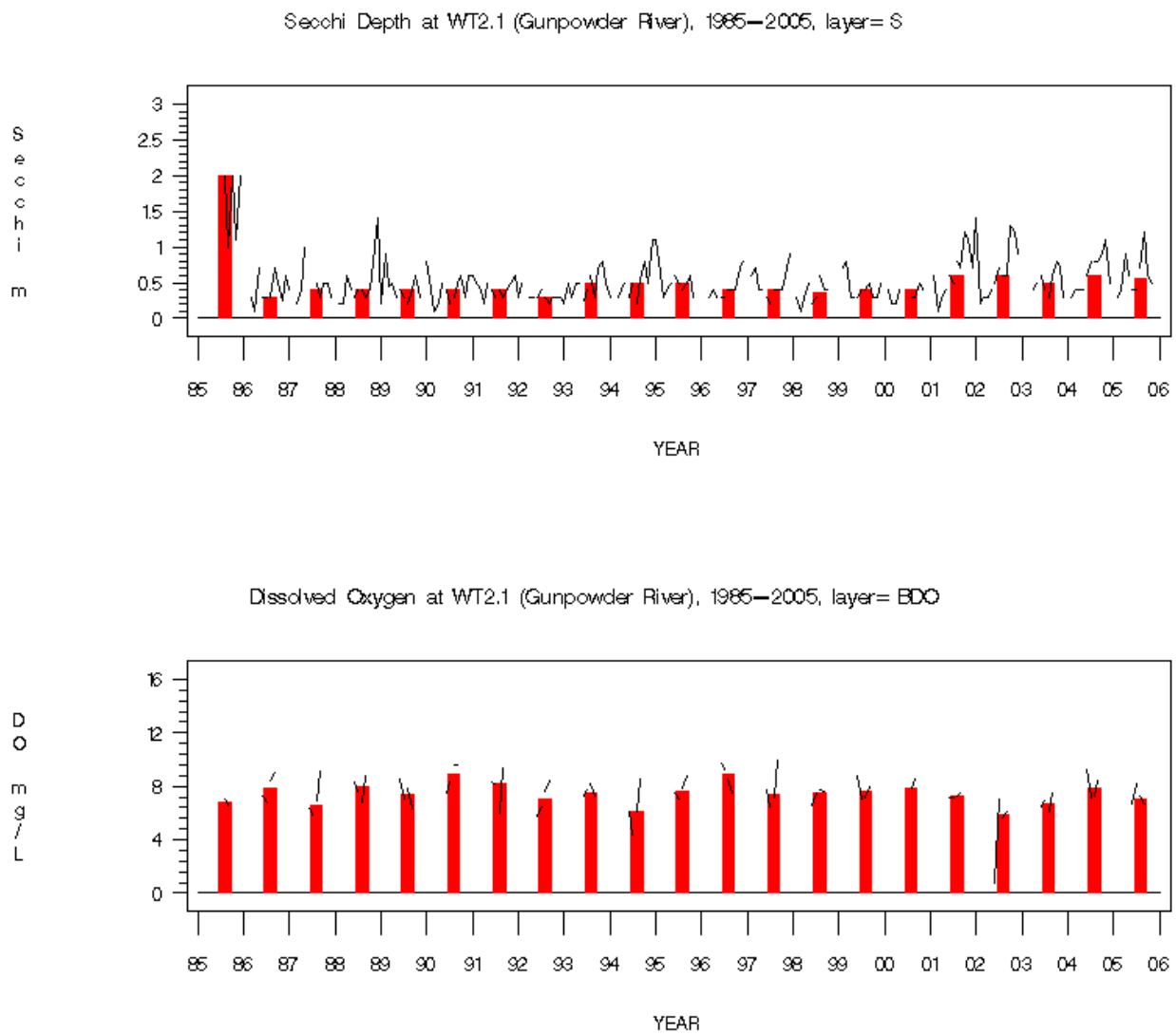


Figure 3-7: Water Clarity and Dissolved Oxygen Tidal Monitoring Results in Gunpowder River

3.4.2 Biological Data

Baltimore County conducts biological monitoring of benthic macroinvertebrates on an annual basis using the Maryland Biological Stream Survey (MBSS) protocols (Stranko 2007). The MBSS is a random-site design stream sampling program that was initiated by the Maryland DNR in 1993. It is intended to provide unbiased, statewide and watershed estimates of the biological resources in streams and rivers.

Benthic macroinvertebrates are organisms without a backbone that live on the bottom of streams and can be seen with the naked eye. They are an important part of stream ecosystems as they are a source of food for other aquatic life, including fish. The presence, numbers, and types of benthic macroinvertebrates also convey information about a water body's quality. Results of the MBSS protocol include a benthic Index of Biological Integrity (BIBI) score based on the benthic community at a sampling site. Qualitative ratings of stream biological integrity are based on IBI scores and range from good (4.0 – 5.0), denoting minimally impacted conditions, to very poor (1.0 – 1.9), indicating severe degradation.

Sites for the Baltimore County biological sampling program are randomly selected, focusing on the Patapsco/Back River Basin in odd years and the Gunpowder/Deer Creek Basin in even years. Between 2004 and 2012, 26 sites were sampled in the Bird River watershed by Baltimore County. Figure 3-8 shows the distribution of sites, as well as their BIBI narrative ratings. All of the 26 sites received ratings of Poor or Very Poor. In addition to data collected by the County, Maryland DNR sampled five random sites in the watershed through the MBSS program (Figure 3-9). The DNR data were in agreement with the County data, and no sites were rated above the Poor category, using the BIBI.

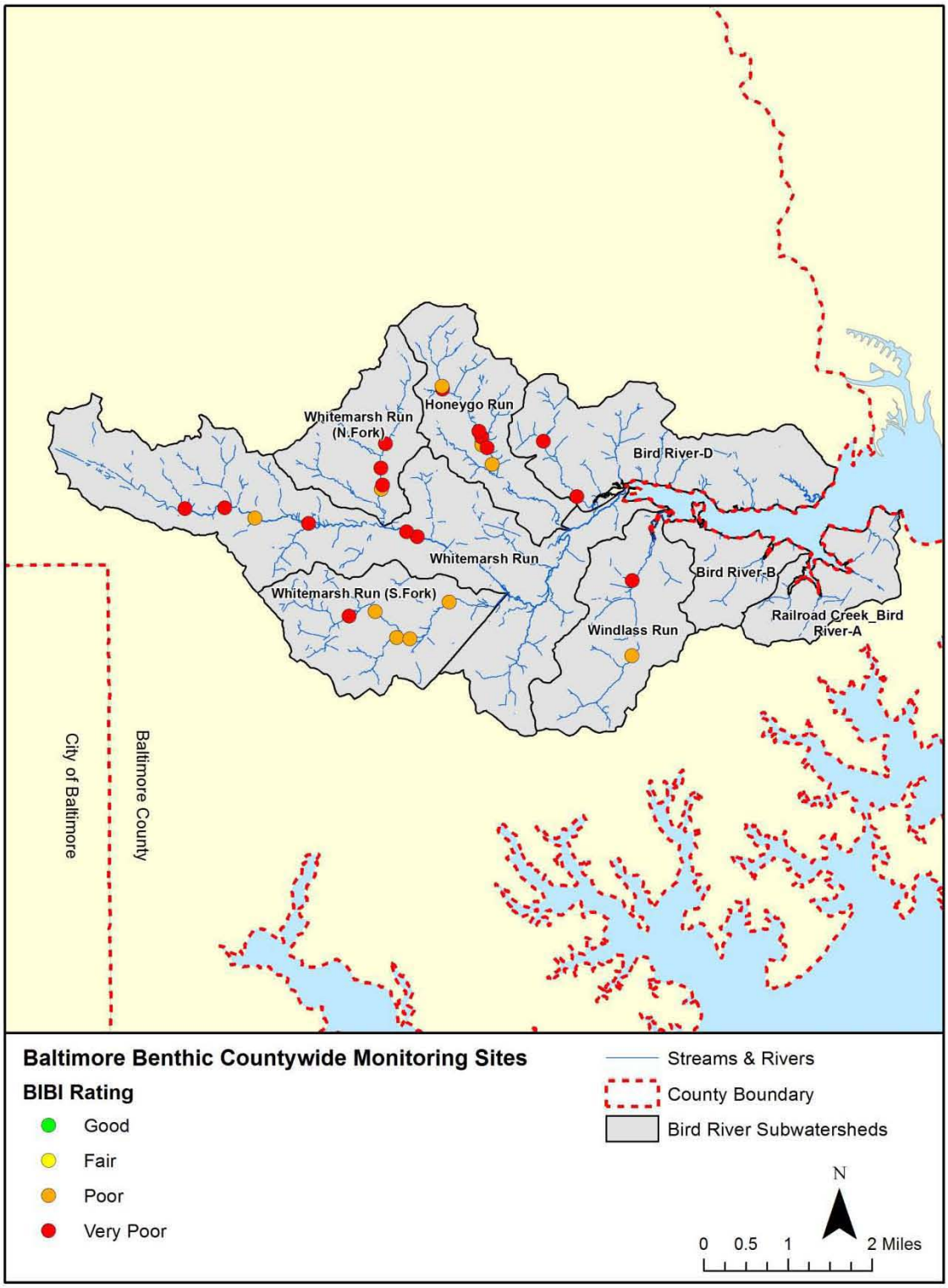


Figure 3-8: Results at Biological Monitoring Locations Sampled by Baltimore County in Bird River Watershed (2004-2012)

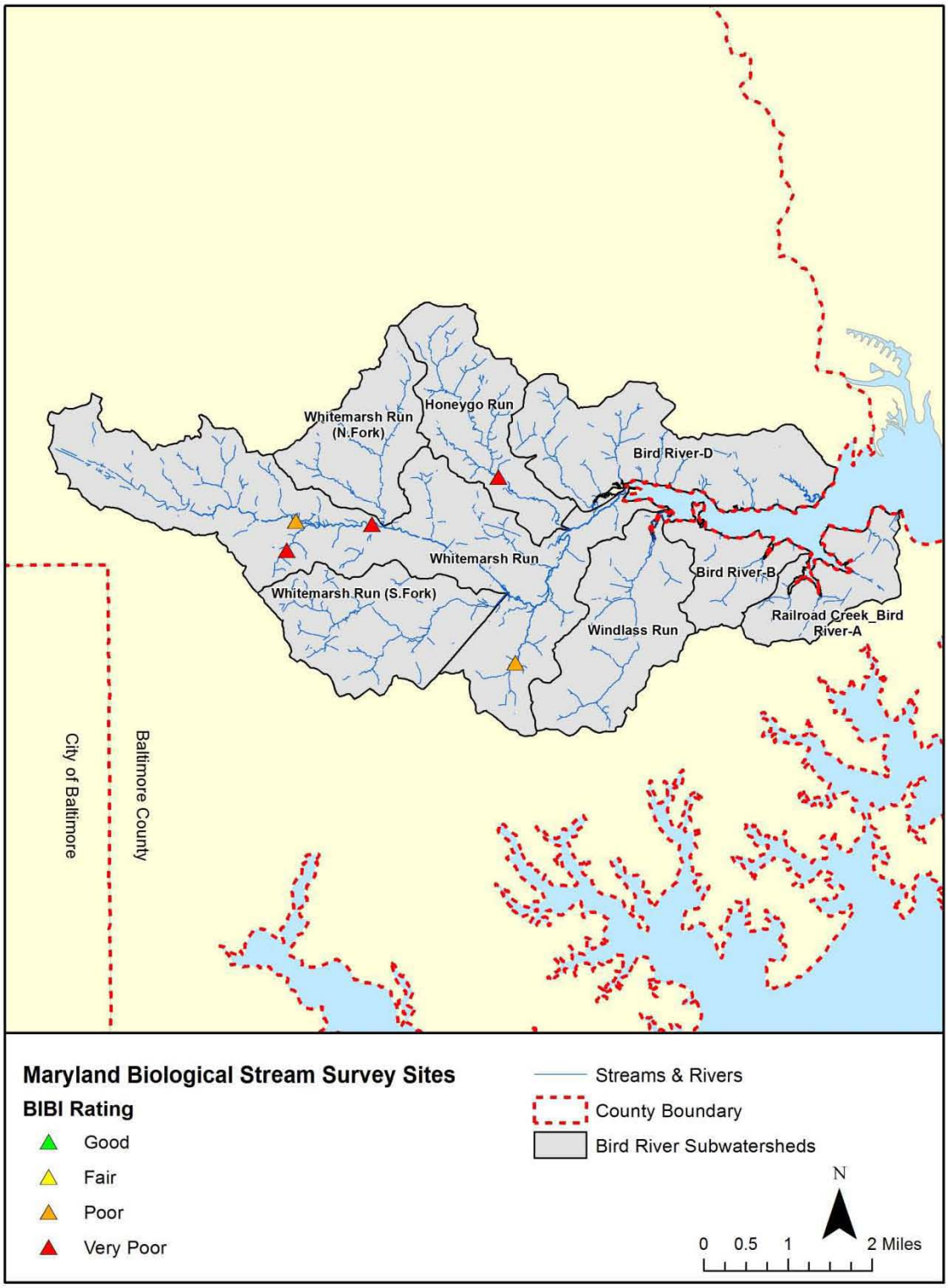


Figure 3-9: Results at Monitoring Locations Sampled by the Maryland Biological Stream Survey (1995-2012)

3.4.3 County SAV Monitoring

The presence of Submerged Aquatic Vegetation (SAV) is a key indicator of the health of a water body and Baltimore County has been monitoring SAV since 1989. Currently there are 30 waterways being monitored by the County. MDE has developed SAV acreage goals for all tidal water segments in the state including the portion of the Gunpowder River that includes Bird River (GUNHO2). The SAV acreage goal and the portion of that goal met on an annual basis from 2009-2012 are shown in Table 3-18. SAV distributions are measured in the spring and summer of each year during peak growth periods in accordance with U.S. Fish and Wildlife methodologies. SAV location, density, and species types are all recorded. Total SAV coverage is calculated by the following formula to account for overlap between the seasons:

$$\text{Total SAV}_{acres} = (\text{Spring SAV}_{acres} - \text{Overlap}_{acres}) + (\text{Summer SAV}_{acres} - \text{Overlap}_{acres}) + \text{Overlap}_{acres}$$

Table 3-18: SAV Goal and SAV Monitoring Results for Segment GUNHO02 (2009-2012)

		2009		2010		2011		2012	
SAV Goal (Acres)	Water Clarity Depth (m)	Acres	% of Goal	Acres	% of Goal	Acres	% of Goal	Acres	% of Goal
572	2.0	296.9	51.7	255.4	44.7	270.9	47.4	266.2	46.5

3.4.4 Illicit Discharge and Elimination Data

Baltimore County tracks illicit discharges through a program of routine outfall screening. The program consists of three parts:

1. A quantitative analysis of the effluent that includes measuring the effluent flow rate, temperature and pH, and field testing for parts per million (ppm) of chlorine, phenols, ammonia, and copper using a specially configured LaMotte NPDES test kit;
2. A qualitative assessment of the effluent, outfall structure, and receiving channel, noting conditions such as water color, odor, vegetative condition, sedimentation, erosion, damage, etc.; and
3. A visual inspection of each outfall that identifies any structural damage.

The County has an outfall prioritization system based on data from the outfall screening. There are approximately 270 outfalls in Bird River watershed. About 83 percent (225) of these are minor outfalls (less than 3 feet in diameter). The remaining 45 outfalls are classified as major (greater than 3 feet in diameter); 39 of these have a prioritization rating (Table 3-19, Figure 3-10). The prioritization system allows for a more streamlined approach in selecting outfalls to screen and provides a more efficient use of manpower.

Under that outfall prioritization system, major outfalls that have not been screened at least three times are not prioritized. Outfalls that are inaccessible are removed from the database. Prioritized major outfalls, those screened three or more times, are assigned one of the following priority ratings:

- **Priority 0 (Not Prioritized)**: Outfalls with insufficient data to determine a priority rating. This may be due to the outfall only having been screened once.

- **Priority 1 (Critical)**: Outfalls with 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 (High)**: Outfalls with Mod. to minor problems that have the potential to become severe. These outfalls are sampled once a year.

- **Priority 3 (Low)**: Outfalls with minor or no problems that do not require close monitoring. These outfalls are sampled on a 10-year cycle.

A second screening is conducted if nearly a decade has passed since the previous screening. If no pollution problems were indicated, then the outfall is considered a low priority. This allows more focus on outfalls with greater potential of an illicit connection. A second screening is also performed at an outfall when prior screening indicates that one or more of the water quality criteria were exceeded. The second screening helps determine whether the pollutant is a persistent constituent of the effluent or simply an anomaly. No remedial action is taken if the second screening indicates that the pollutant is within acceptable levels; however, the outfall is considered to have a potential illicit connection and is automatically queued for re-screening within one year. If the problem is severe enough to warrant immediate correction, an investigation begins immediately. Some sites are determined to have problems severe enough to warrant immediate investigation and/or corrective action only after one screening.

Table 3-19: Major Outfalls by Priority Level in Bird River Subwatersheds

	Bird River-B	Bird River-D	Honeygo Run	Railroad Creek_Bird River-A	Whitemarsh Run	Whitemarsh Run (N. Fork)	Whitemarsh Run (S. Fork)	Windlass Run	Total
Outfall Priority Rating									
Priority 0	0	0	0	2	1	2	0	1	6
Priority 1	0	0	0	0	1	0	1	0	2
Priority 2	0	0	0	0	7	2	0	0	9
Priority 3	0	0	3	0	9	11	5	0	28
Total	0	0	3	2	18	15	6	1	45

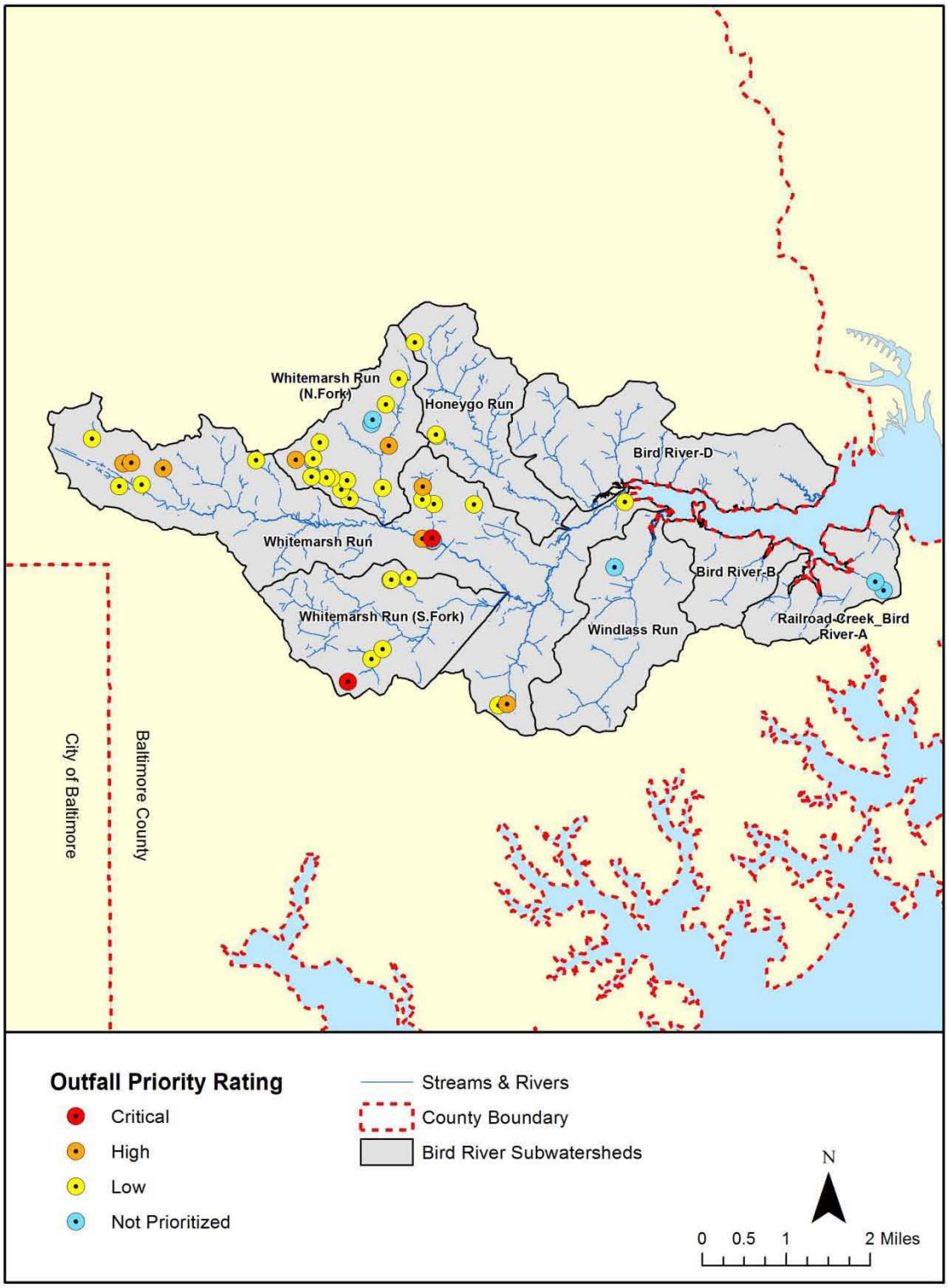


Figure 3-10: Major Outfalls by Priority Level in Bird River Watershed

3.4.5 Landfill Monitoring

There are a total of three landfills located within the Bird River watershed. Two of these facilities are located in White Marsh: Days Cover Rubble Landfill (DCRLF) and Eastern Sanitary Landfill (ESL). Groundwater monitoring is performed and reported on semi-annually at these two facilities. DCRLF is privately-owned and operated while ESL is owned and operated by the Baltimore County Department of Public Works, Bureau of Solid Waste Management (BSWM).

DCRLF uses a network of 12 groundwater monitoring wells installed around the site perimeter, as well as two surface monitoring sites, and collects samples for laboratory analysis. Some of the parameters measured include alkalinity, pH, metals, TSS, nutrients, volatile organic compounds (VOCs). Results of all sampling are compared to tolerance limits (TLs) that were established using criteria laid out in the Statistical Analysis of Groundwater Monitoring at Resource Conservation and Recovery Act (RCRA) Facilities, Unified Guidance (USEPA 2009b). All sampled Days Cove monitoring wells had at least one parameter in exceedance of its respective TL. Alkalinity, calcium, copper, iron, pH, and potassium are in exceedance of their respective TLs in multiple Days Cove monitoring wells. Additional TL exceedances occurred for: arsenic, barium, and ammonia-nitrogen. Further details and the records of all historical groundwater chemical data may be found in the fall 2012 monitoring report (ARM Group Inc. [ARM] 2012).

ESL uses a network of 12 groundwater monitoring wells and two potable wells and collects samples twice a year, between January-March and July-September. These wells are monitored for water quality parameters, VOCs and metals. Nitrate was detected in most of the groundwater samples, though none exceeded the Maximum Contaminant Level (MCL) of 10 mg/l. Several VOCs were identified in the samples; benzene has exceeded the MCL during 23 of the previous 26 sampling events. All other VOCs were below their established MCLs. Further details and the records of all historical groundwater chemical data may be found in the fall 2012 monitoring report (BSWM 2013). For further information regarding Days Cove, please visit http://www.dayscove.com or call (410) 335-3778. For further information regarding ESL, please call (410) 887-2000.

A third landfill located in the watershed, Honeygo Run Reclamation Center, is located in Perry Hall. This facility is privately-owned and operated. For further information regarding this location, please contact the General Manager, Monte Kamp, at (410) 335-9500 or MonteK@repsrv.com.

3.5 Sewer Overflow Impacts

At present, sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs) are inevitable byproducts of the area's expanding population and aging sewer systems. Sewer overflows can be caused by various factors such as severe weather, insufficient maintenance, pumping station equipment malfunction, electrical outage, sewer line breaks, improper disposal of fats and grease, and vandalism. Raw sewage can enter nearby streams when a sanitary sewer system is overwhelmed by volume or if the infrastructure fails. EPA reports that there are at least 40,000 of these incidents per year nationwide. Environmental and human health consequences of these overflows can be serious. *E. coli* bacteria and other pathogens are typically present in raw sewage and can pose health risks to individuals who come into contact with contaminated water. Sewer overflows can also contain high levels of nutrients (nitrogen and phosphorus), which are toxic to aquatic life and feed organisms that deplete oxygen in

waterways. High levels of sediment are also present in sewer overflows and may clog streams and block sunlight from reaching essential aquatic plants.

In September 2005, EPA and MDE issued a consent decree to Baltimore County with deadlines to reduce and eliminate sanitary sewer overflows. Implementation of work (capital, equipment, operations improvements) in compliance with the consent decree will result in a reduction of nutrients and bacteria entering streams in the Bird River watershed. However, this may not address all impacts associated with the sanitary sewer system, as the consent decree is targeted at overflows. For example, the sanitary sewer system may leak without resulting in an overflow. Depending on the locations of the leaks, which are typically at joints, there may still be adverse impacts to the stream system from the sanitary sewer system.

Figure 3-11 shows the locations of sanitary sewer pump stations throughout the Bird River watershed. The number of SSO events documented and approximate volume discharged between 2000 and 2011 is summarized in Table 3-20 based on Baltimore County's SSO GIS layer. Table 3-21 summarizes the estimated volume and pollutant loads associated during this 12-year period by subwatershed.

Sewage overflows are decreasing both in frequency and volume. Since 2002, sewage spills for a given year have generally not exceeded 50,000 gallons. However, there was a spike in volume in 2007, where a 90,000 gallon spill accounted for over 75% of that year's spill volume. 2011 showed the lowest volume on record, with less than 10,000 gallons of sewage leaked within the Bird River watershed.

Table 3-20: Sanitary Sewer Overflow Events and Volumes in Bird River Watershed, 2000-2011

Year	# of SSO Events	Volume (gallons)
2000	5	18,190
2001	13	431,685
2002	11	126,485
2003	17	35,160
2004	9	10,540
2005	7	19,850
2006	9	47,860
2007	6	118,100
2008	6	24,600
2009	0	0
2010	2	16,200
2011	3	7,100
Total	88	855,770

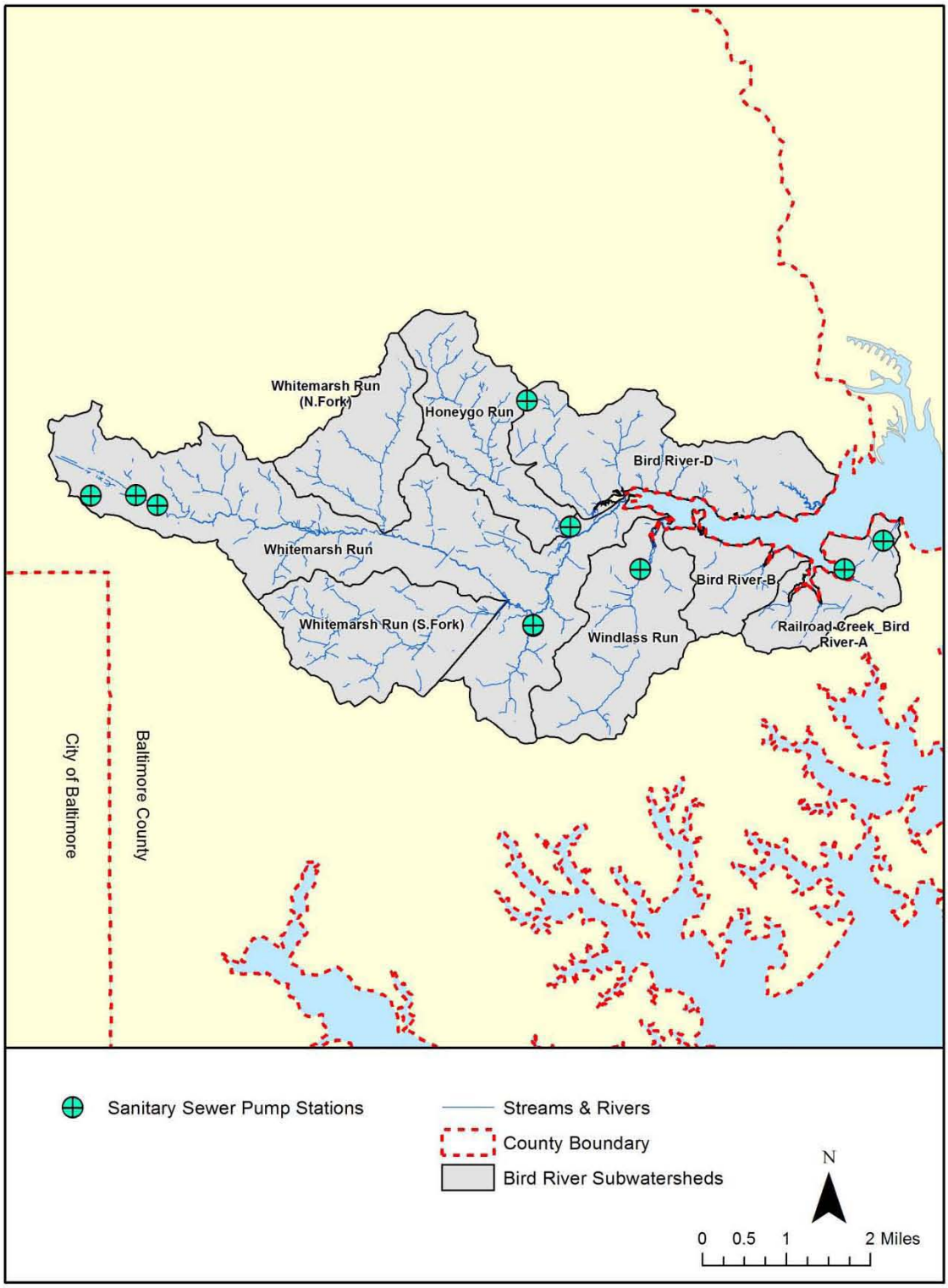


Figure 3-11: Sanitary Sewer Pumping Stations in Bird River Watershed

Table 3-21: Sanitary Sewer Overflow Volumes and Pollutant Loads by Subwatershed, 2000-2011

Subwatershed	# of SSO Events	Volume (gallons)	TP (lbs)	TN (lbs)	Fecal Coliform (MPN)
Bird-River-B	0	0	0.0	0.0	0
Bird River-D	0	0	0.0	0.0	0
Honeygo Run	2	450	0.0	0.1	$1.1x10^{11}$
Railroad Creek_Bird River-A	2	1,500	0.1	0.4	$3.6x10^{11}$
Whitemarsh Run	65	825,675	68.5	206.4	$2.0x10^{14}$
Whitemarsh Run (N. Fork)	13	20,735	1.7	5.2	$5.0x10^{12}$
Whitemarsh Run (S. Fork)	6	7,410	0.6	1.9	$1.8x10^{12}$
Windlass Run	0	0	0.0	0.0	0
Total	88	855,770	71.0	213.9	$2.1x10^{14}$

Pollutant load estimates were calculated based on the following assumptions:

- **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.

- **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.

- **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.

Figure 3-12 shows the location of SSOs in the Bird River watershed. Bird River-B, Bird River-D and Windlass Run subwatersheds had no reported sanitary sewer overflows between 2000 and 2011. Whitemarsh Run is the largest subwatershed, and had by far the highest number of SSOs (65) and the largest volume of leaked sewage (825,675 gallons). It also is the only subwatershed with SSOs that were greater than 10,000 gallons in volume. The sanitary sewer pumping station on Reames Road was responsible for the vast majority of the volume of these overflows reported in Whitemarsh Run. A $4 million upgrade was completed to this pumping station in 2008 and since the upgrade there have been no overflows at this location.

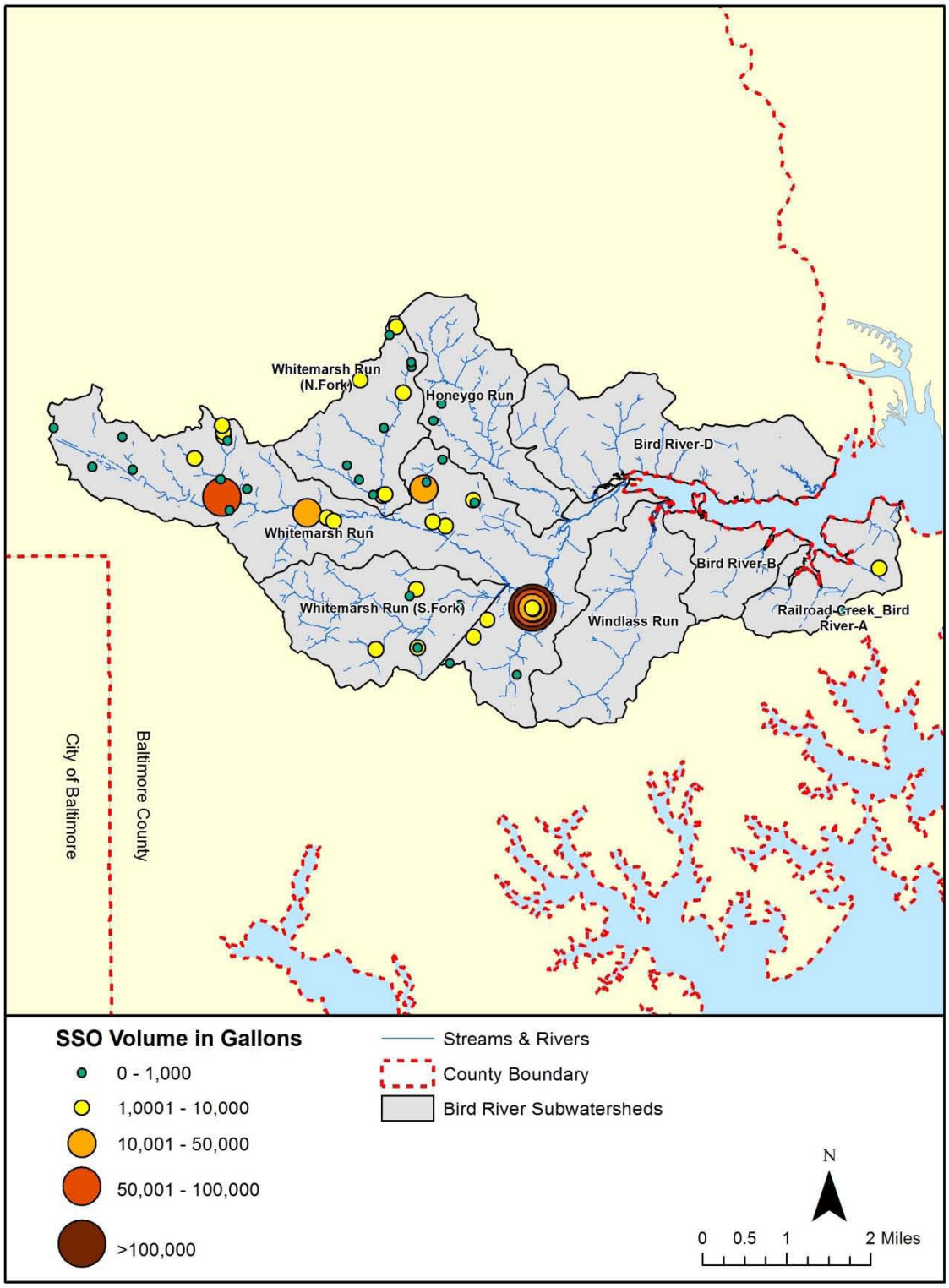


Figure 3-12: Sanitary Sewer Overflow Locations in Bird River Watershed (2000-2011)

3.6 Stream Corridor Assessments

Stream corridor assessments (SCAs) were conducted for a subset of stream reaches in SWAP Area K, within the Bird River-D, Honeygo Run, and Whitemarsh Run subwatersheds. This survey focused on first through third order stream reaches in the Bird River-D subwatershed, and first through fourth order stream reaches in the Honeygo Run and Whitemarsh Run subwatersheds. The stream survey method was based on Maryland DNR's SCA Survey Protocols. The SCA protocols were developed as a tool for environmental managers to quickly evaluate the general physical condition of, and identify environmental problems within, a stream network (Yetman 2001). The SCA is a rapid field survey rather than a detailed scientific assessment. This method helps to identify areas in need of more detailed monitoring, management, or conservation efforts on the watershed and subwatershed scale.

The SCA survey is designed to be flexible and can be modified to suit the needs of the individual project. Modifications to the Area K SCA survey included the deletion of the accessibility and correctability ratings and the representative site forms. A channel condition evaluation was included for erosion sites inventoried during the SCA surveys, which is based on concepts presented in Simon and Hupp (1986) on channel evolution models. The protocols and results of the SCA for Area K are described in the following sections.

3.6.1 Assessment Protocol

The SCA method is used to quickly assess physical conditions and identify common environmental problems in a stream corridor. Two-person field crews walked the wadeable streams within each of the selected subwatersheds and completed forms for each of the following environmental problems that were observed:

- Channelized or Altered Stream Sections (CA),
- Unusual Conditions – Comments (UC-C),
- Erosion Sites (ES),
- Fish Migration Barriers (FB),
- Pipe Outfalls/Exposed Pipes (PO/EP),
- Inadequate Stream Buffers (IB),
- Trash Dumping Sites (TD), and
- In or Near Stream Construction Sites (IC).

The field survey teams walked along the selected stream corridors noting the location of problems on either field maps or a handheld Global Positioning System (GPS) unit. At least one photograph was taken at each site to document the conditions observed. After returning from the field, all data was entered into a GIS. Each site was assigned a unique identification (ID) number, which included the Baltimore County grid identification number. Figure 3-13 shows the county grid boundaries within Area K and the streams surveyed in 2013 for the SCAs.

The field survey team scored each problem site on a scale of one to five for severity. A score of five denotes a minor problem, or one that is easily fixed, and a score of one is the worst problem observed in a problem category. The criterion for scoring problem severity is dependent on the problem type and is described in detail in the SCA manual (Yetman 2001). The severity rating

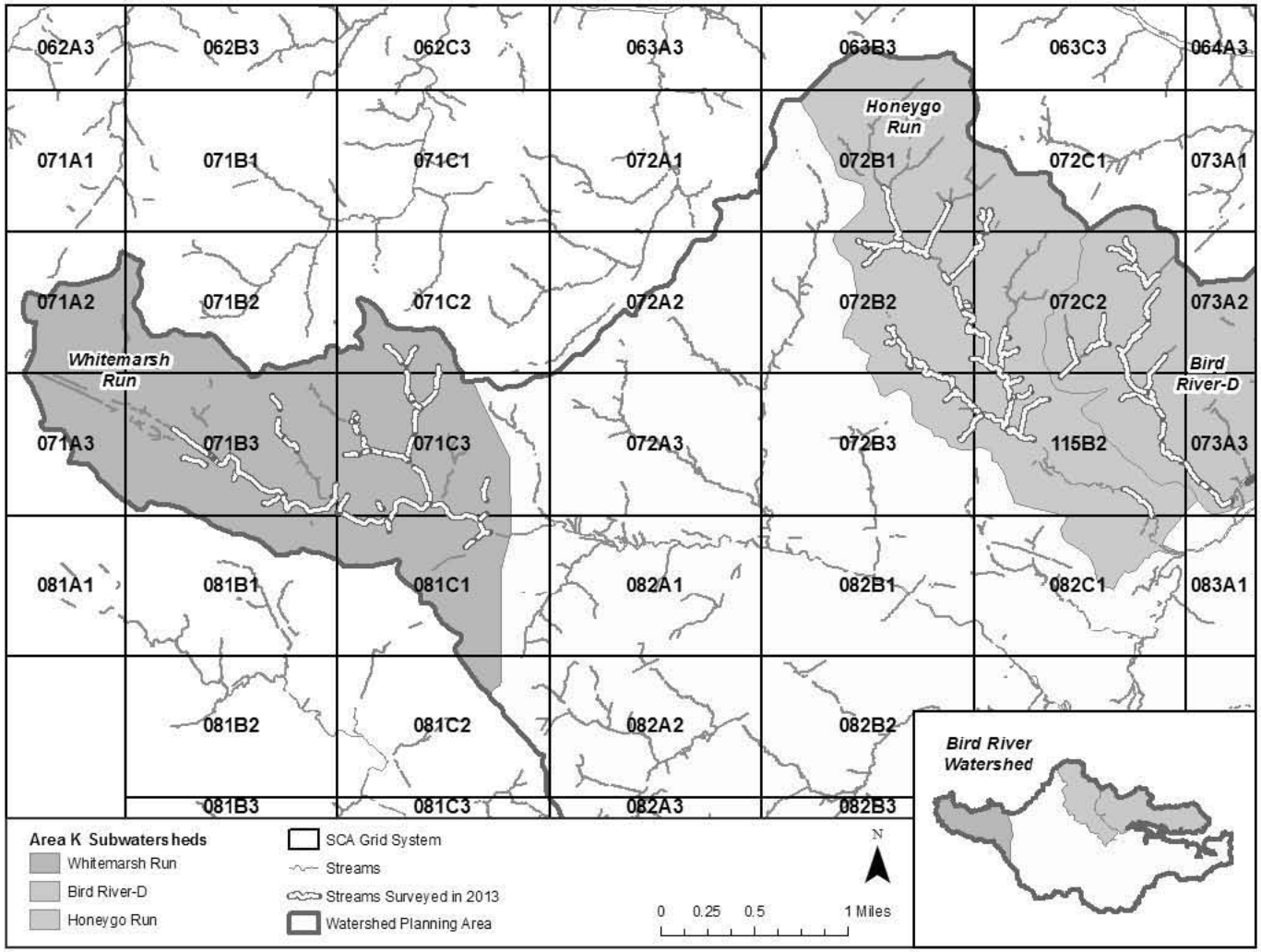


Figure 3-13: Baltimore County Grid Identification System and 2013 Stream Survey Extent

is a measure of how bad a problem site is compared to other problems in the same category; the most severe problems are those with a direct and wide impact on stream resources. These scores can also help prioritize potential restoration opportunities.

For stream reaches with erosion sites, channel condition was evaluated based on existing geomorphic characteristics and channel evolution models presented by Simon and Hupp (1986). There are four stages of channel evolution: Stage I - Incision, Stage II - Widening, Stage III - Deposition, and Stage IV - Recovery and Reconstruction. Characteristics of each stage are detailed in Figure 3-14.

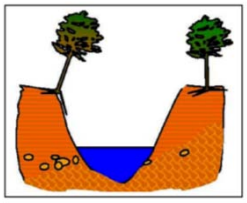
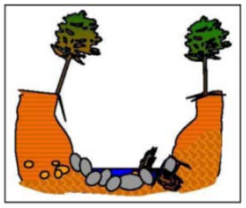
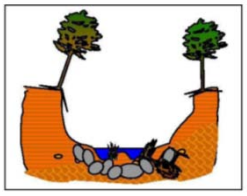
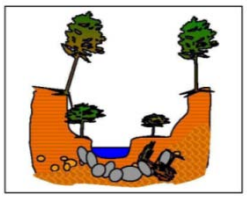
Stage I Incision • Downcutting liberates sediment • Loss of perched bankfull floodplains • “U” shaped channel • Woody vegetation high on bank with many “surfer” trees	
Stage II Channel Widening • Widespread bank failures as banks exceed critical height or were undercut by toe scour • Channel adjusts to new flow regime • Significant sediment loads generated; most significant erosion hazard in this phase • Bank armoring generally ineffective	
Stage III Deposition • Deposition begins from liberated sediment • Vegetation establishes near water line	
Stage IV Recovery and Reconstruction • Bankfull floodplains may be reconstructed from liberated sediment • Woody vegetation establishes near water line • Stability re-established	

Figure 3-14: Four Stages of Channel Evolution

The numbering sequence for the four categories follows an abbreviated version of Simon and Hupp's (1986) progression of change in channel evolution after some type of physical disturbance. During Stage I - Incision, the channel is downcutting, which liberates sediment. The channel cross section becomes "U" shaped and woody vegetation is left high on the unstable banks. Storm flows cannot access the floodplain where erosive energy could be dissipated. In Stage II - Widening, there are widespread bank failures as the banks are undercut by high storm flows which can no longer access the floodplain. As the channel tries to adjust to the new confined flow regime, significant sediment loads are generated. The most significant erosion hazard occurs during this stage, and bank armoring is generally ineffective. In Stage III - Deposition, the enlarged channel can now accommodate higher stormwater volumes and begins to develop a low flow channel nested within a new floodplain created from the deposition of liberated sediment. Vegetation begins to appear near the water line. Stage IV - Recovery and Reconstruction occurs when a new, bankfull floodplain is established. Woody vegetation and stable stream habitat begin to appear and dynamic stability is re-established.

Channel condition evaluation, SCA severity ratings for erosion, local geology, and land use are used to prioritize unstable stream reaches for further study and/or restoration. A summary of SCA data are shown in Appendix F.

3.6.2 Summary of Sites Investigated

The SCA targeted streams in the Bird River-D, Honeygo Run, and Whitemarsh Run subwatersheds. As indicated in Table 3-22, 15.38 stream miles were evaluated in the assigned subwatersheds. A total of 3.38 miles were surveyed in Bird River-D, 6.45 miles were surveyed in Honeygo Run, and 5.55 miles were surveyed in Whitemarsh Run. This represents 27 percent of the stream miles within the selected subwatersheds and approximately 17 percent of streams in the Bird River Watershed.

The stream reaches which were selected for evaluation by the SCA survey were provided in the form of a GIS geodatabase from Baltimore County. The GIS layer of stream lines was compiled by Sanborn Mapping Company using stereophotogrammetry from 2005 orthophotographs. This method of delineating streams can create an overestimate of total stream mileage when compared to field observations. This method can include a number of ephemeral and intermittent stream channels that do not conform to SCA protocols.

Table 3-22: SWAP Area K Miles of Stream Assessed by Subwatershed

Subwatersheds	2013 Stream Miles Surveyed	Total Stream Miles	% Total Stream Miles Surveyed
Bird River-D	3.38	12.74	26.5%
Honeygo Run	6.45	11.73	55.0%
Whitemarsh Run	5.55	32.44	17.1%
Totals	15.38	56.91	27.0%

3.6.3 General Findings

Within the 15.38 miles of streams surveyed in Area K, 596 problems sites were identified. Table 3-23 summarizes the number of potential problems identified in each category for the streams assessed.

Table 3-23: SWAP Area K SCA Survey Results – Number of Potential Problems

Subwatershed	Channel Alterations	Erosion Sites	Exposed Pipes	Fish Barriers	Inadequate Buffers	In or Near Stream Construction	Pipe Outfalls	Trash Dumping	Unusual Conditions	Totals
Bird River-D	16	18	3	7	12	1	14	16	17	104
Honeygo Run	29	36	4	18	15	1	41	42	27	213
Whitemarsh Run	38	46	14	26	22	0	80	35	18	279
Totals	**83**	**100**	**21**	**51**	**49**	**2**	**135**	**93**	**62**	**596**
% of Total	***13.9***	***16.8***	***3.5***	***8.6***	***8.2***	***0.3***	***22.7***	***15.6***	***10.4***	***100***

Pipe outfalls were the most frequent potential problem observed (135) followed by erosion sites (100), trash dumping (93), channel alterations (83), unusual conditions (62), fish barriers (51), inadequate buffers (49), exposed pipes (21), and in or near stream construction (2). Comment sheets are provided in Appendix L and were used to document observations of field conditions that were not identified problems. Total lengths of channel alterations, erosion sites, and inadequate buffers are summarized in Table 3-24 by subwatershed. Descriptions of each problem category are provided in the following sections.

Table 3-24: SWAP Area K SCA Survey Results – Length of Potential Problems

Subwatershed	Length of Channel Alteration (ft)	Length of Erosion (ft)	Length of Inadequate Buffer (ft)
Bird River-D	1,561	4,080	4,542
Honeygo Run	2,602	11,184	10,346
Whitemarsh Run	3,690	12,620	13,278
Totals	7,853	27,884	28,166

3.6.3.1 Channel Alterations

Channel alteration refers to stream sections where the banks or channel have been significantly modified from their natural condition. This includes channelized stream sections where the channel has been dredged, widened, straightened, and/or covered with concrete. Channelized streams are typically intended to convey higher flows while preventing flooding, but often create adverse environmental impacts such as impaired habitat and increased water temperature. Table 3-25 summarizes the number and lengths of channel alteration sites in each subwatershed and their associated severity ratings. Locations of channel alteration sites are shown in Figure 3-15, Figure 3-16, and Figure 3-17. Appendix F provides tables of channel alteration site data for each subwatershed.

Table 3-25: SWAP Area K SCA Survey Results – Channel Alterations

Subwatershed	Severity Rating Inventory						Stream Length		% of Total Stream Length Surveyed
	Very Severe	Severe	Mod.	Low Severity	Minor	Total	Feet	Miles	
Bird River-D	0	1	2	6	7	16	1,561	0.30	8.9
Honeygo Run	0	0	3	7	19	29	2,602	0.49	7.6
Whitemarsh Run	1	3	3	23	8	38	3,690	0.70	12.6
Totals	1	4	8	36	34	83	7,853	1.49	9.7

A total of 83 channel alteration sites were documented during the Area K survey for a total length of 7,853 feet or 9.7 percent of the stream length surveyed. The total length of channel alterations is less than might be expected considering historic agricultural land use and recent urban development of the region. This could be attributed to the amount of time that has passed since active ditching for agriculture has occurred. Many of the older, altered stream segments appear to have reached a new hydrologic and sediment transport equilibrium over time.

Low severity and minor channel alterations made up 43% (36) and 41% (34) of the total channel alteration sites in Area K, respectively. These were most commonly short segments of riprap or gabion lined channel. Very severe and severe channel alterations were observed in Whitemarsh Run. Most of these were concrete channels that were designed to quickly convey stormwater through the system.

Figure 3-15: Bird River-D Subwatershed, Channel Alteration

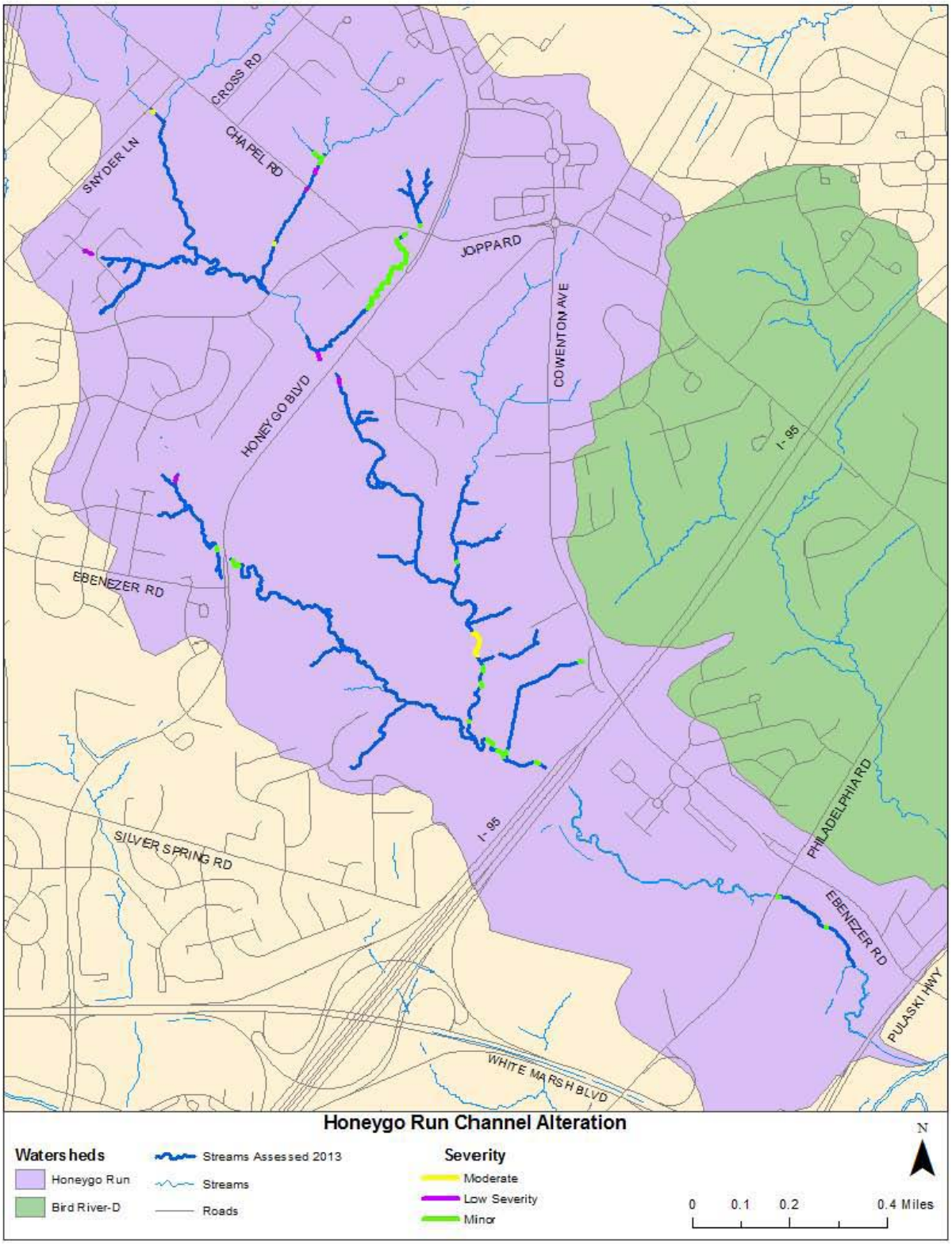


Figure 3-16: Honeygo Run Subwatershed, Channel Alteration

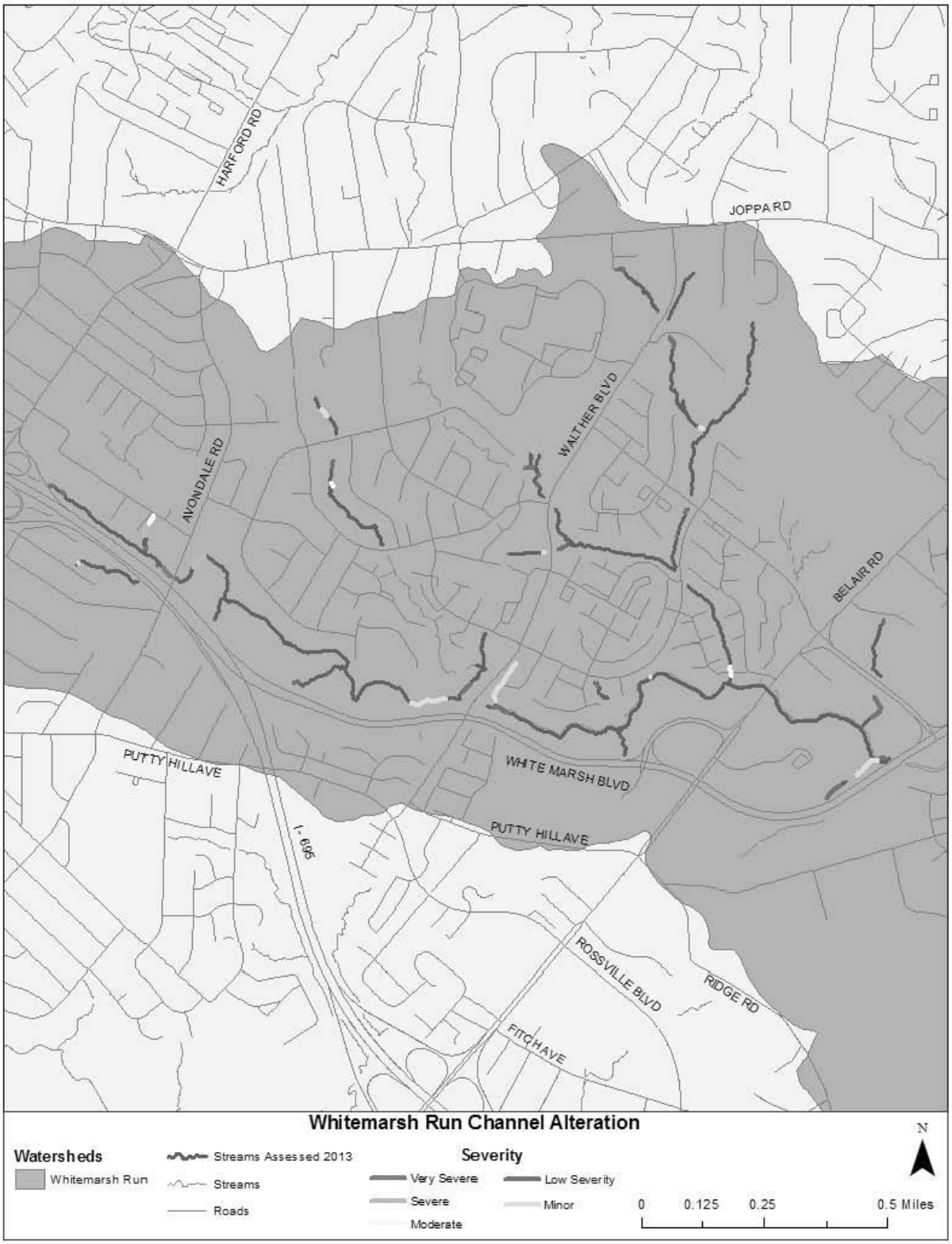


Figure 3-17: Whitemarsh Run Subwatershed, Channel Alteration

Figure 3-18shows examples of severe channel alteration sites in Area K. The figure on the left, site 071B3-CA61, is associated with a 167 foot section of a channelized concrete channel, located directly adjacent to a residential community within Whitemarsh Run. The figure on the right, site 072C2-CA90, is associated with a 500 foot section of a failing concrete drainage swale which conveys stormwater from I-95 directly into a tributary of Bird River-D.

Figure 3-18: Examples of Severe Channel Alteration Sites

3.6.3.2 Unusual Conditions

The unusual conditions form was used to document problems that did not fit into another category, or to provide additional comments on a specific problem. An unusual condition was ranked as very severe if the potential problem was considered to have a direct and wide-reaching impact on the stream's aquatic resources. A site was rated as minor if it was considered to have no significant impact on the stream's aquatic resources. Table 3-26 summarizes the number of unusual conditions in each subwatershed and their severity ratings. Locations of unusual conditions sites are shown in Figure 3-19, Figure 3-20, and Figure 3-21. Tables of unusual conditions site data for each subwatershed are provided in Appendix F.

Table 3-26: SWAP Area K SCA Survey Results – Unusual Conditions

	Severity Rating Inventory					
Subwatershed	Very Severe	Severe	Mod.	Low Severity	Minor	Totals
Bird River-D	0	5	5	7	0	17
Honeygo Run	0	5	11	8	3	27
Whitemarsh Run	1	7	4	3	3	18
Totals	1	17	20	18	6	62

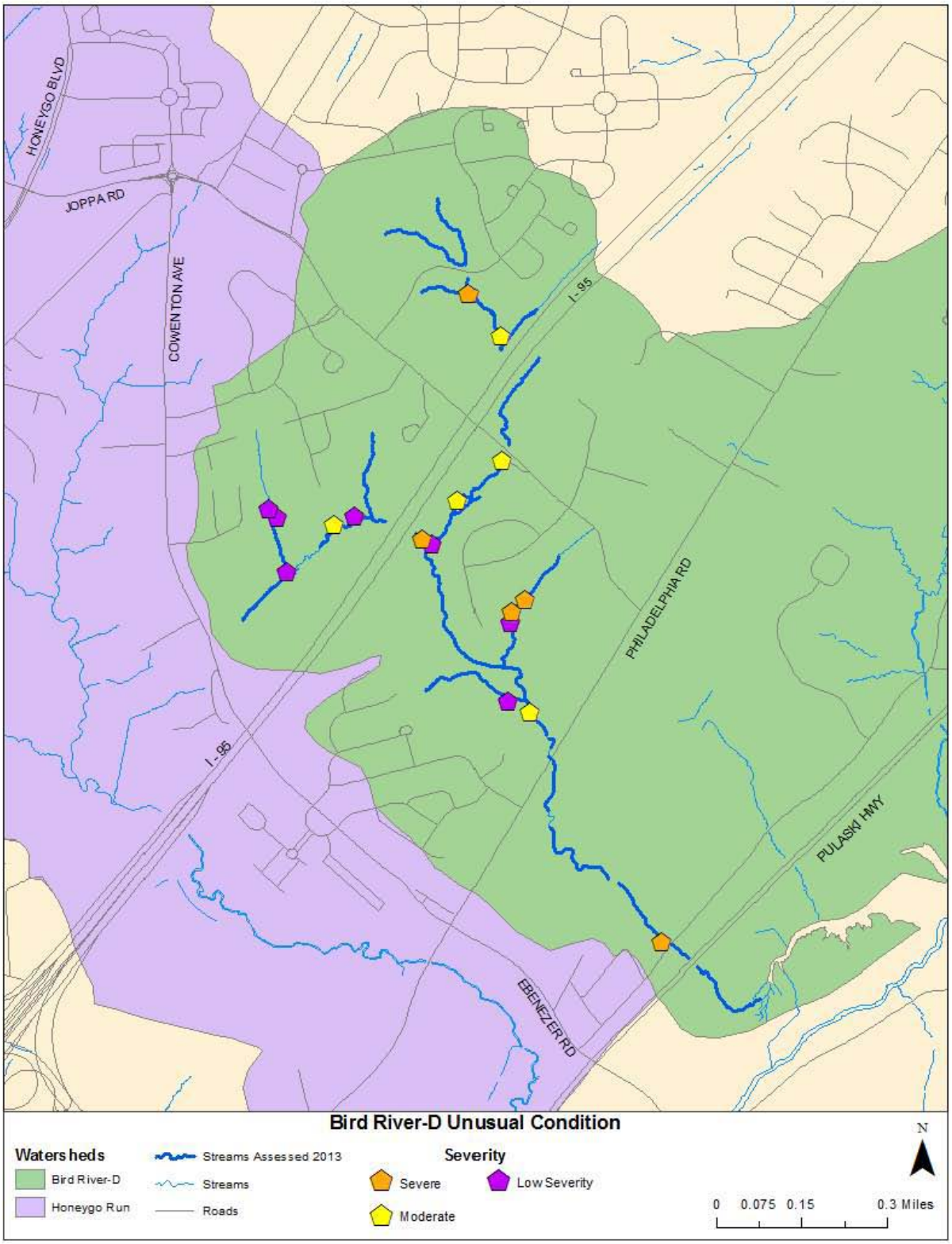


Figure 3-19: Bird River-D Subwatershed, Unusual Conditions

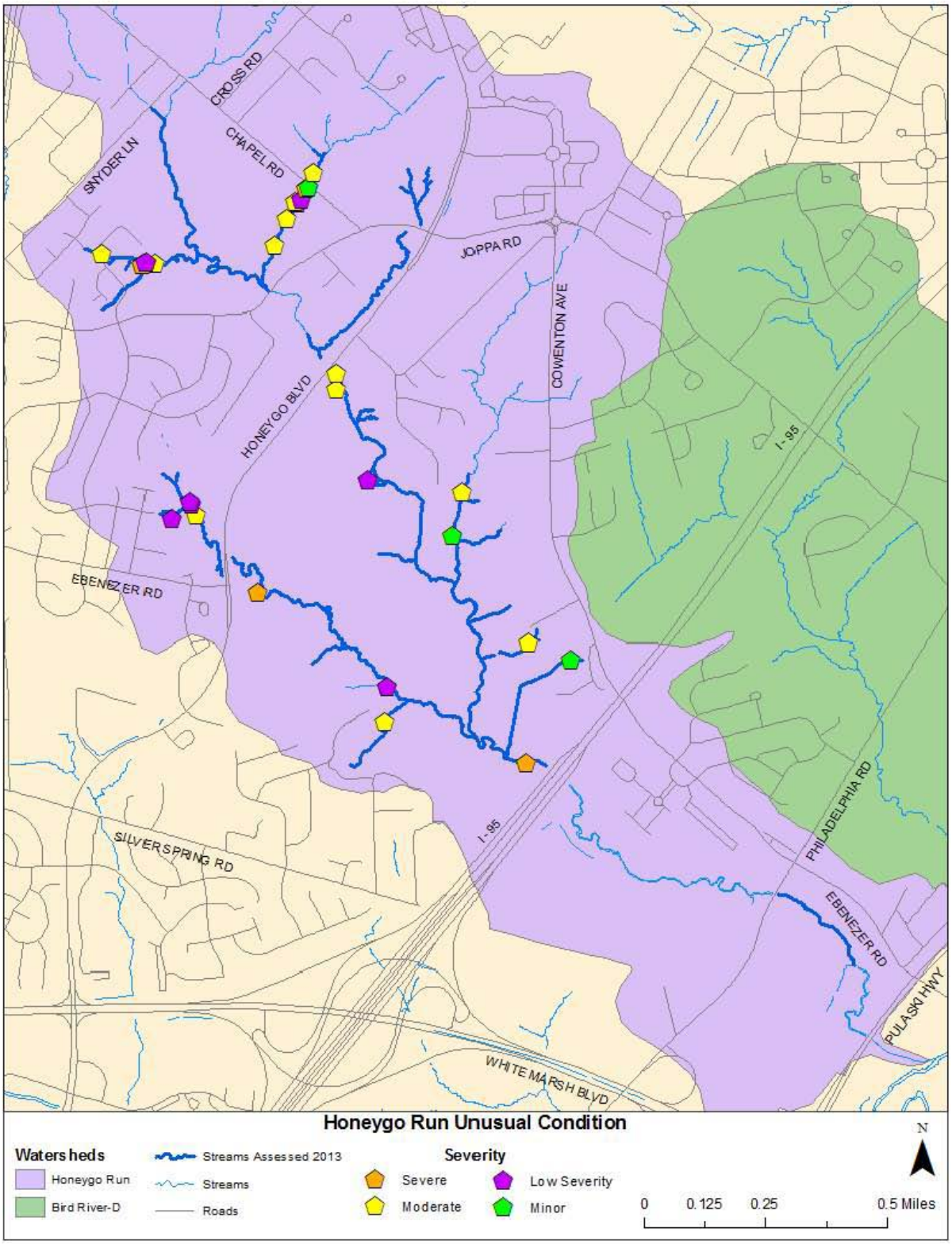


Figure 3-20: Honeygo Run Subwatershed, Unusual Conditions

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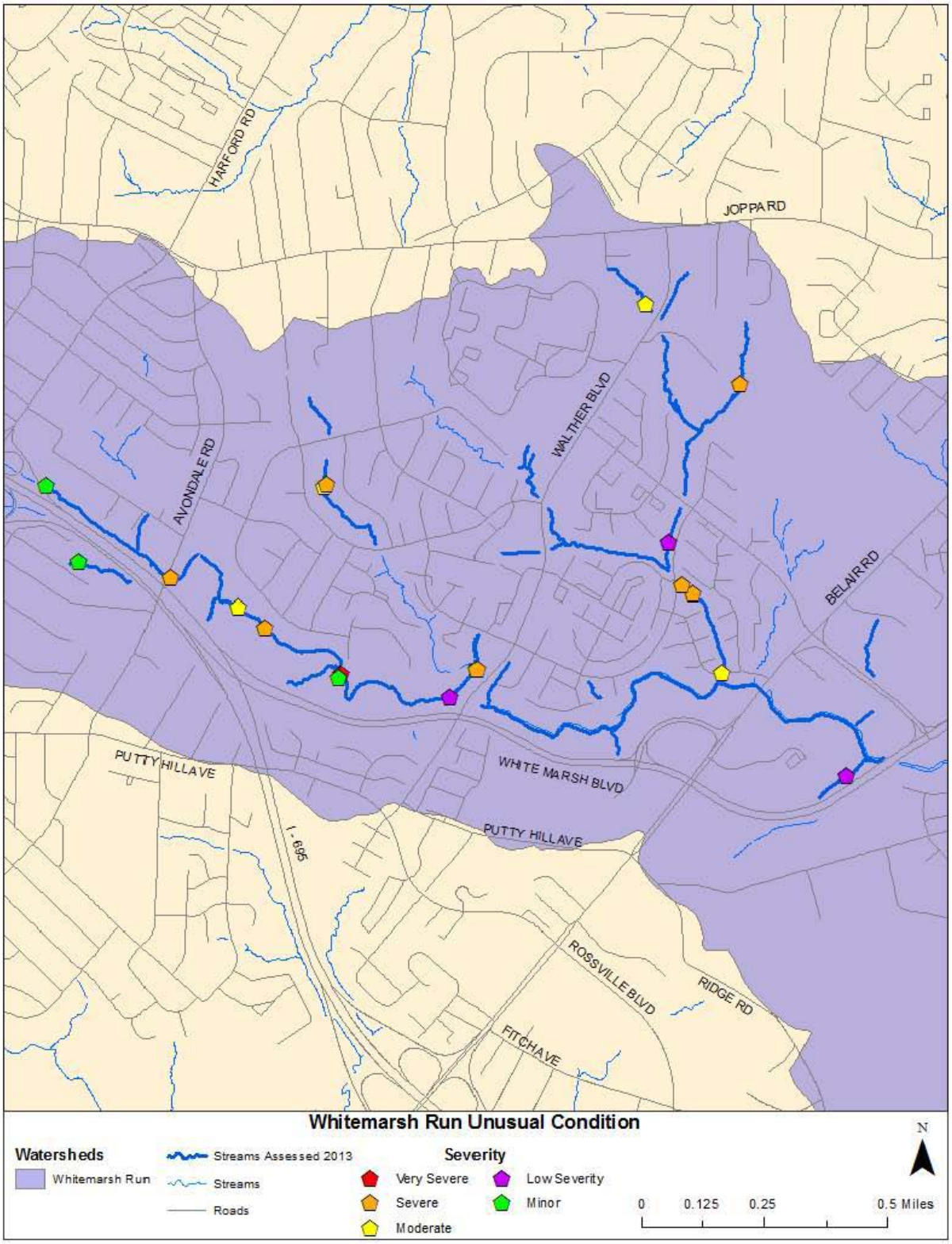

Figure 3-21: Whitemarsh Run Subwatershed, Unusual Conditions

There were 62 unusual conditions sites documented in Area K; 36 of these were headcuts forming off the side of the assessed stream from the floodplain where concentrated flow enters the channel. These were not included as erosion sites because they were not associated with the stream segments that the SCA was scoped to assess. Of the headcuts in Area K, eight were severe, fourteen were Mod., and fourteen were low severity. Many of the remaining unusual conditions in Area K were associated with indications of poor water quality (e.g. excessive algae), public safety issues (e.g. downed power line) or areas where large slabs of concrete were found in the channel. Of these unusual condition sites, one was very severe, eight were severe, seven were Mod., four were low severity, and six were minor.

Figure 3-22 shows examples of very severe unusual condition sites in Area K. The figure on the left, site 071B3-UC35, is associated with a downed power line hanging directly over the stream channel in Whitemarsh Run. The figure on the right, 072B1-UC30, is associated with an area in Honeygo Run where the homeowner is mowing their lawn right up to the bank, resulting in grass clippings in the stream.

Figure 3-22: Examples of Unusual Conditions Rated as Very Severe

3.6.3.3 Erosion Sites

Erosion can destabilize stream banks, impact habitat, and cause sediment pollution problems downstream. Significant erosion is a result of changes to stream hydrology or sediment supply, which are often attributed to land use changes in a watershed (e.g., urbanization, increased impervious cover). However, erosion is a natural process, and so it was not the purpose of the SCA to identify every little occurrence of erosion. Examples of erosion sites that were documented include vertical banks with a lack of vegetative cover and significant erosion along a reach of stream channel. The type of erosion, possible cause, adjacent land uses, and any threats to infrastructure were noted for each erosion site. Locations of erosion sites are shown in Figure 3-23, Figure 3-24, and Figure 3-25. Table 3-27 summarizes the number of erosion sites identified in each subwatershed and their severity ratings. Appendix F provides tables of erosion site data for each subwatershed.

Table 3-27: SWAP Area K SCA Survey Results – Erosion Sites

Subwatershed	Severity Rating Inventory						Stream Length		% of Total Stream Length Surveyed
	Very Severe	Severe	Mod.	Low Severity	Minor	Total	Feet	Miles	
Bird River-D	0	1	2	12	3	18	4,080	0.77	22.8
Honeygo Run	1	4	9	16	6	36	11,184	2.12	32.9
Whitemarsh Run	0	3	12	24	7	46	12,620	2.39	43.1
Totals	1	8	23	52	16	100	27,884	5.28	34.3

A total of 100 erosion sites were documented in Area K. The length of stream channel identified with erosion totaled 27,884 feet, or 34.3 percent of the total stream length surveyed. This corresponds to approximately 111,562 square feet of erosion when factoring in average bank height. It appears that stream widening or lateral migration of the channels was the most common type of channel condition associated with 63 of the erosion sites identified. These were usually found at meander bends and/or associated with steep slopes of the streambanks. Some occurrences of channel widening could be described as natural processes. For example, within Honeygo Run, there were long sections of very sinuous stream in stable, forested parkland. Although the erosion associated with these sinuous sections of stream were documented, they were not considered as a major threat to water quality.

The majority of erosion sites (52 percent) in Area K were identified as having a low severity. However, there were two very severe and eight severe erosion sites, most of which occurred in first order or headwater tributaries where the land use is dominated by residential development. All but one of the severe and very severe erosion sites displayed a Stage I - Incision channel condition. Streams in the incision stage have the most potential for prolonged degradation and may contribute large amounts of sediment downstream through the channel evolution process. Some erosion sites were encroaching on adjacent infrastructure, which could eventually fail with enough lateral migration of the stream channel.

Figure 3-23: Bird River-D Subwatershed, Erosion Sites

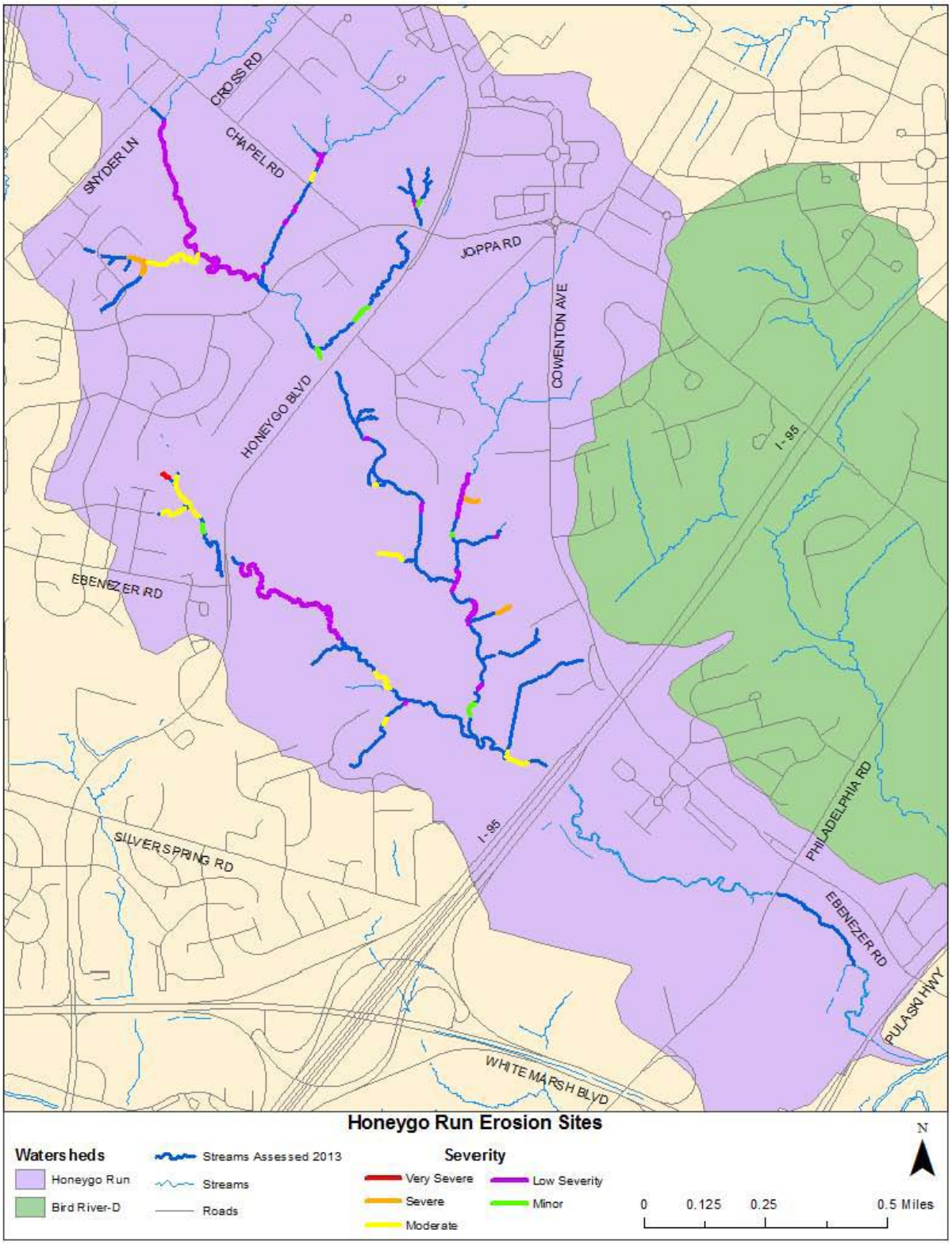

Figure 3-24: Honeygo Run Subwatershed, Erosion Sites

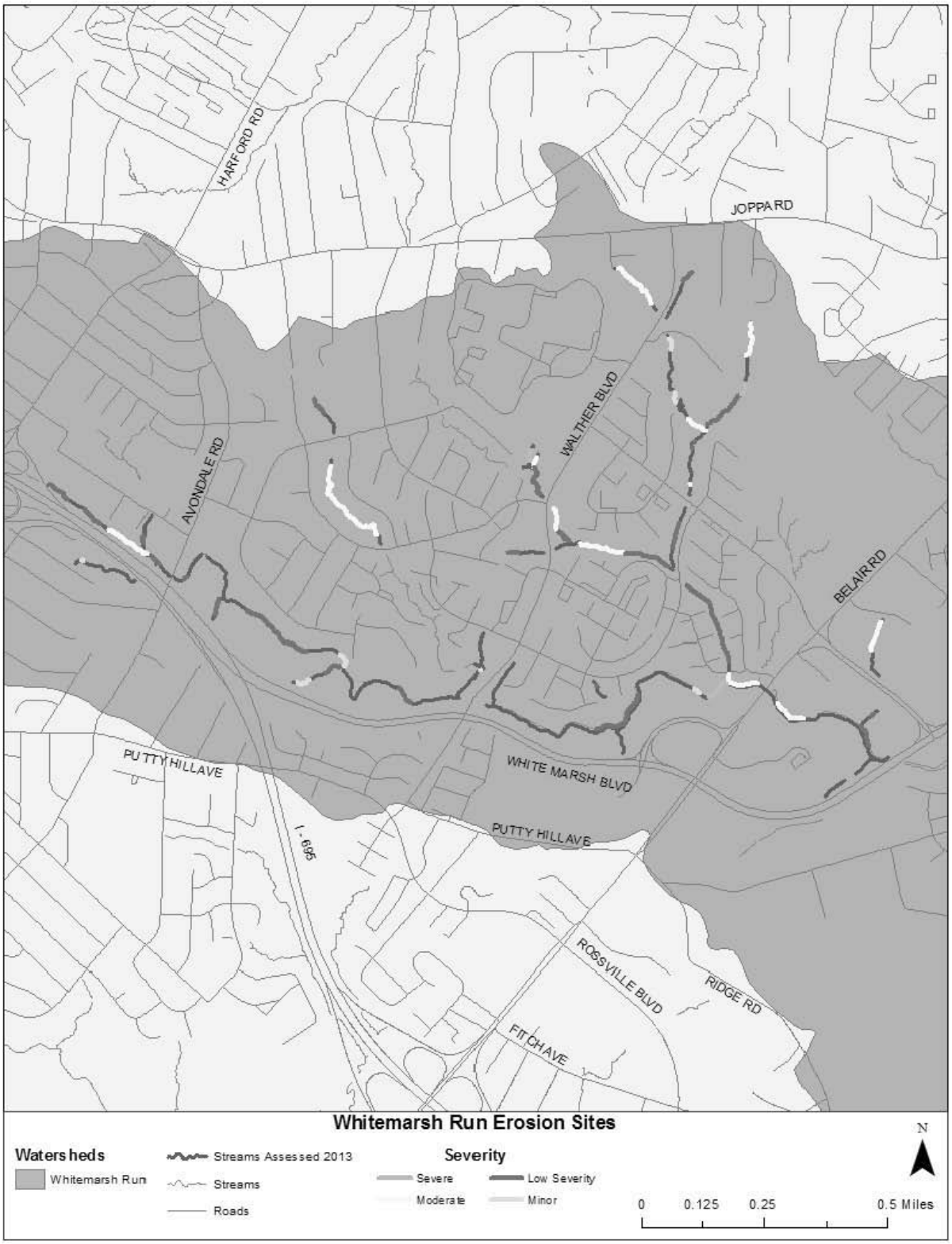

Figure 3-25: Whitemarsh Run Subwatershed, Erosion Sites

Figure 3-26 shows examples of a severe and a very severe erosion site in Area K. The figure on the left, site 071C3-ES117, is associated with severe erosion within Whitemarsh Run, which may potentially affect adjacent infrastructure on the floodplain. The figure on the right, site 072B2-ES02, is associated with a very severe erosion site in the headwaters of Honeygo Run, within adjacent residential development.

Figure 3-26: Examples of Severe (left) and Very Severe (right) Erosion Sites

Table 3-28 summarizes the channel stages associated with each erosion site. In terms of length and frequency, Stage II - Channel Widening was the predominant channel condition in Area K, accounting for 20 percent (3.08 miles) of the surveyed stream miles. A large majority of the Stage II erosion appeared to be due to land use change. Stage I - Incision ranked second in terms of total length with 7.4 percent (1.14 miles) of the stream length assessed in this condition. Stage III - Deposition was only found in Honeygo Run and Bird River-D, and accounted for 6.7 percent (1.03 miles) of the surveyed miles. Stage IV - Recovery and Reconstruction was only found in Honeygo Run, and accounted for 0.2 percent (0.03 miles) of the surveyed miles. Although Stage II was the most common, the most severe erosion observed was associated with sites in the Stage I - Incision condition. Stage I erosion appeared to be most commonly due to pipe outfalls and stormwater runoff from adjacent urban development.

Table 3-28: SWAP Area K SCA Survey Results – Channel Condition

Subwatershed	Channel Condition (Stage)	Length (ft)	Length (mi)	Number of Reaches	Percent Stage Lengths	Percent Stage Reaches
Bird River-D	I Incision	598	0.11	3	14.7	16.7
	II Widening	3,483	0.66	15	85.3	83.3
	III Deposition	0	0	0	0	0
	IV Recovery and Reconstruction	0	0	0	0	0
	Totals	**4,081**	**0.77**	**18**	**100**	**100**
Honeygo Run	I Incision	1,644	0.31	11	14.7	30.6
	II Widening	7,087	1.34	22	63.4	61.1
	III Deposition	2,299	0.44	2	20.6	5.6
	IV Recovery and Reconstruction	155	0.03	1	1.4	2.8
	Totals	**11,185**	**2.12**	**36**	**100**	**100**
Whitemarsh Run	I Incision	3,826	0.72	11	30.3	23.9
	II Widening	5,701	1.08	26	45.2	56.5
	III Deposition	3,093	0.59	9	24.5	19.6
	IV Recovery and Reconstruction	0	0	0	0	0
	Totals	**12,620**	**2.39**	**46**	**100**	**100**

3.6.3.4 Fish Migration Barriers

A fish migration barrier denotes anything in the stream that significantly interferes with the upstream movement of fish. Unimpeded upstream movement is important for various species that migrate throughout a stream system during different parts of their life cycles, such as spawning. Fish barriers can reduce the fish population and diversity in blocked off reaches. Examples of fish barriers include manmade structures such as dams or road culverts, and natural features such as bedrock outcrops or waterfalls. Three main factors were considered in the field when identifying blockages: 1) the vertical drop was too high for fish to swim over (e.g. greater than 6 inches); 2) the water depth was too shallow (e.g., water spread over a large area at channelized sections or road crossings); and 3) the water was moving too fast (e.g., steep culvert pipe discharging high velocity flow). The severity was rated based on the location of the barrier in the stream network and whether the blockage was total, partial, or temporary. A fish migration barrier was considered very severe when a structure completely blocked a large stream or river. A minor rating was assigned to temporary and/or natural fish barriers that blocked little in-stream habitat.

Locations of fish migration barrier sites are shown in Figure 3-27, Figure 3-28, and Figure 3-29. Table 3-29 summarizes the number of fish migration barrier sites identified in each subwatershed and their severity ratings. Appendix F provides tables of fish migration barrier site data for each subwatershed.

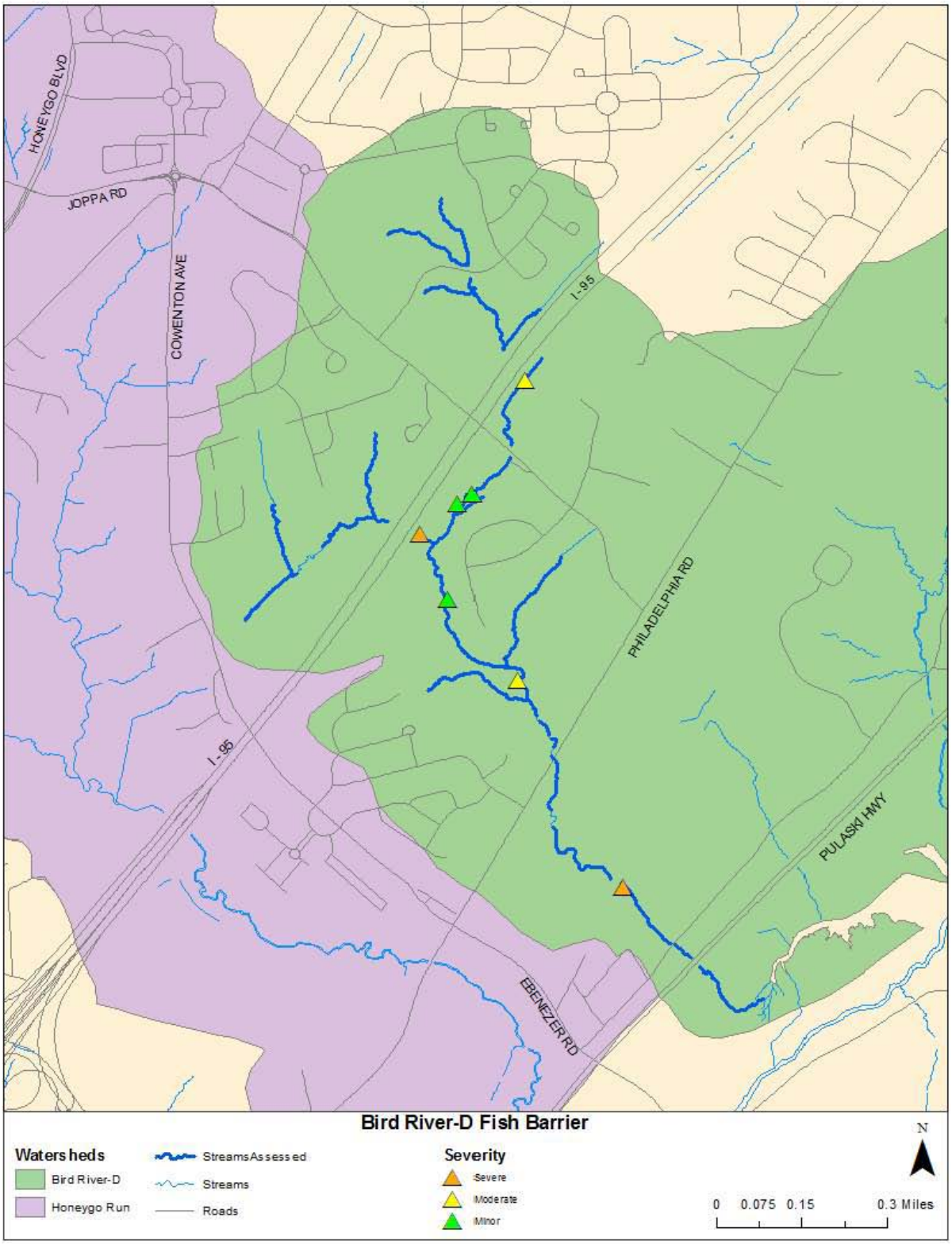

Figure 3-27: Bird River-D Subwatershed, Fish Barriers

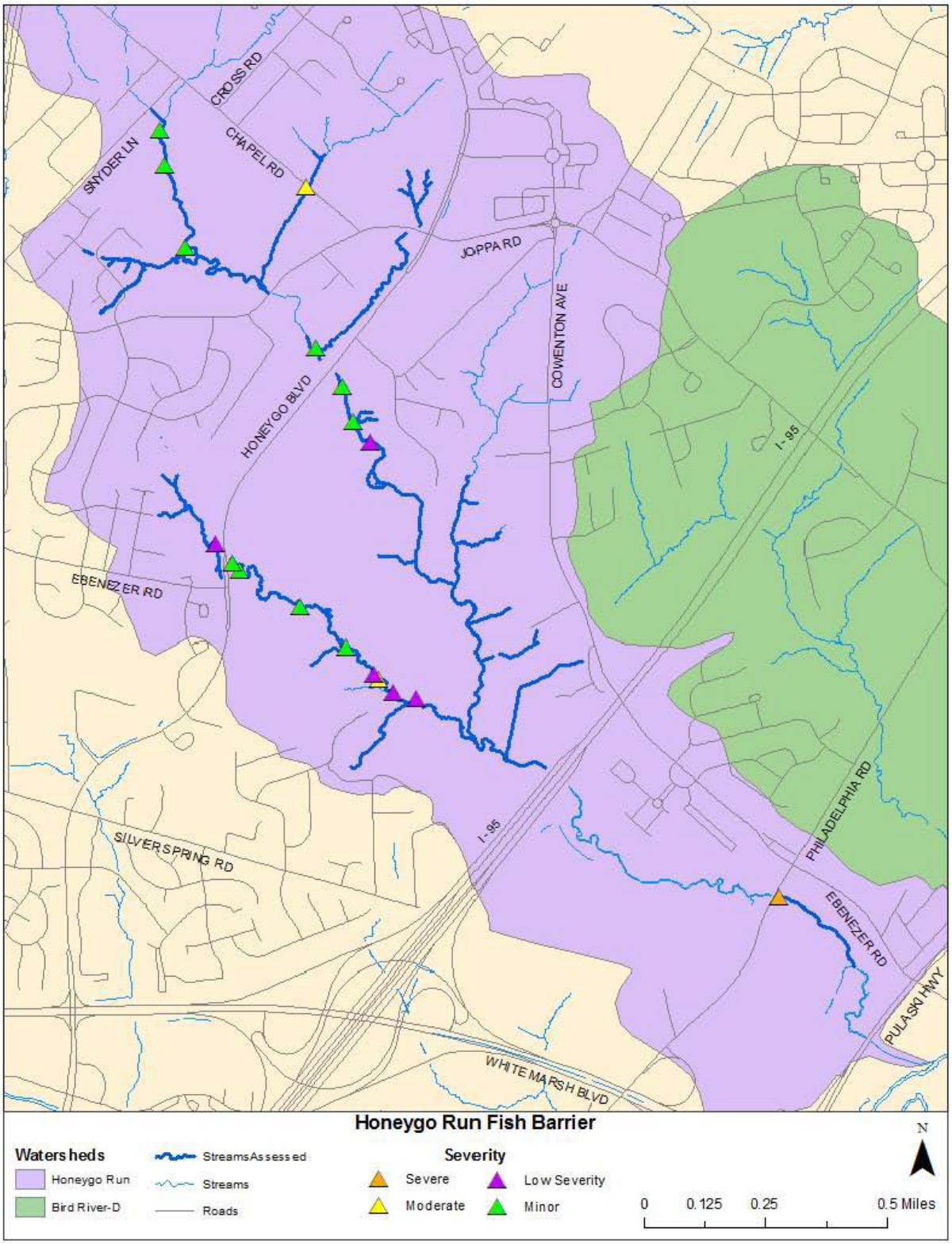

Figure 3-28: Honeygo Run Subwatershed, Fish Barriers

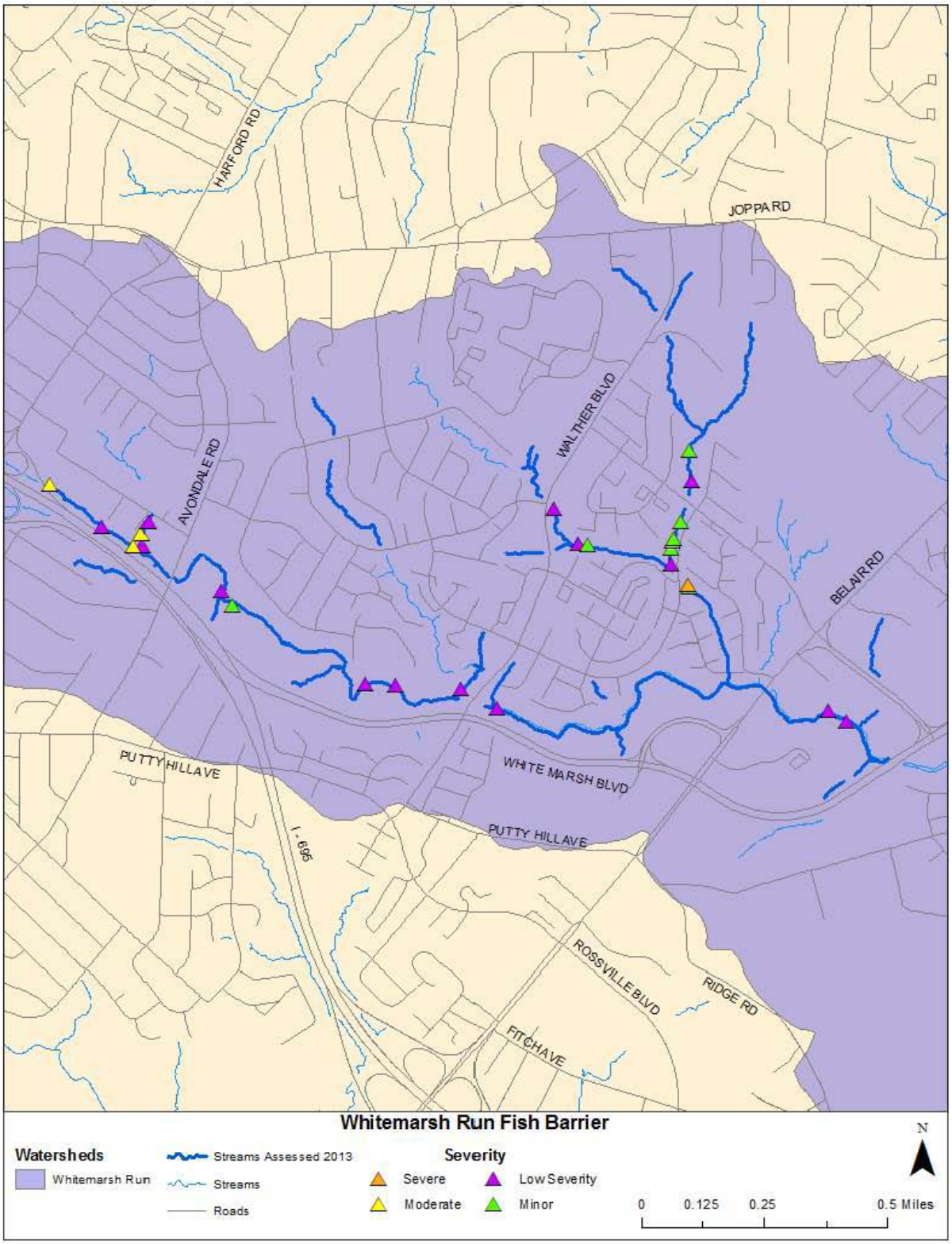

Figure 3-29: Whitemarsh Run Subwatershed, Fish Barriers

Table 3-29: SWAP Area K SCA Survey Results – Fish Migration Barriers

	Severity Rating Inventory					
Subwatershed	Very Severe	Severe	Mod.	Low Severity	Minor	Totals
Bird River-D	0	2	2	0	3	7
Honeygo Run	0	1	2	5	10	18
Whitemarsh Run	0	1	4	14	7	26
Totals	0	4	8	19	20	51

Fish migration barriers occurred frequently in Area K. It should be noted that the criteria for this problem type were originally designed to evaluate problems for anadromous fish found in Maryland, which are relatively weak swimmers. Anadromous fish spend most of their lives in the sea and return to freshwater to spawn. Area K is mostly in the Piedmont physiographic region; most resident fish species live in freshwater their entire life and are adapted to steep, fast moving stream systems. Therefore, ratings of Mod. or lower may not have a significant impact on the migration of local fish species, particularly trout.

A total of 51 fish migration barriers were found in Area K. There were four severe fish migration barriers; two in Bird River-D, one in Honeygo Run and one in Whitemarsh Run. All severe fish migration barriers were total blockages associated with a road crossing, which were preventing fish from accessing a significant portion of the upstream network. There were eight Mod. fish migration barriers, which were also primarily total blockages but were located higher up in the watershed. A total of 39 migration barriers were rated as low or minor severity. These were primarily associated with natural bedrock outcrops in the channel and small temporary debris jams. Figure 3-30 shows examples of severe fish migration barrier sites in Area K. The figure on the left, site 072C3-FB47, is associated with an 18 inch drop at a railroad crossing near the mouth of Bird River-D. The figure on the right, site 072C3-FB81, is associated with an 18 inch drop at Philadelphia Road near the mouth of Honeygo Run.

Figure 3-30: Examples of Severe Fish Migration Barriers

3.6.3.5 Pipe Outfalls and Exposed Pipes

Pipe outfalls included pipes or small manmade channels that discharged into the stream. Pipe outfalls are considered a potential problem since they can carry untreated runoff and pollutants such as oil, heavy metals, and nutrients to a stream system. Pipe outfalls can also create significant erosion problems in the receiving channel if there is not adequate scour protection. All pipe outfalls were inventoried and assessed; a higher severity rating was given if discharge was present with indicators of pollution (e.g., color or odor). The pipe material and size were also recorded. Table 3-30 summarizes the number of pipe outfalls associated with each subwatershed and their severity ratings. Locations of pipe outfalls are shown in Figure 3-31, Figure 3-32, and Figure 3-33. Appendix F provides a table of pipe outfall data for each subwatershed.

Table 3-30: SWAP Area K SCA Survey Results – Pipe Outfalls

	Severity Rating Inventory					
Subwatershed	Very Severe	Severe	Mod.	Low Severity	Minor	Totals
Bird River-D	1	0	2	6	5	14
Honeygo Run	1	1	3	16	20	41
Whitemarsh Run	2	5	12	39	22	80
Totals	4	6	17	61	47	135

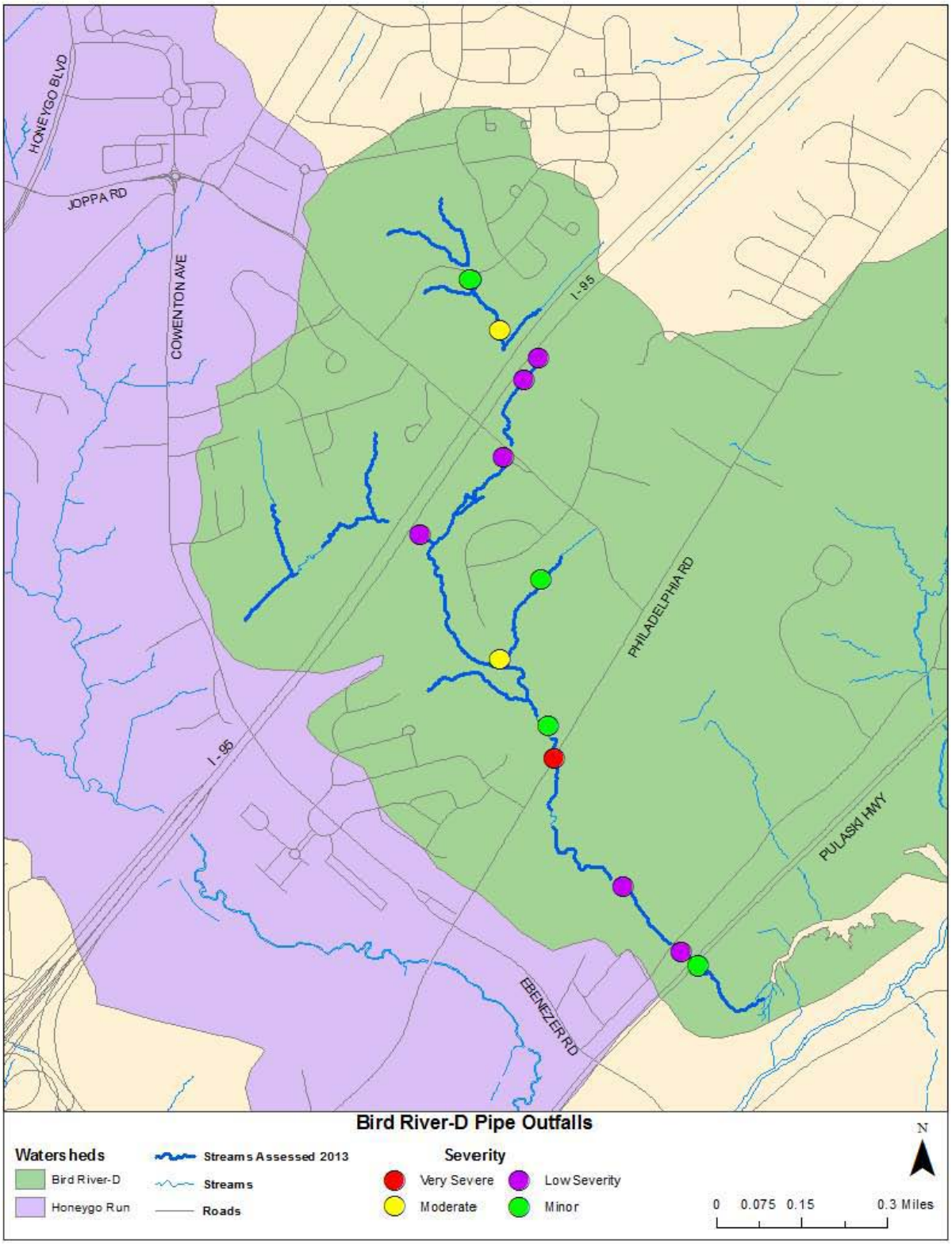

Figure 3-31: Bird River-D Subwatershed, Pipe Outfalls

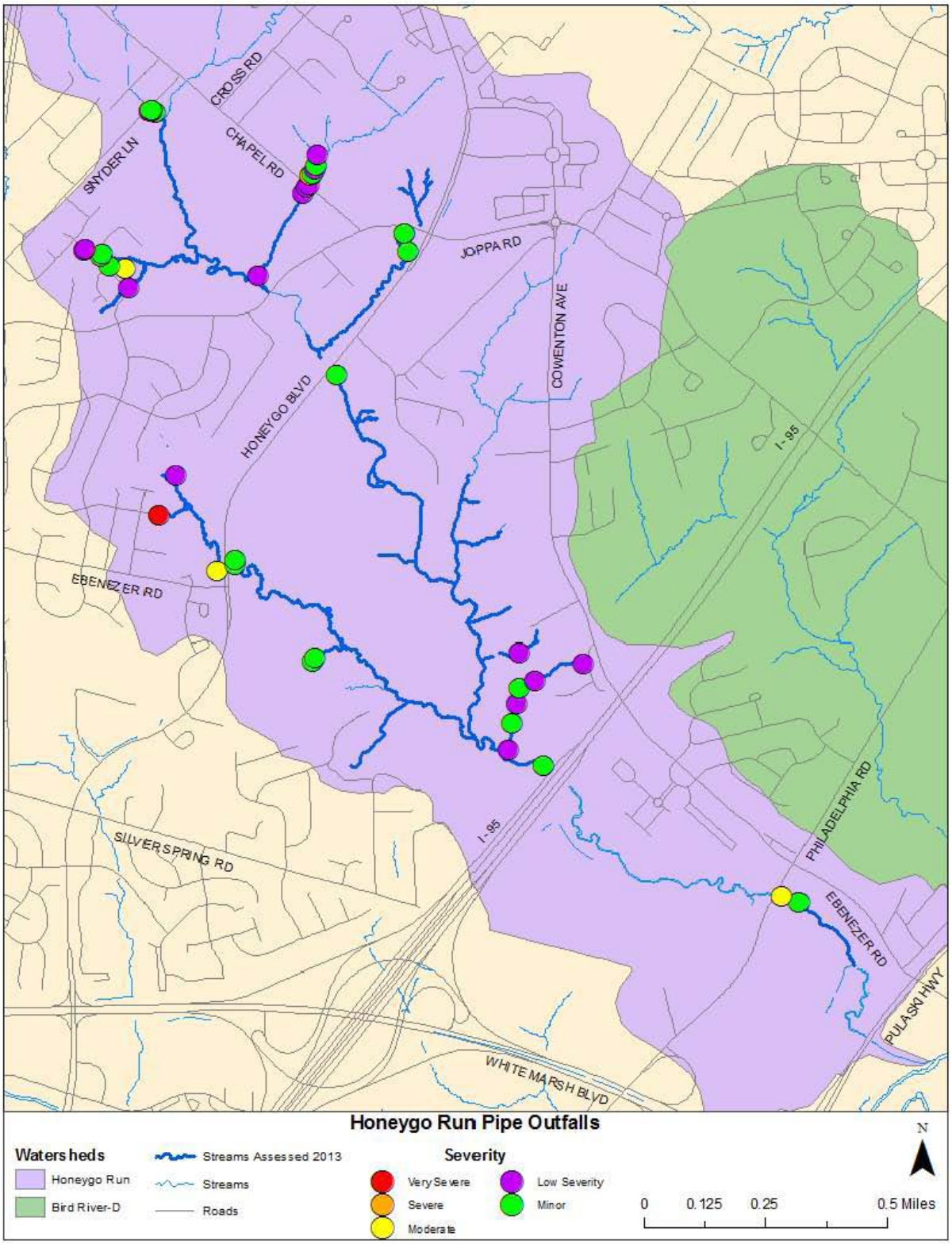

Figure 3-32: Honeygo Run Subwatershed, Pipe Outfalls

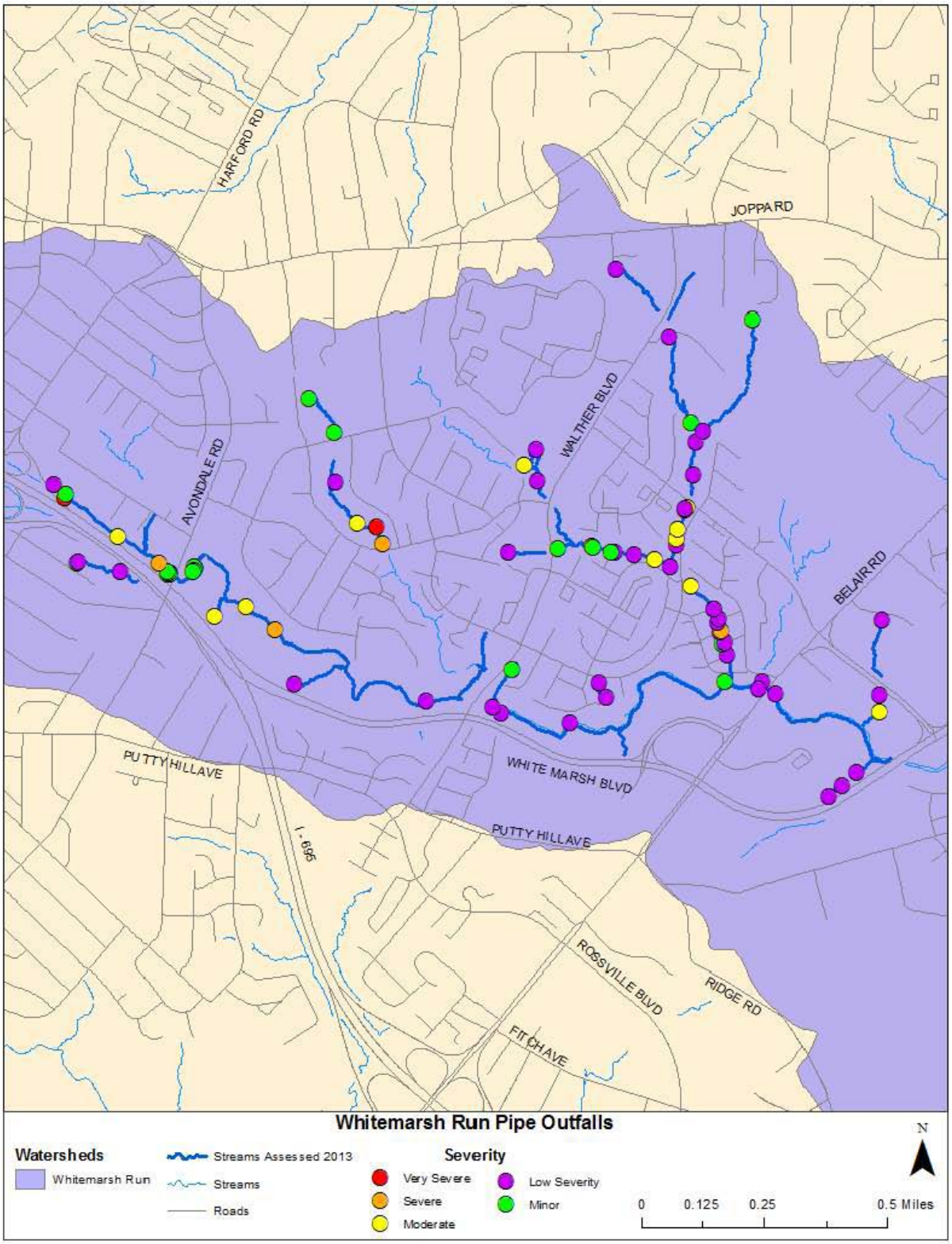

Figure 3-33: Whitemarsh Run Subwatershed, Pipe Outfalls

There were 135 pipe outfalls observed in Area K. A total of 59 percent (80) of the outfalls were located in Whitemarsh Run. Stormwater outfalls accounted for 54 percent (73) of outfalls in Area K, with many of the remaining sites associated with culverts at road crossings. There were four very severe and six severe pipe outfalls; five were discharging a discolored effluent that had the potential to negatively affect water quality, and the other five were failed or unstable outfalls. The majority of pipe outfalls in Area K had a rating of low severity (61) or minor (47). There was no odor associated with any of the pipe outfalls.

Figure 3-34 shows examples of a very severe and a severe pipe outfall site in Area K. The figure on the left, site 072B2-PO12, is associated with a stormwater outfall with a failing concrete apron at the end of Deviation Road within Honeygo Run. The figure on the right, site 071C3-PO23, is associated with a stormwater outfall that is becoming exposed within the left bank on Whitemarsh Run.

Figure 3-34: Examples of Very Severe (Left) and Severe (Right) Pipe Outfalls

Exposed pipes were also assessed. Exposed pipes include manhole stacks, pipes exposed along the stream banks or under the stream bed, and pipes built over a stream but that are low enough to be affected during high storm flows. Exposed pipes threaten the integrity of the infrastructure and water quality because they are susceptible to erosion, scour or being punctured by debris. Table 3-31 summarizes the number of exposed pipes identified in each subwatershed and their severity ratings. Locations of exposed pipes identified in each subwatershed are shown in Figure 3-35, Figure 3-36, and Figure 3-37. Appendix F provides a table of exposed pipe data in each subwatershed.

Table 3-31: SWAP Area K SCA Survey Results – Exposed Pipes

	Severity Rating Inventory					
Subwatershed	Very Severe	Severe	Mod.	Low Severity	Minor	Totals
Bird River-D	0	0	1	2	0	7
Honeygo Run	0	1	2	0	1	18
Whitemarsh Run	1	7	4	2	0	26
Totals	1	8	7	4	1	51

There were 21 exposed pipes in Area K. A total of 67 percent of these were found in Whitemarsh Run. Seven of the sites were exposed manholes, all of which were located in Whitemarsh Run. Four exposed manholes were given a severe or very severe rating because they were in direct contact with the stream. The remaining three exposed manholes were higher up on the bank and were given a Mod. rating. Of the remaining exposed pipes, five were rated as severe and four were rated as Mod.. The low severity and minor rated exposed pipes were short sections of pipe that were likely not at risk of failure.

Figure 3-35: Bird River-D Subwatershed, Exposed Pipes

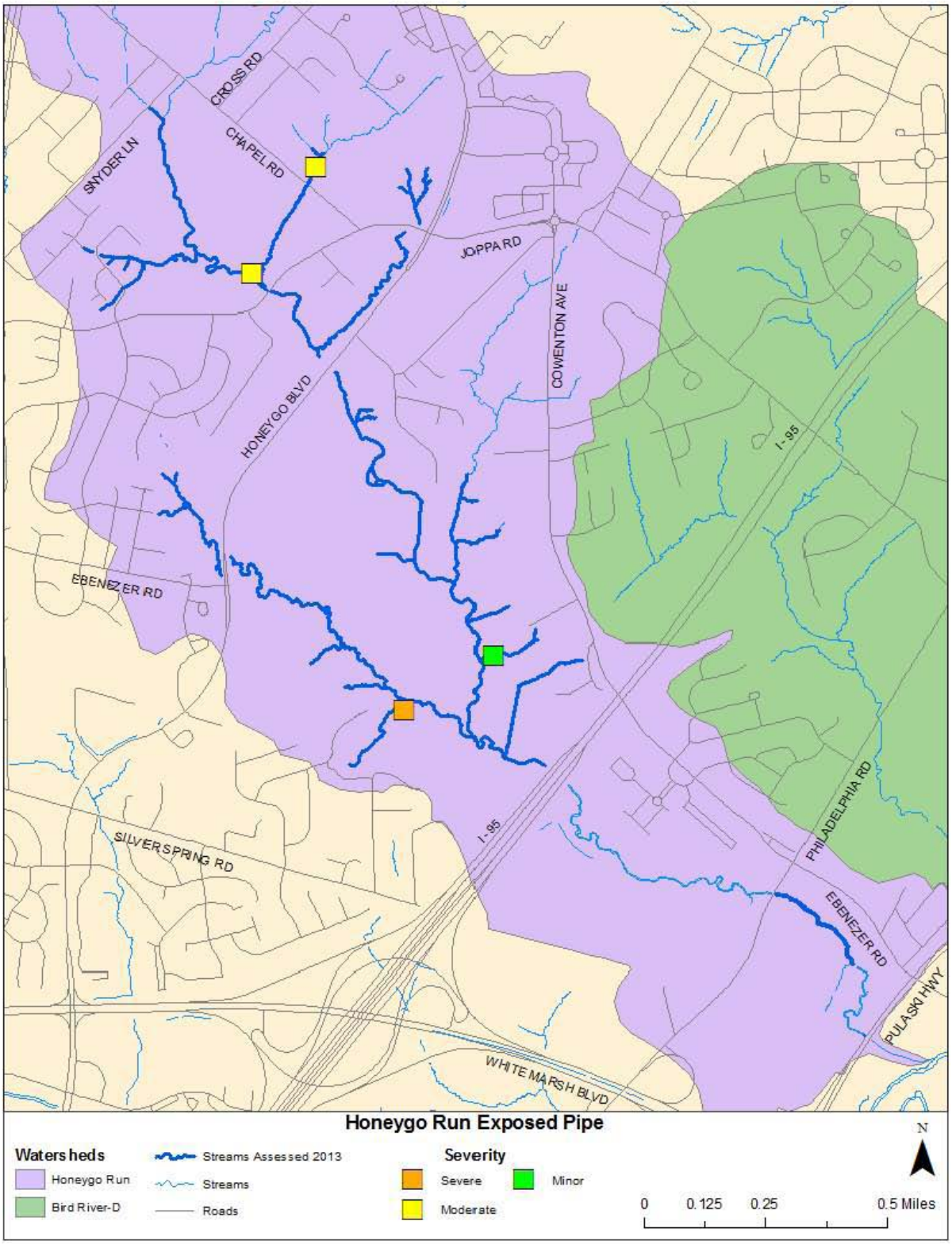

Figure 3-36: Honeygo Run Subwatershed, Exposed Pipes

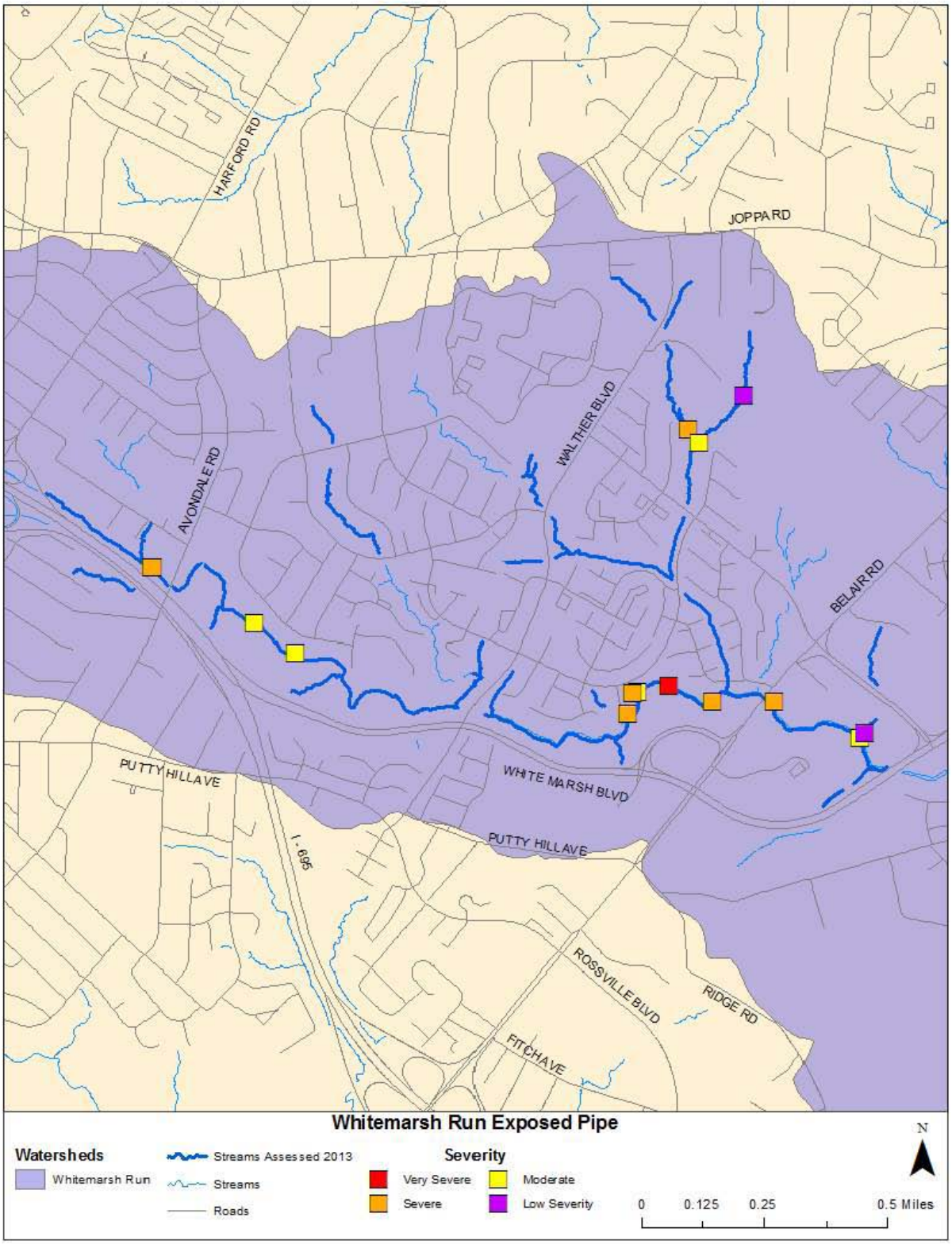

Figure 3-37: Whitemarsh Run Subwatershed, Exposed Pipes

Figure 3-38 shows examples of a severe and very severe exposed pipe site in Area K. The figure on the left, site 071B3-EP80, is associated with a 40 foot section of exposed smooth metal pipe near the toe of the left bank on Whitemarsh Run. The figure on the right, site 071C3-EP123, is associated with an exposed manhole in direct contact with stream flow on Whitemarsh Run.

Figure 3-38: Examples of Severe (Left) and Very Severe (Right) Exposed Pipes

3.6.3.6 Inadequate Stream Buffers

Forested buffer areas along streams are important for water quality and flood mitigation since they help reduce surface runoff, stabilize stream banks (via root systems), shade streams, remove pollutants such as nutrients and sediment from runoff, and provide habitat for various types of terrestrial and aquatic life. For the SCA, a stream buffer was considered inadequate if it was less than 50 feet wide from the edge of the stream.

Table 3-32 summarizes the number of inadequate stream buffer sites, along with the severity rankings and the length of inadequate stream buffer observed. The table also presents the percentage of total stream miles surveyed that were identified with inadequate forested buffer. Locations of inadequate stream buffers are shown in Figure 3-39, Figure 3-40, and Figure 3-41. Appendix F provides a table of inadequate for the subwatersheds.

Figure 3-39: Bird River-D Subwatershed, Inadequate Buffers

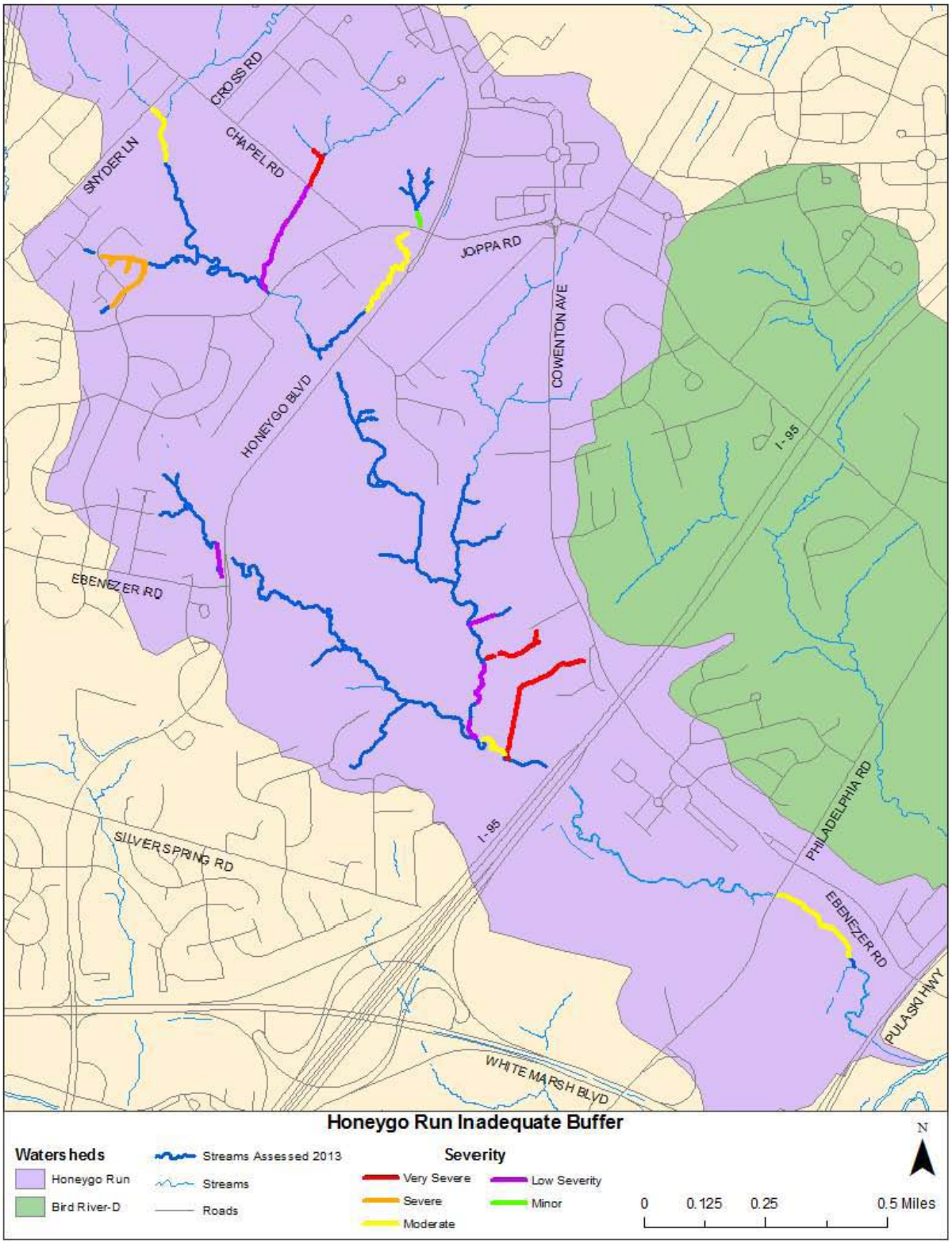

Figure 3-40: Honeygo Run Subwatershed, Inadequate Buffers

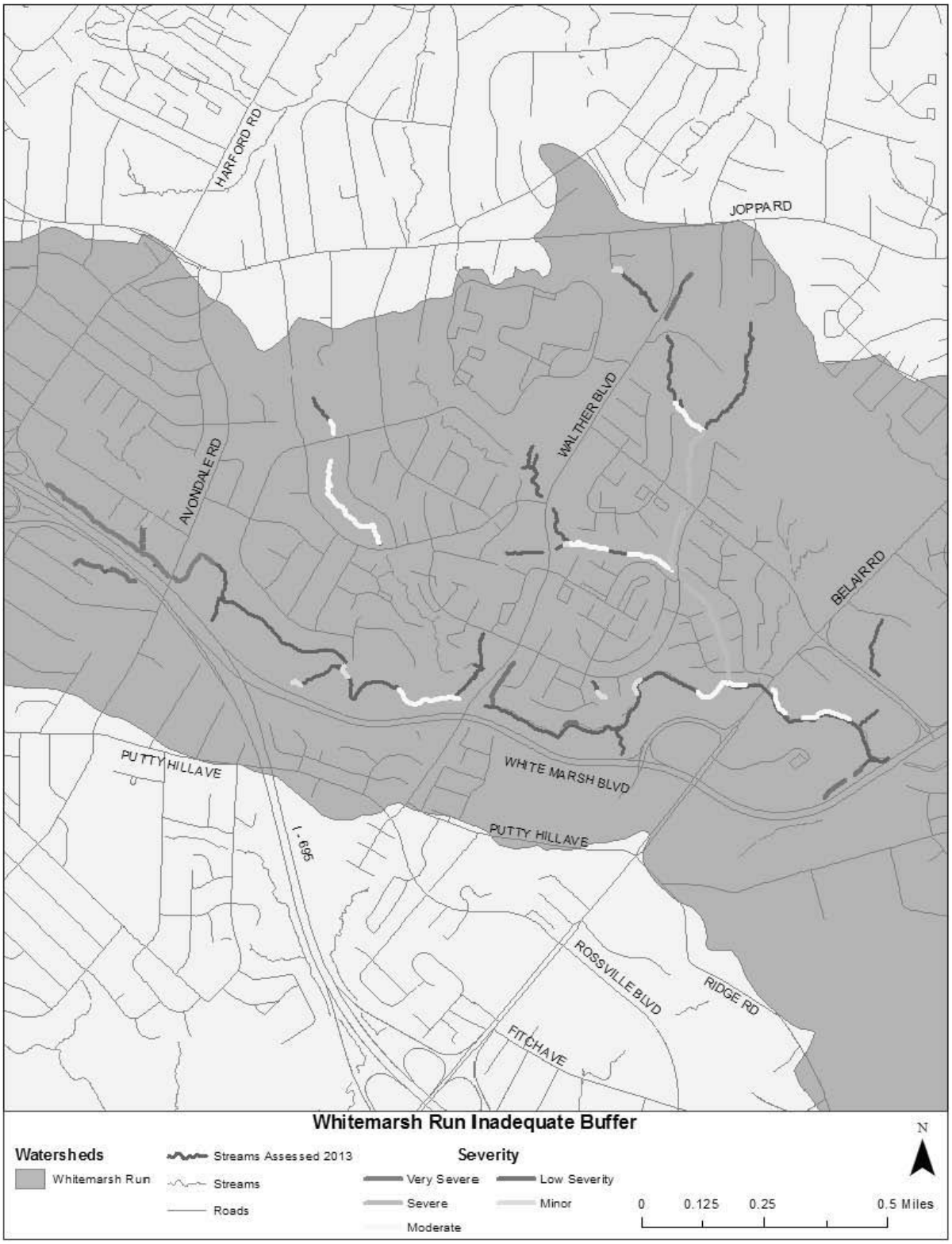

Figure 3-41: Whitemarsh Run Subwatershed, Inadequate Buffers

Table 3-32: SWAP Area K SCA Survey Results – Inadequate Stream Buffers

Subwatershed	Severity Rating Inventory						Stream Length		% of Total Stream Length Surveyed
	Very Severe	Severe	Mod.	Low Severity	Minor	Total	Feet	Miles	
Bird River-D	0	1	4	1	6	12	4,542	0.86	25.4
Honeygo Run	3	2	4	5	1	15	10,346	1.96	30.4
Whitemarsh Run	1	3	6	6	6	22	13,278	2.51	45.2
Totals	4	6	14	12	13	49	28,166	5.33	34.7

There were 49 areas with an inadequate buffer in Area K, encompassing a total length of 28,166 feet or 35 percent of the total stream miles surveyed. All but one of the very severe and severe inadequate buffer sites were found in Whitemarsh Run and Honeygo Run. Whitemarsh Run had one very severe and three severe inadequate buffer sites, all of which were associated with the encroachment of urban development. Urban development was also the cause of the one severe inadequate buffer site in Bird River-D. Honeygo Run had three very severe and two severe inadequate buffer sites. Two of the very severe inadequate buffer sites in Honeygo Run (072C3-IB01 and 072C3-IB20) were located on a Christmas tree farm, where a lack of buffer allowed applied nutrients to wash directly into the stream. The other very severe inadequate buffer site in Honeygo Run, site 072B1-IB41, was located on a private property where the homeowner was mowing to the top of bank and leaving grass clippings in the stream. The remaining Mod., low severity, and minor rated sites had shorter sections of inadequate buffer with less encroachment evident or they were only affecting one side of the stream.

Figure 3-42 shows an example of severe and very severe inadequate buffer sites in Area K. The figure on the left, site 071C3-IB15, is associated with the encroachment of development on both sides of the stream within Whitemarsh Run. The figure on the right, site 072B1-IB41, is associated with a site in Honeygo Run where the homeowner's lawn is maintained up to and below the top of bank.

Figure 3-42: Examples of Severe (Left) and Very Severe (Right) Inadequate Stream Buffers

3.6.3.7 In or Near Stream Construction

In or near stream construction is used to identify major earth disturbance activities within or near the stream corridor. Earth disturbance may lead to increased sedimentation of streams. Sites were ranked based on potential or evidence of sedimentation. Factors taken into consideration for determining the severity rating were the size of the earth disturbance, proximity to the stream, use of appropriate erosion and sediment controls, and evidence that sediment is washing in or accumulating in the stream as a result of the earth disturbance. Table 3-33 summarizes the number of in or near stream construction sites in each subwatershed and their associated severity ratings. Locations of in or near stream construction are shown in Figure 3-43 and Figure 3-44. Appendix F provides a table of in or near stream construction site data in each subwatershed.

Table 3-33: SWAP Area K SCA Survey Results – In or Near Stream Construction

	Severity Rating Inventory					
Subwatershed	Very Severe	Severe	Mod.	Low Severity	Minor	Totals
Bird River-D	0	0	0	1	0	1
Honeygo Run	0	0	1	0	0	1
Whitemarsh Run	0	0	0	0	0	0
Totals	0	0	1	1	0	2

There were only two near stream construction sites in Area K, both of which were associated with construction on I-95. Site 072C3-IC30 is located on the upstream side of I-95 within Honeygo Run. This site appeared to have adequate erosion and sediment control, as there was no evidence of sediment in the channel; however, it was given a Mod. severity rating strictly because of the large magnitude of the construction project. Site 072C2-IC34 is located on the downstream side of I-95 in Bird River-D. This site also had a large area that was impacted; however, it was given a low severity rating because erosion and sediment control appeared to be adequate and there was a forest buffer between the construction site and the stream.

Figure 3-43: Bird River-D Subwatershed, In or Near Stream Construction

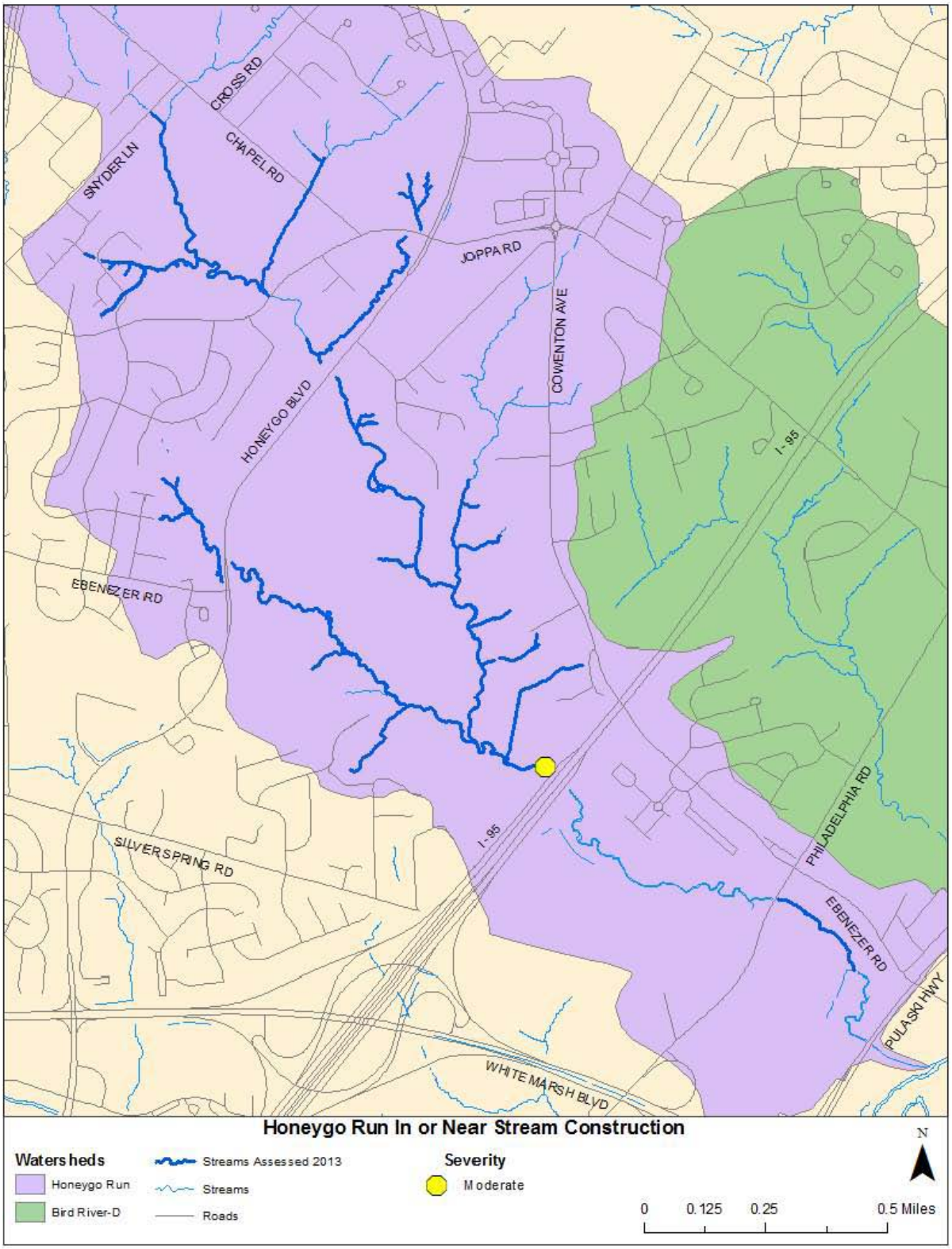

Figure 3-44: Honeygo Run Subwatershed, In or Near Stream Construction

Figure 3-45 shows the two near stream construction sites in Area K. The figure on the left, site 072C2-IC34, is associated with the low severity near stream construction site on Bird River-D. The figure on the right, site 072C3-IC30, is associated with the Mod. severity near stream construction site in Honeygo Run.

Figure 3-45: Examples of Low Severity (Left) and Mod. (Right) Near Stream Construction Sites

3.6.3.8 Trash Dumping

Trash dumping is used to identify locations where large amounts of trash or debris are being dumped in the stream corridor, or to note where trash tends to accumulate. Severity of trash dumping was dependent upon the amount and type of trash present and the safety and accessibility for volunteer cleanup. Table 3-34 summarizes the number of trash dumping sites identified in each subwatershed and their severity ratings. Figure 3-46, Figure 3-47, and Figure 3-48 shows the locations of the trash dumping sites identified within the three subwatersheds. Appendix F provides a table of trash dumping data in each subwatershed.

Table 3-34: SWAP Area K SCA Survey Results – Trash Dumping

	Severity Rating Inventory					
Subwatershed	Very Severe	Severe	Mod.	Low Severity	Minor	Totals
Bird River-D	3	2	1	5	5	16
Honeygo Run	2	4	9	10	17	42
Whitemarsh Run	0	2	1	23	9	35
Totals	5	8	11	38	31	93

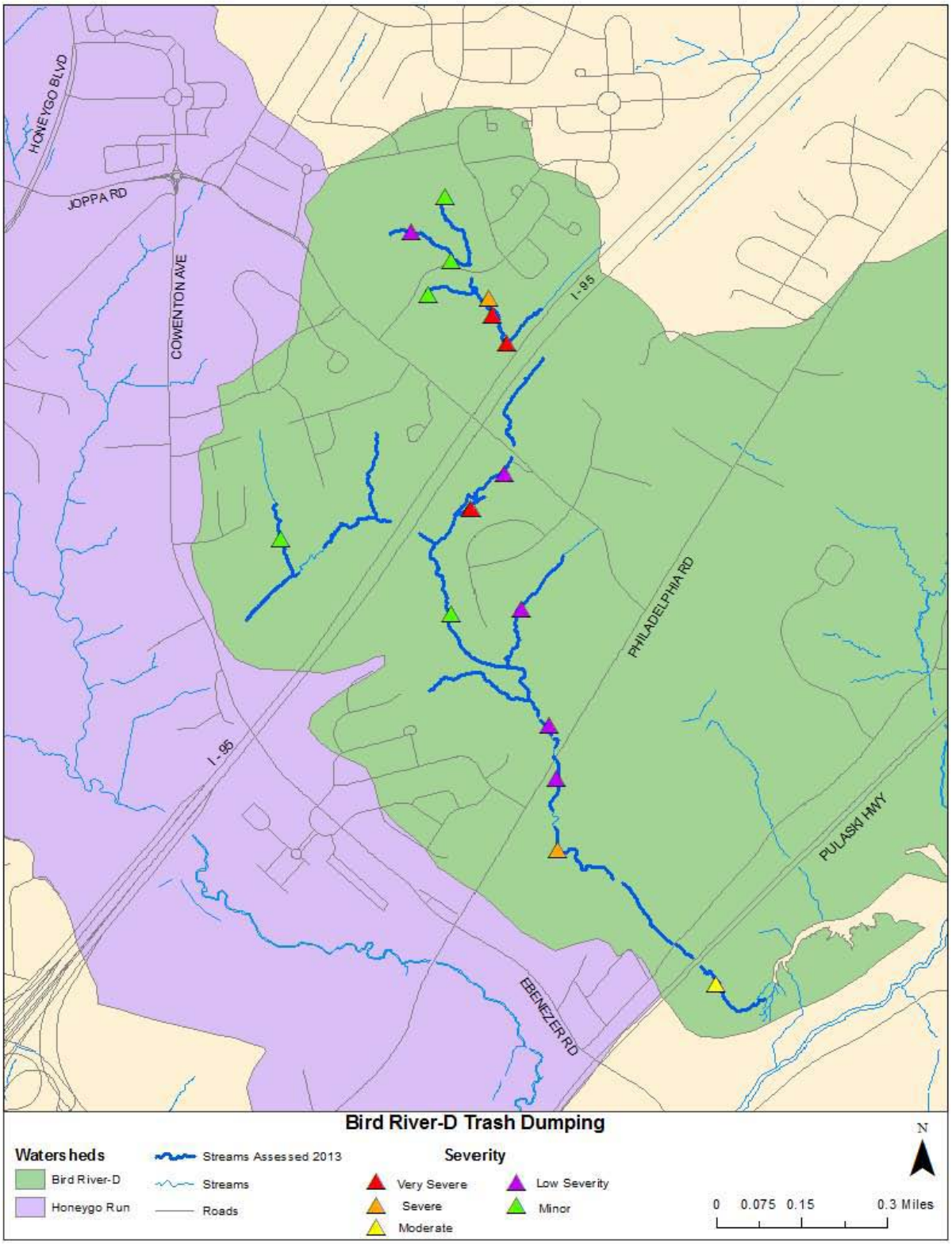

Figure 3-46: Bird River-D Subwatershed, Trash Dumping

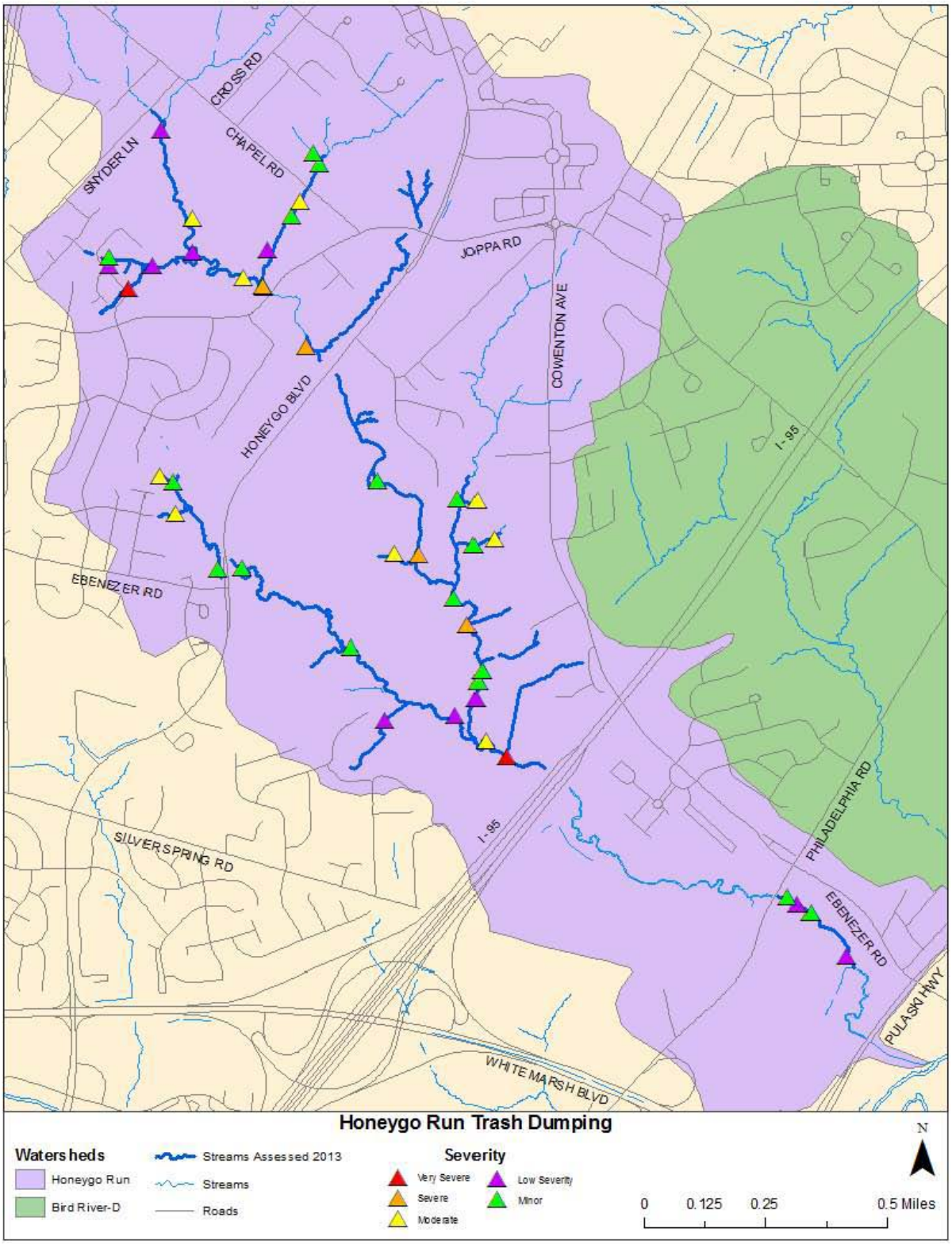

Figure 3-47: Honeygo Run Subwatershed, Trash Dumping

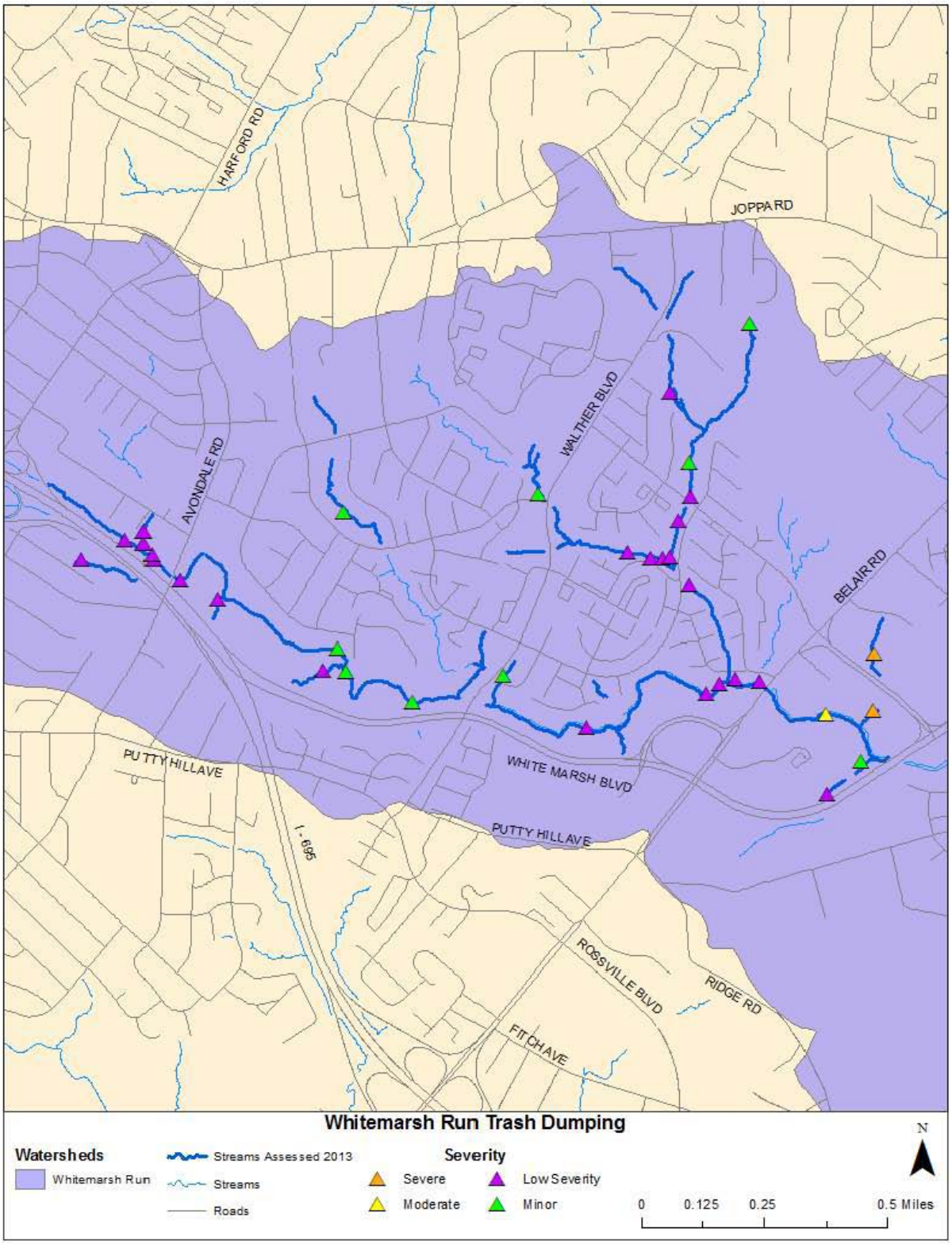

Figure 3-48: Whitemarsh Run Subwatershed, Trash Dumping

There were 93 trash dumping sites in Area K. A total of 41 trash dumping sites were located on private property while 52 were located on public property. Of these, 60 sites were viewed as sites that volunteers could potentially help to clean up. The remaining 33 sites would not be accessible to volunteers because they were either unsafe or heavy machinery would be needed to remove the trash. There were five very severe and eight severe trash dumping sites in Area K. These trash dumping sites were associated with items in or near the stream channel that could have significant impacts on water quality, such as chemical drums, corroded metal and large amounts of yard waste. There were eleven Mod. rated trash dumping sites, nine of which were in Honeygo Run. The majority of the trash dumping sites in Area K have a severity rating of low (38) or minor (31), which were small trash dumping areas that likely have minimal impacts on water quality.

Figure 3-49 shows examples of very severe trash dumping sites in Area K. The figure on the left, site 072C2-TD29, is associated with a chemical drum that was found on the floodplain close to the stream in Bird River-D. The figure on the right, site 072B2-TD47, is associated with a large pile of yard waste, with the smell of manure, found close to the stream in Honeygo Run.

Figure 3-49: Examples of Very Severe Trash Dumping Sites

3.6.3.9 Summary of Stream Corridor Conditions

This section highlights the most significant observations of erosion, unstable channel conditions, and inadequate buffer areas identified during the 2013 field surveys. Although this summary calls attention to particular erosion issues and areas with inadequate riparian buffer observed in 2013, the entire stream assessment data set should be considered when watershed management implementation activities are being prioritized for the Bird River watershed. Findings for each problem type have been discussed in the text above and complete SCA data tables are available in Appendix F.

Many of the most significant cases of erosion in the three subwatersheds studied for SWAP K were located in first or second order streams. These smaller streams tend to be closer to urban development in this area. The most significant erosion sites are shown in Figure 3-50. Table 3-35 shows the total area of significant erosion, based on the average bank height of the eroded stream length within the three subwatersheds assessed.

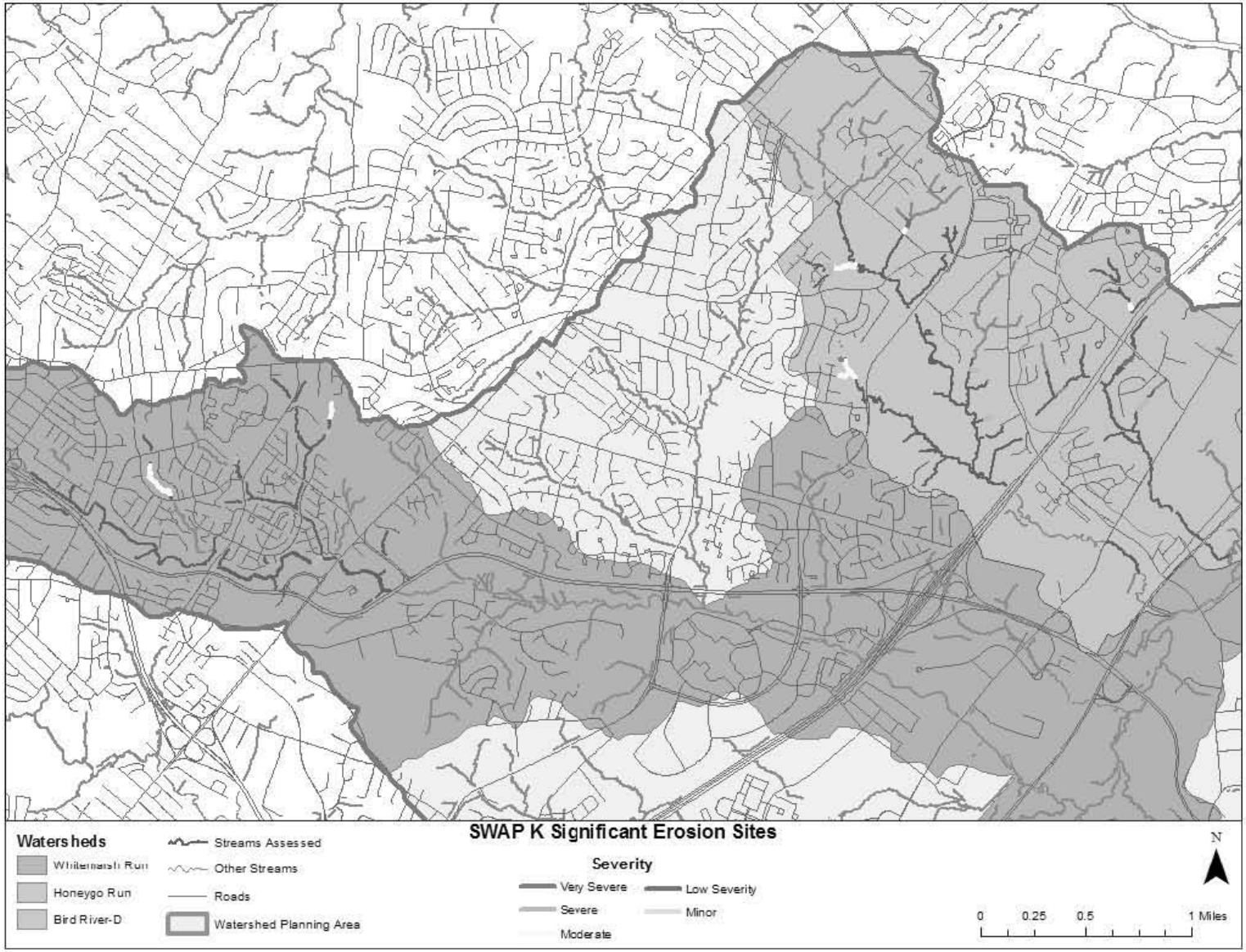
SWAP K Significant Erosion Sites
Watersheds
Whitemarsh Run
Honeygo Run
Bird River-D
Streams Assessed
Other Streams
Roads
Watershed Planning Area
Severity
Very Severe
Severe
Moderate
Low Severity
Minor
N
0
0.25
0.5
1 Miles

Figure 3-50: SWAP Area K Significant Erosion Sites

Table 3-35: SWAP Area K SCA Survey Results – Significant Erosion Sites

Map Site ID	Subwatershed	Site #	Channel Condition	Cause	Street Connection	Avg. Exposed Bank Height (ft)	Severity	Erosion Length (ft)	Erosion Area (sf)
072C2	Bird River-D	072C2-ES24	Stage I Incision	Pipe outfall	Brewers Drive	6	Severe	352	2,112
072C2	Bird River-D	072C2-ES85	Stage II Widening	Land use change	I-95	2	Mod.	145	290
072C2	Bird River-D	072C2-ES56	Stage II Widening	Land use change	E. Joppa Road	2	Low Severity	228	456
							Bird River-D Sites Total Erosion	**725**	**2,858**
072B2	Honeygo Run	072B2-ES02	Stage I Incision	Land use change	Bowline Road	12	Very Severe	92	1,104
072B2	Honeygo Run	072B2-ES43	Stage I Incision	Land use change	Kilbride Court	5	Severe	208	1,040
072B2	Honeygo Run	072B2-ES45	Stage I Incision	Land use change	Kilbride Court	4	Severe	141	564
072C2	Honeygo Run	072C2-ES12	Stage I Incision	Other	Cowenton Avenue	8	Severe	182	1,456
072C3	Honeygo Run	072C3-ES45	Stage I Incision	Land use change	Lolly Lane	4	Severe	174	696
072B2	Honeygo Run	072B2-ES53	Stage II Widening	Land use change	Kilbride Court	5	Mod.	829	4,145
072B2	Honeygo Run	072B2-ES07	Stage II Widening	Other	Bowline Court	5	Mod.	559	2,795
072B2	Honeygo Run	072B2-ES09	Stage II Widening	Land use change	Ballygar Road	6	Mod.	308	1,848
072B1	Honeygo Run	072B1-ES27	Stage II Widening	Land use change	Chapel Road	2	Mod.	82	164
072B1	Honeygo Run	072B1-ES34	Stage II Widening	Land use change	Chapel Road	2	Low Severity	185	370
							Honeygo Run Sites Total Erosion	**2,760**	**14,182**
071C3	Whitemarsh Run	071C3-ES64	Stage I Incision	Below Road Crossing	Belmont Park	8	Severe	136	1,088
071C3	Whitemarsh Run	071C3-ES117	Stage II Widening	Land use change	Belair Road	8	Severe	271	2,168
071C3	Whitemarsh Run	071C3-ES81	Stage I Incision	Pipe outfall	Orbitan Court	7	Severe	118	826
071B3	Whitemarsh Run	071B3-ES03	Stage I Incision	Land use change	Upton Road	6	Mod.	1,167	7,002
071C2	Whitemarsh Run	071C2-ES01	Stage I Incision	Pipe outfall	Belmont Park	4	Mod.	401	1,604
							Whitemarsh Run Sites Total Erosion	**2,093**	**12,688**

Figure 3-50 and Table 3-35 include some erosions sites that ranked as Mod. and two sites that ranked as low severity erosion sites. These sites were incorporated into the significant erosion sites because they: accounted for a relatively large amount of potential erosion area when factoring length of streambank erosion with bank height, were adjacent to severe or very severe erosion sites, and/or coincided with inadequate buffer sites and other problem sites where BMP stacking could potentially provide greater TMDL credit. More than half of the significant erosion sites were associated with a Stage I - Incision channel condition. Of those ranked very severe or severe, nearly 90% were Stage I, while the majority (78%) of Mod. or low severity sites were Stage II. Therefore, the greatest reduction in, or prevention of, sediment input to the Bird River system would occur with prioritizing restoration at Stage I erosion sites. Downstream of US 1 (Belair Road) within the Whitemarsh Run subwatershed, the mainstem of Whitemarsh Run has very high sediment loads that are contributing to unstable channel conditions and poor water quality. Several constructed and proposed stream restoration projects are located on the mainstem of Whitemarsh Run downstream of Belair Road. Further assessment and prioritization of the largest areas of eroding streambank in the headwaters of Whitemarsh Run may act to protect or maintain stream restoration efforts downstream and improve water quality in the Bird River watershed. One example of this is potential stream restoration and SWM BMP opportunities located in Belmont Park within the Whitemarsh Run subwatershed.

There are many sites within Area K that would benefit from an enhanced riparian buffer.

Table 3-36 and Figure 3-51 summarize the major inadequate buffer sites identified during the SCA's. Within Whitemarsh Run, residential and commercial development precludes buffer widening in nearly all of the impaired locations without major land use changes. The longest section of inadequate buffer is 2,231 feet of very severe impairment in Whitemarsh Run, with both sides of the stream affected. Part of this area is adjacent to the I-695 corridor, and thus achieving a 50 foot wide buffer may not be possible. A tributary that branches off of Whitemarsh Run just west of Stillmeadow Road has long reaches of Mod. and severe buffer impairment, but appears to be constrained by residential development.

Two of the very severe inadequate buffer sites in Honeygo Run are located along tributaries that run through a Christmas tree farm (72C3-IB01 and 072C3-IB20). Where these tributaries empty into the Honeygo Run mainstem, Mod. and low severity inadequate buffer conditions exist. This area of reduced buffer quality might benefit from further study and coordination with the property owner to enhance riparian buffer within the farm. The other very severe inadequate buffer site in Honeygo Run was located on a residential property where the homeowner mows the lawn to the top of bank. The severe buffer impairment sites were located in a housing development along Kilbride Court, where a communal lawn is maintained close to the stream.

Areas of buffer impairment in the Bird River-D subwatershed primarily occur along the I-95 corridor and adjacent to residential development. A severe area of impairment, located where the stream crosses Pulaski Highway, is also constrained by businesses on both sides.

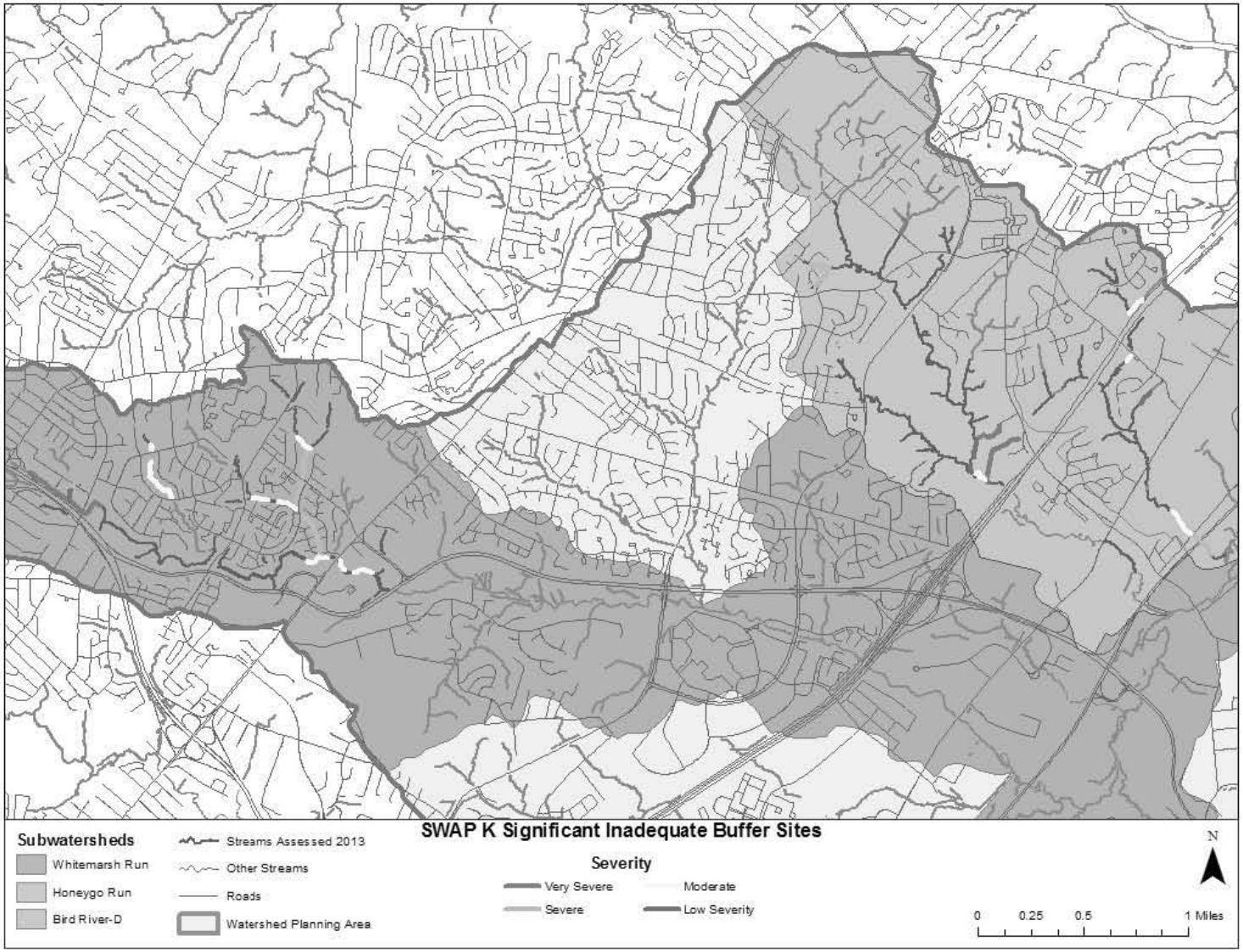

Figure 3-51: SWAP Area K Significant Inadequate Buffer Sites

Table 3-36: SWAP Area K SCA Survey Results – Significant Inadequate Buffer Sites

Map Site ID	Subwatershed	Site #	Buffer Inadequate on	Street Connection	Severity	Inadequate Buffer Length (ft)
072A3	Bird River-D	072A3-IB06	Both	Pulaski Highway	Severe	597
073A3	Bird River-D	073A3-IB01	Both	Red Lion Road	Mod.	755
072C2	Bird River-D	072C2-IB57	Left	E. Joppa Road	Mod.	188
072C2	Bird River-D	072C2-IB89	Both	I-95	Mod.	502
072C2	Bird River-D	072C2-IB26	Both	Brewers Drive	Low Severity	443
Bird River-D Total Inadequate Buffer Length						2,485
072C3	Honeygo Run	072C3-IB20	Both	Cowington Avenue	Very Severe	1,578
072C3	Honeygo Run	072C3-IB01	Both	Lolly Lane	Very Severe	705
072B1	Honeygo Run	072B1-IB41	Both	Chapel Road	Very Severe	485
072B2	Honeygo Run	072B2-IB32	Both	Kilbride Court	Severe	726
072B2	Honeygo Run	072B2-IB44	Both	Kilbride Court	Severe	617
072C2	Honeygo Run	072C2-IB36	Left	I-95	Mod.	398
072C3	Honeygo Run	072C3-IB07	Left	I-95	Low Severity	671
Honeygo Run Total Inadequate Buffer Length						5,180
071B3	Whitemarsh Run	071B3-IB60	Both	Avondale Road	Very Severe	2,231
071C3	Whitemarsh Run	071C3-IB15	Both	Wolsingham Road	Severe	1,178
071C3	Whitemarsh Run	071C3-IB34	Both	Dunfield Road	Severe	1,487
071B3	Whitemarsh Run	071B3-IB87	Both	East Avenue	Severe	133
081C1	Whitemarsh Run	081C1-IB09	Both	Belair Road	Mod.	1,025
071C3	Whitemarsh Run	071C3-IB116	Right	Wolsingham Road	Mod.	450
071C3	Whitemarsh Run	071C3-IB90	Both	Kinfield Drive	Mod.	939
071C3	Whitemarsh Run	071C3-IB74	Right	Gradien Drive	Mod.	473
071B3	Whitemarsh Run	071B3-IB02	Right	Orbitan Road	Mod.	1,484
071B3	Whitemarsh Run	071B3-IB114	Both	East Avenue	Low Severity	275
Whitemarsh Run Total Inadequate Buffer Length						9,675

3.7 Stormwater Management Facilities

As part of the characterization of Bird River watershed and development of the SWAP, existing stormwater management facilities were investigated for potential conversion to improve water quality treatment within the study area. Baltimore County EPS identified 20 existing stormwater management facilities to be evaluated. These existing facilities, listed in Table 3-37, had originally been designed for water quantity management and were assessed to determine if additional water quality benefits could be achieved through a conversion.

Table 3-37: SWM Detention Ponds in Bird River Watershed Evaluated for Conversion Potential, by Subwatershed

Subwatershed	Drainage Area to SWM Ponds Evaluated (acres)	Number of SWM Ponds Evaluated for Potential Conversion
Bird River-D	10.53	1
Whitemarsh Run	195.00	8
Whitemarsh Run (N. Fork)	170.88	7
Whitemarsh Run (S. Fork)	62.54	4
Totals	438.95	20

The County GIS information for each pond was reviewed in office prior to the field investigations. Field maps were created for each site detailing the pond location, drainage area, existing storm drain systems (if applicable) and streams on aerial photos. A Storm Water Management Facility Conversion Evaluation Sheet (developed by Baltimore County EPS) was filled out for each site and included pond type and location, drainage area and ownership. The pond locations were located on ADC maps in order maximize the efficiency of the field investigation work.

The field investigations were conducted on dry weather days between March 29 and April 8, 2013. The County GIS information, such as pond location, type and drainage area boundaries were field verified. The condition of the pond was then assessed based on the following items using Baltimore County's Conversion Evaluation Sheet:

- Riser or outlet pipe condition
- Erosion, trees or evidence of animal borrows on the embankment
- Erosion, wetland vegetation, and/or trees on the pond bottom
- Overall condition of the fence and gate (where applicable)
- On-line or offline pond

The information was collected on the Evaluation Sheets and the overall site condition was initially used to determine whether an existing facility had potential for conversion to increase water quality benefits. Pond ownership was noted but was not a factor in determining conversion potential.

One pond identified within the GIS information could not be located: Pond 611. This pond, last inspected in 2011, was shown on private commercial property located off Philadelphia Road (MD 7). Based on the GIS mapping, the pond was located off the south side of the parking lot within a vegetated area. 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.

Ten existing facilities were identified as potential conversion candidates based on the initial assessment. In order to rank the candidates, the following additional criteria were evaluated:

- Percent impervious cover within the contributing drainage area
    - Impervious surfaces prevent runoff from infiltrating back into the ground.
    - Runoff from impervious surfaces carries pollutants such as oils, fertilizers, sediment and trash into downstream ponds.
- Site accessibility for construction and maintenance
- Site topography/slope for potential facility expansion or grading
- Length of flow path through the facility
    - Possibility to increase the length to provide additional retention and filtering of runoff
- Tree/vegetation impacts during construction
- Potential permit requirements (specifically for in-line ponds)
- Cost vs. environmental benefit of conversion

Ponds that were considerably overgrown, were holding a significant amount of water or located within a stream channel (in-line) were not considered to have conversion potential due to the amount of effort that would be required to provide additional benefits. Even though several ponds were no longer functioning as originally designed (detention pond), they may already be providing additional water quality benefits naturally (e.g., clogged outfall pipes may result in a flooded wetland type facility). These ponds were sometimes given a lower ranking for conversion potential. This is due to the relatively small benefit to be gained from conversion or due to some benefit already being achieved through “self-conversion”.

Table 3-38 details the evaluation of the ponds reviewed and the rank of conversion potential based on the additional evaluation criteria. Appendix J provides photographs of the stormwater facilities evaluated.

Table 3-38: Potential Conversions of Detention Ponds to Improve Water Quality

Pond Number	Ownership	Drainage Area (Acres)	Rank	Subwatershed	Self-Converting to a Wet Pond or Wetland
883	Private	16.90	High	Whitemarsh Run	
951	Private	11.14	High	Whitemarsh Run (N. Fork)	
1166	Private	12.57	High	Whitemarsh Run (S. Fork)	
1633	Public	23.75	High	Whitemarsh Run	
349	Private	11.57	Medium	Whitemarsh Run (N. Fork)	Yes
379	Public	64.10	Medium	Whitemarsh Run	
529	Public	22.00	Medium	Whitemarsh Run	
876	Public	23.40	Medium	Whitemarsh Run (N. Fork)	
919	Private	12.63	Medium	Whitemarsh Run	Yes
1040	Public	26.53	Medium	Whitemarsh Run (S. Fork)	Yes
399	Private	35.48	Low	Whitemarsh Run (N. Fork)	Yes
610	Public	47.40	Low	Whitemarsh Run (N. Fork)	Yes
877	Public	14.00	Low	Whitemarsh Run (N. Fork)	
878	Public	27.89	Low	Whitemarsh Run (N. Fork)	
1850	Private	16.69	Low	Whitemarsh Run	
380	Public	17.60	None	Whitemarsh Run	
790	Private	21.33	None	Whitemarsh Run	Yes
1039	Public	12.06	None	Whitemarsh Run (S. Fork)	
1041	Public	11.38	None	Whitemarsh Run (S. Fork)	
611	Private	10.53	Not Located	Bird River-D	

Of the ten facilities, the following four ponds were considered the highest ranking among the potential candidates and are recommended for conversion: Pond 883, 951, 1166 and 1633. These ponds were ranked highest since water quality benefits could be significantly increased in these ponds with minimal effort. The ponds have relatively high impervious area percentages within the contributing drainage area, are located off-line, and appear in fairly good condition. Improvements may include creating small forebay or micropool areas to capture sediment (and removing existing sediment accumulation), removing concrete or riprap pilot channels, repairing minor erosion and/or replacing or redesigning existing riser structures. Three of the four ponds are privately owned.

1. Pond 883 is located within a residential neighborhood off Van Winkle Lane. According to the County GIS information, the drainage area is 16.90 acres and appears to be mainly comprised of residential homes/trailers and associated roadways. The access road to the pond is well maintained and at a shallow grade. Pockets of wetland vegetation and sediment accumulation were observed near the inflow point. A small eroded channel flows through the wetland forebay area, over a gabion structure and into the pond. The pond bottom is well maintained grass and appears to be stable. A small amount of water was ponding near the stand pipe. The corrugated metal pipe (CMP) riser appears in good condition although some erosion around the riser and top of the embankment overtop the outfall pipe was observed.

2. Pond 951 is located within a residential neighborhood off Silver Hall Road. According to the County GIS information, the drainage area is 11.14 acres and appears to be mainly comprised of residential homes/townhouses, parking lots and associated roadways. Access to the pond from Silver Hall Road is fairly easy and well maintained. Some wetland vegetation, small trees and a significant amount of sediment is located in the pond bottom. The sediment is clogging the majority of the inflow points causing pipe disconnection and separation. The CMP riser and embankment appear in good condition. Several trees along the embankment, adjacent to the nearby school property, have been recently cut down. Expansion of the pond footprint may be possible due to the existing shallow side slopes.

3. Pond 1166 is located on the Central Christian Assembly property off Rossville Boulevard. According to the County GIS information, the drainage area is 12.57 acres and appears to be mainly impervious area comprised of the church, associated parking lot and a small amount of Rossville Boulevard. Access to the pond from the church parking lot is very easy. The pond side slopes are well maintained grass; the bottom of the facility is a concrete channel. Flow from the pond is controlled by a concrete pipe with a small weir and trash rack. Some sediment accumulation was observed in the pipe and in front of the weir. The flow path within the facility is relatively long.

4. Pond 1633 is located within a residential neighborhood off Silver Knoll Road. According to the County GIS information, the drainage area is 23.75 acres and appears to be comprised of residential homes/townhouses, parking lots and associated roadways. Access to the pond from Silver Knoll Road is easy. Similar to Pond 951, some wetland vegetation, small trees and a significant amount of sediment is located in the pond bottom. The bottom half of the existing CMP riser has been retrofitted with concrete although the existing CMP inflow and outflow pipes are severely corroded and would require replacement. The pond side slopes would need to be stabilized with additional vegetation.

Prior to design of any pond conversions, further analysis should be completed to determine the existing pond storage and freeboard.

The majority of the ponds could use minor maintenance. In most cases, the low flow pipes of the riser structure or outfall structure were partially clogged with sediment, silt and/or debris. Minor fence repairs and tree/vegetation removal within the facilities and embankments could also be implemented to improve the capacity, aesthetics, and safety of the facilities.

CHAPTER 4: UPLANDS ASSESSMENT

4.1 Introduction

Upland areas were assessed according to the Unified Subwatershed and Site Reconnaissance (USSR) Manual developed by CWP (CWP 2004) to identify potential pollution sources influencing water quality and to identify restoration project opportunities. The USSR manual is the last manual in a series of 11 regarding techniques for restoring urban watersheds. It provides detailed guidance for field survey techniques and was developed to help watershed groups, municipal staff, and consultants to quickly identify major stormwater pollution sources and to assess subwatershed restoration potential for source controls, pervious area management, and improved municipal maintenance such as education, retrofits, street sweeping, and open space management.

The field survey of upland areas in the Bird River watershed included four major components:

- Neighborhood Source Assessments (NSAs),
- Hotspot Site Investigations (HSIs),
- Institutional Site Investigations (ISIs), and
- Pervious Area Assessments (PAAs).

Each of these components is described in detail in the following sections.

Subwatersheds were assigned the following unique numbers for the purposes of assigning site identification numbers for HSIs, ISIs, and PAAs: Whitemarsh Run (N. Fork) (100); Whitemarsh Run (200); Whitemarsh Run (S. Fork) (300); Honeygo Run (400); Windlass Run (500); Bird River-D (600); Bird River-B (700); and Railroad Creek_Bird River-A (800).

4.2 Neighborhood Source Assessments (NSA)

NSAs describe pollution source areas, stewardship behaviors, and restoration opportunities within individual neighborhoods. Each neighborhood has unique characteristics that are to be considered in deciding if it is possible and/or necessary to implement restoration projects, source controls, and stewardship practices. The sections below describe the methods used to delineate and assess individual neighborhoods in the Bird River watershed.

4.2.1 Assessment Protocol

Prior to conducting NSAs in the field, neighborhoods were delineated using ADC street maps and GIS data such as tax parcels, historical development information and aerial photographs. A neighborhood was delineated based on a group of homes with similar characteristics including lot sizes, road widths, set-backs, year built, and type (apartment complex, rowhomes, single family detached, etc.). NSAs were identified using the classification scheme “NSA_K_123”, where ‘K’ denotes the Bird River watershed and neighborhoods were then numbered sequentially as delineated. The accuracy of these defined neighborhoods was verified in the field. Adjustments were made as necessary to group similar neighborhoods or ungroup dissimilar neighborhoods. If NSA boundaries were modified in the field, additional letters were used to distinguish NSA IDs. For example, if a neighborhood was originally designated as NSA_K_10 but was divided into two separate NSAs because of characteristics observed in the field, they would be denoted as NSA_K_10a and NSA_K_10b.

Field investigations were conducted from January through March 2013, using the NSA protocol documented in the USSR (CWP 2004). The field team drove through every street in a defined neighborhood to identify potential pollution sources and restoration opportunities. To standardize the NSA process, and be able to prioritize potential restoration efforts, data were collected in each neighborhood for four main source areas: yards and lawns; driveways, sidewalks, and curbs; rooftop runoff; and common areas. These are each described briefly below. Opportunities for planting street and shade trees were also noted.

Yards and Lawns

Yards and lawns typically represent a significant portion of the pervious cover in an urban subwatershed and therefore can be a major source of nutrients, pesticides, sediment, and runoff. Maintenance behaviors tend to be similar within individual neighborhoods and certain activities can impact subwatershed quality such as fertilization, pesticide use, watering, landscaping, and waste. Potential pollution sources evaluated under this source category include grass cover and management status (fertilization and irrigation methods), bare soil, outdoor swimming pools, and uncontained junk or trash. The amount of existing shade tree cover and landscaping in neighborhoods were also evaluated, and locations for possible new plantings were noted. These plantings would provide water quality benefits through interception and filtration of stormwater runoff.

Driveways, Sidewalks, and Curbs

Driveways, sidewalks, and curbs are common in many urban subwatersheds and link neighborhood runoff to the storm drain system. Activities such as car washing, deicing, and improper chemical storage can contribute pollutants such as nutrients, oil, sediment, and chlorides into the storm drain system. Data were collected for potential pollution sources including stained/dirty driveways, sidewalks covered with lawn clippings/leaves or receiving non-target irrigation (source of nutrients and sediment), pet waste (bacteria), long-term car parking (unused old cars with potential to leak chemicals, oil, and/or grease) and the amount of sediment, organic matter, and/or trash present along curbs. Potential for street tree planting and street sweeping was also evaluated based on some of these factors.

Rooftops

Rooftop runoff is another contributor to stormwater runoff and pollutants in neighborhoods. Downspout retrofits can help reduce runoff and pollutants introduced to local streams. The field crews identified whether downspouts discharged rooftop runoff to pervious areas, rain barrel, impervious surfaces (driveways, street), and/or directly to the storm drain system, and the proportion of each within a neighborhood. The potential for disconnecting and redirecting downspouts from impervious surfaces or the storm drain system was also evaluated.

Common Areas

Common areas such as community parks, parking lots and alleys are good opportunities to observe community behaviors such as pet waste disposal, storm water management, storm drain marking, and how natural areas or buffers are managed. Good upkeep of these areas indicates that residents or a homeowner's association are active and may represent opportunities for restoration projects. Data was collected on the condition of storm drain inlets (whether they were clean or filled with debris) and presence of pet waste or dumping in common areas to identify potential pollution sources in a neighborhood. The potential for storm drain marking, storm water management practices, and stream buffer planting was also evaluated. In

addition to these four source areas, potential pollution sources were identified in individual neighborhoods by collecting basic information regarding the presence of sewer service and amount of remodeling or redevelopment activities.

Basic neighborhood information collected to help rate restoration potential included lot size, house types, fraction of houses with basements and garages, and whether a homeowner's association exists for the community. After driving around the entire neighborhood and completing the basic information and four major source area sections, any major pollutants that were potentially being generated by the neighborhood were indicated on the field form including nutrients, oil and grease, trash/litter, bacteria, and sediment. For example, if a neighborhood had several stained driveways and/or several long-term parked vehicles/ boats, oil and grease would be flagged as a potential major pollutant being generated in that neighborhood. The presence of trash in several yards or dumping in common areas would be a significant indicator for trash/litter generated in a neighborhood. Sediment was flagged as a major pollutant source if several areas of erosion or bare soil were observed, significant amount of remodeling/redevelopment was occurring, and/or a considerable portion of the curb and gutters were covered with sediment.

After driving through and evaluating an entire neighborhood, specific actions were recommended for neighborhoods in the Bird River watershed included:

- Downspout disconnection, rain barrels, and rain gardens;
- Fertilizer reduction/education;
- BayScaping;
- Storm drain marking;
- Street tree planting;
- Trash management; and
- Multi-family parking lot or alley retrofit.

The last step of the NSA involved rating the overall neighborhood pollution severity and restoration potential. The severity of pollution generated by a neighborhood is denoted by the Pollution Severity Index (PSI) based on benchmarks and scoring system in the USSR manual (CWP 2004). An NSA PSI is rated as severe, high, Mod., or none. A neighborhood's potential for residential restoration projects is rated as high, Mod., or low according to the Restoration Opportunity Index (ROI). The USSR also provides benchmarks and guidelines to establish NSA ROI ratings.

4.2.2 Summary of Sites Investigated

A total of 100 neighborhoods were assessed throughout the Bird River watershed (Figure 4-1). The number of neighborhoods within each subwatershed is summarized in Table 4-1. Note that a neighborhood may exist in more than one subwatershed; in this case the neighborhood was assigned to the subwatershed containing the largest portion of the watershed. Twenty-six of the neighborhoods were rated as having a high PSI. Of these 26, 17 neighborhoods are considered as having a high ROI and nine have a Mod. ROI. The 17 neighborhoods with high PSI and high ROI ratings represent the best areas to target for restoration initially. The distribution of PSI and ROI ratings among the NSAs are shown in Figure 4-2.

Table 4-1: Neighborhoods Surveyed per

Subwatershed

Subwatershed	# of NSAs
Bird River-B	1
Bird River-D	7
Honeygo Run	6
Railroad Creek_Bird River-A	3
White Marsh Run	43
White Marsh Run (N. Fork)	27
White Marsh Run (S. Fork)	11
Windlass Run	2
Total	100

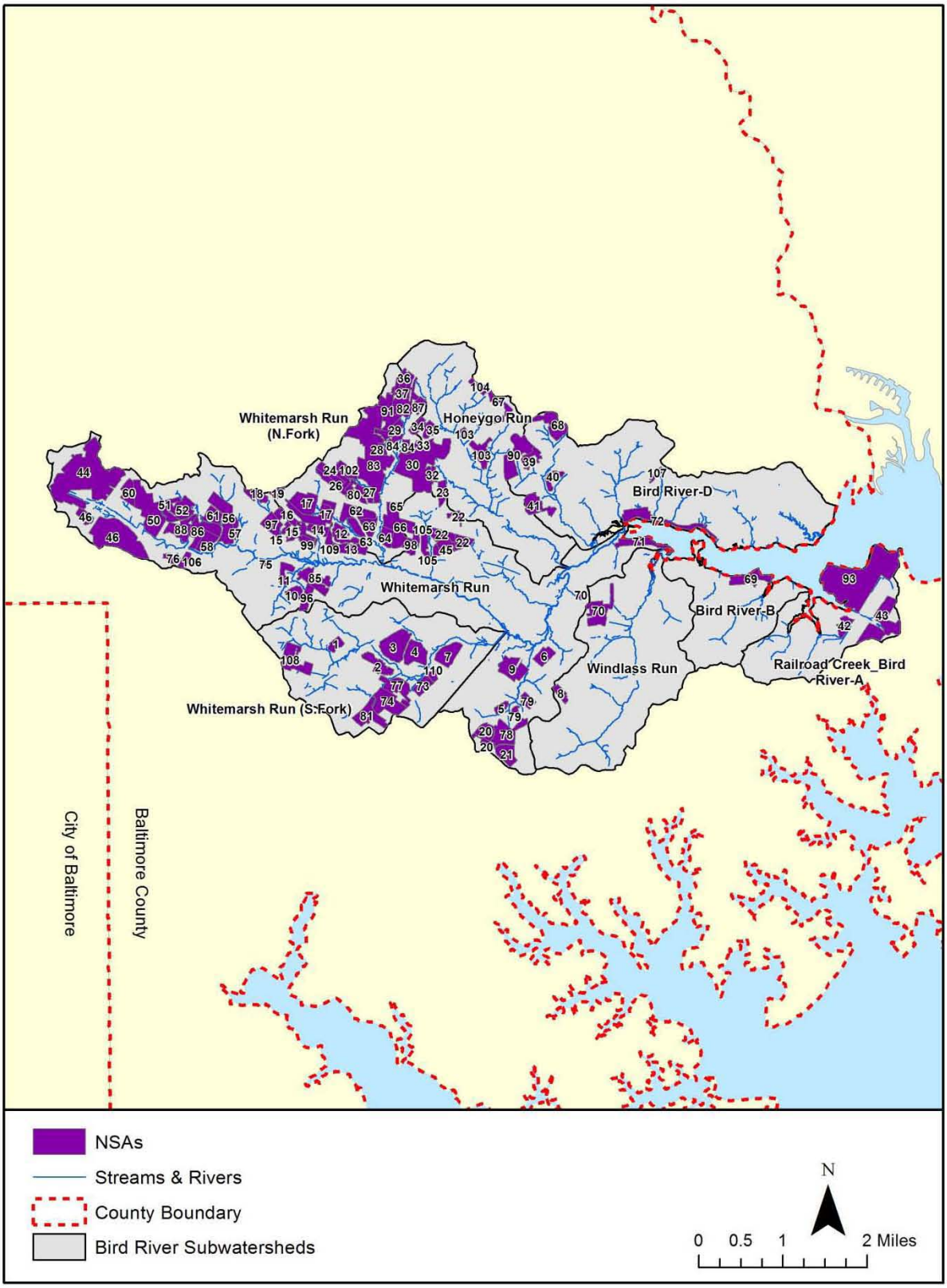

Figure 4-1: Location of NSAs in Bird River Watershed

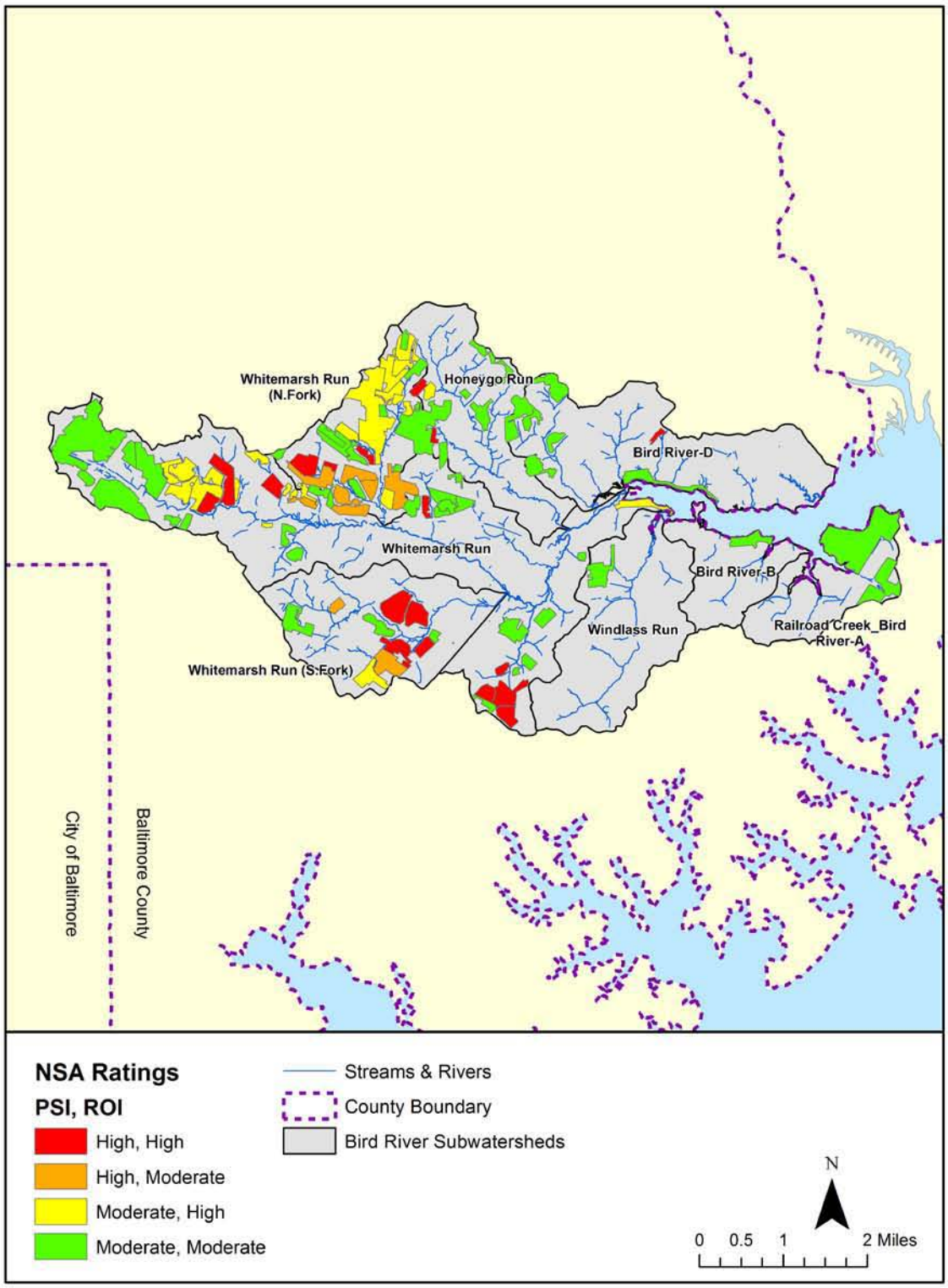

Figure 4-2: Top Target Areas for Restoration Based on NSA Pollution Severity and Restoration Opportunity Indices in Bird River Watershed

4.2.3 General Findings

The following subsections describe the actions recommended based on the NSAs. This includes an explanation of the methodologies and criteria used to evaluate the potential for recommended actions and results expected if these actions were applied. Figures showing general locations of NSAs recommended for certain actions are included in each subsection. Appendix G includes a summary of NSA data collected and recommended actions by individual neighborhoods. Calculations supporting estimates of results for recommended actions are included in Appendix H.

4.2.3.1 Downspout Retrofits: Downspout Disconnection, Rain Barrels, and Rain Gardens

Rooftop runoff is managed via downspouts which are considered as either connected or disconnected. Directly connected downspouts extend underground, discharging runoff directly to the storm drain system without treatment. Indirectly connected downspouts drain to impervious surfaces such as paved driveways, sidewalk, or curb and gutter system with little or no treatment. Disconnected downspouts allow rooftop runoff to infiltrate into the ground and enter streams through the groundwater system in a slower more natural fashion. Downspout retrofitting is desirable because it decreases flow to local streams during storm events; this helps prevent erosion and reduces pollutant loads to streams. Retrofitting may involve redirecting connected downspouts from impervious areas or the storm drain system onto pervious areas such as yards and lawns. Infiltration of rooftop runoff requires at least 15 linear feet of pervious area down gradient from the downspout. Under certain conditions, rain barrels and rain gardens are also retrofit options and may be recommended in lieu of redirection. Rain barrels, for example, may be used to store rooftop runoff for irrigation if there is limited pervious area available for downspout redirection. Rain gardens are the most desirable option in terms of water quality because they consist of amended soils and native plants that capture and treat runoff; this is a potential option for disconnection if the typical neighborhood has several hundred square feet of lawn area available down gradient from the downspout. Rain gardens are also an option in areas where downspouts are already disconnected, and are useful for capturing other types of impervious runoff. They also provide an opportunity for education and outreach, and can be a hands-on activity that opens the door for discussion of other best management practices with homeowners.

Downspout redirection is 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. Table 4-2 includes a summary of the number of neighborhoods recommended for downspout redirection and the acres of rooftop that would be addressed if downspout disconnection was implemented. Figure 4-3 shows an example of downspouts draining directly to an impervious driveway. A neighborhood identified for downspout disconnection may also be recommended for rain gardens and/or rain barrels, which are also noted in the table.

Figure 4-4, Figure 4-5, and Figure 4-6 show the location of neighborhoods recommended for rain barrels, rain gardens, and downspout redirection. Out of the 100 neighborhoods assessed, 55 have the potential for downspout disconnection through redirection, 50 are recommended for rain barrels (Figure 4-7), and 11 are recommended for rain gardens (Figure 4-8).

Table 4-2: Downspout Redirection Recommendations

Subwatershed	# of NSAs Recom-mended for Downspout Redirection	Rooftop Acres Addressed	# of NSAs Recom-mended for Rain Barrels	# of NSAs Recom-mended for Rain Gardens
Bird River-B	1	1.3	1	1
Bird River-D	4	11.5	6	3
Honeygo Run	2	7.7	1	1
Railroad Creek_Bird River-A	3	15.1	3	2
White Marsh Run	24	81.3	18	1
White Marsh Run (N. Fork)	15	48.3	16	0
White Marsh Run (S. Fork)	5	10.5	4	3
Windlass Run	1	1.6	1	0
Total	55	177.3	50	11

Figure 4-3: Example of a House Where Downspout Drains Directly to Impervious Driveway in NSA_K_39

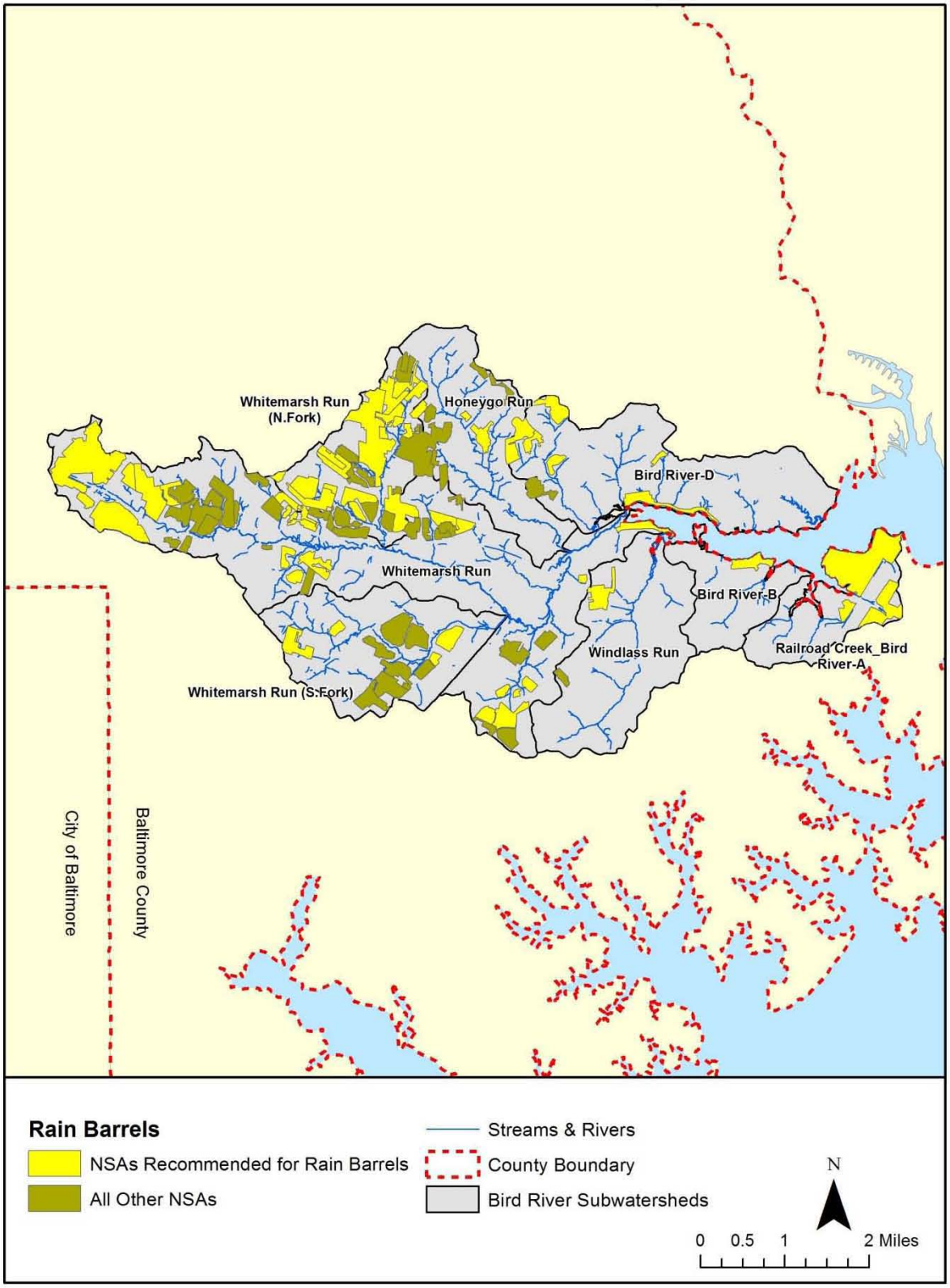

Figure 4-4: Neighborhoods Recommended for Rain Barrels

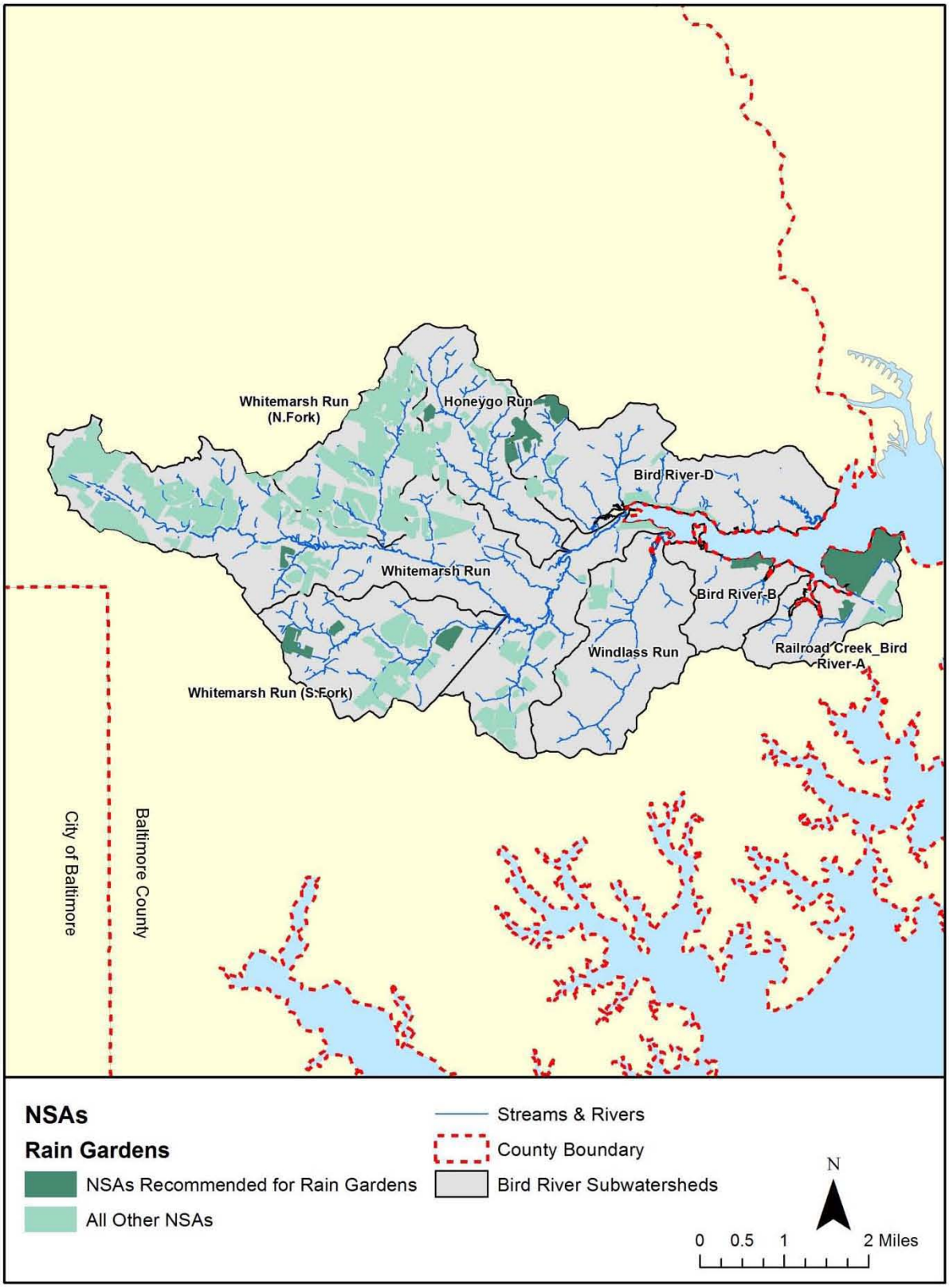

Figure 4-5: Neighborhoods Recommended for Rain Gardens

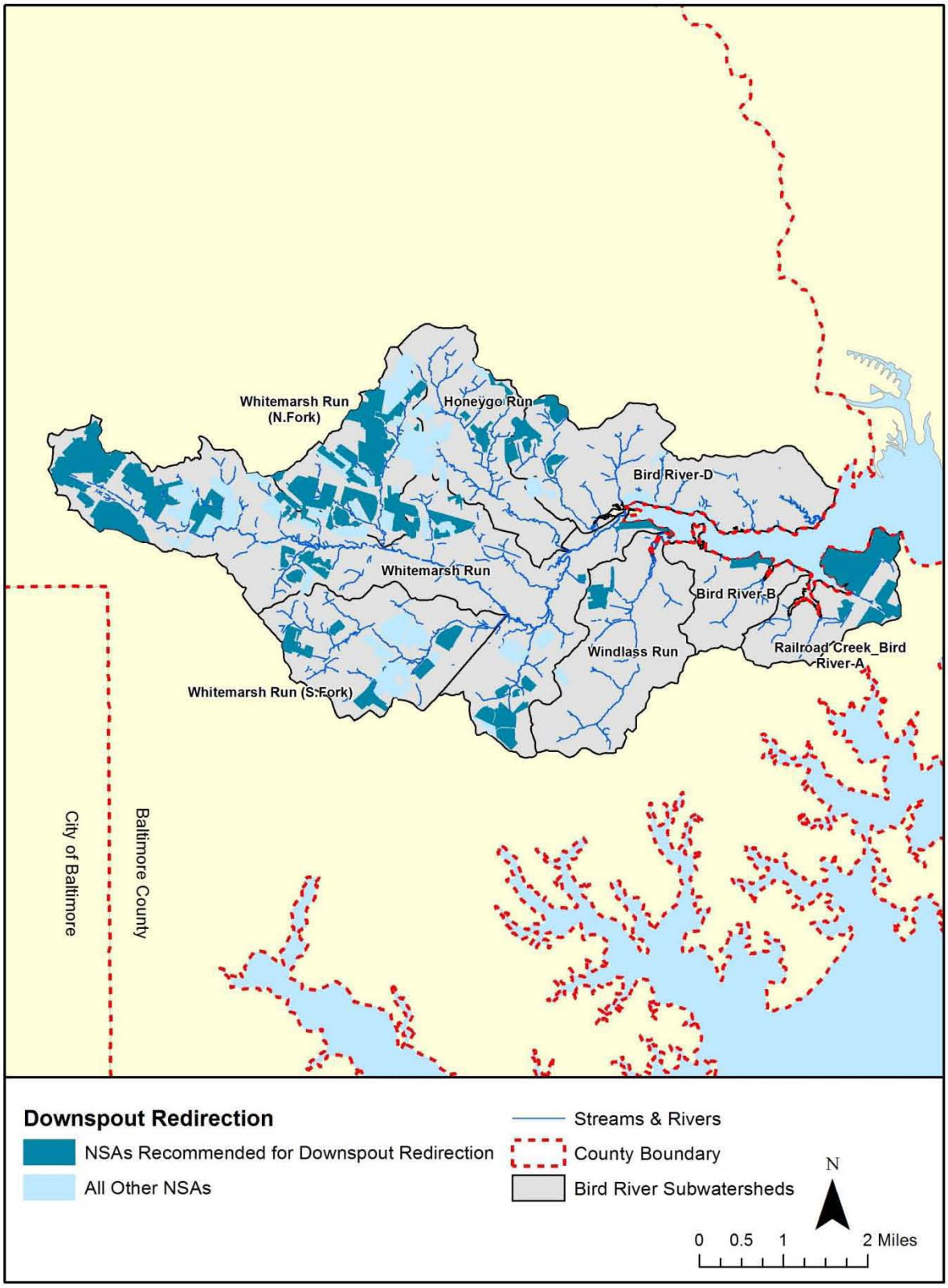

Figure 4-6: Neighborhoods Recommended for Downspout Disconnection

Figure 4-7: Example of a Rain Barrel Installation. Photo Credit: Gunpowder Valley Conservancy (GVC).

Figure 4-8: Example of a Rain Garden. Photo Credit: Gunpowder Valley Conservancy (GVC).

4.2.3.2 Fertilizer Reduction/Education

A well-maintained lawn can be beneficial to the watershed. However, lawn maintenance activities often involve over-fertilization, poor pest-management, and over-watering resulting in polluted stormwater runoff to local streams. Lawns with a dense, uniform grass cover or signs designating poisonous lawn care chemicals indicate high lawn maintenance activities. Neighborhoods where 20 percent or more of the homes appeared to employ high lawn maintenance practices were recommended for fertilizer reduction/education. Table 4-3 includes a summary of the number of neighborhoods recommended for fertilizer reduction/education and the acres of lawn addressed if implemented. Figure 4-9 shows the location of neighborhoods recommended for fertilizer reduction/education (any neighborhood with 20 – 100% high maintenance lawns). Twelve neighborhoods were recommended for fertilizer reduction/education.

Table 4-3: Fertilizer Reduction Recommended in Subwatersheds

Subwatershed	# of NSAs Recommended for Fertilizer Reduction	Acres of Lawn Addressed
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
White Marsh Run	5	13.7
White Marsh Run (N. Fork)	2	5.6
White Marsh Run (S. Fork)	5	79.5
Windlass Run	0	0.0
Total	12	98.8

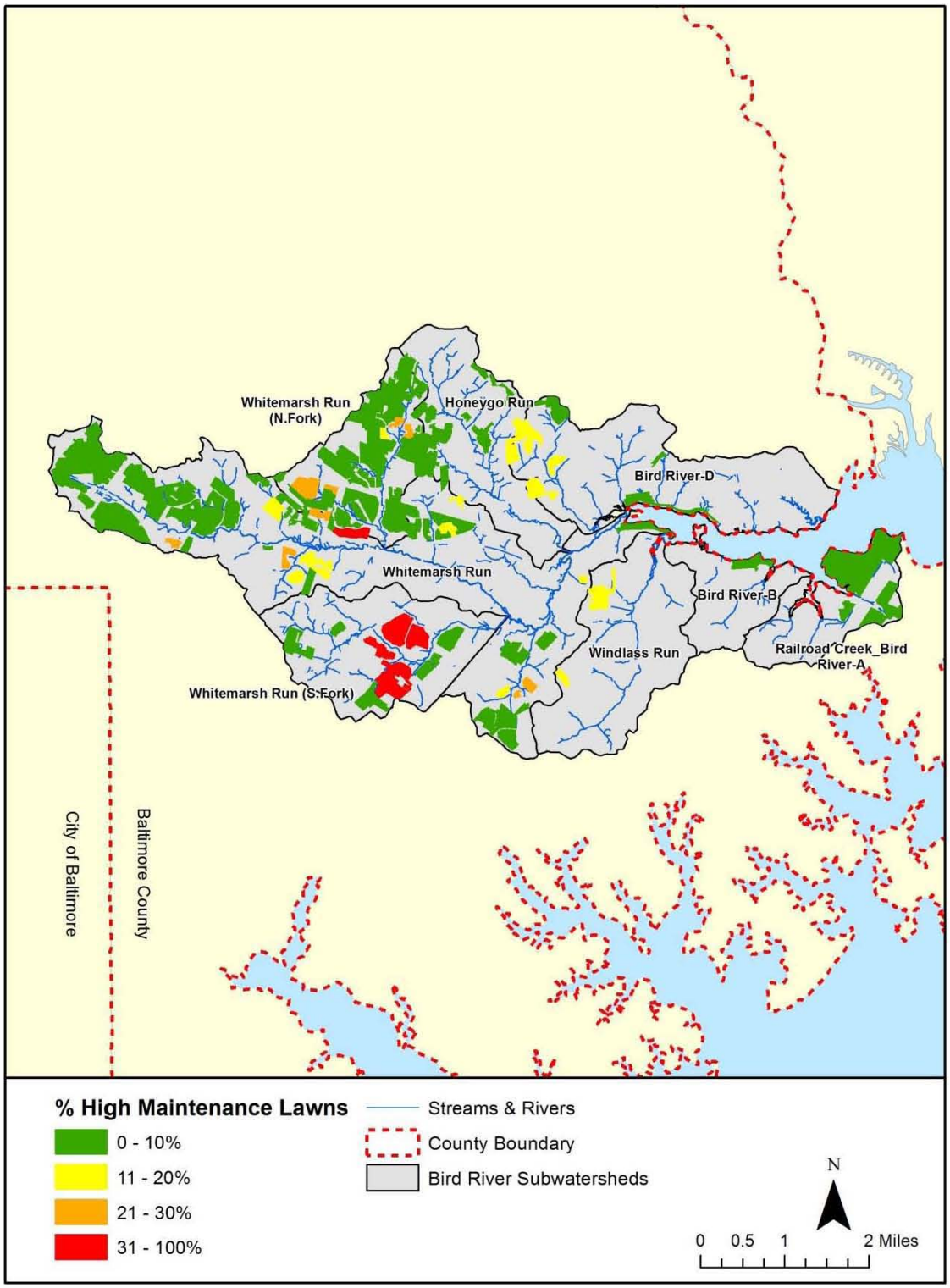

Figure 4-9: Neighborhoods by Percentage of High Maintenance Lawns

4.2.3.3 BayScaping

BayScaping refers to the use of plants native to the Chesapeake Bay watershed for landscaping (Figure 4-10). 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 stormwater pollution and lawn maintenance requirements. BayScaping is also beneficial to wildlife.

All neighborhoods could use more BayScaping; however, the benefits and feasibility of this action are limited by several factors. BayScaping was recommended in neighborhoods where the typical lot was at least ¼ acre in size, was less than 25 percent landscaped, and where there was sufficient grass area available (i.e., where impervious cover on the lot would not inhibit improvement of this percentage). Table 4-4 includes a summary of the number of neighborhoods recommended for BayScaping and the acres of land addressed if implemented. Figure 4-11 illustrates the location of neighborhoods recommended for BayScaping. Out of the 100 neighborhoods assessed, 47 met the criteria and were recommended for BayScaping.

Table 4-4: BayScaping Recommendations

Subwatershed	# of NSAs Recommended for BayScaping	Acres of Land Addressed
Bird River-B	1	10.5
Bird River-D	7	95.8
Honeygo Run	2	66.2
Railroad Creek_Bird River-A	3	200.3
White Marsh Run	18	322.6
White Marsh Run (N. Fork)	11	187.8
White Marsh Run (S. Fork)	3	41.2
Windlass Run	2	24.2
Total	47	948.6

Figure 4-10: Example of BayScaping. Photo Credit: US Fish and Wildlife Service BayScape at Maryland State Treasury Building.

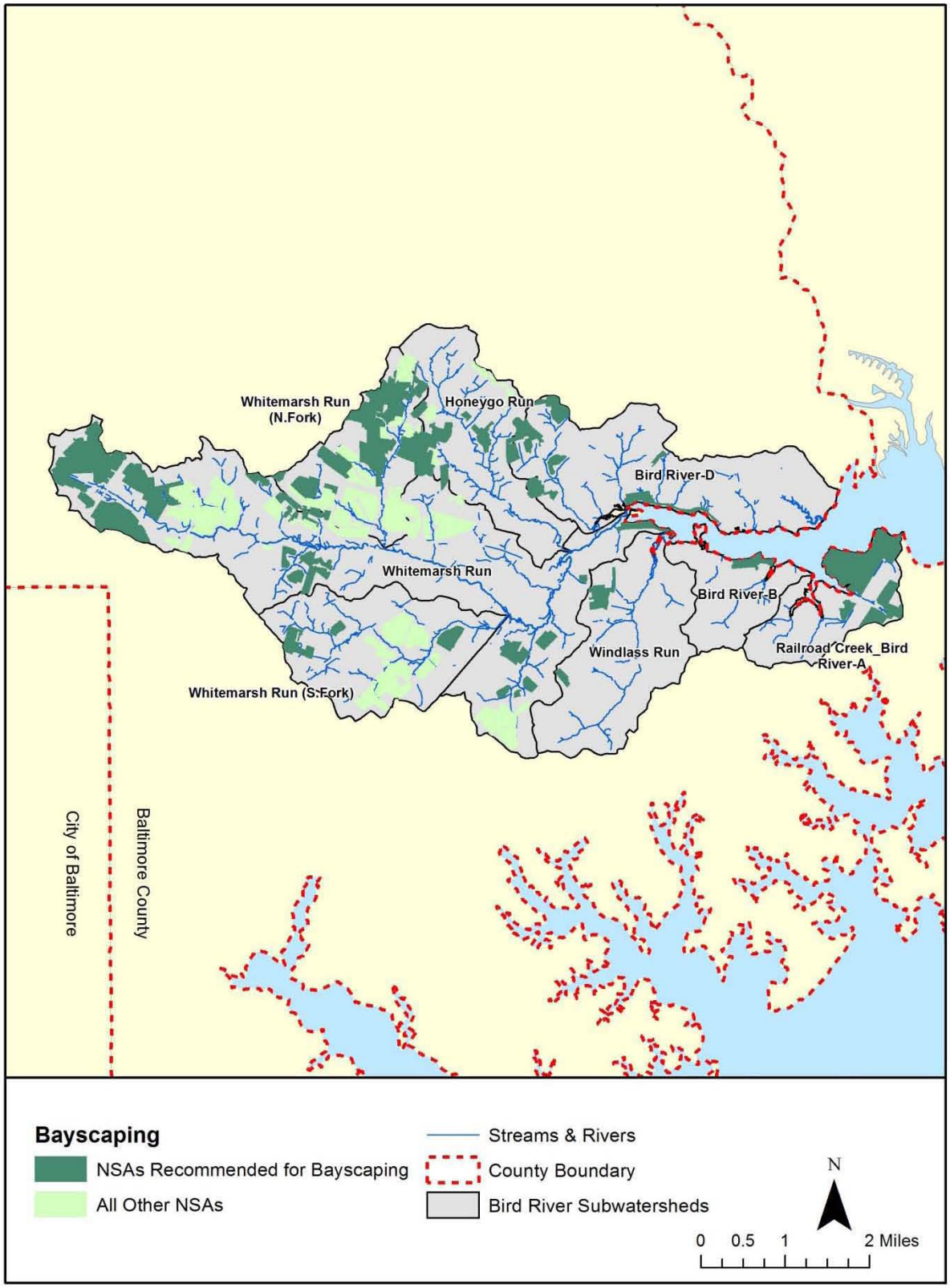

Figure 4-11: Neighborhoods Recommended for BayScaping

4.2.3.4 Storm Drain Marking

Most of the neighborhoods in the Bird River watershed consist of curb and gutter systems. These include storm drain inlets that convey stormwater runoff quickly and directly to the stream system and ultimately into the river and Chesapeake Bay. Marking these inlets is an excellent way to educate the public about the connection between their storm drain inlets and the Bay. Knowing this helps them to understand that anything building up along the curbs and gutters, such as trash and lawn clippings (potential for nutrient pollution), will be washed away after a storm event and end up in the Bird River and/or the Bay. Many neighborhoods had inlets with faded storm drain markings, or no markings at all. Particularly in areas with little or no infiltration of stormwater, there is more potential for pollutants to be carried to the stream system.

Neighborhoods recommended for storm drain marking had curb and gutter systems with inlets appropriate for marking and where less than 10 percent of the existing inlets were already marked (and legible). Table 4-5 includes a summary of the number of neighborhoods recommended for storm drain marking and the inlets addressed if implemented. Figure 4-12 illustrates the location of neighborhoods recommended for storm drain marking. Out of the 100 neighborhoods assessed, 88 met the criteria and were recommended for storm drain marking.

Table 4-5: Storm Drain Marking Recommendations

Subwatershed	# of NSAs Recommended for Storm Drain Marking	Approximate No. of Inlets Addressed	% of Subwatershed Inlets Addressed
Bird River-B	0	0	0
Bird River-D	5	0*	0*
Honeygo Run	6	20	33
Railroad Creek_Bird River-A	2	3	7
White Marsh Run	39	216	40
White Marsh Run (N. Fork)	24	293	53
White Marsh Run (S. Fork)	10	22	27
Windlass Run	2	16	100
Total	88	570	44

*Baltimore County is currently updating their storm drain data and although this current dataset is incomplete and in draft form, it is more accurate and complete than the County's historic storm drain data. This is the reason for storm drain marking recommended in Bird River-D, though no approximate number of inlets to be addressed is available.

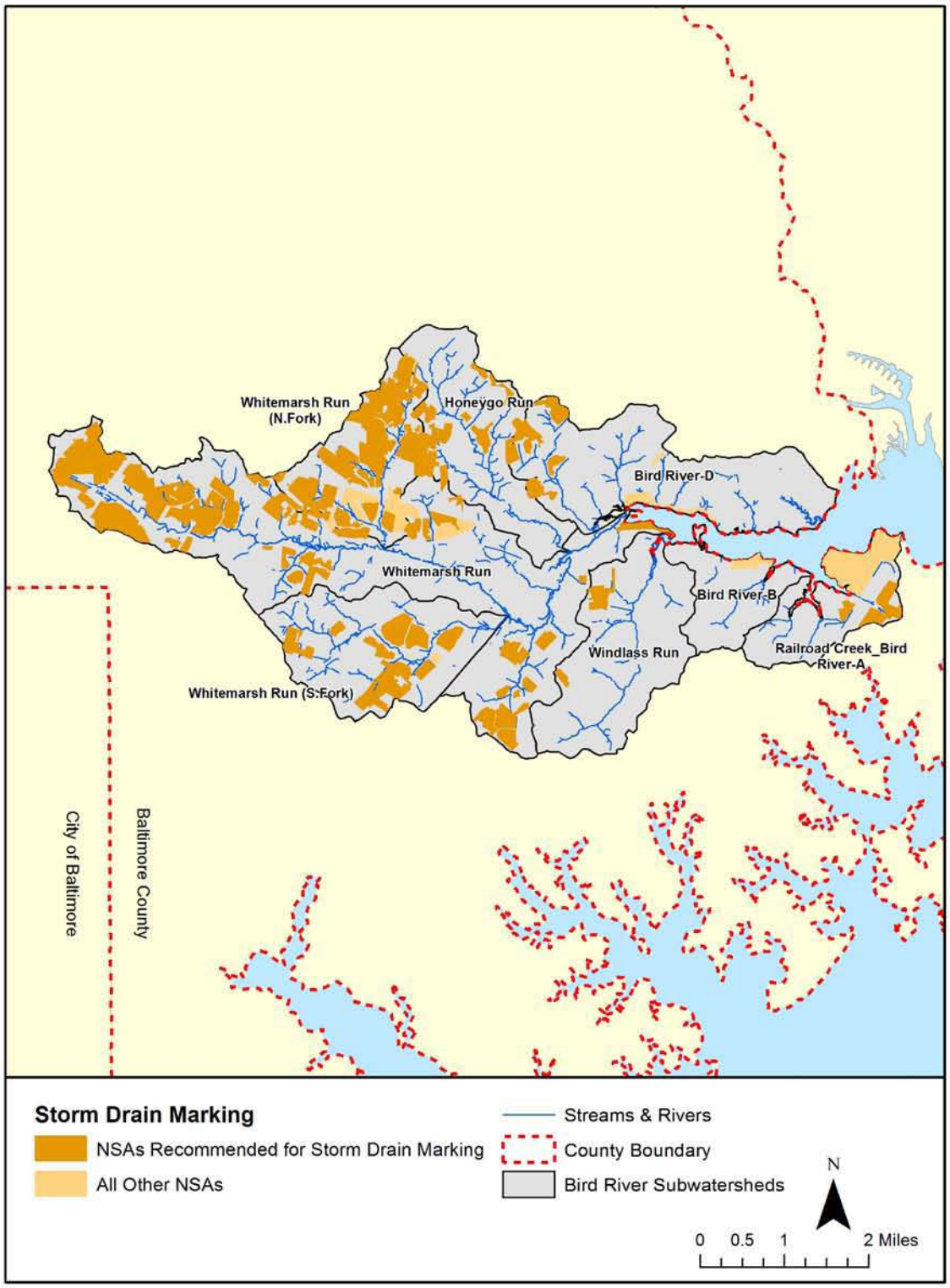

Figure 4-12: NSAs Recommended for Storm Drain Marking

4.2.3.5 Tree Planting Opportunities

Trees are an asset to a neighborhood aesthetically, and they also improve air and water quality as they intercept precipitation with their leaves and can absorb precipitation and nutrients through their root systems. Interception of precipitation with the leaves or infiltration through the root systems slows stormwater runoff and provides some treatment before it reaches the stream system. Street trees were recommended for neighborhoods where at least 25 percent of the streets had a minimum of 6 feet of greenspace between the sidewalk and curb and less than 75 percent of the suitable areas had trees planted. The number of trees was estimated based on a spacing of one tree per 15 to 20 feet. Street tree estimates would be capped at a maximum of 100 per neighborhood and the potential for more than 100 street trees would be noted in these cases; however, no neighborhoods reached this number. Open space trees were recommended for neighborhoods where there were open pervious areas that were not being used by the community for other purposes (Figure 4-13). The recommended planting density on open space land is 200 trees per acre, or a spacing of approximately 15 to 25 feet between trees.

Table 4-6 includes a summary of the number of neighborhoods recommended for tree planting and the number of street and open space trees proposed per subwatershed. Figure 4-14 illustrates the location of neighborhoods where street or open space trees could be planted. Out of the 100 neighborhoods assessed, 49 met the criteria and were recommended for tree planting. Neighborhoods not recommended for street trees did not have sidewalks and a curb and gutter system, had insufficient greenspace between the sidewalk and curb, or lawn trees already provided shade for the street. In several areas, most of the appropriate areas had been planted. There is potential for planting 22 street trees and 7,545 open space trees throughout the watershed. Table 4-7 lists tree species appropriate for tree plantings within the Bird River watershed.

Table 4-6: Tree Planting Potential by Subwatershed

Subwatershed	# of NSAs Recommended for Tree Planting	# of Potential Street Trees	# of Potential Open Space Trees
Bird River-B	0	0	0
Bird River-D	5	0	726
Honeygo Run	4	8	960
Railroad Creek_Bird River-A	1	0	100
White Marsh Run	21	7	2,516
White Marsh Run (N. Fork)	10	0	1,082
White Marsh Run (S. Fork)	8	7	2,161
Windlass Run	0	0	0
Total	49	22	7,545

Figure 4-13: Examples of Neighborhoods with Excellent Tree Planting Opportunities. Top Photo is a Grassy Hill Behind Apartment Buildings in NSA_K_3. Bottom Photos is a Wide, Grassy Area in a Townhome Community in NSA_K_4.

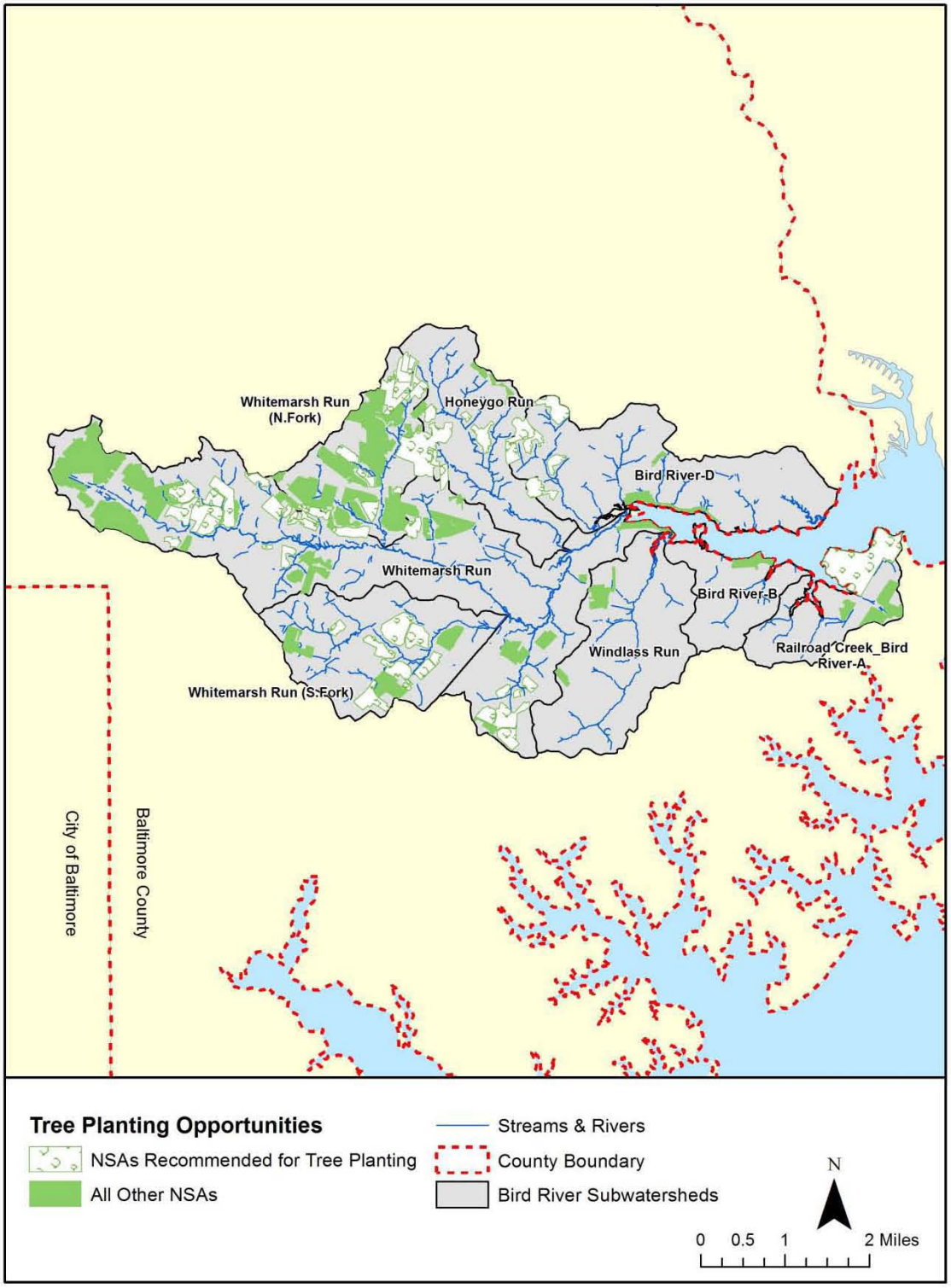

Figure 4-14: Neighborhoods Recommended for Tree Planting

Table 4-7: Native Tree Species Recommended for Street Tree Plantings within the Bird River Watershed.

Common Name	Scientific Name	Positive Attributes
Black gum	*Nyssa sylvatica*	Strong trunks; summer fruits; fall color
Downy juneberry	*Amelanchier arborea*	Small tree; edible fruits; earlier flowerer
Hackberry	*Celtis occidentalis*	Strong trunks; interesting bark pattern
Musclewood	*Carpinus caroliniana*	Strong trunk; slow grower; interesting trunk shapes
Pin oak	*Quercus palustris*	Strong trunks; slow grower; small acorns
Red maple	*Acer rubrum*	Fast grower; good shade tree; fall color
Redbud	*Cercis canadensis*	Small; shade tree
Sassafras	*Sassafras albidum*	Small; shade tree; fall color
Scarlet Oak	*Quercus coccinea*	Fast growing tough oak, resists drought
Serviceberry	*Amelanchier canadensis*	Small tree; edible fruits; earlier flowerer
Slippery elm	*Ulmus rubra*	Strong trunks; fast grower; good wildlife species
Sourwood	*Oxydendron arboreum*	Mod. size; fall color
Sugar maple	*Acer saccharum*	Strong trunks; fall color
Swamp White Oak	*Quercus bicolor*	Tolerates variety of habitats
Yellowwood	*Cladrastis kentukea*	Small tree; interesting showy, fragrant flowers

4.2.3.6 Street Sweeping

Street sweeping helps remove trash, sediment and other organic matter, such as leaves and grass clippings, from the curb and gutter system and prevents them from entering the storm drain system and nearby streams. Street sweeping also reduces other materials, like oil and metals, from being washed into the stream by storm water runoff. Excessive organic matter, sediment, and trash can clog streams and the storm drain system and result in costly maintenance and stream health impairment. As the excess organic matter in the stream begins to decay, oxygen in the water is depleted, which in turn harms fish and other organisms living in the stream. An aggressive street sweeping initiative can ease the effects of a curb and gutter storm drain system on receiving streams.

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. Table 4-8 includes a summary by watershed of the number of neighborhoods recommended for street sweeping and the miles of street that could be addressed if street sweeping was increased. Miles addressed by street sweeping were estimated using Baltimore County's roads GIS layer and determining the miles of roads within each neighborhood recommended for street sweeping. Figure 4-15 illustrates the location of neighborhoods recommended for street sweeping. Out of the 100 neighborhoods assessed, four met the criteria for street sweeping. If initiated, this could address approximately 2.6 miles of road within the neighborhoods surveyed in the watershed.

Table 4-8: Street Sweeping Recommendations by Subwatershed

Subwatershed	# of NSAs Recommended for Street Sweeping	Miles Addressed by Street Sweeping
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
White Marsh Run	3	2.0
White Marsh Run (N. Fork)	0	0.0
White Marsh Run (S. Fork)	1	0.6
Windlass Run	0	0.0
Total	4	2.6

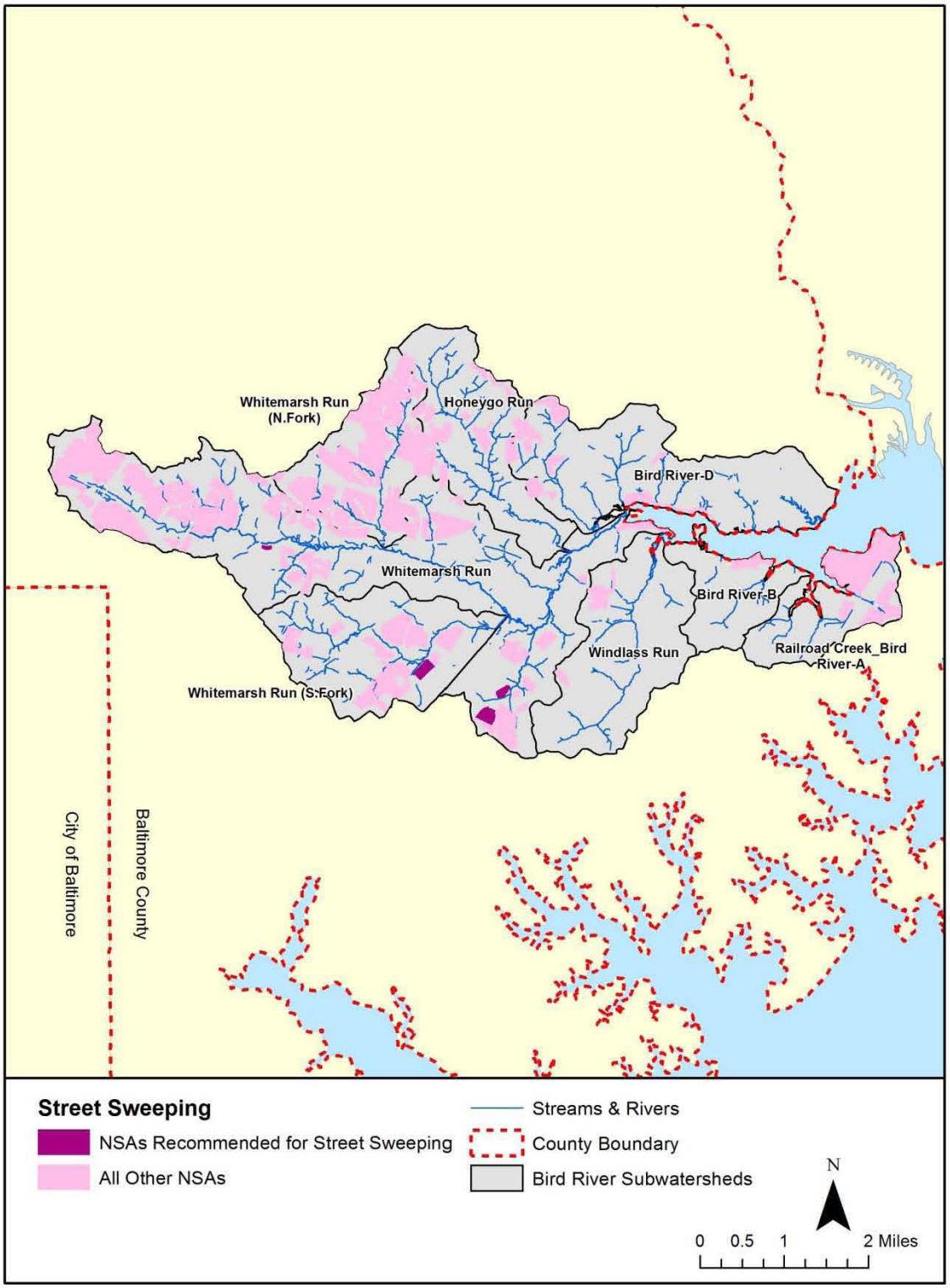

Figure 4-15: Neighborhoods Recommended for Street Sweeping

4.2.3.7 Neighborhood Trash Management

Trash is one of the many types of pollution that may affect a watershed. Neighborhoods where junk or trash was observed in at least 25 percent of yards would be recommended for trash management initiatives. The upland NSA survey revealed that there were no neighborhoods where trash management was an issue. Any ongoing efforts such as community cleanups, trash management education, and working with the Department of Public Works (DPW) to manage any bulk trash pick-up programs should be continued in order to prevent the occurrence of trash pollution in the future.

4.2.3.8 Parking Lot Retrofits

There are many apartment, townhouse, and condo complexes in the Bird River watershed. Multi-family parking lots in these types of neighborhoods can be an opportunity for stormwater retrofits to address runoff from impervious surfaces. This type of retrofit can address a large area of impervious cover within a single design plan. As discussed previously in Chapter 2, infiltration/filtration practices such as bioretention areas with native plantings could be used to capture and treat storm water runoff from impervious parking lots and alleys while requiring minimal maintenance.

Neighborhoods where sufficient greenspace was available down gradient of a multi-family parking lot were recommended for stormwater retrofits. Four neighborhoods with appropriate areas for parking lot retrofits include two locations in Whitemarsh Run (S. Fork) subwatershed and one location each in Bird River-B and Whitemarsh Run subwatersheds.

4.3 Hotspot Site Investigations (HSI)

Stormwater hotspots are areas that have the potential to generate higher concentrations of stormwater pollutants than typically found in urban runoff because they run higher risk of spills, leaks, or illicit discharges due to the nature of their operations (CWP 2007). These generally include commercial, industrial, municipal, or transport-related operations. The purpose of hotspot investigations is to evaluate pollution potential from hotspot operations and identify potential restoration practices that may be necessary.

Hotspots can be regulated or unregulated. Unregulated hotspots, such as retail and wholesale establishments, lawns, employee/customer parking, or roofs of administrative buildings, are not regulated but the nature of their operations makes them likely to be potential pollutant sources. Stormwater pollutants generated as a result of hotspot operations depend on the specific activities but typically include nutrients, hydrocarbons, metals, chloride, pesticides, bacteria, and trash.

Regulated hotspots are known sources of pollution that are subject to applicable federal or state laws. In 1990, the USEPA issued regulations requiring that all stormwater associated with industrial activity be regulated by discharge permits, either individual permits or general permits. General permits are also known as a Multi-Sector General Permit (MSGP). Maryland's new MSGP is permit No. 12-SW.

A permit is required if there is an opportunity for pollutants from the industrial facility to be carried away by stormwater runoff ("exposure"). Generally, if all operations, movement of materials, and storage of materials are under a roof, then a permit is not needed. However, as

long as there is any potential for exposure, a permit is required. In the context of stormwater hotspots, regulated activities are covered either under individual permits or under the MSGP.

The EPA has identified six types of activities at industrial facilities that have the potential to be major sources of pollutants in stormwater (EPA 2009a):

- Loading and Unloading Operations

  Loading and unloading operations can include pumping of liquids or gases from tankers to storage facilities, pneumatic transfer of dry chemicals, transfer by mechanical conveyor systems, or transfer of bags, boxes, drums or other containers by forklift or other material handling equipment. Material spills or losses in these areas can accumulate and be washed away during a storm.

- Outdoor Storage

  Outdoor storage activities include storage of fuels, raw materials, by-products, intermediate products, final products, and process residuals. Materials may be stored in containers, on platforms or pads, in bins, boxes or silos, or as piles. Storage areas that are exposed to rainfall and/or runoff can contribute pollutants to stormwater when solid materials wash off or materials dissolve into solution.

- Outdoor Process Activities

  Although many manufacturing activities are performed indoors, some activities, such as timber processing, rock crushing, and concrete mixing, occur outdoors. Outdoor processing activities can result in liquid spillage and losses of material solids, which makes associated pollutants available for discharge in runoff.

- Dust or Particulate Generating Processes

  Dust or particulate generating processes include industrial activities with stack emissions or process dusts that settle on surfaces. Some industries, such as mines, cement manufacturing, and refractories, also generate significant levels of dust that can be mobilized in stormwater runoff.

- Illicit Connections and Non-Stormwater Discharges

  Illicit connections of process wastes or other pollutants to stormwater collection systems, instead of to sanitary sewers, can be a significant source of stormwater pollution. Non-stormwater discharges include any discharge from the facility that is not generated by rainfall runoff (for example, wash water from industrial processes). With few exceptions, these non-stormwater discharges are prohibited. Permits include a list of authorized non-stormwater discharges.

- Waste Management

  Waste management practices include everything from landfills to waste piles to trash containment. All industrial facilities conduct some type of waste management at their

site, much of it outdoors, which must be controlled to prevent pollutant discharges in stormwater.

So, while these HSIs are not focused on permitted industrial facilities, which already have rigorous self- inspection requirements, we can look for the same opportunities for illicit discharges throughout the watershed at commercial, institutional, municipal and transportation-related sites that engage in the activities listed above. Additionally, oil prevention laws in Maryland require that facilities with 1,320 gallons of oily liquids stored above ground receive permits and develop Spill Prevention Control and Countermeasures plans (SPCCs). Hotspot investigations are also an opportunity to note any obvious violations of SPCC requirements or bad housekeeping practices for those facilities where storage of oily liquids exceeds 1,320 gallons. In fact some private facilities may be storing more than the 1,320 gallon threshold and may not know that they are required to apply for a permit and develop a SPCC. The HSI field work is a good opportunity to bring these situations to the County's attention as these sites have potential for significant non-stormwater discharges.

4.3.1 Field Investigation Protocol

A field crew was tasked with investigating potential hotspots throughout the Bird River watershed. The 2013 field visits employed a hotspot investigation form modified by the County for previous SWAPs. The following subsections describe the methods used to identify and assess hotspots.

The types of parcels or land use categories that are typically associated with pollution activity include the following:

Commercial hotspots include a range of businesses and activities but are often grouped together in subwatersheds. Operations characteristic of commercial hotspots include waste or wash water generation, outdoor material storage, fuel handling, and auto/boat repair. Common commercial hotspots include auto repair shops, car dealers, car washes, parking facilities, gas stations, marinas, garden centers, construction equipment and building material lots, swimming pools, and restaurants.

Industrial operations utilize, generate, handle, and/or store pollutants that can be washed off with stormwater, spilled, or mistakenly discharged into the storm drain. Many industrial hotspots are regulated under NPDES industrial discharge permits and include various manufacturing operations such as metal production, chemical manufacturing, and food processing.

Municipal hotspots typically refer to local government operations such as solid waste, wastewater, road and vehicle maintenance, and yard waste. Like industrial operations, many municipal hotspots are subject to NPDES stormwater permits.

Transport-related hotspots normally include areas of significant impervious cover and extensive private storm drain systems. Many are regulated and include uses such as airports, ports, highway construction, and trucking centers.

Following the Baltimore County HSI protocol, which is largely based on CWP (2007), each hotspot investigation involved an evaluation of six common operations at each potential hotspot: vehicle operations, outdoor materials, waste management, physical plant, turf/landscaping, and stormwater infrastructure.

The field team conducted windshield surveys and walked as much of the property of each potential hotspot as was accessible to look for potential or confirmed pollution sources and document them with photographs. Parameters evaluated within each operation category are described briefly below.

1. Vehicle Operations

For each site, any vehicle operations done outdoors (*e.g.* maintenance, repair, recycling, fueling, washing or long-term parking) were noted since they can be a major source of hydrocarbons and nutrients. Connections between outdoor vehicle operations exposed to precipitation and the storm drain system without any site-specific or regional stormwater water quality management facilities are the main focus of this category.

2. Outdoor Materials

Water quality issues can result from improper handling or storage of outdoor materials at hotspots. Locations where materials were loaded or unloaded were examined to see if liquid or transportable materials could be exposed to rain and drain to a storm drain. The field team also looked for improperly labeled storage containers, lack of secondary containment for liquids, and whether the storage area was directly or indirectly connected to the storm drain system.

3. Waste Management

Businesses typically generate waste as a result of daily operations, which can be potentially hazardous sources of stormwater pollution depending on the type of waste and how it is stored. The field team noted the type of waste generated (e.g., consumer packaging, food products, used cooking oils, construction materials etc.) and the condition of dumpsters. Dumpsters exposed to precipitation with no runoff diversion methods and with no cover or open lids, with leaks, damaged/in poor condition, and/or overflowing were noted as potential pollution sources.

4. Physical Plant

Common physical plant practices include cleaning, maintaining, or repairing the building, outdoor work areas, and parking lots. These activities can be a source of sediment, nutrients, paints, and solvents in stormwater runoff. For each hotspot, the condition of the building itself was evaluated. Stained, dirty, or damaged buildings were noted as evidence of potential pollution sources, as well as staining or discoloration around a building, which is evidence that maintenance activities (e.g., painting, power-washing, resealing, etc.) may discharge to storm drains. Similarly, parking lots that were stained, dirty, and/or breaking up, were recorded as potential pollution sources. Downspouts connected to impervious surfaces or connected directly to the storm drain system were also recorded.

5. Turf/Landscaping

Maintenance of turf/landscaped areas was also evaluated. High maintenance turf and improper irrigation practices were noted since they are potential pollution sources of nutrients, fertilizer, and pesticides. The field team also determined whether landscaped areas drained directly to storm drains or if organics (leaves, grass) accumulated on impervious surfaces. Areas of more than 20 percent of bare soil in turf/landscaped areas were flagged as a sediment pollution source.

6. Stormwater Infrastructure

If stormwater management practices were not present, the location was flagged as a potential pollution source. Private storm drains with considerable amounts of sediment, organics, and/or trash were identified as potential pollution sources.

For each operation listed on the HSI field form, there are observed pollution source indices and potential pollution source indices which can be checked off and summed to calculate a “Hotspot status” for the site. Finally, one or more of the follow-up actions listed below could be recommended based on initial field observations:

- Refer for immediate enforcement,
- Follow-up on-site inspection,
- Test for illicit discharge,
- Future education effort, and
- On-site non-residential retrofit.

4.3.2 Summary of Hotspot Investigations

Field investigations were conducted in May and June 2013. Table 4-9 shows the list of the 29 sites visited, which included sites selected during a GIS desktop analysis and sites that the field teams discovered while in the field. The table also details the type of facility; its “Hotspot Status” and number of potential pollution sources (i.e., number of circles filled-in on the HSI forms); any observed pollution sources; and follow-up actions and notes. Figure 4-16 shows the location of each candidate hotspot investigated within the watershed.

Unique ID numbers were assigned to HSI sites using the classification scheme “HSI_K_101”, where ‘K’ denotes the Bird River watershed and the first digit of the site number corresponds to a specific subwatershed. The eight subwatersheds were assigned unique numbers (100 to 800) for the purposes of the upland assessments, as described in Section 4.1. For example, HSI locations in Whitemarsh Run (subwatershed 200) would be identified as 202, 203, etc.

Table 4-9: Summary of Hotspot Investigations, May-June 2013, Bird River Watershed, Baltimore County, MD

Site ID	Date of Investigation	Type - Description	Hotspot Status (# filled circles)	Observed Pollution Source	Recommended Follow-up Actions / Notes
HSI_K_101	6/18/2013	Commercial – Outdoor mall/shopping center	Confirmed (13)	Yes	Multiple dumpsters with lids open at rear of facility. Grease dumpsters have oil/grease drippings. One restaurant was storing filthy food fryers outdoors and looked to be poised to wash them outdoors with hose. Include in future outreach and education. Refer for immediate enforcement.
HSI_K_103	5/31/2013	Commercial – Small machine and party rental	Confirmed (11)	No	Small engine repair being done on-site. 55-gallon drums of petroleum projects just inside garage door. Plenty of oil stains on ground. Include in future education efforts.
HSI_K_104	5/31/2013	Commercial - Shopping mall with supermarket and restaurants	Potential (9)	No	Some trash on the ground behind the facility as well as at loading dock, but not excessive. 2 of 8 dumpsters were not covered.
HSI_K_132	5/31/2013	Commercial - Restaurant	Potential (7)	No	Nothing recommended at this time.
HSI_K_143	6/21/2013	Commercial - Restaurant	Confirmed (8)	Yes	Dumpster area had food waste around it and a leaky dumpster with significant dumpster juice pooled and plenty of staining. Sent to county for immediate enforcement and for inclusion in future education efforts.
HSI_K_148	6/18/2013	Commercial – Grocery store	Potential (9)	No	Great retrofit opportunity. A lot of impervious surface at rear of building that might be candidate for removal. Also, a lot of bare grass in rear and along the side of building that can be turned into a rain garden, which would capture roof runoff.
HSI_K_212	5/29/2013	Commercial - Office trailer and outdoor storage for construction company	Potential (9)	No	Nothing recommended at this time.
HSI_K_233	5/28/2013	Commercial - Automobile dealership	Confirmed (10)	Yes	Vehicles being washed outdoors behind car wash. Car wash is tracking water outside. 4 dumpsters are missing covers. Immediate enforcement action required on washing. Recommend for future education efforts.
HSI_K_234	5/28/2013	Commercial - Heavy truck repair	Confirmed (10)	No	Outdoor storage of used truck parts and poor waste management is biggest threat from this site. 55-gallon drums being stored outdoors without secondary containment. Recommended for inspection by county and future education efforts. Retrofit inside of rip rap channel dividing parking lots may be possible to reduce sediment export.

Table 4-9: Summary of Hotspot Investigations, May-June 2013, Bird River Watershed, Baltimore County, MD

Site ID	Date of Investigation	Type - Description	Hotspot Status (# filled circles)	Observed Pollution Source	Recommended Follow-up Actions / Notes
HSI_K_235	6/8/2013	Commercial - Restaurant	Potential (6)	No	Grease dumpster leaving staining on ground and is proximate to catch basin. Suggest moving it to another location or putting under roof.
HSI_K_236	6/8/2013	Commercial - Restaurant	Confirmed (9)	Yes	Grease dumpster leaking directly to catch basin. Suggest moving it to another location or putting under roof. Sent to county for immediate enforcement.
HSI_K_238	5/29/2013	Commercial - Retail goods sales	Potential (8)	No	Dumpsters and adjacent area are exceptionally clean.
HSI_K_239	5/28/2013	Commercial - Restaurant	Confirmed (12)	No	Internal drain (white PVC) routed outdoors needs to be investigated. Dumpster covers all open. Grease dumpster is filthy but at least it's over grass and not asphalt. Referred to County for further inspection.
HSI_K_240	5/28/2013	Commercial - Used car sales	Confirmed (3)	Yes	Actively washing vehicle in parking lot. Likely being done daily. Drainage of site is not clear, but rain events will certainly carry some detergents onto Pulaski Highway.
HSI_K_241	5/29/2013	Commercial - Construction materials and retail sales	Potential (7)	No	Nothing recommended at this time.
HSI_K_242	5/29/2013	Commercial - Warehouse and storefront	Confirmed (14)	No	Because of quantities of bulk liquids stored outdoors, this facility would be good candidate for future education efforts. Some sediment in parking lot, which could be source of pollution.
HSI_K_244	5/28/2013	Commercial - Retail goods sales and automobile repair	Not a hotspot (4)	No	Exceptionally orderly. Nothing recommended at this time.
HSI_K_313	5/29/2013	Commercial - Trucking operation, dirt/aggregate stockpiles/fleet maintenance & fueling	Confirmed (10)	Yes	Recommend for follow up inspection and possible enforcement of poor spill control and countermeasures (SPCC) for outdoor fueling operation which is showing significant staining on ground and on the fuel tanks themselves from leaking pipes, lack of protection from collisions and dragging hoses. Stockpiles are not protected. This facility requires review to verify if stormwater management exists. If not, additional BMPs should be included to prevent non stormwater discharges. Facility should be included in education efforts.
HSI_K_314	5/29/2013	Commercial - Construction company's outdoor materials and vehicles storage	Potential (8)	No	Nothing recommended at this time.

Table 4-9: Summary of Hotspot Investigations, May-June 2013, Bird River Watershed, Baltimore County, MD

Site ID	Date of Investigation	Type - Description	Hotspot Status (# filled circles)	Observed Pollution Source	Recommended Follow-up Actions / Notes
HSI_K_316	5/29/2013	Commercial - Drilling machinery design and construction with outdoor storage of vehicles and equipment.	Potential (7)	No	Site is very clean and orderly. Nothing recommended at this time.
HSI_K_317	5/29/2013	Commercial - Roofing supplies and construction company. Outdoor materials and vehicle storage and fueling operations.	Potential (9)	No	Recommend for follow up inspection and possible enforcement of poor spill control and countermeasures (SPCC) for outdoor fueling operation which is showing staining on ground and dragging fueling hoses. Stockpiles are not protected. This facility requires review to verify if stormwater management exists. If not, additional BMPs should be included to prevent non-stormwater discharges. Facility should be included in education efforts.
HSI_K_318	5/29/2013	Commercial - Earth moving machinery rental, maintenance and storage.	Confirmed (14)	No	Outdoor fuel Aboveground Storage Tank (AST) has no collision protection and shows signs of staining on tank itself. Multiple 55 gallon drums outdoors without labels and some may be unsealed. Recommend for education and site visit by county.
HSI_K_331	5/29/2013	Commercial - Business park, auto repair, etc.	Potential (10)	No	Dumpsters not covered and some leaking, otherwise facility looks decent.
HSI_K_420	5/31/2013	Commercial - Supermarket	Potential (9)	No	Some trash on the ground behind the facility as well as at loading dock, but not excessive. Catch basin at rear had dry weather flow but most likely AC condensate from roof. One dumpster had broken lid.
HSI_K_421	5/31/2013	Commercial - Auto repair	Potential (10)	No	Site looks clean. Only discrepancy was an unsealed 55-gallon drum in dumpster area half filled with lubricating oil. They should be included in future education efforts.
HSI_K_446	5/28/2013	Commercial - Retail fuel and food sales + car wash	Potential (8)	No	Car wash could be perennial source of detergents depending on thoroughness of rinse cycle. Recommend inspection and water quality test for detergents.
HSI_K_625	5/28/2013	Commercial - Construction company offices	Potential (9)	No	Site looks clean. Only discrepancy was two unsealed 55-gallon drums in rear filled with roofing tar which looks to have hardened. They should be included in future education efforts.

Table 4-9: Summary of Hotspot Investigations, May-June 2013, Bird River Watershed, Baltimore County, MD

Site ID	Date of Investigation	Type - Description	Hotspot Status (# filled circles)	Observed Pollution Source	Recommended Follow-up Actions / Notes
HSI_K_637	5/28/2013	Commercial - Earth moving equipment sales and repair	Confirmed (13)	Yes	Repair bay / wash bay is draining into parking lot rather than into interior drain. Outdoor storage of 55-gallon drums and other liquids containers without secondary containment. Uncovered dumpsters overflowing with garbage. Recommend for immediate enforcement action as well as future education efforts. Site may also be exceeding 1,320 gallon threshold for ASTs requiring SPCC.
HSI_K_647	5/28/2013	Industrial - Aluminum awning manufacturer	Confirmed (12)	No	Tipped over 55-gallon drum under trailer. One very large AST whose markings were not viewable during inspection visible in interior courtyard. Are spill control measures in place? Partially covered loading dock has many cans of liquids present without secondary controls with catch basin in proximity. Some minor erosion also discovered in front landscaping. They should be included in future education efforts.

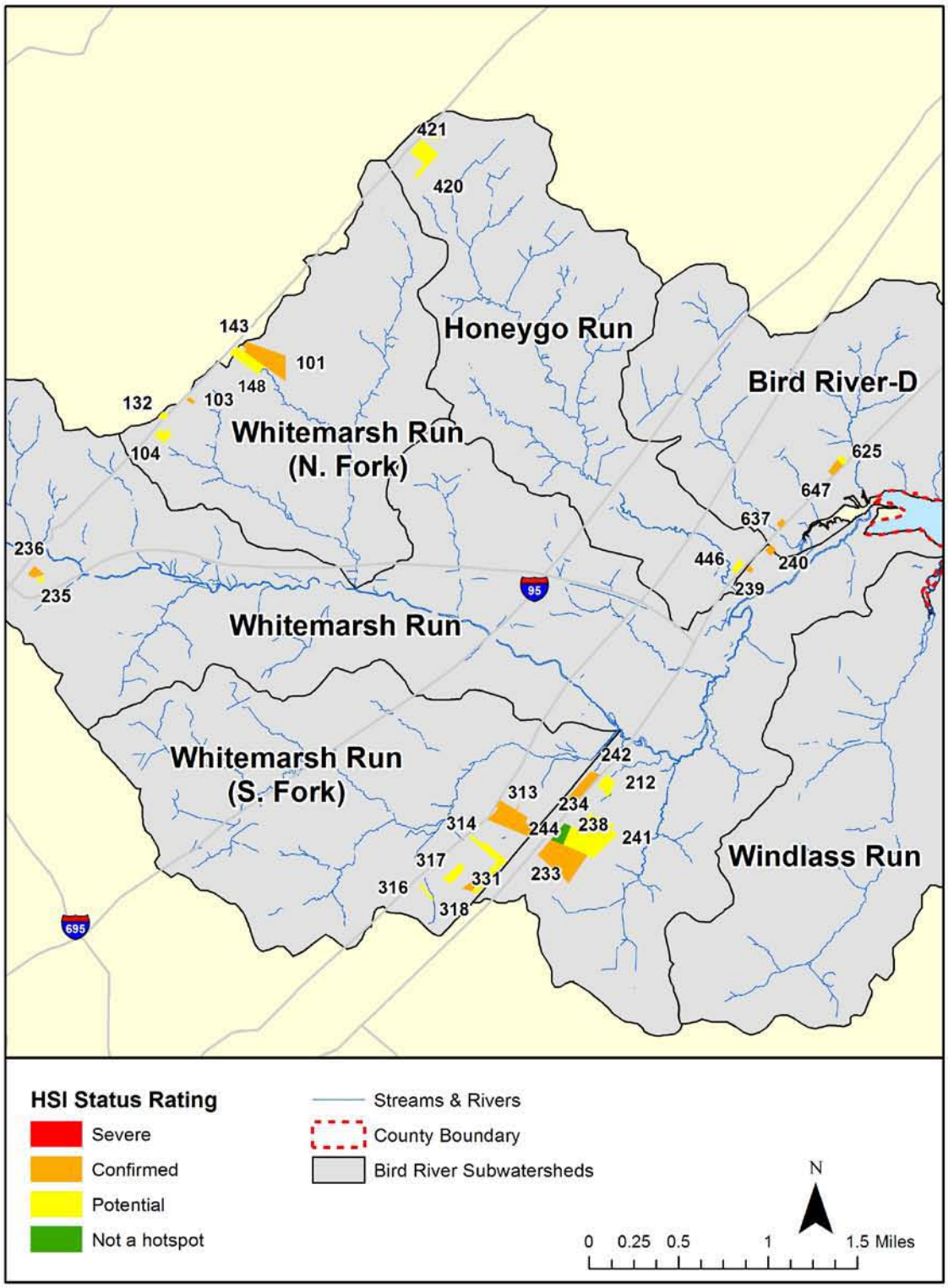

Figure 4-16: Location of Hotspots Investigated in Bird River Watershed, Baltimore County, Maryland in May-June 2013

4.3.3 Results of Investigations

An initial GIS desktop analysis identified 30 potential hotspots to be investigated. However, due to issues regarding site access a number of substitutions were made in the field, as crews identified new areas that were suspected to be likely pollutant sources. In the end a total of 35 hotspot investigations were performed. However, during data entry it was determined that six of these investigations were performed just outside of the Bird River watershed boundary. Forms for these five locations will be submitted to the County separately from this report. The other 29 investigations are included as a part of this report.

All but one of the investigated sites (28 of 29) were commercial-type land uses. The remaining site investigated was an industrial-type land use (aluminum manufacturing). In terms of severity, none of the locations were designated as a “Severe Hotspot.” Thirteen locations were categorized as “Confirmed Hotspots.” A summary of the HSI data may be found in Appendix G. All of the completed HSI forms can be found in Appendix K. Fifteen sites were labeled as “Potential Hotpots” and one site visited was not considered to be a hotspot. 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. Table 4-10 summarizes the field crew reports, as well as subsequent actions taken by the County.

Seven sites had observed pollution sources. Two automobile sales facilities were actively washing vehicles outdoors on asphalt with no control measures. One heavy equipment operator was allowing sediment-laden wash water and perhaps other non-stormwater discharges related to equipment repair to leave the interior of a building and flow into the MS4. Two restaurants had especially messy grease dumpsters and one of those two had food matter strewn around the garbage dumpster. Another restaurant was storing grease-covered fryers outdoors with the apparent intention to wash them on asphalt (as indicated by the adjacent water hose). One trucking repair facility was storing used automotive parts and other garbage in the open.

Messy grease dumpsters were present at almost every restaurant, with very few exceptions. However, only those found to be staining the asphalt/concrete were noted. At some point, the County may want to establish new guidelines for dumpster design and standard operating procedures for filling and emptying of those dumpsters by contractors. Uncovered dumpsters were quite common. In fact, most facilities had uncovered dumpsters. The cleanest, most orderly waste management was found at sites with garbage shoots leading from the interior of buildings into completely enclosed dumpsters. This was not common and only found at larger chain-store facilities.

Selected photographs of commercial HSIs are included below (Figure 4-17 through Figure 4-32).

Table 4-10: Summary of Field Crew Concerns Reported to Baltimore County and Follow-up Actions

Site ID	Date of Report to County	Issues Reported	County Follow-up Actions	Date of Resolution
HSI_K_101	06/21/2013	Fryers sitting behind restaurant in strip mall with nearby hose – concern that they are going to be cleaned outside, and wastewater contaminated with grease and detergents will enter storm drain; another restaurant in the strip mall also has a grease dumpster in need of cleaning	Reported to Environmental Health Services (EHS) and grease cleaned up	7/22/13
Near HSI_K_104	6/21/2013	Grease dumpster and trash dumpster and adjacent areas in need of cleaning	Reported to EHS and grease cleaned up	7/12/13
HSI_K_143	06/21/2013	Food waste on ground around dumpster and being washed into parking lot; grease dumpster also leaking into parking lot	Reported to EHS and grease cleaned up	7/18/13
HSI_K_233	05/29/2013	Facility appears to be washing (or detailing?) cars outdoors without visible controls for wastewater from hose; car wash is also releasing water outside of the bay, should investigate and confirm that this is detergent-free rinse water	Site visit by EPS did not reveal any problems. No evidence of outdoor washing and storm drains were noted nearby.	8/9/13
HSI_K_236	6/21/2013	Area very clean except for a grease dumpster with a shiny trail leading right into storm drain	Reported to EHS and grease cleaned up	7/18/13
HSI_K_239	6/27/2013	PVC pipe drains from building to storm drain, possibly draining food-service related equipment, possible introduction of foodborne pathogens into stormwater; dumpsters are open and draining to storm drain; grease dumpster is at the rear of overflow parking	Reported to EHS, drain line observed to be drained to floor drain which leads to sanitary sewer (PVC probably AC condensate), dumpster and grease issues addressed	8/9/13
HSI_K_240	05/29/2013	No control of wastewater from washing vehicles; potential for contaminated wastewater to enter storm drain during rain events	Reported to MDE. MDE indicated there is no longer car washing going on here.	8/22/13
HSI_K_313	6/27/2013	Poor spill prevention and control practices for outdoor fueling operation	Reported to MDE oil control program on 7/18/13, still awaiting response after several follow up emails and voicemails left	ongoing
HSI_K_317	6/27/2013	Facility may be lacking or not following good spill prevention and control practices; staining around outdoor fueling operation and the dragging hoses.	Reported to MDE oil control program on 7/18/13, still awaiting response after several follow up emails and voicemails left	ongoing

Table 4-10: Summary of Field Crew Concerns Reported to Baltimore County and Follow-up Actions

Site ID	Date of Report to County	Issues Reported	County Follow-up Actions	Date of Resolution
HSI_K_318	6/27/2013	Above-ground tank near entrance to a garage has no collision protection and shows sign of spills; 55-gallon drums stored outside unlabeled and unsealed	Reported to MDE oil control program on 7/18/13, still awaiting response after several follow up emails and voicemails left	ongoing
HSI_K_420	6/27/2013	Noted dry weather discharge into storm drain behind building; may be air conditioning condensate traveling through roof leaders; no smell or unusual odors, but mineral precipitate noted at discharge point; source of discharge should be confirmed	Inlet too deep to access, outfall tested on 8/22/13 behind shopping center. Elevated copper detected. Need to return with extension pole to test inlet.	ongoing
Near HSI_K_420	05/31/2013	Discharge from grease dumpster	Reported to EHS and grease cleaned up	7/22/13
HSI_K_637	05/29/2013	Runoff from indoor power washing running out both sides for front bay – drainage has a direct route to storm drain	Referred to MDE, MDE inspected on 8/27/13 and observed no violations, washwater drains to holding tank in floor of wash bay area	9/11/13
Non-HSI Related (Residential Property)	05/31/2013	Hose from a swimming pool at a private residence directing overflow straight into storm drain	Picture showed hose was draining rainwater from off of the top of the pool cover, no investigation needed	6/24/13

Figure 4-17: Food Fryers Behind Restaurant, Ready to Be Washed with Hose Onto Asphalt, Bird River Watershed, Baltimore County, June 2013

Figure 4-18: Typical Uncovered and Messy Grease Dumpster, Bird River Watershed, Baltimore County, June 2013

Figure 4-19: Uncovered and Messy Grease Dumpster with Obvious Staining Leading Directly to Catch Basin, Bird River Watershed, Baltimore County, June 2013

Figure 4-20. Typical Grease Dumpster with Staining on Asphalt, Bird River Watershed, Baltimore County, June 2013

Figure 4-21. Typical Grease Dumpster with Staining on Asphalt, Bird River Watershed, Baltimore County, June 2013

Figure 4-22. Typical Grease Dumpster with Staining on Ground, Bird River Watershed, Baltimore County, June 2013

Figure 4-23. Typical Uncovered and Messy Grease Dumpster with Staining on Asphalt, Bird River Watershed, Baltimore County, June 2013

Figure 4-24. Unknown Pipe from Restaurant Drainage to a Catch Basin, Bird River Watershed, Baltimore County, June 2013

Figure 4-25: Outdoor Fueling at Private Commercial Site with No Collision Protection, Dragging Hoses, and Significant Signs of Spills; Bird River Watershed, Baltimore County, June 2013

Figure 4-26: Outdoor Car Wash at Used Car Sales Facility, Bird River Watershed, Baltimore County, June 2013

Figure 4-27: Outdoor Car Washing at Car Sales Facility, Bird River Watershed, Baltimore County, June 2013

Figure 4-28: Used Car Parts and Other Garbage Being Stored in the Open at a Truck Service Facility, Bird River Watershed, Baltimore County, June 2013

Figure 4-29: Non-stormwater Discharge From Inside Earth Moving Equipment Maintenance Facility Onto Asphalt and Into Street, Bird River Watershed, Baltimore County, June 2013

Figure 4-30: Abandoned and Unsealed 55-gallon Drums of Material Presumed to Be Roofing Tar, Bird River Watershed, Baltimore County, June 2013

Figure 4-31. Facility with Bulk Liquids Being Stored Outdoors Creating Potential for Non-Stormwater Discharges, Bird River Watershed, Baltimore County, June 2013

Figure 4-32. Outdoor Storage of 55-gallon Drums and Other Bulk Liquids Without Secondary Containment and Outdoor Fueling Without Protection From Collisions, Bird River Watershed, Baltimore County, June 2013

4.4 Institutional Site Investigations (ISI)

The USSR manual does not treat institutional sites as a separate component of the uplands survey; instead, institutions can be assessed using protocols adapted from the HSI protocols. Consistent with all previous Baltimore County SWAPs, a modified version of the HSI field form was used to assess institutional sites since HSI protocols do not exactly match conditions encountered on institutional properties and because institutional areas make up nearly 2.6% percent of the watershed area. The ISI method was first developed and implemented for the Lower Jones Falls and Upper Back River studies and was also used for this Bird River study. Institutions surveyed as part of this study include the following types of community-based facilities: 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). The following subsections describe the methods used to identify and evaluate pollution sources and restoration potential at institutional facilities.

4.4.1 Assessment Protocol

Forty-five examples of institutional properties were identified and selected in the office prior to conducting the field assessment using GIS tax parcel information, land use data, aerial photographs, and an ADC map. These were shown and labeled on aerial field maps created for each site and on larger base maps showing the entire watershed. Unique ID numbers were assigned to ISIs using the classification scheme “ISI_K_101”, where ‘K’ denotes the Bird River watershed and the first number corresponds to a specific subwatershed. Institutional sites were

numbered sequentially in the order they were identified within the watershed. For example, ISIs in Honeygo Run subwatershed (subwatershed code 400) would be identified as 434, 435, etc.

In most cases and when practical, the entire property of an institutional site was walked by the field team to collect necessary data and take photographs. Basic information was filled out first including type of institution, address, and ownership (public or private). Ownership is important because different approaches may be used to contact and work with private versus public institutions. For example, a message may be received differently when coming from the government as opposed to from a non-profit group. Strategies for individual institutions will incorporate these different approaches. The ISI field form includes many of the pollution source categories used on the HSI form. Some of the restoration opportunities and recommended actions from the NSAs and PAAs are also incorporated into the ISI. The focus of ISIs is to identify potential restoration opportunities, educate the community, and provide water quality benefits. The information collected for each of the pollution source and restoration categories are briefly described below.

Tree Planting

Potential tree planting locations at an ISI site were marked on aerial photographs while walking the property. After walking the entire site, the total number of trees that could be planted at the site was estimated based on a 40-foot spacing between trees. Note that previous SWAPs, including Lower Patapsco, estimated potential trees per site based on 15-foot spacing. More accurate numbers of trees can be determined during the post-fieldwork desktop analysis after restoration opportunities have been selected and prioritized.

Exterior

The exterior category is similar to the physical plant category in the HSI, except that it also includes restoration opportunities. The condition of the building(s) and parking lot(s) were noted. Stained, dirty, and damaged/breaking up surfaces were noted as potential pollution sources for both of these components. If no stormwater management was provided for impervious parking areas, this was also considered as a potential pollution source. Exterior storm drain inlets were inspected for evidence of maintenance or wash water dumping and poor erosion/sediment control, cleaning, or material storage practices for construction activities. Any observations of staining, discoloration, or mop threads around a storm drain inlet indicated a potential pollution source as a result of these activities. Building downspouts that were directly connected to the storm drain system or indirectly connected to impervious surfaces were also recorded as potential pollution sources.

Potential restoration opportunities that were evaluated in the exterior category included impervious cover removal and downspout disconnection. Locations where excess impervious cover could be removed were marked on aerial field maps. Examples include unused or underutilized parking areas and abandoned foot paths.

Waste Management

Every institution generates waste as a result of daily operations, but unlike hotspots, it is typically just garbage. The field team noted the type of waste generated (e.g., hazardous, garbage, etc.) and the condition of the dumpsters. Dumpsters with no cover or open lids, with leaks, damaged/in poor condition, and/or overflowing were noted as potential pollution sources.

The field team also observed whether trash was present that could leave the site with wind or rain. Dumpsters located near storm drain inlets or lacking runoff diversion methods were also recorded as potential pollution sources.

Vehicle Operations

Most institutions did not have vehicle operations but a few, such as churches, stored buses on-site. Vehicle operations include maintenance, repair, recycling, fueling, washing, or long-term parking. The presence of any of these activities was noted for each site since they can be a source of metals, oil and grease, and hydrocarbons. For the most part, it appeared the institutions likely only stored vehicles on-site, however CCBC Essex Campus had a vehicle maintenance facility. Outdoor activities including vehicle storage, repair, fueling, and washing were also noted as potential pollution sources when present.

Outdoor Materials

Materials such as mulch piles, storage drums, and de-icing salt are sometimes stored on institution grounds. Locations where materials were loaded or unloaded were examined to determine if areas were uncovered and draining toward a storm drain inlet. Storage areas were evaluated for types of materials stored outdoors and their potential for entering the storm drain system. Uncovered materials and stained storage areas were used as indicators of poor outdoor storage practices and potential pollution sources.

Turf/Landscaping

The percentage of forest canopy, turf grass, landscaping, and bare soil covering the pervious area of a site was recorded on the field form. Sites with more than 20% of bare soil were noted as potential sources of sediment pollution. Ground maintenance activities for turf/landscaped areas were also evaluated. High turf management and improper irrigation practices (non-target/over-watering) were noted since they are potential pollution sources of nutrients, fertilizer, and pesticides. The field team also determined whether landscaped areas drained directly to storm drains or if organics (leaves, grass) accumulated on impervious surfaces. Evidence of buffer encroachment and whether a buffer was adequately planted was also recorded for evaluating restoration potential.

Stormwater Infrastructure

The field team checked whether storm drains were marked and whether stormwater treatment practices were present. These were evaluated for potential pollution sources and restoration potential.

After walking the entire property and evaluating the categories discussed above, one or more of the follow-up actions listed below were recommended based on initial field observations:

- Tree planting
- Storm drain marking
- Downspout disconnection
- Stormwater retrofit
- Education

- Impervious cover removal
- Stream buffer improvement
- Develop a Pollution Prevention Plan
- Trash management

4.4.2 Summary of Sites Investigated

A total of 40 institutions were assessed throughout the Bird River watershed. The number and type of institutions assessed within each subwatershed is summarized in Table 4-11.

Figure 4-33 shows the distribution of the various types of institutions assessed throughout the watershed.

Table 4-11: Types of Institutions Assessed by Subwatershed

Subwatershed	Faith-based	Hospital/ Care Center	Public School	College/ Research Facility	Municipal Facility	Other	TOTAL
Bird River-B	1	0	0	0	0	1	**2**
Bird River-D	0	0	1	0	0	0	**1**
Honeygo Run	3	0	0	0	1	1	**5**
Railroad Creek_Bird River-A	2	0	0	0	0	0	**2**
Whitemarsh Run	7	1	1	0	2	2	**13**
Whitemarsh Run (N. Fork)	6	0	2	0	0	0	**8**
Whitemarsh Run (S. Fork)	4	2	0	1	1	0	**8**
Windlass Run	0	0	1	0	0	0	**1**
Total	**23**	**3**	**5**	**1**	**4**	**4**	**40**

4.4.3 General Findings

The number of the different types of recommended actions for ISIs is summarized in Table 4-12 by subwatershed.

Table 4-12: ISI Recommended Actions by Subwatershed

Subwatershed	# of Trees	Storm Drain Marking	Down-spout Discon-nect	SW Retrofit	Future Educa-tion	Imper-vious Cover Removal	Buffer Improve-ment	Pollution Preven-tion Plan	Trash Manage-ment
Bird River-B	11	0	0	0	0	0	0	0	**0**
Bird River-D	41	1	0	1	1	0	0	0	**0**
Honeygo Run	5	3	0	0	0	0	0	0	**0**
Railroad Creek_ Bird River-A	1	0	0	0	0	0	0	0	**0**
Whitemarsh Run	225	6	5	6	2	1	2	1	**4**
Whitemarsh Run (N. Fork)	220	6	4	7	2	2	0	1	**1**
Whitemarsh Run (S. Fork)	155	8	0	1	1	0	1	1	**3**
Windlass Run	8	1	1	1	1	0	0	0	**1**
Total	**666**	**25**	**10**	**16**	**7**	**3**	**3**	**3**	**9**

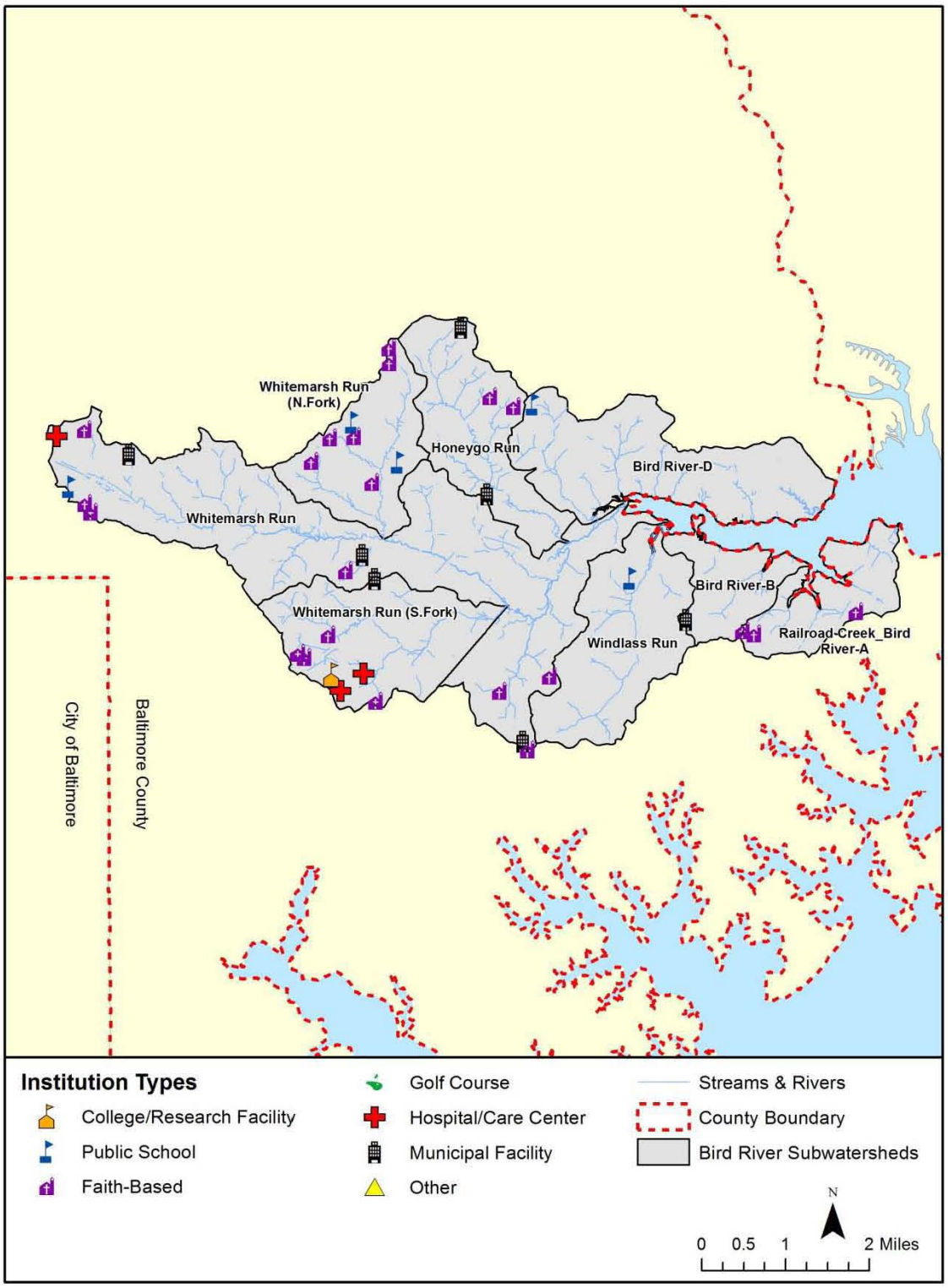

Figure 4-33: ISI Locations in Bird River Watershed

Tree Planting

An estimated 666 trees can be planted at institutions within the Bird River watershed. Trees were recommended for 31 out of the 40 institutions assessed. Tree planting sites were identified in the field and noted on field maps. Small (i.e., less than 10) quantities of trees were recommended for smaller-acreage institutions such as churches while greater numbers of trees were noted as appropriate for larger institutions such as public schools and the Essex Campus of the Community College of Baltimore County (CCBC). Two examples of potential tree planting areas are shown in Figure 4-34. The number of trees was estimated based on 40-foot spacing between trees. Table 4-12 presents planning-level estimates that would be refined through follow-up site investigations if a site is selected for a restoration/improvement project(s). Like street trees, open space shade trees are not only an asset aesthetically but they also provide air and water quality improvement since they intercept precipitation with their leaves and can absorb precipitation and nutrients through their root systems. This infiltration of precipitation through leaves or the root systems slows flow rates and provides some treatment before stormwater runoff reaches the stream network.

Figure 4-34: Potential Tree Planting Areas at ISI-K-329 (Left) and at ISI-K-213 (Right)

Stormwater Retrofits

As presented in Table 4-12, the action that was recommended the most after tree planting was storm drain marking (25 sites). Stormwater retrofits were recommended at 6 public institutions and 10 private facilities (16 sites in all). Downspout disconnection was recommended for 10 sites where sufficient pervious area was available to redirect rooftop runoff into rain gardens.

Bioretention incorporates vegetation and filter media through which storm water infiltrates for pollutant removal prior to groundwater recharge or entering the stream system. An example of a bioretention retrofit opportunity is presented in Figure 4-35. At the Baltimore County Police Department Precinct 9 Barracks, parking lot runoff enters a storm drain inlet via a concrete channel. A bioretention area could be constructed in available space around the inlet to receive, infiltrate, and treat the water. At the Essex Campus of CCBC, the existing stormwater treatment facility located next to a large parking lot could be enlarged so that more of the runoff from the parking area can be more effectively treated. These actions present an opportunity to educate the community about the connection between the storm drain system and Bird River and how their individual actions can improve its water quality.

Figure 4-35: Opportunities for Bioretention Stormwater Retrofits at ISI-K-219 (Left) and at ISI-K-329 (Right)

4.4.3.1 Impervious Cover Removal

As discussed previously, impervious surfaces prevent precipitation from naturally infiltrating into the ground. Because runoff from impervious surfaces is often accelerated and concentrated when it reaches the storm drain and stream systems, it can contribute to stream erosion, habitat destruction, and water pollution. Removing unused or underutilized impervious surfaces will help increase pervious area and the watershed's capacity for infiltrating and treating stormwater runoff.

Impervious cover removal was a recommended action at seven of the 40 institutions investigated. Field investigators recommended impervious area removal in locations where impervious surfaces appeared to be abandoned or underutilized, such as parking lots and walking paths. Of the seven sites recommended for impervious cover removal, one was a public school and the remaining six were faith-based facilities. An example of a good opportunity for impervious cover removal is an under-utilized and under-maintained parking lot at Evangelical Cathedral Church of God (Figure 4-36).

Figure 4-36: Potential Impervious Cover Removal at ISI-K-106

4.4.3.2 Buffer Improvement

Forested buffer areas along streams are important for improving water quality and flood mitigation since they can reduce surface runoff, stabilize stream banks with dense rooting systems, provide shade, remove pollutants including nutrients and sediment from runoff, and provide habitat for various types of terrestrial and aquatic life. Three institutions had streams running through their property which would be potential opportunities for improving inadequate stream buffers by introducing native vegetation and trees. At Immanuel Baptist Church, approximately 250 linear feet of a first order stream crosses the southern corner of the property through a former pasture. At present, there is no riparian buffer on any portion of the stream on the property; however, there is ample room for introducing a 50-foot buffer on both banks. Just downstream is Precinct 9 headquarters of the Baltimore County Police Department. This same stream (Figure 4-37) travels across the southern portion of the property before entering a culvert under Perry Hall Boulevard. At present the buffer is present but inadequate; one bank runs adjacent to Perry Hall Boulevard while the other is near a mowed recreation area. Both banks could be augmented, and, together with buffer improvements upstream (and including private property), could result in a contiguous protective buffer on the upper reach of this stream, nearly to the headwaters. At CCBC Essex Campus, a first order stream crosses a mowed grassy area between a wet pond and Rossville Boulevard. Room is available for creating a robust buffer extending 100 feet from each bank, in conjunction with tree planting in the general area and a retrofit of the current wet pond upstream of the targeted buffer improvement.

Figure 4-37: Potential Stream Buffer Restoration at ISI-K-218 (Left) and ISI-K-219 (Right)

4.4.3.3 Pollution Prevention Planning

A Stormwater Pollution Prevention Plan (SWPPP) establishes procedures for minimizing the potential for pollutants to be carried away in storm water discharges. These procedures emphasize the use of BMPs to provide the flexibility to address varying sources of pollutants at different categories of industrial facilities. If they do not already exist, the development of SWPPPs was recommended at a total of 4 institutional sites in the watershed. Parkville High School, Essex Campus of CCBC, Perry Hall High School, and Baltimore County Police Precinct 9 Barracks were identified as candidates for developing Pollution Prevention Plans if they do not already exist. All of these facilities had outdoor, uncovered fleet fueling areas and in some cases stored chemicals and materials outside in uncovered areas where they have the potential to pollute stormwater (Figure 4-38).

Figure 4-38: Stormwater Pollution Prevention Planning (SWPPP) Opportunities at ISI-K-209 (Left) and ISI-K-329 (Right)

4.4.3.4 Trash and Other Waste Management

Trash/waste management is an area in need of improvement throughout various areas of the watershed, including institutions. A total of nine institutional sites were recommended for trash management action. Waste management education is recommended to address leaking dumpsters, open or uncovered dumpsters where trash can leave the site, and dumpster placement near storm drain inlets or streams. When field investigators noted dumpsters that were open and overflowing with trash or were leaking, those institutions were identified as locations where trash management was necessary (Figure 4-39). Signs of past leakage, such as stains or rust on impervious surfaces, were also noted. Dumpsters with evidence of past leakage include those at CCBC Essex Campus, Vincent Elementary School, Perry Hall Methodist Church, Morningside House Assisted Living, and Perry Hall Middle School. Excess trash or overflowing dumpsters were noted at Perry Hall Methodist Church, Morningside House Assisted Living, and Parkville High School. These trash management problems may be addressed through various measures such as trash campaigns, waste management education, improving bulk trash pick-up options, and community clean-ups.

Figure 4-39: Trash Management Opportunities at ISI-K-216 (Left) and ISI-K-539 (Right)

4.5 Pervious Area Assessment (PAA)

PAAs were conducted to identify and evaluate sites within the Bird River watershed with potential for land reclamation, reforestation, or re-vegetation. Field investigations took place May 3 through May 10, 2013. The following subsections describe the methods used to identify and evaluate restoration potential of pervious areas.

4.5.1 Assessment Protocol

Large parcels of open land throughout the watershed were identified in the office prior to conducting the field assessment using GIS tax parcel information, land use data, aerial photographs, and an ADC map. These were shown and labeled on maps created for NSAs and on larger base maps showing the entire watershed. Upon visiting pervious areas identified in the office, a PAA was conducted if the field team verified the site as having sufficient space and potential for restoration. In some cases, additional sites were identified for PAAs while surveying

other upland areas such as underutilized areas on institutional property and highway medians. The USSR manual recommends assessing publicly-owned pervious areas greater than two acres and privately-owned areas greater than five acres. Because some of the subwatersheds in Bird River are highly urbanized, all sites greater than approximately 1 acre were considered.

Unique ID numbers were assigned to PAAs using the classification scheme “PAA_K_100”, where ‘K’ denotes the Bird River watershed and the first number corresponds to a specific subwatershed. As described in Section 4.1, subwatersheds were assigned numbers of 100-800 for the purposes of labeling PAA sites. Pervious areas were numbered sequentially in the order they were surveyed within a particular subwatershed. For example, PAAs in Whitemarsh Run (N. Fork) would be identified as 101, 102, etc.

The entire property of a PAA site was walked by the field team to collect necessary data and take photographs. Basic information was filled out first including site accessibility, ownership, current management, and whether the site was connected to other pervious area. The area of the site was determined in the office using GIS tax parcel information and aerial photographs.

Access to the site is important when considering its restoration potential. The field team determined in the field whether the site could be accessed by foot, vehicle, and/or heavy equipment. A site that can only be accessed by foot may have less potential for restoration if it requires greater disturbance or costs to restore (e.g., constructing an access road). Ownership is also important because different approaches may be used to coordinate with private versus public institutions. Current management describes the current use of the land including the following: school, park, right-of-way, or vacant land. The presence and type of connected pervious area is also relevant to the restoration potential of a pervious area. For example, if a site connects forested areas, reforesting the site would help to continue the forested corridor for wildlife habitat or stream buffer purposes. If a site is connected to an existing wetland area, it could be reforested to protect the wetland or re-vegetated to extend the wetland area. The other data categories assessed are briefly described below.

Current Vegetative Cover

The current vegetative cover was assessed including the proportion of the site covered by turf, herbaceous, bare soil, trees, or shrubs. Turf management status was also recorded including turf height, mowing frequency, and condition (e.g., thick, sparse, continuous, etc.). The presence of invasive species was noted including percent of site with invasive species and type.

Impacts

Impacts were assessed to indicate the amount of site preparation required to restore the pervious area. Possible impacts noted include soil compaction, erosion, trash and dumping, and poor vegetative health. Significant impacts from any of these factors will influence site preparation required, types of plants that can survive and success of an implemented project.

Reforestation Constraints

Similar to impacts, information regarding factors that may impede reforestation efforts was collected. The type of sun exposure was recorded as full sun, partial sun, or shade. The field team noted whether there was a nearby water source for supplemental water if necessary.

Other constraints related to reforestation that were noted include overhead wires, underground utilities, pavement, and buildings. Private ownership was noted as a potential constraint.

Recommendations for pervious area restoration based on initial field observations included one or more of the following:

- Good candidate for natural regeneration
- May be reforested with minimal site preparation
- May be reforested with Mod. site preparation
- May be reforested with extensive site preparation
- Poor reforestation or regeneration site

4.5.2 Summary of Sites Investigated

A total of 25 pervious areas were assessed within the Bird River watershed, totaling 238.46 acres (Table 4-13). The following numbers of PAAs were conducted according to subwatershed: 2 in Whitemarsh Run (N. Fork); 10 in Whitemarsh Run; 4 in Whitemarsh Run (S. Fork); 5 in Honeygo Run; 3 in Bird River-D; and 1 in Railroad Creek/Bird River-A. Parcel sizes ranged from 0.65-acre to 36.13 acres. Eighteen of the sites assessed were less than 10 acres in size. All sites surveyed were considered as open pervious cover type, but in reality were a mixture of treed, shrubby, and open areas. Figure 4-40 shows the location and size of PAAs within the watershed.

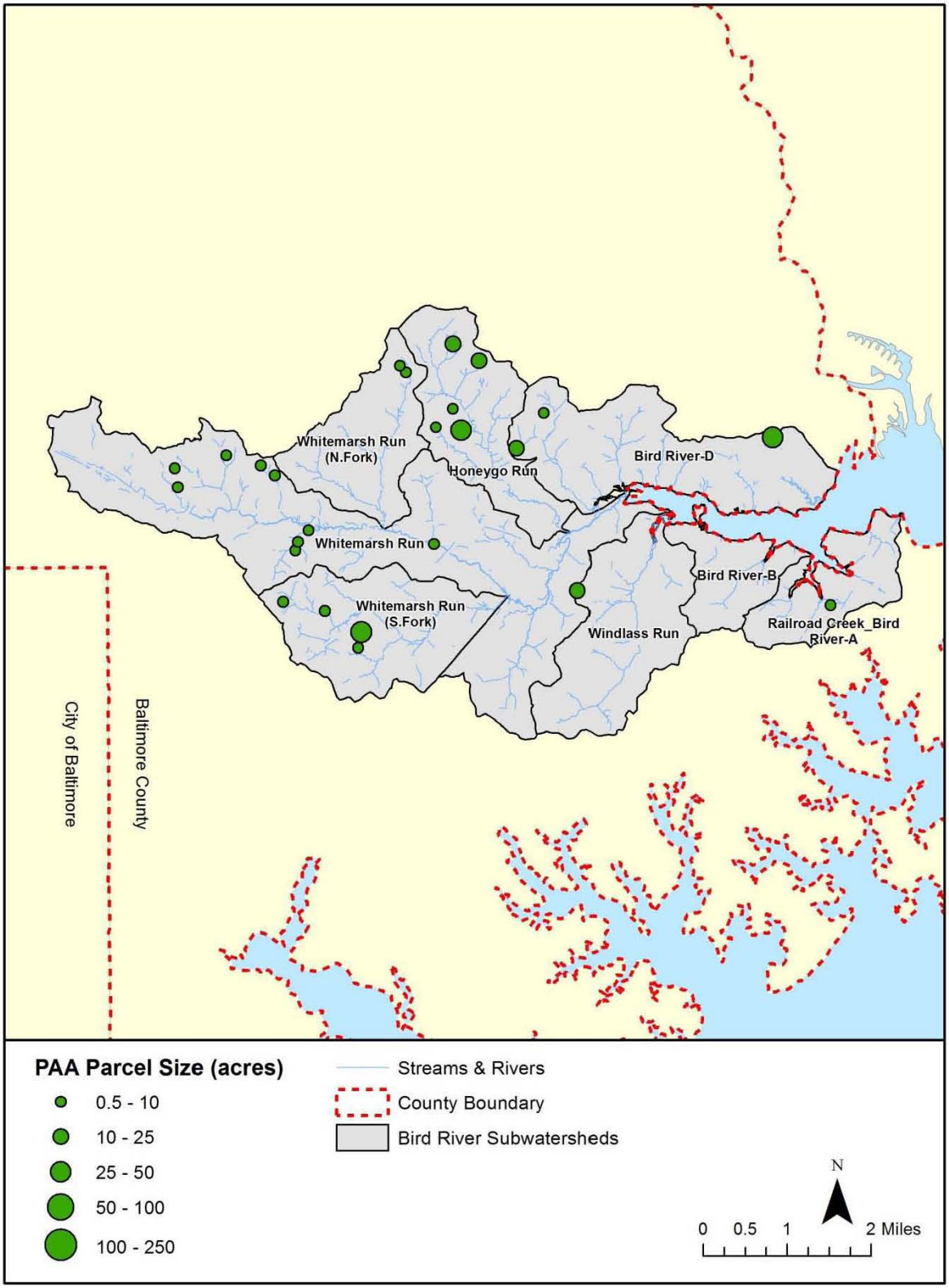

Figure 4-40: PAA Locations in Bird River Watershed

4.5.3 General Findings

A summary of PAA results including parcel size, ownership, management, percent turf cover, and site preparation required for the sites assessed is provided in Table 4-13.

Table 4-13: Summary of Bird River PAA Results

Site ID	Site Name	Total Parcel Size (acres)	Plantable Area (acres)	Ownership	Management	Turf (%)	Site Prep.
PAA_K_101	County Open Space - A	0.78	0.73	Public	Green Space	94	Minimal
PAA_K_102	County Open Space - B	0.82	0.82	Public	Green Space	100	Minimal
PAA_K_203	JHP Open Space	1.18	1.03	Private	Green Space	99	Minimal
PAA_K_204	County Open Space - D	0.72	0.64	Public	Green Space/Park	95	Minimal
PAA_K_205	Belmont Park (non-playing field section)	6.81	2.17	Public	Park	80	Minimal
PAA_K_206	Ridgley's Choice HOA	3.12	0.64	Private	Green Space	30	Minimal
PAA_K_207	SHA - A	1.19	0.38	Public	Green Space	15	Minimal (nat.regen.)
PAA_K_208	SHA - C	10.52	3.61	Public	Green Space	40	Minimal
PAA_K_209	SHA - D	8.09	2.11	Public	Green Space	40	Minimal (nat.regen. in part)
PAA_K_210	County Open Space - G	5.27	1.22	Public	Green Space	20	Minimal
PAA_K_211	Glen Arbor North HOA	0.65	0.55	Private	Green Space	100	Minimal
PAA_K_212	County Open Space - H	5.86	1.43	Public	Green Space	30	Minimal
PAA_K_313	Nottingham Park	36.13	2.83	Public	Park	70	Minimal
PAA_K_314	Winters Manor	2.52	0.78	Public and Private	Green Space	80	Minimal (nat.regen. in part)
PAA_K_315	County Open Space - F	3.39	0.79	Public	Green Space	40	Minimal
PAA_K_316	Mayor & City Council Bureau of Engineering	9.91	1.47	Public	Green Space/Utility	20	Minimal
PAA_K_417	Honeygo Park	35.59	7.26	Public	Park	90	Minimal
PAA_K_418	North Gate Hall Community Association A	8.86	6.39	Private	Green Space	80	Minimal

Table 4-13: Summary of Bird River PAA Results

Site ID	Site Name	Total Parcel Size (acres)	Plantable Area (acres)	Ownership	Management	Turf (%)	Site Prep.
PAA_K_419	North Gate Hall Community Association B	3.08	3.01	Private	Green Space	99	Minimal
PAA_K_420	Perry Hall Crossing II HOA & County	18.15	0.00	Public and Private	Green Space	0	Minimal (nat.regen.)
PAA_K_421	Perry Hall Crossing I HOA	11.00	0.00	Private	Green Space	0	Minimal (nat.regen.)
PAA_K_622	Gunpowder Falls State Park	35.46	23.89	Public	Re-claimed Landfill	95	Extensive
PAA_K_623	Cowenton Avenue Park	20.36	1.19	Public	Park	60	Mod.
PAA_K_624	County Open Space - C	7.51	6.18	Public	Green Space	95	Minimal
PAA_K_825	SHA - B	1.49	0.80	Public	Green Space	0	Minimal (nat.regen. in part)
Totals		238.46	69.92				

Based on the history of previous SWAP assessments in the County, the most likely candidates for successful pervious area restoration 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. Of the 25 sites surveyed, 19 are under public ownership and most were considered to require minimal site preparation (2 of these 19 are under both public and private ownership). These 19 were considered the best opportunities for plantings. All 25 pervious area sites assessed are briefly described below.

County Open Space - A

The County Open Space - A site is located north of Four Mills Road, and is maintained by Baltimore County (Figure 4-41). It is relatively small and is currently covered almost entirely by turf grasses. This site receives full sun exposure and is easily accessible by foot, vehicle, and heavy equipment. There is one very small herbaceous wetland area in the north-central part of the site. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-41: Photos of PAA_K_101, County Open Space - A

County Open Space - B

The County Open Space - B site is located off Ramblebrook Road, southeast of Four Mills Road (Figure 4-42). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. It is completely covered by turf (100%), and receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-42: Photos of PAA_K_102, County Open Space - B

JHP Open Space

The JHP Open Space site (named after the site developer, JHP Open Space LLC) is located off of Upton Road, near its intersection with Kintore Drive (Figure 4-43). It is privately-owned and maintained but is easily accessible by foot, vehicle, or heavy equipment. It is nearly completely covered by turf (99%), and receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-43: Photos of PAA_K_203, JHP Open Space

County Open Space - D

The County Open Space - D site is located east of Ridgely Avenue, south of its intersection with Orbitan Court (Figure 4-44). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. It is nearly completely covered by turf (95%), and receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site (a playground in part) and tree planting could be a potential community project.

Figure 4-44: Photos of PAA_K_204, County Open Space - D

Belmont Park (non-playing field section)

The Belmont Park (non-playing field section) site is located east of Walther Boulevard (Figure 4-45). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. It is nearly completely covered by turf (95%), and receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-45: Photos of PAA_K_205, Belmont Park (Non-playing Field Section)

Ridgley's Choice Homeowners Association (HOA)

The Ridgley's Choice HOA site is located off Foxford Stream Road, near its intersection with Ridgely Choice Drive (Figure 4-46). It is privately-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. About thirty percent (30%) of the site is covered by turf, and it receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-46: Photos of PAA_K_206, Ridgley's Choice HOA

SHA – A

The SHA - A site is located off Belair Road at Necker Avenue (Figure 4-47). It is State-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. About fifteen percent (15%) of the site is covered by turf, and it receives full to partial sun exposure. An overhead electric distribution line and some existing old pavement would present Mod. constraints to tree planting. Further, some areas of small trees exist in parts of the site. We recommend, therefore, that this site is likely a good candidate for natural regeneration. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-47: Photos of PAA_K_207, SHA – A

SHA – C

The SHA – C site is located at the terminus of Hilltop Road, near White Marsh Boulevard (Figure 4-48). It is State-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. About forty percent (40%) of the site is covered by turf, and it receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-48: Photos of PAA_K_208, SHA – C

SHA – D

The SHA – D site is located off Mercantile Road, near its intersection with Cordon Way (Figure 4-49). It is State-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. About forty percent (40%) of the site is covered by turf, and it receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-49: Photos of PAA_K_209, SHA – D

County Open Space - G

The County Open Space - G site is located off Rose Haven Road (Figure 4-50). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. About twenty percent (20%) of the site is covered by turf, and it receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-50: Photos of PAA_K_210, County Open Space - G

Glen Arbor North HOA

The Glen Arbor North HOA site is located at the end of Tulip Poplar Court, off White Marsh Road (Figure 4-51). It is privately-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. The entire site is covered by turf (100%), and it receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-51: Photos of PAA_K_211, Glen Arbor North HOA

County Open Space - H

The County Open Space - H site is located off Cool Meadow Court, off White Marsh Road (Figure 4-52). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. About thirty percent (30%) of the site is covered by turf, and it receives full sun exposure. A steeply-sided stormwater facility exists in the southeastern-most part of the site. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-52: Photos of PAA_K_212, County Open Space - H

Nottingham Park

The Nottingham Park site is located off of King Avenue, near I-95 (Figure 4-53). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. A large part of the park is covered by turf (70%), and receives full sun exposure. A large part of the park consists of playing fields, and would not be suitable for tree planting. One narrow area along the northern part of the park is adjacent to existing forest; tree planting could be completed in this area. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-53: Photos of PAA_K_313, Nottingham Park

Winters Manor Community Association (CA)

The Winters Manor CA site is located off of Chesterfield Way, near its intersection with King Avenue (Figure 4-54). Part of the site is owned and maintained by Baltimore County; the other part is privately owned. It is easily accessible by foot, vehicle, or heavy equipment. A large part of the site is covered by turf (80%), and receives full sun exposure. The part of the site appropriate for tree planting consists of a large open lawn area that is currently regularly mowed; it is privately owned by the Community Association. The southern part of the site, owned by Baltimore County, consists of a stormwater facility that has already been planted with trees along its edges. Reforestation of the site would require verification that it would not interfere with the current use of the site; tree planting could be a potential community project.

Figure 4-54: Photos of PAA_K_314, Winters Manor Community Association

County Open Space - F

The County Open Space - F site is located off Springhouse Circle, near its intersection with Babikow Road (Figure 4-55). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. About forty percent (40%) of the site is covered by turf, and it receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-55: Photos of PAA_K_315, County Open Space - F

Mayor & City Council Bureau of Engineering

The Mayor & City Council Bureau of Engineering site is located off of Perry Hall Boulevard, near its intersection with Ridge Road (Figure 4-56). The site is owned and maintained by the City of Baltimore. It is easily accessible by foot, vehicle, or heavy equipment. About twenty percent (20%) of the site is covered by turf, and receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-56: Photos of PAA_K_316, Mayor & City Council Bureau of Engineering

Honeygo Park

The Honeygo Park site is located off of Honeygo Boulevard (Figure 4-57). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. A large part of the park is covered by turf (90%), and receives full sun exposure. Much of the park consists of playing fields, and would not be suitable for tree planting. Two narrow areas could be planted along the edges of the playing fields on a parcel of the park to the west of Honeygo Boulevard. In addition, several narrow areas could be planted along the edges of the football field, playing fields, and parking lots of the main part of the park. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-57: Photos of PAA_K_417, Honeygo Park

North Gate Hall Community Association – A

The North Gate Hall Community Association – A site is located off of Bowline Road, near its intersection with Vicky Road (Figure 4-58). It is privately-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. A large part of the site (80%) is covered by turf, and it receives full sun exposure. Some of the eastern part of the site contains non-tidal wetlands associated with a pond that drains south to a perennial stream. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-58: Photos of PAA_K_418, North Gate Hall Community Association – A

North Gate Hall Community Association – B

The North Gate Hall Community Association – B site is located off of Kahl Avenue, near its intersection with Joppa Road (Figure 4-59). It is privately-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. Virtually the entire site (99%) is covered by turf, and it receives full sun exposure. The site appears to consist of well-drained uplands. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-59: Photos of PAA_K_419, North Gate Hall Community Association – B

Perry Hall Crossing II HOA & County

The Perry Hall Crossing II HOA & County site is located off of Cross Road and Cross Brook Drive, near Honeygo Boulevard (Figure 4-60). Part of the site is owned and maintained by Baltimore County; the other part is privately-owned. It is easily accessible by foot, vehicle, or heavy equipment. This site, however, consists of parcels of existing County Forest Conservation Areas, and they already either possess mature trees, or have been planted with sapling trees. Even though no tree planting is prescribed here, this site should be inspected regularly for problem invasive species; they should be removed as soon as practicable.

Figure 4-60: Photos of PAA_K_420, Perry Hall Crossing II HOA & County

Perry Hall Crossing II HOA

The Perry Hall Crossing II HOA & County site is located off of Cross Brook Drive, southwest of Honeygo Boulevard (Figure 4-61). The site is privately-owned. It is easily accessible by foot, vehicle, or heavy equipment. This site, however, consists of parcels of existing County Forest Conservation Areas, and they already possess mature trees, or have been planted with sapling trees. Even though no tree planting is prescribed here, this site should be inspected regularly for problem invasive species; they should be removed as soon as practicable.

Figure 4-61: Photos of PAA_K_421, Perry Hall Crossing II HOA

Gunpowder Falls State Park

The Gunpowder Falls State Park site is located off of Days Cove Road (Figure 4-62). It is State-owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment, although some relatively steep areas are present. This site is immediately adjacent to the (active) Baltimore County Eastern Landfill, and appears to be reclaimed landfill that has been annexed into the state park. A large part of the park is covered by turf (95%), and receives full sun exposure. Reforestation of the site would require verification that tree planting is an acceptable action according to health and safety plans for closing of this part of the landfill.

Figure 4-62: Photos of PAA_K_622, Gunpowder Falls State Park

Cowenton Avenue Park

The Cowenton Avenue Park site is located off of Cowenton Avenue, northwest of I-95 (Figure 4-63). It is owned and maintained by Baltimore County, and is easily accessible by foot, vehicle, or heavy equipment. A large part of the park is covered by turf (90%), and receives full sun exposure. Much of the park consists of playing fields, and would not be suitable for tree planting. Three small areas in the southwestern part of the park (adjacent to the southern parking lot) could be planted with trees. Another long, linear parcel in the northern part of the park (at the base of the slope and immediately north of the playing fields) could also be planted with trees. A large area to the south of the existing playing fields consists of an existing County Forest Conservation Areas, and they already possess mature trees. Even though no tree planting is prescribed for this area, it should be inspected regularly for problem invasive species; they should be removed as soon as practicable. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-63: Photos of PAA_K_623, Cowenton Avenue Park

County Open Space – C

The County Open Space - C site is located off Peach Blossom Avenue, near its intersection with Joppa Road (Figure 4-64). It is owned and maintained by Baltimore County, and is easily

accessible by foot, vehicle, or heavy equipment. From aerial photography, it appears that this site is a former peach orchard (property immediately east of Peach Blossom Avenue consists of an active peach orchard). Virtually the entire site (95%) is currently covered by turf, and it receives full sun exposure. Reforestation of the site would require verification that it would not interfere with the current use of the site and tree planting could be a potential community project.

Figure 4-64: Photos of PAA_K_624, County Open Space – C

SHA – B

The SHA – B site is located off Ebenezer Road, near its intersection with Harewood Road (Figure 4-65). It is State owned and maintained, and is easily accessible by foot, vehicle, or heavy equipment. None of the site is covered by turf, and it receives full to partial sun exposure. Much of the ground at the site is currently covered in a deep layer of recycled wood chips. The central part of the site possesses open areas that are not treed; these present good areas for tree planting. The peripheries of the site should be allowed to naturally regenerate, with invasive species management. Reforestation of the site would require verification that it would not interfere with the current use of the site; tree planting could be a potential community project.

Figure 4-65: Photos of PAA_K_825, SHA – B

CHAPTER 5: RESTORATION AND PRESERVATION OPTIONS

5.1 Introduction

This chapter presents an overview of the best management practices (BMPs) potentially suitable for the Bird River watershed. There is a significant difference in land cover and runoff characteristics between residential and agricultural areas, and the difference extends to stormwater BMPs as well. For that reason, potential treatment approaches for the Bird River watershed are discussed based on those that apply to developed areas and those applicable to agricultural lands. In addition, citizen awareness activities, volunteer restoration programs, and land preservation options are discussed.

5.2 Best Management Practices for Developed Areas

5.2.1 County Restoration Programs

5.2.1.1 Stormwater Management Upgrades

Stormwater Management Conversion

Older stormwater management facilities were typically designed only for flood control and have little to no pollutant removal capacity. However, these facilities can generally be altered to capture and retain stormwater runoff to provide water quality benefits. Consideration must be given to the pond's storage capacity and overflow outlets to ensure the structure is capable of handling large storm events. Conversion to an extended detention facility typically requires adjustments to the facility's outlet structure. This will result in water quality benefits by allowing sediments and pollutants to settle out, in addition to controlling the amount of runoff entering receiving waters. Wetland vegetation can be planted in and around an extended detention pond for additional environmental benefits. Dry detention ponds have the greatest potential for conversion to extended detention BMPs.

Stormwater Retrofits

Retrofitting involves the implementation of stormwater management controls in developed areas where previous practices did not exist. Stormwater retrofits improve water quality by capturing, slowing and treating runoff before it reaches receiving water bodies. Retrofits are targeted towards specific objectives, depending on BMP type; objectives may include water quality, soil stabilization, and runoff flow control. Several considerations must be taken into account to select appropriate stormwater treatment measures such as ecological benefit, available land area, cost, and community acceptance. There are factors which limit the effectiveness of stormwater retrofitting, such as insufficient land area in an appropriate portion of the subwatershed (i.e., no available area large enough to intercept a significant amount of runoff). Small-scale BMPs such as bioretention for parking lot/alley retrofits can be effective if space is limited. See Section 5.5 for more information about these and other citizen-led BMPs.

5.2.1.2 Stream Corridor Restoration

Stream corridor restoration practices are used to enhance the ecological function, stability, and riparian habitat of degraded stream corridors. These types of practices typically involve a comprehensive approach using earth-moving equipment to address wide-spread channel degradation. Stream corridor restoration practices are often combined with stormwater management upgrades and riparian enhancement practices to meet watershed restoration objectives. Primary practices considered for Bird River watershed stream corridors include stream restoration, buffer restoration, and wetland restoration.

Stream Restoration

Stream restoration projects are implemented to restore physical, biological, and/or ecological function to a natural watercourse which has become degraded. Degradation of a stream often occurs due to changes in the watershed, such as an increase in impervious surface and/or vegetation removal, and alterations made to the channel itself, such as straightening, lining with concrete or gabions, and/or culvert installation for road crossings.

The goal of stream restoration is to return a degraded channel to a stable state, one in which it does not significantly erode or fill with sediment, can convey runoff for a range of storm events, and has improved ecological function.

A sound restoration project should utilize native materials such as rock, wood, and vegetation to imitate a natural, self-sustaining and ecologically functional stream system. The design approach of a stream restoration project requires an extensive quantity of field collected data and scientifically defensible calculations to determine the appropriate size, shape, and planform of the degraded channel. The design should take into account existing and possible future land use within the watershed. Hydrology and stormwater management practices upstream of a restoration site will dictate the velocity and volume of runoff that will reach a site. In addition, the sediment supply of the upstream channel is also an important consideration during the design of a stream restoration.

Implementation of a stream restoration project usually involves grading of the earth to reconfigure the shape and planform of the degraded channel and/or using structural controls where required for optimal hydrological and ecological function. Stream restoration utilizes a number of techniques to stabilize eroded stream banks, prevent stream bed degradation, recreate habitat, and protect adjacent infrastructure such as utilities, roads and structures. Bank stabilization improves water quality by attenuating the erosion of soils and adhered pollutants, in addition to reducing the likelihood of sewer line breaks. Appropriate placement of bed features and the use of grading and/or structures dissipates energy, creates a variety of aquatic habitats, and oxygenates the water.

Buffer Restoration

Riparian buffers are vegetated areas along rivers, streams, and shorelines that help stabilize banks and prevent erosion; filter pollutants such as sediment and nutrients; provide wildlife habitat; and aid in regulating stream water temperatures. Several portions of the Bird River watershed stream system have inadequate riparian buffers as a result of human activities.

This restoration strategy enhances or reforests areas adjacent to streams with a variety native trees, shrubs, and herbaceous plantings. Plants are selected based on the growing conditions

at each site and the plant's requirements. Implementation of targeted educational programs can teach private and institutional property owners that having vegetation along the stream can help preserve their property, as well as about what plants are appropriate for their site and the water quality benefits of riparian buffers. The inclusion of stream buffer signs is one way to remind residents of the importance of this essential vegetation.

Wetland Creation

Wetlands are highly valuable lands in terms of their ability to both improve water quality by filtering and slowing runoff, and as critical habitat for many species. A wetland is an area of land that has a specific soil type that remains wet or covered with water, and native vegetation that is adapted to these conditions. Swamps, marshes, and bogs are all types of wetland. Unfortunately, many wetlands were drained and converted to land useable for agriculture or development before their importance was realized. One strategy entails the reintroduction of wetlands in settings where they have been lost in the past but favorable conditions still exist. Unfortunately, due to the very specific parameters required, it can be difficult to create and sustain new wetlands. Preservation of the few remaining wetlands and limiting changes to hydrology in the landscape adjacent to existing wetlands are key strategies for watershed protection.

5.2.1.3 Reforestation

The Community Reforestation Program (CRP) was established by Baltimore County*s Department of Environmental Protection and Sustainability (EPS) to provide a dedicated workforce for planting, monitoring, and maintaining forest mitigation projects. The program is funded through fees-in-lieu of mitigation for forests removed as a result of public and private land development, as required by the implementation of the County's Forest Conservation Act and Chesapeake Bay Critical Area Regulations. The CRP is the only full-time county-wide reforestation mitigation program among Maryland's counties.

The CRP includes a four-person reforestation crew that carries out year-round reforestation operations. The crew is based at a one-acre site in eastern Baltimore County that is provided by the Department of Recreation and Parks. This home base houses a growing out nursery for 13,000 tree seedlings; equipment and machinery needed for planting, monitoring, and maintaining the reforestation projects; and office space for the reforestation team. Occasionally, the CRP will undertake special grant-funded projects to improve water quality and groundwater recharge, as well as wildlife habitat. The most recent example is the expansion of forest buffers and the reforestation of fields on private rural properties.

In addition to mitigatory reforestation, the newly named Sustainability and Forest Management program in EPS is working to increase tree canopy in support of the County's Tree Canopy Goals announced in spring 2013, and to increase total tree cover by about 1,500 acres by 2025 as part of the County's Chesapeake Bay Watershed Implementation Plan (WIP). County revenues from the State-mandated stormwater remediation fees will be used mostly for contractor-installed reforestation projects. Planting in urban areas will include street trees; County facilities; and managed urban lands such as apartments, condominiums, businesses, and private institutions. Trees will also be planted by homeowners who purchase potted saplings through the County's Big Trees sales. EPS will also track citizen planting projects on County lands under the Policy & Guidelines for Community Tree Planting Projects. The Gunpowder Valley Conservancy organizes citizens' tree planting projects. Contractor-installed

planting in rural areas will include large-lot rural residential subdivisions, properties with conservation easements, and other properties where landowners want to increase tree cover.

5.2.2 County Management Programs

Municipal management programs can directly support watershed restoration efforts through services, monitoring, and development review. Street sweeping, inlet cleaning, and trash and recycling collection are services that help protect water quality. The Illicit Discharge Detection and Elimination Program monitors stormwater outfalls to identify any potential contamination. The land development review process imposes a rigorous review of impacts to natural resources. This section describes these municipal programs.

5.2.2.1 Street Sweeping

Baltimore County has an active street sweeping program to remove debris, dirt, and pollutants from the roads before they enter the storm drain system. Effective street sweeping usually involves using a vacuum assisted sweeper, and a schedule that takes into account factors such as trash pickup days and seasonal changes, such as leaf litter in the fall and more frequent lawn care activities by residents in spring and summer.

5.2.2.2 Inlet Cleaning

The Baltimore County storm drain system consists of approximately 1,760 miles of storm drain pipe, 72,096 inlets, and 8,640 outfalls. To keep the entire system clean of trash, debris, and sediment, the Department of Public Works maintains three storm drain cleaning vehicles. Each vehicle has a two man crew and operates each day, cleaning the storm drains and pipes. Removing the material from the storm drain system reduces street flooding, a potential safety hazard, and aids in the detection of illicit connections.

5.2.2.3 Illicit Discharge Detection and Elimination Program

The county's illicit connection program ensures that all discharges to and from the municipal separate storm sewer system that are not stormwater are either permitted by the Maryland Department of the Environment (MDE) or eliminated. The County is required to screen a minimum of 150 storm drain outfalls annually for the purposes of detecting and removing these unpermitted discharges. The illicit connection program is responsible for performing outfall screenings, reporting screening data, and coordinating remedial actions. The illicit connection program also investigates illicit connection complaints from other agencies, citizens, or volunteers in the Stream Watch Program. Stream Watch allows citizens to adopt a stream, which includes tracking the health of that stream and reporting problems or potential problems they observe.

Routine outfall screenings for detection of illicit connections complements screenings and follow-up triggered by citizen reports of problems they observe. The routine outfall screenings catch the chronic problems that may be missed by the public, such as chlorine leaks from the municipal water supply. Citizens provide additional surveillance at a level beyond that of the monitoring staff. A majority of the time citizens call while they are actually observing a problem and often can provide immediate local information that increases the chance of eliminating illicit

connections. The illicit connections program also recently began taking data on potential retrofit opportunities at the outfalls that are investigated.

5.2.2.4 Waterway Dredging

Dredging of tidal waterways to restore or enhance use and navigability for both recreational and commercial boat traffic is an integral component in the management of the County's waterways. Recreational and commercial boating and the industries it supports have developed into a significant component of the County's economy.
Baltimore County DEPRM initiated a comprehensive dredging program in 1987 to address the demand for dredging and to identify and control the sources of sediment in waterways. The funding for the dredging program is typically cost shared between Maryland Department of Natural Resources (DNR) and Baltimore County funds. The State DNR funding is from the State Excise Tax, which is generated from the tax on the sale of boats; thus, the state funds are used to benefit boaters. In order to systematically address issues and establish a County-wide program, a study was completed in 1988 to develop priorities for all the tidal waterways in the County. The report prioritized 63 segments of 26 creeks. The study evaluated the volume of material to be dredged and the number of boaters benefiting from each dredging project. This report has been used as a tool for implementation of the County's program.

Baltimore County EPS administers the dredging program which includes: collecting the necessary data to determine the need for dredging; identifying environmental constraints; evaluating dredged material placement opportunities; applying for State and Federal Permits; assisting spur applicants with permit applications; and the design and construction management for the project. Baltimore County also identifies problems and implements necessary corrections to improve water quality for each creek through water quality improvement projects. Baltimore County DEPRM planned, designed, permitted and oversaw the construction of dredging projects on Bird River in 1982 and 2003.

Bird River was last dredged in 2003. Funding is not currently available to initiate the design of a dredging project. However, Baltimore County did have a bathymetric (depths/bottom characteristics) survey conducted by Maryland DNR in 2010, which confirmed that some maintenance dredging is needed. Baltimore County EPS intends to keep submitting for the State funding even though the State Waterway Improvement Program has denied our request for the past two years, mainly due to the poor revenue associated with the vessel/boat sales that support the fund. EPS applied again this year and is currently awaiting a response from Maryland DNR. Once funding is secured a design will need to be completed and permits secured. Most likely a dredging project is several years out. One positive and huge hurdle already passed is that EPS has an approved material disposal site adjacent to the Bird River. For more information on dredging in Bird River, please contact Baltimore County EPS, Watershed Restoration section at 410-887-2904.

5.2.2.5 Land Development Review

New development and redevelopment projects undergo a rigorous review for impacts to natural resources. Regulations are in place for the protection of stream buffers, forests, tidal shorelines, groundwater, and stormwater runoff. In addition, on-site inspections take place during the construction process for erosion and sediment control. Tidal shoreline protection must be inspected before a development project is released for occupancy. Stormwater facilities must be confirmed to be functional one year after construction before "close-out" can occur and security

bonds are returned to the developer. After construction is complete, stream buffers and forest conservation areas are inspected on a random basis for compliance. The following are the current regulatory programs applicable to the development and redevelopment plan review process and follow-up inspections.

Riparian Forest Buffers

Baltimore County enacted the Regulations for the Protection of Water Quality, Streams, Wetlands and Floodplains in 1991. These regulations require development designs to include a 75- or 100-foot stream buffer and include provisions for expansion of the riparian buffer for steep slopes, wetlands, and floodplains. Development plans must minimize stream and buffer road crossings, have stormwater management facilities and outfalls outside of the riparian buffer, and place utilities outside the buffer to the extent possible. In cases where fish passage is an issue, stream crossings should be either open bottom bridges or provide for low flow fish passage. These regulations are intended to maintain the integrity of the riparian buffer.

Forest Conservation

The main purpose of the Maryland Forest Conservation Act, enacted in 1991, is to minimize the loss of Maryland's forest resources during land development by making the identification and protection of forests and other sensitive areas an integral part of the site planning process. EPS oversees local implementation of these regulations during the development review process and conducts inspections during the construction and post-construction closeout process. Of primary interest are areas adjacent to streams or wetlands; those on steep or erodible soils; or those within or adjacent to large contiguous blocks of forest or wildlife corridors. Identification of priority areas is completed prior to design of the development plan. Any construction activity or development proposal for an area that is 40,000 square feet (approximately one acre) or greater is subject to the Forest Conservation Act and requires a Forest Conservation Plan prepared by a licensed forester, licensed landscape architect, or other qualified professional.

Chesapeake Bay Critical Area

The Chesapeake Bay Critical Area law and criteria were designed to foster more sensitive land use and development activity along the tidal shorelines and to ensure the implementation of appropriate long-term conservation measures to protect important habitats. The law identified the "Critical Area" as all land within 1,000 feet of the mean high water line of tidal waters or the landward edge of tidal wetlands. The Critical Area Act, passed in 1984, was significant and far-reaching, and marked the first time that the state and local governments jointly addressed the impacts of land development on habitat and aquatic resources.

Groundwater Management

The Groundwater Management section of EPS is charged with the responsibility of managing and protecting the groundwater resources of Baltimore County. It handles issues related to drinking water wells, septic systems, and removal of residential underground storage tanks. These systems are regulated during the development review process and property title transfers to protect residents and groundwater resources.

Stormwater Management

Stormwater management in the State of Maryland has evolved over time, with the initial emphasis on quantity control in the mid to late 1980s, to quantity and quality control in the 1990s, to the more recent emphasis on channel protection (one-year storm management) and diffusing stormwater over the site (Low Impact Development [LID]). The control of erosive flows through stormwater management augments the riparian forest buffer in the protection of natural resources. The latest state regulations, revised and updated by MDE in 2009, require Environmental Site Design (ESD) to the Maximum Extent Practicable (MEP). ESD is using a combination of planning practices, alternate ground cover, and small-scale practices, which in combination, are intended to retain, infiltrate, and treat as much runoff as possible on-site (MDE 2000). Development or redevelopment projects that were already in the process of seeking approval for stormwater management plans at the time the new regulations were enacted were "grandfathered" in under the older regulations – in other words, they were granted a waiver so that they could complete their projects without needing to seek additional funding or investment for regulations that did not exist at the time the projects were designed. These projects were required to attain final project approval by May 4, 2013, when all waivers were set to expire. Jurisdictions were permitted to grant extensions in special cases; no waivers were permitted to extend beyond May 4, 2017.

Erosion and Sediment Control

Baltimore County has authority delegated from the Maryland Department of the Environment to enforce the State Erosion and Sediment Control Program. The main function of this program is to monitor best management practices (BMPs) for sediment from new development and redevelopment during the construction phase. These practices prevent sediment and other pollutant inputs into the storm drain system and stream network. The sediment control BMPs are specified in the sediment and erosion control plan for each development site. Sediment control plans are required for any construction activity disturbing an area greater than 5,000 square feet. Standard Plans are used in lieu of Sediment and Erosion Control Plans approved by the Baltimore County Soil Conservation District for residential construction activities that disturb less than 30,000 square feet and for all other construction activities that disturb less than 20,000 square feet.

5.2.2.6 Trash and Recycling

Single Stream Recycling

All recyclables (e.g., plastics, glass, metals, paper, and cardboard) are collected co-mingled at the curbside or in the alley for all single-family homes. The majority of multifamily complexes (apartments, condominiums) also have single stream recycling collection each week. Under this program, recycling rates increased as a result of a greater number of accepted materials, convenience of placing everything in the same container, and weekly pickup. Recycling saves energy, helps protect natural resources, reduces air and water pollution, extends the life of the Eastern Sanitary Landfill, and saves the County money.

Household Hazardous Waste Collection

In response to numerous requests from citizens and elected officials concerned with disposal of hazardous wastes from their own homes, Baltimore County citizens can drop off household hazardous waste materials for recycling or proper disposal at a permanent processing facility located at the Eastern Sanitary Landfill Solid Waste Management Facility. Materials dropped off for processing include unwanted household chemicals, such as paints, flammable cleaning

solvents, automotive fluids, pesticides, pool chemicals, acids, mercury thermometers, gasoline, corrosive material, etc. In addition, EPS holds two one-day collection events annually, in the spring and fall, at different locations around Baltimore County.

Waterway Trash Boom

Trash can collect in storm drains and then enter waterways, where it poses additional hazards: fish, birds, and mammals may ingest plastic materials or become tangled in debris; garbage may smother or damage aquatic habitat; and waste materials may harbor pathogens or leach toxic substances into the aquatic environment. Refuse also detracts from the aesthetic and recreational value of streams and rivers. Floating trash booms may be installed on targeted waterways to intercept and corral trash and debris, preventing it from spreading throughout a river system. Designs vary, but a typical boom consists of a series of floats, a curtain that hangs below the water surface, and a bottom anchor to keep the boom in place. These booms require maintenance and frequent cleaning, particularly after rain events.

Baltimore County has installed and manages one trash boom located in the tidal Back River area. This boom was installed in 2010 and is maintained by a local citizen-based watershed group using grant funds supplied by Baltimore County.

5.3 Best Mangement Practices for Agricultural Areas

There are a large number of agricultural practices that are used by farmers to reduce soil loss, trap nutrients, and minimize the amounts of nutrients and pesticides used on the land. For many of these agricultural best management practices (BMPs), the Chesapeake Bay Program has assigned specific reduction efficiencies for nitrogen, phosphorus, and sediment to each practice. The following descriptions of agricultural BMPs are derived from the Natural Resource Conservation Service (NRCS) and further information is available at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/

5.3.1 Farm Conservation Plans

A Soil Conservation and Water Quality Plan (SCWQP) is a comprehensive plan that addresses natural resource management on agricultural lands and describes BMPs that will be used to control erosion and sediment loss, and manage runoff. SCWQPs include management practices (*e.g.* crop rotations) and structural practices (*e.g.* grassed waterways and diversions). At the request of a farmer, a Soil Conservation District (SCD), Maryland Department of Agriculture (MDA), or U.S. Department of Agriculture NRCS professional provides assistance to determine the group of practices needed to address environmental concerns specific to the farm. The practices are designed to reduce erosion to an acceptable level and to be compatible with management and cropping systems. A SCWQP can be used for up to ten years without revision, if substantial changes in the farm's operation or management do not occur. Nutrient reduction is only one of many benefits derived from SCWQPs. Also included in a SCWQP are recommendations concerning forestry management; wildlife habitat and plantings; and other natural resources management. SCWQPs are required on agricultural land in the critical area by The Code of Maryland Regulations (COMAR 27.01.06.03 C). These plans must be approved by SCD and updated every five years; enforcement authority lies with MDE. Plans are also required on agricultural land under preservation easement, such as Coastal Rural Legacy, and

enforcement of these plans are by the holder of the easement. BMPs that have been installed in Bird River are discussed below.

Cover Crops

Use of cover crop entails growing a crop of grass, small grain or legumes and is primarily for seasonal protection and soil improvement. Cover and green manure crops are grown on cropland, orchards, vineyards, and certain recreation and wildlife areas where seasonal benefits of a cover crop are needed. These crops are usually plowed under or desiccated to accommodate the primary crop being produced on the site. This practice controls erosion; adds fertility and organic material to the soil; improves soil tilth; takes up excess nutrients; and increases infiltration and aeration of the soil. In orchards, this practice is also used to increase populations of bees for pollination purposes. In addition, cover and green manure crops have beneficial effects on water quantity and quality. Cover crops act as a filter and reduce the movement of sediment and pathogens, as well as dissolved and sediment-attached pollutants.

Nutrient Management

Nutrient management involves managing the amount, placement, and timing of plant nutrients in order to obtain optimum yields and minimize the risk of surface and groundwater pollution. The practice may be used on any area of land where plant nutrients are applied to enhance yields and maintain or improve chemical and biological condition of the soil. The source of plant nutrients may be from organic wastes, commercial fertilizer, legumes, or crop residue. The objective is to apply the proper amount of nutrients at the proper time to achieve the desired yield and minimize entry of nutrients into surface or groundwater supplies.

Integrated Pest Management

Integrated pest management (IPM) is an approach for reducing the adverse effects of weeds, insects and diseases on plant growth, crop production, and natural resources. This practice establishes the acceptable thresholds of a pest and its effects and then determines the appropriate measures necessary to stay below those thresholds. IPM includes appropriate cultural, biological, and chemical controls, and combinations thereof. The pest management programs developed are designed to address both crop production goals and environmental concerns

Residue and Tillage Management – Mulch Till

Mulch tilling is a technique used to manage crop residue on a year-round basis in order to limit erosion to an acceptable rate, conserve soil moisture, and maintain or improve soil tilth. This practice is generally applied to cropland but may also be used on other areas where field crops are grown, such as wildlife or recreation lands. The term mulch tillage refers to non-inversion tillage methods (*e.g.* chiseling and disk harrowing) that partially incorporate organic material left on the soil surface. The benefits of this practice are significant. Soil slowly but steadily improves when erosion is reduced and organic matter increases. Soil tilth improves and productivity increases as the constant supply of organic material left on the soil surface is decomposed by a healthy population of earth worms and other organisms.

Residue and Tillage Management – NoTill

No till is a technique used to manage the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round. Crops are planted and grown in narrow slots or tilled strips, established in the untilled seedbed of the previous crop. The objective of this practice is to maintain most of the crop residue on the soil surface throughout the year. The practice may be referred to as no-till, zero-till, slot plant, rowtill, strip-till, or simply generic term conservation tillage. The common characteristic of this practice is that the only tillage performed is a very narrow strip prepared by coulters, sweeps, or similar devices attached to the front of the planter. Weeds and other pests are generally managed by using agriculture chemicals. The chemicals used are approximately the same as those used with a tillage based system, but a "no-till" residue management system requires a higher level of technology and management than a more conventional tillage system. The fields must be scouted on a regular basis and the farm operator must be very familiar with the pests, understand the concept of pest threshold populations, and be aware of other IPM technologies. The benefits of this practice are significant. Erosion is usually reduced to an acceptable level due to the protective residue left on the surface. Soil organic matter increases, as do the populations of beneficial soil organisms, such as earth worms. The soil tilth improves, and productivity increases as the constant supply of organic material left on the surface is decomposed by more robust populations of soil organisms.

Conservation Crop Rotation

Conservation crop rotation entails growing various crops on the same piece of land in a planned sequence. This sequence may involve growing high residue producing crops, such as corn or wheat, in rotation with low residue producing crops, such as vegetables or soybeans. The rotation may also involve growing forage crops in rotation with various field crops. The effects of crop rotation on the land vary with the soil type, crops produced, farming operations, and how the crop residue is managed. The most effective crops for soil improvement are fibrous-rooted, high-residue producing crops such as grass and small grain. Perennial plants used for forage are very effective in crop rotations due to increases in organic matter and reduced soil erosion. In addition, crop rotations help break insect, disease and weed cycles. Rotations add diversity to farm operations and often reduce economic and environmental risks. Crop rotation is a low cost practice that often forms the basis for other conservation practices. Practices such as residue management, contouring, stripcropping, diversions, terraces and grassed waterways may not function properly without a planned crop rotation.

Stripcropping

Stripcropping is growing crops in a systematic arrangement of strips across the field to reduce soil erosion by water and/or wind. This practice is used on cropland, as well as certain recreation and wildlife lands where field crops are grown. The crops are arranged so that a strip of grass or close-growing crop is alternated with a clean tilled strip or a strip with less protective cover. Generally the strip widths are equal across the field. On sloping land where sheet and rill erosion are a concern, the strips are laid out on the contour or across the general slope. Where wind erosion is a concern, the strips are laid out as close to perpendicular as possible to the prevailing erosive wind direction.

5.3.2 Nutrient Management Plans

Nutrient management plans (NMPs) are comprehensive plans required by MDA that describe the optimum use of nutrient inputs for crop yield to minimize loss of excess nutrients to the environment. A NMP details the type, rate, timing, and placement of nutrients for each crop. Soil, plant tissue, manure and/or sludge tests are used to assure optimal application rates. Plans are prepared either by University of Maryland Extension or by certified private consultants. Though some of these plans are written to cover a three year period, most are revised every year so that they incorporate management, fertility, and technology changes.

5.4 Citizen Awareness Activities

Residents and businesses can engage in behaviors and activities that can negatively influence water quality, including over-fertilizing lawns, using excessive amounts of pesticides, poor housekeeping practices (such as inappropriate disposal of paints, household cleaners or automotive fluids), and dumping into storm drains. Alternatively, positive behaviors such as tree planting, disconnecting downspouts, and picking up pet waste can help improve water quality. Whether a pollution prevention program is designed to discourage negative behaviors or encourage positive ones, targeted education is needed to deliver messages that promote changes in behavior. Local watershed organizations, such as the GVC, and other civic groups, such as the Master Gardeners, are in a position to influence these changes using pollution prevention education and outreach to teach citizens how to properly care for the watershed.

5.4.1 Stormwater Runoff

A survey regarding people's knowledge about stormwater was conducted in 2007 by the Herring Run Watershed Association and the Jones Falls Watershed Association (both organizations are now part of Blue Water Baltimore) in conjunction with OpinionWorks. It concluded that even citizens who want to reduce the negative impacts of stormwater runoff do not realize their role in controlling runoff. By slowing and reducing the amount of stormwater runoff, more water can infiltrate into the ground and lessen damaging stormwater surges into streams. Annually, Baltimore County holds a one-day truckload sale of rain barrels for citizens to purchase. There is more detail on this and other ways that homeowners can help reduce stormwater runoff in section 5.5.

5.4.2 Pet Waste/Bacteria Awareness

Pet waste is one of the contributors of bacteria to streams and can cause health problems in humans. A pet waste station is a sign reminding pet owners of the importance of proper disposal of pet waste and it usually includes a supply of bags for pet waste cleanup. Often it is located next to an existing trashcan or it includes one. Pet waste stations can help neighborhoods to reduce bacteria flowing into their local streams and help to keep their neighborhood park or school site clean. Citizens can participate by monitoring the supply of bags to make sure they are continually available. In collaboration with other county agencies, EPS is developing an awareness campaign for better pet waste management.

5.4.3 Fertilizer Reduction

A well-manicured and responsibly maintained lawn can be an asset to the watershed. Too often, however, over fertilization and irresponsible pest management result in pollutant-charged runoff to local streams. Significant reductions of total nitrogen to stormwater can be achieved through careful fertilizer management. Homeowners should be reminded to follow the fertilizer

application instructions so that it is applied in the correct amount, during the right season, and under the right conditions so that the fertilizer does not wash away in a rainstorm. Citizens can be more cognizant about fertilizer placement so that it doesn't land on driveways and sidewalks where it may wash directly into the street and storm drain system. The County also promotes eco-friendly lawn care, including the use of mulching lawn mowers that reduce the need for fertilizer and decrease the amount of material handled by the yard material collection program.

5.4.4 Trash and Recycling

Compost Bins

Baltimore County holds a one-day compost bin sale for residents to purchase bins for composting yard waste in their backyards. By composting leaves and weeds in backyard bins, the amount of material handled by the municipal yard material collection is reduced. Use of compost is an environmentally friendly way of improving soil and avoids the application of manufactured chemical fertilizer. This event is held in conjunction with the annual rain barrel sale.

Stewardship Projects

EPS provides assistance in planning and advertising local stewardship projects such as Project Clean Stream, an annual stream cleanup hosted by the Alliance for the Chesapeake Bay.

Reuse Directory

The Reuse Directory is a listing of reuse organizations for Baltimore County residents and businesses that is available online and in print. In it are all of the places that you can take unwanted items for reuse, including construction materials, appliances, office supplies, clothing, household items, automobiles, food, medical equipment, and more. By donating reusable items, you will: help other people and organizations, reduce disposal costs, reduce air and water pollution, and conserve space in the landfill. The directory is published by the Baltimore County Bureau of Solid Waste Management
http://resources.baltimorecountymd.gov/Documents/Public_Works/solidwastemanagement/reuse130927web.pdf

The Re-Source Newsletter

The Re-Source Newsletter is an online resource that is published quarterly and provides information and updates about Baltimore County's solid waste reduction, reuse, recycling, and refuse disposal programs.
http://www.baltimorecountymd.gov/Agencies/publicworks/recycling/newsletter/index.html

5.4.5 Environmental Awareness and Education

Outreach and education programs are intended to communicate to the public how to reduce the potential for pollutants to reach waterways. These programs are designed to change pollutant-causing behaviors by providing information on how certain habits and actions affect water quality and to recommend new behaviors that can reduce impacts. There are also a number of activities that can reduce runoff or improve water quality that don't involve pollution prevention, such as landscaping improvements, which could be the target of an outreach program.

A pollution prevention program can be designed to discourage negative behaviors and/or encourage positive behaviors. Either way, the goal is to deliver a tailored message through targeted education to promote behavior changes. Local watershed organizations such as the Gunpowder Valley Conservancy can help influence these changes using pollution prevention education and outreach to teach citizens how to properly care for the watershed. The upland assessments described in Chapter 4 identified pollution prevention or source control education programs which could be effective in the Bird River watershed.

Community-based facilities present good opportunities for educating the public about water quality issues and opportunities for improving the health of the watershed. This can be accomplished by implementing water quality BMPs such as rain gardens and bioretention areas at these sites. In addition to environmental education, these BMPs have water quality and aesthetic benefits for property users. Tree plantings present great opportunities for community involvement and education, as do water quality sampling and monitoring of stormwater management.

5.5 Volunteer Restoration Programs

There are several restoration activities that citizens in the watershed can engage in to help restore and protect the watershed. These activities are described in the following sections and include downspout disconnection, BayScaping, tree canopy improvement, fertilizer reduction/education, planting open space trees, and participating in a citizen stream watch program. The GVC, as well as the Master Gardeners, can provide education and workshops on these activities.

5.5.1 Downspout Disconnection

In addition to road runoff, rooftops can sometimes contribute stormwater directly into streams. Many downspouts are connected directly to the storm drain system through underground pipes, while others are funneled toward driveways and sidewalks, which then are connected to the street. By redirecting downspouts to a pervious area, this runoff is allowed to infiltrate the ground in areas such as gardens and lawns.

Downspout disconnection refers to several practices that capture or treat rooftop runoff from individual downspouts through either a simple disconnection that allows the runoff to spread across the lawn or yard where it filters or infiltrates into the ground, a rain barrel that captures the runoff for re-use in watering gardens, or a rain garden that infiltrates the runoff. Several of the neighborhoods assessed in the Bird River watershed were recommended for downspout disconnection because they are draining to impervious surfaces such as driveways, sidewalks, or the curb and gutter system.

Simple downspout disconnection can be achieved, where appropriate, if the downspouts are relocated to drain onto pervious areas (i.e. lawn). This will allow rooftop runoff to be filtered by vegetation, and soak into the ground. This decreases flow to local streams during storm events, reducing erosion and pollutant loads to streams.

The use of rain barrels for the collection and reuse of the runoff is a highly sustainable practice, and is effective when there is limited space on the property and other disconnection practices are not possible. Downspouts are directed into rain barrels, where rooftop water is captured and

stored for later use to water the yard or garden, or simply to be released onto a pervious area on a dry day.

Finally, some of the residential lots in the watershed have sufficient room for rain gardens, which are the most desirable option in terms of water quality. Rain gardens capture runoff from impervious surfaces such as roofs, roads, patios and driveways. They are planted with native perennials and shrubs that are compatible with wet soils. A downhill area that naturally collects rain water is an ideal location for a rain garden. The garden temporarily holds runoff, allowing it to gradually percolate into the ground, thus replenishing groundwater and reducing floods. Garden plants naturally filter pollutants and improve the water quality.

5.5.2 BayScaping

Numerous water quality benefits are achieved from converting turf into landscaping and through increasing the area of urban tree canopy. A BayScape is a designed feature that uses native plants to provide habitat for local and migratory animals, improve water quality, and reduce the need for chemical pesticides and herbicides. BayScaping plants, such as trees, shrubs and perennials, are able to make better use of rain water than typical lawn grasses, and so require less watering once established. They are also better at trapping and removing nitrogen and pollutants from rain water so that it is not released into nearby waterbodies. A BayScape is also valuable for the gardener or landowner because it offers greater visual interest than lawn; reduces the time and expense of mowing, watering, fertilizing, and treating lawn and garden areas; and can address areas with problems such as erosion, poor soils, steep slopes, or poor drainage. The removal of exotic, invasive plant species also benefits native plant and animal communities.

5.5.3 Tree Canopy Improvement

Programs to promote tree planting in residential yards and commercial open space can increase the tree canopy, increase evapotranspiration and interception, slow runoff, and allow greater infiltration of stormwater into the ground due to tree roots reducing soil compaction. Trees also reduce erosion by holding soil and by reducing the impact of rain to bare ground. These types of programs also provide an opportunity to involve volunteers from neighborhoods, businesses, and schools to help plant trees throughout the watershed while also educating the community about the importance of trees for air and water quality.

Baltimore County holds the Big Tree Sale; the County has its own native tree nursery for county reforestation projects. Twice a year, in the spring and fall, trees from the nursery are made available to the public to encourage planting of native trees, especially oaks, which have exceptional water quality, air quality, and wildlife benefits. Trees are sold at one-day sale events.

The State of Maryland's TREE-MENDOUS program provides high-quality, native trees and shrubs, available at reasonable prices, for plantings on public lands. The trees may be planted in places such as community open spaces, schools, government facilities, and rights-of-way. They may not be planted at private residences.

5.5.4 Fertilizer Reduction/Education

Proper lawn and turf care practices can reduce excess nitrogen, phosphorus, insecticides, and herbicides from getting into local streams. Education on soil testing, fertilizer application, and pesticide use is intended to reduce the amount of these materials applied to the land.

5.5.5 Stream Watch Program

The Stream Watch Program is intended to develop citizen stewardship through participation of citizen volunteers who actively assume the responsibility of caring for segments of the stream network by observing changes in the system, providing stream clean-ups, and participating in planting activities. The Stream Watch Program also includes identification of potential restoration projects for possible inclusion in the Waterway Capital Improvement Program and provides a valuable addition to the county's Illicit Connection Program through reports of potential illicit discharges by Stream Watch participants. The GVC organizes the Stream Watch Program within the Bird River watersheds and works with Baltimore County EPS in reporting the outcomes of these activities.

5.5.6 Open Space Trees

Open pervious areas (i.e., areas covered with turf grass, rather than pavement or forest) and natural area remnants provide important natural groundwater recharge functions within a subwatershed, and should be optimized to promote natural infiltration. These areas also present an opportunity for reforestation in the watershed. Reforestation is the best way to improve the infiltration, recharge function, and pollutant reduction capability of a site. Other techniques, such as soil aeration, amendments, and establishing native plantings or meadows may be used when reforestation is not an option, as all of these alternatives still provide greater benefit(s) than turf grass. Ideal sites for planting have little evidence of soil compaction, invasive plants, or trash/dumping, and can be reforested with minimal site preparation.

5.6 Institutional Initiatives

There are several restoration activities that institutions in the watershed such as churches and schools can engage in to help restore and protect the watershed. These activities are described in the following sections.

5.6.1 Parking Lot Retrofits

Often large parking surfaces are included in commercial and institutional development projects for events that occur very infrequently. If reducing the impervious cover is not an option, then filtering practices can provide a substantial benefit when applied over large areas. Onsite commercial and institutional retrofit practices often include the use of sand filters, bioretention, and grass swales adjacent to parking lots. Larger redevelopment projects often include underground storage or filtering systems. Several research groups are exploring innovative parking surfaces to develop a surface that is both durable and porous. These surfaces are another option for providing better filtration of runoff, while still allowing for the same number of parking spaces.

5.6.2 Open Space Planting

An increasing number of faith-based institutions are showing interest in adopting conservation landscaping practices. This often begins with removal of unused turf areas at these institutions. These areas are then replaced by an assortment of more sustainable and environmentally-friendly practices. Options include: planting trees, restoring wildlife habitat, introducing no-mow zones, and creating meadows, all of which also improve the quality and quantity of stormwater runoff. Trees planted near buildings provide wind protection and shade, which can reduce energy use, leading to lower heating and cooling costs. When lawn area is eliminated there is less mowing required, reducing fossil fuel consumption and the associated air pollution.

5.7 Land Preservation

Land preservation complements the implementation of BMPs by insuring that land use is stabilized over time. Unlike park land, land preservation maintains certain restrictions on the land's use in perpetuity. The restrictions range from limits on development to specific resource protection, such as forest, stream buffer or prime land protection.

These preservation areas may be large, multi-parcel blocks or small, individual parcels. Land preservation in Baltimore County complements the long-term multifaceted efforts to limit sprawl and protect rural resources, water supplies, and rural economies. The limitations on the property vary depending on the principle of the easement program, and as specifically limited by the Deed of Conservation Easement. For example, the Maryland Environmental Trust easements provide for a broad array of environmental protection restrictions. The Agricultural Protection programs focus on protection of prime and productive soils, while still permitting resource extraction. Rural Legacy blends these two objectives.

For purposes of watershed management, an understanding of existing protected lands can provide a starting point in prioritizing potential protection and restoration activities. In many cases, protected lands may provide a better opportunity for restoration projects simply because the risk of the land being converted to development is removed, thus the investment involved in the implementation of the practice is secure. A summary of current conservation easements is provided in Chapter 2.

Descriptions of the land preservation programs in effect in the Bird River watershed follow.

5.7.1 Maryland and County Rural Legacy Programs

Baltimore County, in partnership with the GVC, participates in the State's Rural Legacy Program. The program was developed in 1997 to protect large, continuous tracts of valuable cultural and natural resource lands through state grants made to local land trusts. Within the Bird River watershed, Baltimore County has 130 acres in the state-approved Coastal Rural Legacy, which aims to protect large blocks of farmland, forest, wetlands, and other environmental resources that affect Chesapeake Bay both directly and indirectly. Protection is afforded through the purchase of development rights and the placement of a perpetual Conservation Easement on the property. The easements are held by the GVC, state or county, or a combination. In all cases, the land trust and the governmental co-holder of the easement are responsible for monitoring the property to assure compliance with the easement.

5.7.2 Maryland Environmental Trust and Local Land Trusts

Created by the Maryland General Assembly in 1967 to protect Maryland's natural environment, the Maryland Environmental Trust (MET) seeks donated easements on farms and forestlands, wildlife habitats, waterfront acreages, natural areas, historic sites, and other valuable and scenic features. In 1974, a landowner in Baltimore County was one of the first to protect their property through this program. Today, Baltimore County remains a leader in the state, with county landowners preserving over 18,500 acres through donations, 35 acres of which are in the Bird River watershed. Although both MET and local land trusts prefer to accept donations on lands greater than 25 acres, local land trusts are often willing to work with smaller property owners. Donations are accepted throughout the year. Landowners may qualify for a significant tax deduction and/or credit. MET also provides loans to qualified groups for the purchase of land for preservation.

5.7.3 Maryland Agricultural Land Preservation Foundation

Created in 1979, this program has been dedicated to preserving farmland and fostering commercial agriculture. With joint funding by the county and the state, over 22,000 acres of farmland have been preserved in Baltimore County, 105 acres of which are located in the Bird River watershed. To qualify for this program, a farm must be a minimum of 50 acres or located adjacent to a preserved property. Applications to sell development rights may be made annually by July 1st following enrollment in an Agricultural District. Landowners receive cash payments for participating in the easement program.

5.7.4 Baltimore County Agricultural Land Preservation Program

Created in 1994 to preserve working family farms, this Baltimore County program has used innovative and collaborative funding mechanisms for land preservation. Landowners have protected over 5,600 acres through this program, though no farms within the Bird River watershed are currently enrolled in this program. To participate, a farm must be 50 acres in size or located adjacent to a preserved property.

5.8 Public Lands/Open Space

Lands in the SWAP area, owned by Baltimore County, Baltimore City, and the State of Maryland, meet various public needs as described.

Baltimore County Department of Recreation and Parks

Belmont Park

Belmont Park is a 43-acre park located in the Parkville community. Amenities include trails, athletic fields, a playground and a picnic area. The Parkville Recreation Office manages daily operations and reservations for this park.

Cowenton Ridge Park

Cowenton Ridge Park is a 25-acre park located in White Marsh. Amenities include athletic fields, a playground and a nature trail. Facilities at this park are managed by the White Marsh/Perry Hall Recreation Office.

Honeygo Run Regional Park

Honeygo Run Regional Park is a 206-acre park that provides both indoor and outdoor recreational opportunities to the community. Amenities include a community center, pavilions, athletic fields, a playground, and an extensive walking path and trail system. Additional information regarding these facilities is available through the Perry Hall Community Office. http://www.baltimorecountymd.gov/Agencies/recreation/programdivision/region3/honeygorglpark.html

Maryland Department of Natural Resources

Gunpowder Falls State Park

Gunpowder Falls State Park is the largest of Maryland's state parks, encompassing over 18,000 acres. The Days Cove section of the park is located within the Bird River watershed. It includes 4.5 acres of forested wetland that were constructed and planted in 1998 through a joint partnership between MDE and Maryland DNR. The Days Cove area is also part of the Baltimore County Public Schools' (BCPS) Outdoor Science Education Program; the Harry Schmuck Environmental Education Center is located there.

CHAPTER 6: REFERENCES

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APPENDIX F: STREAM CORRIDOR ASSESSMENT (SCA) DATA SUMMARY

Bird River SCA Survey
Channel Alteration

Subshed	Site	Type	Bottom Width (ft)	Perennial Flow	Sediment Deposition	Vegetation	Road Crossing	Channelized Length Above Road (ft)	Channelized Length Below Road (ft)	Severity
Bird River-D	072C2-CA32	Rip-rap	3	Y	N	Y	No			Low Severity
Bird River-D	072C2-CA37	Rip-rap	5	Y	N	N	Below		20	Low Severity
Bird River-D	072C2-CA41	Rip-rap	2	Y	N	N	No			Minor
Bird River-D	072C2-CA45	Rip-rap	2	Y	N	N	No			Minor
Bird River-D	072C2-CA60	Concrete	2	Y	N	N	Below		50	Mod.
Bird River-D	072C2-CA64	Other	8	Y	N	N	No			Low Severity
Bird River-D	072C2-CA67	Rip-rap	5	Y	N	N	Below		5	Low Severity
Bird River-D	072C2-CA78	Rip-rap	4	Y	N	Y	Below		30	Minor
Bird River-D	072C2-CA90	Concrete	1	N	N	N	No			Severe
Bird River-D	072C3-CA51	Concrete	6	Y	N	Y	Below		340	Minor
Bird River-D	072C3-CA55	Concrete	8	Y	N	Y	No			Low Severity
Bird River-D	072C3-CA58	Concrete	8	Y	N	N	No			Minor
Bird River-D	072C3-CA66	Rip-rap	2	Y	N	N	No			Minor
Bird River-D	073A3-CA08	Rip-rap	6	Y	N	Y	Below		160	Low Severity
Bird River-D	073A3-CA09	Rip-rap	8	Y	N	Y	Below		10	Minor
Bird River-D	073A3-CA11	Concrete	8	Y	N	N	Below		130	Mod.
Honeygo Run	072B1-CA02	Concrete	10	Y	N	N	Below		20	Mod.
Honeygo Run	072B1-CA22	Concrete	6	Y	N	N	Below		20	Low Severity
Honeygo Run	072B1-CA31	Concrete	1	Y	N	N	No			Low Severity
Honeygo Run	072B1-CA37	Concrete	2	Y	N	Y	No			Minor
Honeygo Run	072B1-CA39	Concrete	1	N	N	Y	No			Minor
Honeygo Run	072B2-CA06	Rip-rap	15	N	N	N	No			Low Severity
Honeygo Run	072B2-CA09	Rip-rap	10	Y	N	N	Below		60	Low Severity
Honeygo Run	072B2-CA12	Rip-rap	8	Y	N	N	Above	70		Low Severity
Honeygo Run	072B2-CA16	Rip-rap	2	Y	N	N	Below		90	Minor
Honeygo Run	072B2-CA18	Rip-rap	3	Y	Y	Y	No			Minor

Bird River SCA Survey
Channel Alteration

Subshed	Site	Type	Bottom Width (ft)	Perennial Flow	Sediment Deposition	Vegetation	Road Crossing	Channelized Length Above Road (ft)	Channelized Length Below Road (ft)	Severity
Honeygo Run	072B2-CA18	Rip-rap	0	N	N	Y	No			Minor
Honeygo Run	072B2-CA21	Rip-rap	4	Y	Y	N	Above	40		Minor
Honeygo Run	072B2-CA31	Rip-rap	5	Y	N	N	No			Mod.
Honeygo Run	072B2-CA34	Concrete	5	Y	N	N	Below		20	Low Severity
Honeygo Run	072B2-CA36	Gabion	2	Y	N	N	Above	20		Low Severity
Honeygo Run	072C1-CA02	Rip-rap	3	Y	N	N	Above	10		Minor
Honeygo Run	072C2-CA04	Rip-rap	6	Y	N	N	No			Minor
Honeygo Run	072C2-CA20	Rip-rap	3	Y	N	Y	Below		40	Minor
Honeygo Run	072C3-CA05	Concrete	8	Y	N	N	No			Minor
Honeygo Run	072C3-CA08	Concrete	6	Y	N	N	No			Minor
Honeygo Run	072C3-CA13	Concrete	12	Y	N	Y	No			Minor
Honeygo Run	072C3-CA22	Rip-rap	3	N	N	Y	Below		30	Minor
Honeygo Run	072C3-CA29	Concrete	2	Y	N	N	No			Minor
Honeygo Run	072C3-CA32	Rip-rap	15	Y	N	N	Above	30		Minor
Honeygo Run	072C3-CA37	Concrete	10	Y	N	Y	No			Minor
Honeygo Run	072C3-CA39	Concrete	8	Y	N	Y	No			Minor
Honeygo Run	072C3-CA41	Concrete	10	Y	N	N	No			Mod.
Honeygo Run	072C3-CA74	Gabion	6	Y	N	Y	No			Minor
Honeygo Run	072C3-CA79	Rip-rap	15	Y	N	N	Below		30	Minor
Whitemarsh Run	071B3-CA09	Gabion	3	N	N	N	No			Mod.
Whitemarsh Run	071B3-CA100	Rip-rap	10	Y	N	N	No			Low Severity
Whitemarsh Run	071B3-CA105	Concrete	15	Y	N	N	Below		50	Low Severity
Whitemarsh Run	071B3-CA11	Gabion	4	Y	N	Y	No			Low Severity
Whitemarsh Run	071B3-CA113	Gabion	6	Y	N	N	Below		10	Minor
Whitemarsh Run	071B3-CA12	Gabion	10	Y	N	Y	Below		20	Low Severity
Whitemarsh Run	071B3-CA15	Rip-rap	3	Y	N	N	No			Minor
Whitemarsh Run	071B3-CA19	Rip-rap	5	Y	N	N	No			Low Severity

Bird River SCA Survey
Channel Alteration

Subshed	Site	Type	Bottom Width (ft)	Perennial Flow	Sediment Deposition	Vegetation	Road Crossing	Channelized Length Above Road (ft)	Channelized Length Below Road (ft)	Severity
Whitemarsh Run	071B3-CA27	Rip-rap	10	Y	Y	Y	No			Minor
Whitemarsh Run	071B3-CA42	Rip-rap	4	Y	Y	N	Below		40	Low Severity
Whitemarsh Run	071B3-CA61	Concrete	8	Y	N	N	No			Severe
Whitemarsh Run	071B3-CA69	Rip-rap	6	Y	N	N	Below		30	Low Severity
Whitemarsh Run	071B3-CA73	Concrete	8	Y	N	N	Above	140		Very Severe
Whitemarsh Run	071B3-CA83	Concrete	6	Y	N	N	No			Low Severity
Whitemarsh Run	071B3-CA88	Concrete	10	Y	N	N	Below		130	Severe
Whitemarsh Run	071B3-CA91	Gabion	8	Y	N	N	Below		100	Mod.
Whitemarsh Run	071C2-CA05	Other	3	Y	Y	Y	No			Low Severity
Whitemarsh Run	071C2-CA12	Gabion	4	Y	Y	N	Below		120	Low Severity
Whitemarsh Run	071C3-CA01	Rip-rap	5	Y	N	N	Below		280	Low Severity
Whitemarsh Run	071C3-CA110	Gabion	4	Y	N	N	Below		70	Low Severity
Whitemarsh Run	071C3-CA112	Gabion	3	Y	Y	Y	Above	30		Minor
Whitemarsh Run	071C3-CA125	Rip-rap	15	Y	N	N	No			Minor
Whitemarsh Run	071C3-CA129	Rip-rap	6	N	N	N	Below		50	Low Severity
Whitemarsh Run	071C3-CA131	Other	15	Y	N	N	Below		110	Low Severity
Whitemarsh Run	071C3-CA133	Rip-rap	3	N	N	N	Below		480	Minor
Whitemarsh Run	071C3-CA141	Concrete	4	Y	N	N	Below		30	Low Severity
Whitemarsh Run	071C3-CA16	Gabion	8	Y	Y	N	Both	50	50	Mod.
Whitemarsh Run	071C3-CA44	Gabion	6	Y	N	N	No			Low Severity
Whitemarsh Run	071C3-CA48	Rip-rap	6	Y	Y	Y	Below		40	Low Severity
Whitemarsh Run	071C3-CA68	Rip-rap	4	N	N	N	Below		20	Low Severity
Whitemarsh Run	071C3-CA78	Concrete	4	Y	N	N	No			Minor
Whitemarsh Run	071C3-CA80	Gabion	4	N	N	N	No			Severe

Bird River SCA Survey

Channel Alteration

Subshed	Site	Type	Bottom Width (ft)	Perennial Flow	Sediment Deposition	Vegetation	Road Crossing	Channelized Length Above Road (ft)	Channelized Length Below Road (ft)	Severity
Whitemarsh Run	071C3-CA84	Rip-rap	5	Y	N	N	No			Low Severity
Whitemarsh Run	071C3-CA87	Gabion	8	Y	N	N	No			Low Severity
Whitemarsh Run	071C3-CA89	Rip-rap	3	Y	Y	N	No			Low Severity
Whitemarsh Run	081C1-CA01	Rip-rap	8	Y	Y	N	Above	60		Low Severity
Whitemarsh Run	081C1-CA02	Rip-rap	3	Y	N	Y	Above	290		Minor
Whitemarsh Run	081C1-CA15	Gabion	2	Y	Y	Y	Below		200	Low Severity

Bird River SCA Survey
Erosion

Subshed	Site	Channel Condition	Cause	Avg. Exposed Bank Ht. (ft)	Land Use Left Bank	Land Use Right Bank	Infrastructure Threat	Severity
Bird River-D	072C2-ES24	Stage I Incision	Pipe outfall	6	Lawn	Shrubs and small trees	N	Severe
Bird River-D	072C2-ES30	Stage I Incision	Other	3	Forest	Forest	N	Low Severity
Bird River-D	072C2-ES31	Stage II Widening	Land use change	2	Forest	Forest	N	Low Severity
Bird River-D	072C2-ES35	Stage II Widening	Below road crossing	3	Forest	Forest	N	Low Severity
Bird River-D	072C2-ES40	Stage II Widening	Land use change	2	Forest	Forest	N	Low Severity
Bird River-D	072C2-ES46	Stage II Widening	Other	4	Forest	Shrubs and small trees	N	Low Severity
Bird River-D	072C2-ES49	Stage I Incision	Other	3	Shrubs and small trees	Lawn	N	Low Severity
Bird River-D	072C2-ES52	Stage II Widening	Other	3	Forest	Forest	N	Low Severity
Bird River-D	072C2-ES56	Stage II Widening	Land use change	2	Lawn	Forest	N	Low Severity
Bird River-D	072C2-ES63	Stage II Widening	Land use change	3	Forest	Paved	Y	Low Severity
Bird River-D	072C2-ES66	Stage II Widening	Land use change	4	Forest	Paved	N	Low Severity
Bird River-D	072C2-ES85	Stage II Widening	Land use change	2	Shrubs and small trees	Forest	Y	Mod.
Bird River-D	072C3-ES48	Stage II Widening	Land use change	2	Forest	Forest	N	Minor
Bird River-D	072C3-ES60	Stage II Widening	Land use change	2	Forest	Forest	N	Minor
Bird River-D	072C3-ES63	Stage II Widening	Other	7	Forest	Forest	N	Mod.
Bird River-D	072C3-ES68	Stage II Widening	Land use change	2	Forest	Forest	N	Minor
Bird River-D	073A3-ES03	Stage II Widening	Land use change	2	Lawn	Lawn	N	Low Severity
Bird River-D	073A3-ES05	Stage II Widening	Below road crossing	3	Lawn	Forest	N	Low Severity
Honeygo Run	072B1-ES07	Stage II Widening	Land use change	4	Forest	Forest	N	Low Severity
Honeygo Run	072B1-ES12	Stage II Widening	Land use change	6	Forest	Forest	N	Low Severity
Honeygo Run	072B1-ES16	Stage II Widening	Land use change	5	Pasture	Lawn	N	Low Severity
Honeygo Run	072B1-ES27	Stage II Widening	Land use change	2	Lawn	Lawn	N	Mod.

Bird River SCA Survey
Erosion

Subshed	Site	Channel Condition	Cause	Avg. Exposed Bank Ht. (ft)	Land Use Left Bank	Land Use Right Bank	Infrastructure Threat	Severity
Honeygo Run	072B1-ES34	Stage II Widening	Land use change	2	Lawn	Lawn	N	Low Severity
Honeygo Run	072B2-ES01	Stage II Widening	Other	20	Forest	Forest	N	Mod.
Honeygo Run	072B2-ES02	Stage I Incision	Land use change	12	Lawn	Other	N	Very Severe
Honeygo Run	072B2-ES05	Stage II Widening	Bend at steep slope	7	Forest	Forest	N	Low Severity
Honeygo Run	072B2-ES07	Stage II Widening	Other	5	Forest	Forest	N	Mod.
Honeygo Run	072B2-ES09	Stage II Widening	Land use change	6	Forest	Forest	N	Mod.
Honeygo Run	072B2-ES13	Stage II Widening	Land use change	4	Forest	Forest	N	Minor
Honeygo Run	072B2-ES17	Stage II Widening	Land use change	3	Paved	Forest	N	Minor
Honeygo Run	072B2-ES23	Stage II Widening	Other	3	Forest	Forest	N	Minor
Honeygo Run	072B2-ES28	Stage II Widening	Land use change	6	Other	Other	N	Low Severity
Honeygo Run	072B2-ES43	Stage I Incision	Land use change	5	Lawn	Lawn	N	Severe
Honeygo Run	072B2-ES45	Stage I Incision	Land use change	4	Lawn	Forest	N	Severe
Honeygo Run	072B2-ES53	Stage II Widening	Land use change	5	Forest	Forest	N	Mod.
Honeygo Run	072B3-ES02	Stage I Incision	Other	5	Forest	Forest	N	Mod.
Honeygo Run	072B3-ES14	Stage III Deposition	Other	3	Forest	Forest	N	Low Severity
Honeygo Run	072C1-ES03	Stage I Incision	Other	2	Forest	Forest	N	Low Severity
Honeygo Run	072C1-ES04	Stage I Incision	Other	1	Forest	Forest	N	Minor
Honeygo Run	072C2-ES02	Stage II Widening	Land use change	3	Forest	Forest	N	Low Severity
Honeygo Run	072C2-ES03	Stage II Widening	Land use change	3	Forest	Forest	N	Low Severity
Honeygo Run	072C2-ES06	Stage II Widening	Land use change	2	Forest	Forest	N	Minor
Honeygo Run	072C2-ES07	Stage II Widening	Land use change	3	Forest	Forest	N	Low Severity
Honeygo Run	072C2-ES09	Stage III Deposition	Land use change	4	Forest	Forest	N	Low Severity
Honeygo Run	072C2-ES12	Stage I Incision	Other	8	Forest	Forest	N	Severe

Bird River SCA Survey
Erosion

Subshed	Site	Channel Condition	Cause	Avg. Exposed Bank Ht. (ft)	Land Use Left Bank	Land Use Right Bank	Infrastructure Threat	Severity
Honeygo Run	072C2-ES15	Stage I Incision	Other	3	Forest	Forest	N	Mod.
Honeygo Run	072C2-ES18	Stage II Widening	Land use change	4	Forest	Forest	N	Low Severity
Honeygo Run	072C3-ES10	Stage II Widening	Land use change	5	Other	Forest	N	Low Severity
Honeygo Run	072C3-ES12	Stage IV Recovery and Reconstruction	Other	4	Other	Forest	N	Minor
Honeygo Run	072C3-ES17	Stage I Incision	Other	3	Forest	Forest	N	Low Severity
Honeygo Run	072C3-ES19	Stage I Incision	Other	4	Forest	Forest	N	Mod.
Honeygo Run	072C3-ES33	Stage II Widening	Land use change	5	Forest	Other	N	Mod.
Honeygo Run	072C3-ES42	Stage II Widening	Land use change	4	Forest	Forest	N	Low Severity
Honeygo Run	072C3-ES45	Stage I Incision	Land use change	4	Lawn	Forest	N	Severe
Whitemarsh Run	071B3-ES03	Stage I Incision	Land use change	6	Other	Other	N	Mod.
Whitemarsh Run	071B3-ES110	Stage II Widening	Bend at steep slope	4	Other	Lawn	N	Minor
Whitemarsh Run	071B3-ES14	Stage I Incision	Other	4	Forest	Forest	N	Low Severity
Whitemarsh Run	071B3-ES22	Stage II Widening	Land use change	3	Forest	Forest	N	Minor
Whitemarsh Run	071B3-ES30	Stage II Widening	Land use change	4	Forest	Other	N	Low Severity
Whitemarsh Run	071B3-ES38	Stage I Incision	Other	3	Forest	Forest	N	Low Severity
Whitemarsh Run	071B3-ES40	Stage II Widening	Bend at steep slope	2	Forest	Lawn	N	Minor
Whitemarsh Run	071B3-ES45	Stage II Widening	Land use change	3	Other	Forest	N	Minor
Whitemarsh Run	071B3-ES47	Stage II Widening	Land use change	4	Forest	Forest	N	Low Severity
Whitemarsh Run	071B3-ES57	Stage II Widening	Pipe outfall	4	Forest	Forest	N	Low Severity
Whitemarsh Run	071B3-ES67	Stage III Deposition	Land use change	8	Lawn	Forest	N	Low Severity
Whitemarsh Run	071B3-ES78	Stage III Deposition	Land use change	7	Lawn	Paved	N	Low Severity
Whitemarsh Run	071B3-ES82	Stage II Widening	Land use change	8	Lawn	Paved	N	Mod.

Bird River SCA Survey
Erosion

Subshed	Site	Channel Condition	Cause	Avg. Exposed Bank Ht. (ft)	Land Use Left Bank	Land Use Right Bank	Infrastructure Threat	Severity
Whitemarsh Run	071B3-ES86	Stage II Widening	Land use change	4	Lawn	Other	Y	Low Severity
Whitemarsh Run	071B3-ES97	Stage II Widening	Land use change	5	Lawn	Paved	N	Low Severity
Whitemarsh Run	071B3-ES98	Stage II Widening	Land use change	4	Lawn	Lawn	N	Low Severity
Whitemarsh Run	071C2-ES01	Stage I Incision	Pipe outfall	4	Lawn	Lawn	N	Mod.
Whitemarsh Run	071C2-ES06	Stage I Incision	Pipe outfall	4	Forest	Forest	N	Mod.
Whitemarsh Run	071C2-ES10	Stage I Incision	Land use change	3	Other	Forest	N	Low Severity
Whitemarsh Run	071C3-ES04	Stage II Widening	Pipe outfall	4	Paved	Forest	N	Low Severity
Whitemarsh Run	071C3-ES07	Stage III Deposition	Land use change	5	Other	Other	N	Mod.
Whitemarsh Run	071C3-ES102	Stage II Widening	Land use change	5	Other	Other	N	Low Severity
Whitemarsh Run	071C3-ES113	Stage II Widening	Pipe outfall	2	Forest	Other	N	Low Severity
Whitemarsh Run	071C3-ES117	Stage II Widening	Land use change	8	Forest	Other	Y	Severe
Whitemarsh Run	071C3-ES122	Stage III Deposition	Land use change	3	Forest	Forest	N	Minor
Whitemarsh Run	071C3-ES13	Stage I Incision	Pipe outfall	2	Paved	Paved	N	Mod.
Whitemarsh Run	071C3-ES140	Stage II Widening	Bend at steep slope	6	Forest	Other	N	Low Severity
Whitemarsh Run	071C3-ES18	Stage III Deposition	Land use change	4	Other	Other	N	Low Severity
Whitemarsh Run	071C3-ES37	Stage II Widening	Land use change	4	Paved	Paved	N	Low Severity
Whitemarsh Run	071C3-ES53	Stage II Widening	Land use change	4	Lawn	Lawn	N	Mod.
Whitemarsh Run	071C3-ES58	Stage II Widening	Land use change	6	Lawn	Lawn	N	Low Severity
Whitemarsh Run	071C3-ES60	Stage III Deposition	Land use change	8	Lawn	Lawn	N	Low Severity
Whitemarsh Run	071C3-ES63	Stage III Deposition	Bend at steep slope	2	Forest	Forest	N	Low Severity
Whitemarsh Run	071C3-ES64	Stage I Incision	Below road crossing	8	Forest	Forest	N	Severe
Whitemarsh Run	071C3-ES69	Stage I Incision	Pipe outfall	5	Forest	Forest	N	Mod.

Bird River SCA Survey
Erosion

Subshed	Site	Channel Condition	Cause	Avg. Exposed Bank Ht. (ft)	Land Use Left Bank	Land Use Right Bank	Infrastructure Threat	Severity
Whitemarsh Run	071C3-ES71	Stage II Widening	Bend at steep slope	3	Forest	Forest	N	Minor
Whitemarsh Run	071C3-ES73	Stage II Widening	Bend at steep slope	2	Forest	Forest	N	Minor
Whitemarsh Run	071C3-ES75	Stage II Widening	Land use change	3	Forest	Other	Y	Mod.
Whitemarsh Run	071C3-ES81	Stage I Incision	Pipe outfall	7	Forest	Forest	Y	Severe
Whitemarsh Run	071C3-ES85	Stage II Widening	Land use change	3	Forest	Forest	N	Low Severity
Whitemarsh Run	071C3-ES86	Stage I Incision	Land use change	4	Forest	Forest	Y	Mod.
Whitemarsh Run	071C3-ES93	Stage II Widening	Land use change	4	Paved	Paved	Y	Mod.
Whitemarsh Run	071C3-ES94	Stage II Widening	Land use change	2	Other	Other	N	Low Severity
Whitemarsh Run	071C3-ES96	Stage II Widening	Land use change	6	Other	Other	Y	Mod.
Whitemarsh Run	081C1-ES06	Stage III Deposition	Land use change	4	Forest	Paved	N	Low Severity
Whitemarsh Run	081C1-ES19	Stage III Deposition	Land use change	3	Forest	Forest	N	Low Severity

Bird River SCA Survey

Exposed Pipes

Subshed	Site	Pipe is:	Material	Pipe Diameter (In.)	Length Exposed (ft)	Purpose of Pipe	Evidence of Discharge	Color	Odor	Severity
Bird River-D	072C2-EP81	Exposed along stream	Plastic	2	25	Unknown	Y	Clear	None	Low Severity
Bird River-D	072C3-EP52	Above stream	Plastic	6	10	Unknown	N	NA	NA	Mod.
Bird River-D	073A3-EP04	Exposed across bottom	Smooth Metal	4	2	Unknown	N	NA	NA	Low Severity
Honeygo Run	072B1-EP33	Exposed across bottom	Plastic	6	2	Unknown	N	NA	NA	Mod.
Honeygo Run	072B2-EP23	Above stream	Plastic	3	15	Other	N	NA	NA	Mod.
Honeygo Run	072C3-EP04	Exposed across bottom	Other	6	2	Unknown	N	NA	NA	Minor
Honeygo Run	072C3-EP18	Exposed along stream	Corrugated Metal	48	12	Unknown	Y	Clear	None	Severe
Whitemarsh Run	071B3-EP48	Exposed across bottom	Smooth Metal	6	20	Unknown	N	NA	NA	Mod.
Whitemarsh Run	071B3-EP52	Exposed manhole		0	0	Unknown				Mod.
Whitemarsh Run	071B3-EP80	Exposed along stream	Smooth Metal	18	40	Unknown	N	NA	NA	Severe
Whitemarsh Run	071C3-EP08	Exposed manhole		0	0	Unknown				Severe
Whitemarsh Run	071C3-EP120	Exposed manhole		0	0	Sewage				Severe
Whitemarsh Run	071C3-EP123	Exposed manhole		0	0	Unknown				Very Severe
Whitemarsh Run	071C3-EP126	Exposed manhole		0	0	Sewage				Mod.
Whitemarsh Run	071C3-EP127	Exposed manhole		0	0	Sewage				Severe
Whitemarsh Run	071C3-EP61	Exposed manhole		0	0	Unknown				Mod.
Whitemarsh Run	071C3-EP65	Exposed along stream	Concrete	36	15	Unknown	N	NA	NA	Low Severity
Whitemarsh Run	071C3-EP76	Exposed along stream	Concrete	18	3	Unknown	N	NA	NA	Severe
Whitemarsh Run	081C1-EP07	Exposed across bottom	Smooth Metal	24	15	Sewage	N	NA	NA	Mod.

Bird River SCA Survey

Exposed Pipes

Subshed	Site	Pipe is:	Material	Pipe Diameter (In.)	Length Exposed (ft)	Purpose of Pipe	Evidence of Discharge	Color	Odor	Severity
Whitemarsh Run	081C1-EP08	Exposed across bottom	Corrugated Metal	12	3	Unknown	N	NA	NA	Low Severity
Whitemarsh Run	081C1-EP20	Above stream	Corrugated Metal	12	8	Unknown	N	NA	NA	Severe

Bird River SCA Survey
Fish Barriers

Subshed	Site	Blockage Type	Barrier Type	Blockage Because:	Water Drop (in.)	Water Depth (in.)	Severity
Honeygo Run	072C3-FB81	Total	Road Crossing	Too high	18	1	Severe
Bird River-D	072C3-FB69	Temporary	Debris Dam	Too high	6	1	Minor
Bird River-D	072C2-FB38	Total	Road Crossing	Too shallow	4	1	Severe
Bird River-D	072C2-FB53	Temporary	Debris Dam	Too high	6	2	Minor
Bird River-D	072C2-FB55	Temporary	Debris Dam	Too high	6	1	Minor
Bird River-D	072C2-FB68	Total	Road Crossing	Too high	6	4	Mod.
Bird River-D	072C3-FB47	Total	Road Crossing	Too high	18	1	Severe
Bird River-D	072C3-FB62	Temporary	Debris Dam	Too high	2	3	Mod.
Honeygo Run	072B2-FB08	Partial	Natural Falls	Too high	18	1	Minor
Honeygo Run	072B2-FB15	Total	Natural Falls	Too high	36	2	Minor
Honeygo Run	072B1-FB09	Temporary	Debris Dam	Too high	6	1	Minor
Honeygo Run	072B1-FB10	Temporary	Debris Dam	Too high	12	3	Minor
Honeygo Run	072B2-FB19	Partial	Debris Dam	Too high	6	1	Minor
Honeygo Run	072B1-FB42	Total	Road Crossing	Too high	18	1	Mod.
Honeygo Run	072B2-FB04	Total	Natural Falls	Too high	12	3	Low Severity
Honeygo Run	072B2-FB06	Partial	Natural Falls	Too high	6	1	Minor
Whitemarsh Run	071C3-FB132	Total	Natural Falls	Too high	18	4	Low Severity
Whitemarsh Run	071B3-FB20	Partial	Debris Dam	Too high	12	4	Low Severity
Whitemarsh Run	071B3-FB31	Total	Natural Falls	Too high	96	3	Low Severity
Whitemarsh Run	071B3-FB32	Total	Natural Falls	Too high	72	6	Low Severity
Whitemarsh Run	071B3-FB55	Partial	Natural Falls	Too high	6	1	Minor
Whitemarsh Run	071B3-FB59	Total	Natural Falls	Too high	24	2	Low Severity
Whitemarsh Run	071B3-FB84	Partial	Pipe Crossing	Too high	6	1	Low Severity
Whitemarsh Run	071B3-FB89	Total	Other	Too high	18	1	Mod.
Whitemarsh Run	071B3-FB92	Total	Other	Too high	8	1	Low Severity
Whitemarsh Run	071B3-FB93	Total	Pipe Crossing	Too high	1	1	Mod.
Whitemarsh Run	071B3-FB96	Total	Natural Falls	Too high	120	3	Low Severity
Whitemarsh Run	071B3-FB104	Total	Road Crossing	Too high	18	1	Mod.
Honeygo Run	072C3-FB16	Total	Debris Dam	Too high	18	2	Low Severity

Bird River SCA Survey
Fish Barriers

Subshed	Site	Blockage Type	Barrier Type	Blockage Because:	Water Drop (in.)	Water Depth (in.)	Severity
Honeygo Run	072C3-FB20	Total	Other	Too high	12	1	Low Severity
Honeygo Run	072B3-FB06	Total	Other	Too high	5	3	Mod.
Honeygo Run	072B3-FB07	Total	Debris Dam	Too high	1	2	Low Severity
Honeygo Run	072B3-FB13	Temporary	Debris Dam	Too high	6	1	Minor
Honeygo Run	072B3-FB15	Temporary	Debris Dam	Too high	12	3	Minor
Honeygo Run	072B2-FB14	Partial	Natural Falls	Too high	24	2	Minor
Honeygo Run	072B2-FB17	Partial	Other	Too high	6	2	Minor
Honeygo Run	072B2-FB22	Total	Other	Too high	12	3	Low Severity
Whitemarsh Run	071C3-FB92	Partial	Road Crossing	Too high	6	1	Low Severity
Whitemarsh Run	071C3-FB95	Total	Natural Falls	Too high	60	2	Low Severity
Whitemarsh Run	071C3-FB97	Total	Natural Falls	Too high	24	1	Minor
Whitemarsh Run	081C1-FB10	Total	Natural Falls	Too high	24	3	Low Severity
Whitemarsh Run	071C3-FB05	Total	Natural Falls	Too high	24	3	Low Severity
Whitemarsh Run	071C3-FB29	Total	Natural Falls	Too high	12	3	Minor
Whitemarsh Run	071C3-FB30	Total	Road Crossing	Too high	3	1	Severe
Whitemarsh Run	071C3-FB35	Partial	Natural Falls	Too high	12	3	Low Severity
Whitemarsh Run	071C3-FB38	Temporary	Debris Dam	Too high	6	6	Minor
Whitemarsh Run	071C3-FB41	Partial	Other	Too high	12	2	Mod.
Whitemarsh Run	071C3-FB43	Total	Natural Falls	Too high	12	2	Minor
Whitemarsh Run	071C3-FB47	Total	Natural Falls	Too high	3	1	Minor
Whitemarsh Run	071C3-FB54	Temporary	Debris Dam	Too high	36	2	Low Severity
Whitemarsh Run	071C3-FB57	Temporary	Debris Dam	Too high	12	2	Minor

Bird River SCA Survey
In- or Near-Stream
Construction

Subshed	Site	Type of Activity	Sediment Control	Sediment Below Site	Length of Stream Affected (ft)	Severity
Bird River-D	072C2-IC34	Road	Adequate	N	100	Low Severity
Honeygo Run	072C3-IC30	Road	Adequate	N	50	Mod.

Bird River SCA Survey
Inadequate Buffer

Subshed	Site	Buffer Inadequate Bank:	Stream Bank Unshaded	Left Buffer Width (ft)	Left Inadequate Buffer Length (ft)	Right Buffer Width (ft)	Right Inadequate Buffer Length (ft)	Land Use Left Bank	Land Use Right Bank	Buffer Recently Estab.	Live-stock Present	Severity
Bird River-D	072A3-IB06	Both	Both	15	600	5	600	Paved	Paved	N	N	Severe
Bird River-D	072C2-IB26	Both	Neither	20	440	30	300	Lawn	Shrubs Small Trees	Y	N	Low Severity
Bird River-D	072C2-IB57	Left	Left	0	190	> 100	0	Lawn	Forest	N	N	Mod.
Bird River-D	072C2-IB62	Right	Neither	> 100	0	30	110	Forest	Paved	N	N	Minor
Bird River-D	072C2-IB65	Right	Neither	> 100	0	45	680	Forest	Paved	N	N	Minor
Bird River-D	072C2-IB72	Right	Neither	> 100	0	35	180	Forest	Paved	N	N	Minor
Bird River-D	072C2-IB83	Left	Neither	40	230	> 100	0	Shrubs Small Trees	Forest	Y	N	Minor
Bird River-D	072C2-IB89	Both	Both	40	500	35	390	Paved	Shrubs Small Trees	Y	N	Mod.
Bird River-D	072C2-IB91	Left	Neither	30	40	60	0	Lawn	Forest	N	N	Minor
Bird River-D	072C3-IB49	Both	Neither	5	260	30	720	Other	Lawn	N	N	Mod.
Bird River-D	072C3-IB65	Left	Neither	45	100	> 100	0	Lawn	Paved	N	N	Minor
Bird River-D	073A3-IB01	Both	Both	30	480	10	200	Lawn	Forest	N	N	Mod.
Honeygo Run	072B1-IB01	Both	Both	10	670	20	330	Lawn	Lawn	N	N	Mod.
Honeygo Run	072B1-IB14	Right	Neither	40	380	> 100	0	Forest	Lawn	N	N	Low Severity
Honeygo Run	072B1-IB41	Both	Both	0	480	0	480	Lawn	Lawn	N	N	Very Severe
Honeygo Run	072B2-IB16	Both	Both	40	1350	40	1350	Paved	Other	Y	N	Mod.
Honeygo Run	072B2-IB25	Both	Neither	40	160	45	840	Lawn	Other	N	N	Low Severity
Honeygo Run	072B2-IB26	Right	Right	>100	0	25	370	Forest	Paved	Y	N	Low Severity
Honeygo Run	072B2-IB32	Both	Both	5	720	5	720	Lawn	Lawn	Y	N	Severe
Honeygo Run	072B2-IB44	Both	Both	5	620	5	430	Lawn	Lawn	N	N	Severe
Honeygo Run	072C1-IB01	Both	Both	10	50	25	150	Paved	Lawn	N	N	Minor
Honeygo Run	072C2-IB36	Left	Left	10	400	> 100	0	Shrubs Small Trees	Forest	N	N	Mod.

Bird River SCA Survey
Inadequate Buffer

Subshed	Site	Buffer Inadequate Bank:	Stream Bank Unshaded	Left Buffer Width (ft)	Left Inadequate Buffer Length (ft)	Right Buffer Width (ft)	Right Inadequate Buffer Length (ft)	Land Use Left Bank	Land Use Right Bank	Buffer Recently Estab.	Live-stock Present	Severity
Honeygo Run	072C3-IB01	Both	Both	5	700	5	700	Shrubs Small Trees	Lawn	N	N	Very Severe
Honeygo Run	072C3-IB07	Left	Left	25	650	> 100	0	Shrubs Small Trees	Forest	N	N	Low Severity
Honeygo Run	072C3-IB20	Both	Both	0	800	0	1580	Shrubs Small Trees	Shrubs Small Trees	N	N	Very Severe
Honeygo Run	072C3-IB44	Left	Left	20	290	> 100	0	Shrubs Small Trees	Forest	Y	N	Low Severity
Honeygo Run	072C3-IB73	Both	Neither	35	1120	> 100	130	Paved	Paved	N	N	Mod.
Whitemarsh Run	071B3-IB02	Right	Neither	50	0	40	1480	Paved	Paved	N	N	Mod.
Whitemarsh Run	071B3-IB114	Both	Both	35	270	50	50	Lawn	Lawn	N	N	Low Severity
Whitemarsh Run	071B3-IB26	Right	Right	> 100	0	20	740	Forest	Paved	Y	N	Mod.
Whitemarsh Run	071B3-IB34	Left	Neither	20	150	> 100	0	Lawn	Forest	Y	N	Minor
Whitemarsh Run	071B3-IB41	Right	Neither	> 100	0	25	110	Forest	Paved	Y	N	Minor
Whitemarsh Run	071B3-IB60	Both	Both	25	2230	25	2230	Lawn	Paved	N	N	Very Severe
Whitemarsh Run	071B3-IB87	Both	Both	0	130	0	130	Lawn	Lawn	N	N	Severe
Whitemarsh Run	071C2-IB07	Left	Neither	30	100	100	0	Paved	Paved	N	N	Minor
Whitemarsh Run	071C2-IB09	Both	Neither	40	90	30	280	Other	Paved	N	N	Low Severity
Whitemarsh Run	071C3-IB109	Right	Neither	> 100	0	35	100	Forest	Paved	N	N	Minor
Whitemarsh Run	071C3-IB116	Right	Neither	80	0	10	450	Forest	Paved	N	N	Mod.
Whitemarsh Run	071C3-IB124	Left	Left	45	180	> 100	0	Paved	Forest	N	N	Minor
Whitemarsh Run	071C3-IB135	Both	Both	10	520	40	520	Paved	Paved	Y	N	Low Severity
Whitemarsh Run	071C3-IB139	Right	Neither	100	0	30	110	Paved	Paved	N	N	Minor
Whitemarsh Run	071C3-IB15	Both	Both	20	1180	20	1180	Paved	Paved	N	N	Severe
Whitemarsh Run	071C3-IB34	Both	Neither	25	1490	35	1490	Paved	Paved	N	N	Severe
Whitemarsh Run	071C3-IB74	Right	Neither	> 100	0	5	470	Forest	Paved	N	N	Mod.
Whitemarsh Run	071C3-IB90	Both	Neither	45	100	30	990	Paved	Paved	N	N	Mod.

Bird River SCA Survey

Inadequate Buffer

Subshed	Site	Buffer Inadequate Bank:	Stream Bank Unshaded	Left Buffer Width (ft)	Left Inadequate Buffer Length (ft)	Right Buffer Width (ft)	Right Inadequate Buffer Length (ft)	Land Use Left Bank	Land Use Right Bank	Buffer Recently Estab.	Live-stock Present	Severity
Whitemarsh Run	081C1-IB04	Right	Right	75	0	40	410	Paved	Paved	Y	N	Low Severity
Whitemarsh Run	081C1-IB09	Both	Neither	30	840	25	500	Paved	Paved	N	N	Mod.
Whitemarsh Run	081C1-IB22	Left	Neither	30	140	> 100	0	Paved	Forest	N	N	Low Severity
Whitemarsh Run	071B3-IB106	Both	Neither	35	320	25	330	Paved	Paved	N	N	Low Severity

Bird River SCA Survey
Pipe Outfalls

Subshed	Site	Type of Outfall	Type of Pipe	Location	Pipe Diameter (in.)	Channel Width (ft)	Evidence of Discharge	Color	Odor	Severity
Bird River-D	072C2-PO76	Other	Concrete Pipe	Head of Stream	72	4	Y	Clear	None	Minor
Bird River-D	072C2-PO77	Other	Concrete Pipe	Head of Stream	60	4	N	NA	NA	Minor
Bird River-D	072C2-PO87	Other	Plastic	Left Bank	2	4	Y	Clear	None	Mod.
Honeygo Run	072C3-PO77	Other	Plastic	Left Bank	4	8	N	NA	NA	Minor
Honeygo Run	072C3-PO80	Other	Corrugated Pipe	Left Bank	18	15	N	NA	NA	Mod.
Bird River-D	073A3-PO10	Other	Corrugated Pipe	Head of Stream	72	5	Y	Clear	None	Minor
Bird River-D	073A3-PO12	Other	Smooth Metal Pipe	Left Bank	4	8	Y	Yellow Brown	None	Low Severity
Bird River-D	072C2-PO39	Other	Concrete Pipe	Head of Stream	72	4	Y	Clear	None	Low Severity
Bird River-D	072C2-PO61	Other	Concrete Pipe	Head of Stream	72	4	Y	Clear	None	Low Severity
Bird River-D	072C2-PO69	Other	Concrete Pipe	Head of Stream	72	5	Y	Clear	None	Low Severity
Bird River-D	072C2-PO70	Stormwater	Concrete Pipe	Head of Stream	24	3	Y	Yellow Brown	None	Low Severity
Honeygo Run	072B2-PO33	Stormwater	Concrete Pipe	Head of Stream	42	5	Y	Clear	None	Low Severity
Honeygo Run	072B2-PO35	Stormwater	Plastic	Right Bank	6	5	Y	Clear	None	Low Severity
Honeygo Run	072B2-PO37	Other	Concrete Pipe	Head of Stream	42	5	Y	Clear	None	Minor
Honeygo Run	072B2-PO38	Other	Concrete Pipe	Head of Stream	18	5	Y	Clear	None	Minor
Honeygo Run	072B2-PO42	Stormwater	Concrete Pipe	Head of Stream	2	18	N	NA	NA	Minor
Honeygo Run	072B2-PO42	Stormwater	Concrete Pipe	Head of Stream	18	2	Y	Clear	None	Mod.
Honeygo Run	072B2-PO48	Stormwater	Concrete Pipe	Head of Stream	18	2	N	NA	NA	Low Severity
Bird River-D	073C3-PO46	Other	Concrete Pipe	Head of Stream	3	20	Y	Clear	None	Low Severity
Bird River-D	072C3-PO53	Other	Concrete Pipe	Left Bank	30	6	Y	Medium Brown	None	Very Severe
Bird River-D	072C3-PO56	Other	Smooth Metal Pipe	Left Bank	1	8	N	NA	NA	Minor
Bird River-D	072C3-PO64	Other	Plastic	Left Bank	18	6	Y	Clear	None	Mod.
Bird River-D	072C2-PO28	Other	Concrete Pipe	Head of Stream	24	2	Y	Clear	None	Minor

Bird River SCA Survey
Pipe Outfalls

Subshed	Site	Type of Outfall	Type of Pipe	Location	Pipe Diameter (in.)	Channel Width (ft)	Evidence of Discharge	Color	Odor	Severity
Honeygo Run	072B2-PO11	Other	Corrugated Pipe	Head of Stream	144	20	Y	Clear	None	Minor
Honeygo Run	072C2-PO19	Stormwater	Concrete Pipe	Left Bank	30	2	Y	Clear	None	Minor
Honeygo Run	072C2-PO21	Other	Concrete Pipe	Head of Stream	36	3	Y	Clear	None	Minor
Honeygo Run	072C2-PO22	Other	Concrete Pipe	Head of Stream	30	3	N	NA	NA	Minor
Honeygo Run	072B1-PO03	Other	Concrete Pipe	Head of Stream	72	3	Y	Clear	None	Minor
Honeygo Run	072B1-PO04	Other	Plastic	Left Bank	6	10	Y	Clear	None	Low Severity
Honeygo Run	072B1-PO05	Stormwater	Concrete Pipe		18	10	N	NA	NA	Minor
Honeygo Run	072B1-PO06	Other	Plastic	Right Bank	3	10	N	NA	NA	Minor
Honeygo Run	072B2-PO27	Other	Corrugated Pipe	Head of Stream	48	15	Y	Clear	None	Low Severity
Honeygo Run	072B1-PO21	Other	Plastic	Right Bank	4	4	Y	Clear	None	Low Severity
Honeygo Run	072B1-PO24	Other	Concrete Pipe	Head of Stream	48	6	Y	Clear	None	Low Severity
Honeygo Run	072B1-PO26	Other	Corrugated Pipe	Left Bank	12	2	Y	Clear	None	Low Severity
Honeygo Run	072B1-PO28	Other	Concrete Pipe	Right Bank	4	4	Y	Clear	None	Severe
Honeygo Run	072B1-PO29	Other	Plastic	Right Bank	1	3	N	NA	NA	Minor
Honeygo Run	072B1-PO32	Other	Plastic	Right Bank	6	1	Y	Clear	None	Low Severity
Honeygo Run	072B1-PO35	Other	Plastic	Right Bank	6	3	N	NA	NA	Minor
Honeygo Run	072B1-PO38	Other	Plastic	Right Bank	3	1	N	NA	NA	Low Severity
Honeygo Run	072C3-PO21	Stormwater	Concrete Pipe	Head of Stream	48	3	Y	Clear	None	Low Severity
Honeygo Run	072C3-PO24	Other	Concrete Pipe	Head of Stream	30	2	Y	Clear	None	Low Severity
Honeygo Run	072C3-PO25	Other	Plastic	Head of Stream	30	2	Y	Clear	None	Minor
Honeygo Run	072C3-PO26	Other	Corrugated Pipe	Head of Stream	24	2	Y	Clear	None	Low Severity
Honeygo Run	072C3-PO27	Other	Plastic	Head of Stream	30	2	Y	Clear	None	Minor
Honeygo Run	072C3-PO28	Other	Plastic	Right Bank	4	1	N	NA	NA	Low Severity

Bird River SCA Survey
Pipe Outfalls

Subshed	Site	Type of Outfall	Type of Pipe	Location	Pipe Diameter (in.)	Channel Width (ft)	Evidence of Discharge	Color	Odor	Severity
Honeygo Run	072C3-PO31	Other	Concrete Pipe	Head of Stream	120	15	Y	Clear	None	Minor
Whitemarsh Run	071B3-PO10	Stormwater	Concrete Pipe	Head of Stream	18	3	N	NA	NA	Low Severity
Whitemarsh Run	071B3-PO13	Other	Concrete Pipe	Head of Stream	48	4	Y	Clear	None	Minor
Whitemarsh Run	071B3-PO16	Stormwater	Concrete Pipe	Right Bank	18	3	Y	Clear	None	Minor
Whitemarsh Run	071C3-PO118	Other	Plastic	Left Bank	6	12	N	NA	NA	Minor
Whitemarsh Run	081C1-PO23	Stormwater	Concrete Pipe	Left Bank	18	15	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO130	Stormwater	Concrete Pipe	Right Bank	36	8	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO134	Stormwater	Concrete Pipe	Head of Stream	12	3	N	NA	NA	Minor
Whitemarsh Run	071C3-PO137	Other	Corrugated Pipe	Head of Stream	120	15	Y	Clear	None	Low Severity
Whitemarsh Run	071B3-PO28	Other	Concrete Pipe	Right Bank	36	5	Y	Clear	None	Low Severity
Whitemarsh Run	071B3-PO43	Other	Concrete Pipe	Head of Stream	36	4	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO138	Other	Corrugated Pipe	Head of Stream	48	3	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO142	Other	Concrete Pipe	Head of Stream	48	4	Y	Yellow Brown	None	Low Severity
Whitemarsh Run	071B3-PO50	Stormwater	Concrete Pipe	Left Bank	18	10	N	NA	NA	Severe
Whitemarsh Run	071B3-PO53	Stormwater	Concrete Pipe	Left Bank	18	3	Y	Clear	None	Mod.
Whitemarsh Run	071B3-PO56	Other	Concrete Pipe	Head of Stream	48	4	Y	Yellow Brown	None	Mod.
Whitemarsh Run	071B3-PO62	Stormwater	Plastic	Left Bank	3	6	N	NA	NA	Minor
Whitemarsh Run	071B3-PO63	Stormwater	Plastic	Left Bank	3	6	N	NA	NA	Minor
Whitemarsh Run	071B3-PO64	Stormwater	Plastic	Left Bank	3	6	N	NA	NA	Minor
Whitemarsh Run	071B3-PO65	Stormwater	Plastic	Left Bank	4	6	N	NA	NA	Minor
Whitemarsh Run	071B3-PO66	Stormwater	Plastic	Left Bank	4	8	N	NA	NA	Minor
Whitemarsh Run	071B3-PO71	Stormwater	Plastic	Right Bank	6	8	Y	Clear	None	Low Severity
Whitemarsh Run	071B3-PO72	Stormwater	Smooth Metal Pipe	Right Bank	4	10	N	NA	NA	Minor

Bird River SCA Survey
Pipe Outfalls

Subshed	Site	Type of Outfall	Type of Pipe	Location	Pipe Diameter (in.)	Channel Width (ft)	Evidence of Discharge	Color	Odor	Severity
Whitemarsh Run	071B3-PO74	Stormwater	Smooth Metal Pipe	Right Bank	4	8	N	NA	NA	Minor
Whitemarsh Run	071B3-PO75	Stormwater	Smooth Metal Pipe	Right Bank	4	8	N	NA	NA	Minor
Whitemarsh Run	071B3-PO76	Stormwater	Smooth Metal Pipe	Right Bank	4	6	N	NA	NA	Minor
Whitemarsh Run	071B3-PO77	Other	Corrugated Pipe	Head of Stream	60	5	Y	Yellow Brown	None	Severe
Whitemarsh Run	071B3-PO95	Stormwater	Concrete Pipe	Right Bank	18	10	N	NA	NA	Mod.
Whitemarsh Run	071B3-PO99	Stormwater	Plastic	Right Bank	8	10	Y	Other	None	Very Severe
Whitemarsh Run	071B3-PO101	Stormwater	Plastic	Left Bank	4	10	N	NA	NA	Minor
Whitemarsh Run	071B3-PO103	Stormwater	Corrugated Pipe	Left Bank	24	15	Y	Yellow Brown	None	Low Severity
Whitemarsh Run	071B3-PO107	Stormwater	Concrete Pipe	Left Bank	24	6	N	NA	NA	Low Severity
Whitemarsh Run	071B3-PO111	Stormwater	Plastic	Right Bank	4	6	N	NA	NA	Minor
Whitemarsh Run	071B3-PO112	Stormwater	Corrugated Pipe	Head of Stream	60	6	Y	Clear	None	Low Severity
Honeygo Run	072B2-PO05	Stormwater	Concrete Pipe	Head of Stream	24	8	Y	Yellow Brown	None	Low Severity
Honeygo Run	072B2-PO12	Stormwater	Concrete Pipe	Head of Stream	36	2	Y	Yellow Brown	None	Very Severe
Honeygo Run	072C3-PO03	Other	Plastic	Head of Stream	30	3	Y	Other	None	Low Severity
Honeygo Run	072B3-PO10	Stormwater	Corrugated Pipe	Head of Stream	8	3	N	NA	NA	Minor
Honeygo Run	072B3-PO11	Stormwater	Corrugated Pipe	Right Bank	8	2	N	NA	NA	Minor
Honeygo Run	072B2-PO19	Stormwater	Concrete Pipe	Right Bank	36	4	Y	Green	None	Minor
Honeygo Run	072B2-PO20	Other	Concrete Pipe	Head of Stream	96	2	Y	Clear	None	Minor
Honeygo Run	072B2-PO27	Stormwater	Concrete Pipe	Head of Stream	18	4	Y	Clear	None	Mod.
Whitemarsh Run	071C3-PO67	Other	Concrete Pipe	Head of Stream	36	4	Y	Clear	None	Low Severity
Whitemarsh Run	081C1-PO11	Other	Concrete Pipe	Head of Stream	60	6	Y	Clear	None	Low Severity
Whitemarsh Run	081C1-PO16	Stormwater	Concrete Pipe	Head of Stream	48	3	Y	Yellow Brown	None	Low Severity
Whitemarsh Run	081C1-PO18	Stormwater	Concrete Pipe	Right Bank	24	2	N	NA	NA	Low Severity

Bird River SCA Survey
Pipe Outfalls

Subshed	Site	Type of Outfall	Type of Pipe	Location	Pipe Diameter (in.)	Channel Width (ft)	Evidence of Discharge	Color	Odor	Severity
Whitemarsh Run	071C2-PO04	Stormwater	Concrete Pipe	Head of Stream	24	2	Y	Clear	None	Low Severity
Whitemarsh Run	071C2-PO11	Other	Concrete Pipe	Head of Stream	48	7	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO77	Other	Plastic	Right Bank	6	5	N	NA	NA	Minor
Whitemarsh Run	071C3-PO79	Stormwater	Concrete Pipe	Head of Stream	48	8	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO83	Other	Corrugated Pipe	Head of Stream	60	5	Y	Clear	None	Mod.
Whitemarsh Run	071C3-PO88	Stormwater	Corrugated Pipe	Left Bank	12	6	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO98	Stormwater	Concrete Pipe	Right Bank	24	5	N	NA	NA	Severe
Whitemarsh Run	071C3-PO99	Other	Plastic	Right Bank	4	5	N	NA	NA	Minor
Whitemarsh Run	071C3-PO100	Stormwater	Concrete Pipe	Right Bank	12	6	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO101	Stormwater	Plastic	Right Bank	4	6	Y	Clear	None	Minor
Whitemarsh Run	071C3-PO104	Stormwater	Concrete Pipe	Right Bank	12	6	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO106	Other	Concrete Pipe	Right Bank	18	6	N	NA	NA	Mod.
Whitemarsh Run	071C3-PO108	Stormwater	Concrete Pipe	Right Bank	24	6	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO111	Other	Corrugated Pipe	Head of Stream	48	3	Y	Clear	None	Minor
Whitemarsh Run	071C3-PO114	Stormwater	Corrugated Pipe	Head of Stream	18	3	Y	Clear	None	Low Severity
Whitemarsh Run	071B3-PO01	Other	Concrete Pipe	Head of Stream	48	3	Y	Clear	None	Severe
Whitemarsh Run	071B3-PO04	Stormwater	Corrugated Pipe	Left Bank	18	3	Y	Clear	None	Very Severe
Whitemarsh Run	071B3-PO05	Stormwater	Concrete Pipe	Right Bank	18	4	Y	Clear	None	Mod.
Whitemarsh Run	081C1-PO03	Stormwater	Concrete Pipe	Head of Stream	24	3	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO03	Other	Concrete Pipe	Head of Stream	3	5	Y	Clear	None	Mod.
Whitemarsh Run	071C3-PO09	Other	Corrugated Pipe	Head of Stream	120	40	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO11	Stormwater	Corrugated Pipe	Left Bank	48	10	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO12	Stormwater	Corrugated Pipe	Right Bank	36	4	N	NA	NA	Low Severity

Bird River SCA Survey
Pipe Outfalls

Subshed	Site	Type of Outfall	Type of Pipe	Location	Pipe Diameter (in.)	Channel Width (ft)	Evidence of Discharge	Color	Odor	Severity
Whitemarsh Run	071C3-PO19	Stormwater	Concrete Channel	Left Bank	18	10	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO20	Stormwater	Concrete Pipe	Right Bank	12	10	N	NA	NA	Minor
Whitemarsh Run	071C3-PO21	Stormwater	Concrete Pipe	Left Bank	12	10	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO22	Stormwater	Concrete Pipe	Right Bank	18	10	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO23	Stormwater	Corrugated Pipe	Left Bank	24	10	Y	Green	None	Severe
Whitemarsh Run	071C3-PO24	Stormwater	Concrete Pipe	Left Bank	18	10	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO25	Stormwater	Concrete Pipe	Right Bank	12	10	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO26	Stormwater	Concrete Pipe	Right Bank	18	10	N	NA	NA	Minor
Whitemarsh Run	071C3-PO27	Stormwater	Concrete Pipe	Left Bank	18	10	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO33	Other	Corrugated Pipe	Head of Stream	120	15	Y	Clear	None	Mod.
Whitemarsh Run	071C3-PO39	Stormwater	Corrugated Pipe	Left Bank	18	3	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO42	Stormwater	Concrete Pipe	Left Bank	24	6	N	NA	NA	Mod.
Whitemarsh Run	071C3-PO45	Stormwater	Corrugated Pipe	Right Bank	36	5	Y	Clear	None	Mod.
Whitemarsh Run	071C3-PO49	Stormwater	Corrugated Pipe	Left Bank	24	6	Y	Green Brown	None	Mod.
Whitemarsh Run	071C3-PO50	Other	Corrugated Pipe	Head of Stream	120	10	Y	Clear	None	Mod.
Whitemarsh Run	071C3-PO51	Stormwater	Corrugated Pipe	Right Bank	24	6	N	NA	NA	Low Severity
Whitemarsh Run	071C3-PO55	Stormwater	Concrete Pipe	Left Bank	18	3	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO59	Stormwater	Concrete Pipe	Right Bank	3	4	Y	Clear	None	Low Severity
Whitemarsh Run	071C3-PO62	Stormwater	Concrete Pipe	Left Bank	18	5	Y	Clear	None	Low Severity
Whitemarsh Run	071C2-PO02	Stormwater	Concrete Pipe	Head of Stream	12	2	N	NA	NA	Minor

Bird River SCA Survey

Trash Dumping

Subshed	Site	Type of Trash	Amount (Pick-up Truck Loads)	Other Measure	Trash Confined To:	Volunteer Opportunity	Ownership	Name (if Public Land)	Severity
Bird River-D	072C2-TD79	Construction	1		Large Area	Y	Public	Unknown	Minor
Bird River-D	072C2-TD82	Construction	5		Single Site	N	Public	Unknown	Severe
Bird River-D	072C2-TD84	Industrial	2		Single Site	N	Public	Unknown	Very Severe
Bird River-D	072C2-TD88	Industrial	1		Single Site	N	Public	Unknown	Very Severe
Honeygo Run	072C3-TD72	Construction	2		Single Site	Y	Private		Low Severity
Honeygo Run	072C3-TD75	Construction	0	48" pipe, 1' long	Single Site	N	Private		Minor
Honeygo Run	072C3-TD76	Construction	2		Large Area	Y	Private		Low Severity
Honeygo Run	072C3-TD78	Residential	1		Single Site	Y	Private		Minor
Bird River-D	073A3-TD07	Yard Waste	4		Single Site	Y	Private		Mod.
Bird River-D	072C2-TD29	Industrial	1		Single Site	N	Private		Very Severe
Bird River-D	072C3-TD70	Residential	1		Single Site	Y	Public	Unknown	Minor
Bird River-D	072C2-TD47	Construction	1		Single Site	Y	Public	Unknown	Minor
Bird River-D	072C2-TD58	Yard Waste	2		Single Site	Y	Private		Low Severity
Bird River-D	072C2-TD73	Residential	1		Single Site	Y	Public	Unknown	Minor
Bird River-D	072C2-TD74	Construction	1		Large Area	Y	Public	Unknown	Low Severity
Bird River-D	072C2-TD75	Residential	1		Single Site	Y	Public	Unknown	Minor
Honeygo Run	072B2-TD40	Floatables	1		Large Area	Y	Private		Minor
Honeygo Run	072B2-TD41	Yard Waste	1		Single Site	Y	Private		Low Severity
Honeygo Run	072B2-TD47	Yard Waste	10		Large Area	Y	Private		Very Severe
Honeygo Run	072B2-TD50	Industrial	1		Single Site	Y	Public	Snyder Park	Low Severity
Bird River-D	072C3-TD50	Industrial	3		Single Site	N	Private		Severe
Bird River-D	072C3-TD54	Construction	1		Single Site	Y	Private		Low Severity
Bird River-D	072C3-TD57	Yard Waste	1		Single Site	Y	Private		Low Severity
Bird River-D	072C2-TD25	Industrial	2		Single Site	Y	Private		Low Severity

Bird River SCA Survey
Trash Dumping

Subshed	Site	Type of Trash	Amount (Pick-up Truck Loads)	Other Measure	Trash Confined To:	Volunteer Opportunity	Ownership	Name (if Public Land)	Severity
Honeygo Run	072B2-TD14	Industrial	2		Single Site	N	Private		Severe
Honeygo Run	072B1-TD08	Residential	2		Single Site	Y	Public	Syder Park	Low Severity
Honeygo Run	072B1-TD11	Industrial	0	Car: 4' by 8'	Single Site	N	Public	Syder Park	Mod.
Honeygo Run	072B2-TD20	Industrial	0	24" pipe, 12' long	Single Site	N	Public	Syder Park	Low Severity
Honeygo Run	072B2-TD22	Industrial	2		Single Site	N	Public	Syder Park	Mod.
Honeygo Run	072B2-TD24	Construction	3		Single Site	Y	Public	Syder Park	Minor
Honeygo Run	072B2-TD26	Industrial	0	Old drum 3' wide, 6' long	Single Site	N	Public	Syder Park	Severe
Honeygo Run	072B2-TD29	Yard Waste	2		Single Site	Y	Public	Unknown	Low Severity
Honeygo Run	072B1-TD15	Residential	1		Single Site	Y	Private		Minor
Honeygo Run	072B1-TD19	Construction	2		Large Area	N	Private		Mod.
Honeygo Run	072B1-TD36	Construction	1		Single Site	Y	Private		Minor
Honeygo Run	072B1-TD40	Industrial	1		Single Site	Y	Private		Minor
Honeygo Run	072C3-TD35	Industrial	1		Single Site	N	Public	Honeygo Run Park	Very Severe
Honeygo Run	072C3-TD40	Industrial	3		Single Site	Y	Public	Honeygo Run Park	Mod.
Honeygo Run	072C3-TD43	Industrial	1		Single Site	N	Public	Honeygo Run Park	Severe
Honeygo Run	072C2-TD01	Tires	1		Single Site	Y	Private		Minor
Honeygo Run	072C2-TD08	Residential	1		Single Site	Y	Private		Minor
Honeygo Run	072C2-TD10	Residential	3		Single Site	N	Private		Mod.
Honeygo Run	072C2-TD11	Yard Waste	2		Single Site	Y	Private		Minor
Honeygo Run	072C2-TD13	Yard Waste	3		Single Site	N	Private		Mod.
Honeygo Run	072C2-TD16	Tires	6		Large Area	Y	Public	Honeygo Run Park	Mod.
Honeygo Run	072C2-TD17	Tires	1		Single Site	N	Public	Honeygo Run Park	Severe
Honeygo Run	072B2-TD03	Residential	1		Single Site	Y	Public	Honeygo Run Park	Minor
Whitemarsh Run	071C3-TD119	Construction	2		Single Site	N	Private		Low Severity

Bird River SCA Survey
Trash Dumping

Subshed	Site	Type of Trash	Amount (Pick-up Truck Loads)	Other Measure	Trash Confined To:	Volunteer Opportunity	Ownership	Name (if Public Land)	Severity
Whitemarsh Run	071C3-TD121	Construction	0	36" pipe, 7' long	Single Site	N	Public	Unknown	Low Severity
Whitemarsh Run	081C1-TD21	Residential	2		Single Site	Y	Public	Unknown	Low Severity
Whitemarsh Run	071C3-TD136	Residential	1		Large Area	Y	Private		Minor
Whitemarsh Run	071B3-TD29	Residential	1		Single Site	Y	Public	Unknown	Minor
Whitemarsh Run	072B3-TD36	Floatables	1		Single Site	Y	Public	Unknown	Minor
Whitemarsh Run	071B3-TD39	Residential	2		Large Area	Y	Public	Unknown	Low Severity
Whitemarsh Run	071B3-TD46	Floatables	1		Large Area		Public	Unknown	Minor
Whitemarsh Run	071B3-TD58	Residential	1		Large Area	Y	Public	Unknown	Low Severity
Whitemarsh Run	071B3-TD68	Construction	0	12" pipe, 20' long	Single Site	N	Public	Unknown	Low Severity
Whitemarsh Run	071B3-TD79	Construction	0	18" pipe, 4' long	Single Site	N	Public	Unknown	Low Severity
Whitemarsh Run	071B3-TD81	Floatables	1		Single Site	Y	Public	Unknown	Low Severity
Whitemarsh Run	071B3-TD85	Construction	3		Single Site	Y	Private		Low Severity
Whitemarsh Run	071B3-TD90	Industrial	1		Single Site	Y	Private		Low Severity
Whitemarsh Run	071B3-TD94	Construction	0	24" pipe, 5' long	Single Site	N	Public	Unknown	Low Severity
Whitemarsh Run	071B3-TD109	Yard Waste	2		Single Site	Y	Private		Low Severity
Honeygo Run	072B2-TD03	Construction	4		Large Area	Y	Private		Mod.
Honeygo Run	072B2-TD04	Residential	1		Single Site	Y	Public	Unknown	Minor
Honeygo Run	072B2-TD10	Residential	3		Large Area	N	Private		Mod.
Honeygo Run	072C3-TD06	Floatables	1		Single Site	Y	Private		Minor
Honeygo Run	072C3-TD09	Tires	1		Single Site	Y	Private		Minor
Honeygo Run	072C3-TD11	Construction	3		Single Site	Y	Private		Low Severity
Honeygo Run	072C3-TD14	Residential	1		Single Site	Y	Public	Honeygo Run Park	Low Severity
Honeygo Run	072B3-TD01	Construction	1		Single Site	N	Public	Honeygo Run Park	Low Severity
Honeygo Run	072B3-TD09	Construction	0	18" pipe, 5' long	Single Site	N	Public	Honeygo Run Park	Minor

Bird River SCA Survey
Trash Dumping

Subshed	Site	Type of Trash	Amount (Pick-up Truck Loads)	Other Measure	Trash Confined To:	Volunteer Opportunity	Ownership	Name (if Public Land)	Severity
Honeygo Run	072B2-TD15	Construction	1		Single Site	Y	Public	Honeygo Run Park	Minor
Honeygo Run	072B2-TD28	Residential	1		Large Area	Y	Public	Unknown	Minor
Whitemarsh Run	071C3-TD70	Industrial	2		Single Site	N	Private		Severe
Whitemarsh Run	081C1-TD17	Flotables	1		Large Area	Y	Private		Low Severity
Whitemarsh Run	071C3-TD72	Construction	1		Large Area	Y	Public	Belmont Park	Low Severity
Whitemarsh Run	071C3-TD91	Flotables	1		Large Area	Y	Public	Unknown	Minor
Whitemarsh Run	071C3-TD103	Construction	2		Large Area	N	Private		Low Severity
Whitemarsh Run	071C3-TD105	Construction	1		Single Site	N	Private		Low Severity
Whitemarsh Run	071C3-TD107	Construction	1		Single Site	N	Private		Low Severity
Whitemarsh Run	071B3-TD06	Construction	1		Single Site	N	Public	Unknown	Minor
Whitemarsh Run	081C1-TD05	Other	5		Large Area	Y	Private		Minor
Whitemarsh Run	071C3-TD02	Residential	2		Single Site	Y	Public	Unknown	Severe
Whitemarsh Run	071C3-TD06	Residential	2		Single Site	Y	Private		Mod.
Whitemarsh Run	071C3-TD10	Construction	0	48" pipe, 5' long	Single Site	N	Public	Unknown	Low Severity
Whitemarsh Run	071C3-TD14	Residential	1		Single Site	Y	Public	Unknown	Low Severity
Whitemarsh Run	071C3-TD32	Construction	1		Single Site	Y	Public	Unknown	Low Severity
Whitemarsh Run	071C3-TD36	Residential	1		Single Site	Y	Public	Unknown	Low Severity
Whitemarsh Run	071C3-TD46	Construction	0	60" pipe, 4' long	Single Site	N	Public	Unknown	Low Severity
Whitemarsh Run	071C3-TD52	Residential	1		Single Site	Y	Public	Unknown	Low Severity
Whitemarsh Run	071C3-TD56	Residential	1		Single Site	Y	Public	Unknown	Minor
Whitemarsh Run	071C2-TD03	Tires	1		Single Site	Y	Public	Belmont Park	Minor

Bird River SCA Survey

Unusual Condition or Comment

Subshed	Site	Type	Description	Notes	Potential Cause	Severity
Bird River-D	072C2-UC23	Unusual Condition	Other	3 headcuts on RB	Upland runoff	Severe
Bird River-D	072C2-UC27	Unusual Condition	Other	2 headcuts on LB	Upland runoff	Severe
Bird River-D	072C2-UC33	Unusual Condition	Other	Fence blow out at stream crossing	Storm flow	Low Severity
Bird River-D	072C2-UC36	Unusual Condition	Water Color/Clarity	Excessive iron flocculant laden water coming out of SWM facility	Natural processes	Severe
Bird River-D	072C2-UC42	Unusual Condition	Other	Headcut on LB	Upland runoff	Low Severity
Bird River-D	072C2-UC43	Unusual Condition	Other	Headcut on LB	Upland runoff	Mod.
Bird River-D	072C2-UC44	Unusual Condition	Other	Headcut on RB	Upland runoff	Low Severity
Bird River-D	072C2-UC50	Unusual Condition	Other	Headcut on LB	Upland runoff	Low Severity
Bird River-D	072C2-UC51	Unusual Condition	Other	Headcut on RB and LB	Upland runoff	Low Severity
Bird River-D	072C2-UC54	Unusual Condition	Other	Headcut on LB	Upland runoff	Mod.
Bird River-D	072C2-UC59	Unusual Condition	Other	LB eroded up to asphalt road	Bank erosion	Mod.
Bird River-D	072C2-UC80	Unusual Condition	Other	Wire on floodplain	Downed powerline	Severe
Bird River-D	072C2-UC86	Unusual Condition	Other	Headcut on LB	Upland runoff	Mod.
Bird River-D	072C3-C71	Comment		Rock in channel for long distance upstream; could cause fish blockages		
Bird River-D	072C3-UC59	Unusual Condition	Other	Headcut on LB	Upland runoff	Mod.
Bird River-D	072C3-UC61	Unusual Condition	Other	Headcut on RB	Upland runoff	Low Severity
Bird River-D	072C3-UC67	Unusual Condition	Other	Headcut on LB	Upland runoff	Low Severity

Bird River SCA Survey
Unusual Condition or Comment

Subshed	Site	Type	Description	Notes	Potential Cause	Severity
Bird River-D	073A3-UC02	Unusual Condition	Other	Silt fence on RB potentially going to fail	Bank erosion	Severe
Honeygo Run	072B1-UC13	Unusual Condition	Other	Headcut on RB	Upland runoff	Mod.
Honeygo Run	072B1-UC17	Unusual Condition	Other	Headcut on LB	Upland runoff	Low Severity
Honeygo Run	072B1-UC18	Unusual Condition	Other	Headcut on RB	Upland runoff	Mod.
Honeygo Run	072B1-UC20	Unusual Condition	Other	Headcut on LB	Upland runoff	Low Severity
Honeygo Run	072B1-UC23	Unusual Condition	Other	Erosion on LB from roadway	Runoff from roadway	Severe
Honeygo Run	072B1-UC25	Unusual Condition	Other	Pipe from fire hydrant in culvert		Minor
Honeygo Run	072B1-UC30	Unusual Condition	Other	Grass clippings in stream	Recent mowing	Mod.
Honeygo Run	072B2-C21	Comment		30' section of Mod. erosion within less severe erosion site		
Honeygo Run	072B2-C49	Comment		Drainage swale ends		
Honeygo Run	072B2-UC02	Unusual Condition	Other	Headcut on RB	Upland runoff	Low Severity
Honeygo Run	072B2-UC07	Unusual Condition	Other	Headcut on RB	Upland runoff	Mod.
Honeygo Run	072B2-UC08	Unusual Condition	Other	Large pile of deposition	Unknown	Low Severity
Honeygo Run	072B2-UC10	Unusual Condition	Other	Eroding drainage swale on LB	Runoff from roadway	Mod.
Honeygo Run	072B2-UC11	Unusual Condition	Other	Headcut on RB	Upland runoff	Low Severity
Honeygo Run	072B2-UC13	Unusual Condition	Other	Headcut on RB	Pipe Outfall	Severe
Honeygo Run	072B2-UC24	Unusual Condition	Other	Headcut on LB	Upland runoff	Mod.
Honeygo Run	072B2-UC25	Unusual Condition	Other	Headcut on LB	Upland runoff	Low Severity

Bird River SCA Survey
Unusual Condition or Comment

Subshed	Site	Type	Description	Notes	Potential Cause	Severity
Honeygo Run	072B2-UC30	Unusual Condition	Other	LB Scour DS of imbricated wall	Imbricated wall	Mod.
Honeygo Run	072B2-UC39	Unusual Condition	Other	Grass clippings in stream	Recent mowing	Mod.
Honeygo Run	072B2-UC46	Unusual Condition	Other	Headcut on LB	Upland runoff	Severe
Honeygo Run	072B2-UC51	Unusual Condition	Other	Headcut on RB	Upland runoff	Low Severity
Honeygo Run	072B2-UC52	Unusual Condition	Other	Headcut on RB	Upland runoff	Mod.
Honeygo Run	072B3-C05	Comment		Stream fenced off		
Honeygo Run	072B3-C08	Comment		start braided channel		
Honeygo Run	072B3-C12	Comment		End braided channel		
Honeygo Run	072B3-C16	Comment		Undercut portion of bank mass wasting		
Honeygo Run	072B3-UC03	Unusual Condition	Other	Headcut on LB	Unknown	Mod.
Honeygo Run	072B3-UC04	Unusual Condition	Other	Headcut forming at mouth of tributary	Unknown	Low Severity
Honeygo Run	072C2-UC05	Unusual Condition	Other	Bridge crossing	Apart of park trail system	Minor
Honeygo Run	072C2-UC14	Unusual Condition	Other	Headcut on LB	Upland runoff	Mod.
Honeygo Run	072C3-C38	Comment		Side channel on RB		
Honeygo Run	072C3-UC02	Unusual Condition	Other	Large mulch pile near stream		Mod.
Honeygo Run	072C3-UC23	Unusual Condition	Other	Concrete and brick added near stream	Erosion prevention	Minor
Honeygo Run	072C3-UC34	Unusual Condition	Other	Headcut on RB	Upland runoff	Severe

Bird River SCA Survey

Unusual Condition or Comment

Subshed	Site	Type	Description	Notes	Potential Cause	Severity
Whitemarsh Run	071B3-C07	Comment		Headcut a part of 071B3-ES03		
Whitemarsh Run	071B3-C25	Comment		Channel ends		
Whitemarsh Run	071B3-UC07	Unusual Condition	Other	Headcut on RB	Pipe Outfall	Mod.
Whitemarsh Run	071B3-UC08	Unusual Condition	Other	Headcut on LB	Pipe Outfall	Severe
Whitemarsh Run	071B3-UC102	Unusual Condition	Other	Potential pipe crossing	Pipe protection	Minor
Whitemarsh Run	071B3-UC108	Unusual Condition	Other	Concrete slabs in channel	Old structure	Minor
Whitemarsh Run	071B3-UC18	Unusual Condition	Other	Debris jam		Low Severity
Whitemarsh Run	071B3-UC24	Unusual Condition	Other	Headcut on LB	Upland runoff	Severe
Whitemarsh Run	071B3-UC35	Unusual Condition	Other	Downed powerline	Downed tree	Very Severe
Whitemarsh Run	071B3-UC37	Unusual Condition	Other	Old road crossing		Minor
Whitemarsh Run	071B3-UC51	Unusual Condition	Other	Headcut on LB	Pipe Outfall	Severe
Whitemarsh Run	071B3-UC54	Unusual Condition	Other	Headcut on LB	Pipe Outfall	Mod.
Whitemarsh Run	071B3-UC70	Unusual Condition	Other	Culvert filled with sediment	DS erosion at meander bend	Severe
Whitemarsh Run	071C2-UC08	Unusual Condition	Other	Headcut on RB	Upland runoff	Mod.
Whitemarsh Run	071C3-C82	Comment		Headcut on RB part of 071C3-ES81		
Whitemarsh Run	071C3-UC17	Unusual Condition	Other	Erosion undermining bridge abutment	Storm flow	Mod.
Whitemarsh Run	071C3-UC28	Unusual Condition	Other	50' section of wire in channel	Unknown	Severe
Whitemarsh Run	071C3-UC31	Unusual Condition	Excessive Algae	Excessive algae throughout stream	Nutrient input	Severe

Bird River SCA Survey

Unusual Condition or Comment

Subshed	Site	Type	Description	Notes	Potential Cause	Severity
Whitemarsh Run	071C3-UC369	Unusual Condition	Other	Blown out road crossing	Failed Structure	Severe
Whitemarsh Run	071C3-UC40	Unusual Condition	Other	Slabs of concrete in channel	Structural blowout	Low Severity
Whitemarsh Run	081C1-UC13	Unusual Condition	Other	Headcut US of pipe outfall	Runoff from roadway	Low Severity

APPENDIX G: UPLAND ASSESSMENT DATA SUMMARY

Bird River Upland Assessments
Hotspot Investigations (HSIs)

Site ID	Subshed	Hotspot Status	Cat.	Business Type	Vehicle Oper.	Outdoor Materials	Waste Mgmt.	Physical Plant	Turf Land-scaping	Stormwtr. Infrastruc.	Refer for Enforce-ment
HSI_K_101	Whitemarsh Run (N. Fork)	Confirmed hotspot	Commercial	Shopping Center	N/A			X			X
HSI_K_103	Whitemarsh Run (N. Fork)	Confirmed hotspot	Commercial	Small machines and table rental, etc.							
HSI_K_104	Whitemarsh Run (N. Fork)	Potential hotspot	Commercial	Strip mall/shipping center	N/A						
HSI_K_132	Whitemarsh Run (N. Fork)	Potential hotspot	Commercial	Fast food restaurant							
HSI_K_143	Whitemarsh Run (N. Fork)	Confirmed hotspot	Commercial	Restaurant	N/A	N/A	X				X
HSI_K_148	Whitemarsh Run (N. Fork)	Potential hotspot	Commercial	Grocery store	N/A						
HSI_K_212	Whitemarsh Run	Potential hotspot	Commercial	Storage yard and office for construction company.							
HSI_K_233	Whitemarsh Run	Confirmed hotspot	Commercial	Dealership and repair facility	X						X
HSI_K_234	Whitemarsh Run	Confirmed hotspot	Commercial	Heavy truck repair							X
HSI_K_235	Whitemarsh Run	Potential hotspot	Commercial	Fast food restaurant	N/A	N/A					
HSI_K_236	Whitemarsh Run	Confirmed hotspot	Commercial	Restaurant	N/A	N/A	X				X
HSI_K_238	Whitemarsh Run	Potential hotspot	Commercial	Large retail stores							
HSI_K_239	Whitemarsh Run	Confirmed hotspot	Commercial	Restaurant	N/A						X
HSI_K_240	Whitemarsh Run	Confirmed hotspot	Commercial	Used car sales.	X	N/A					X
HSI_K_241	Whitemarsh Run	Potential hotspot	Commercial	Large retail property with outdoor storage	N/A						
HSI_K_242	Whitemarsh Run	Confirmed hotspot	Commercial	Warehouse/store front with storage lot.							

Bird River Upland Assessments
Hotspot Investigations (HSIs)

Site ID	Subshed	Hotspot Status	Cat.	Business Type	Vehicle Oper.	Outdoor Materials	Waste Mgmt.	Physical Plant	Turf Land-scaping	Stormwtr. Infrastruc.	Refer for Enforce-ment
HSI_K_244	Whitemarsh Run	Not a hotspot	Commercial	Car repair and parts retailer	N/A						
HSI_K_313	Whitemarsh Run (S. Fork)	Confirmed hotspot	Commercial	Storage lot with one building.	X	X					
HSI_K_314	Whitemarsh Run (S. Fork)	Potential hotspot	Commercial	Construction storage lot with one building							
HSI_K_316	Whitemarsh Run (S. Fork)	Potential hotspot	Commercial	Two buildings with storage area			N/A				
HSI_K_317	Whitemarsh Run (S. Fork)	Potential hotspot	Commercial	Main building with storage lot behind.							
HSI_K_318	Whitemarsh Run (S. Fork)	Confirmed hotspot	Commercial	Maintenance building and storage lot							
HSI_K_331	Whitemarsh Run (S. Fork)	Potential hotspot	Commercial	One building with many businesses							
HSI_K_420	Honeygo Run	Potential hotspot	Commercial	Grocery store.	N/A						
HSI_K_421	Honeygo Run	Potential hotspot	Commercial	Car repair							
HSI_K_446	Honeygo Run	Potential hotspot	Commercial	Gas station, car wash, convenience store.	N/A						
HSI_K_625	Bird River-D	Potential hotspot	Commercial	Construction retailer/storage	N/A						X
HSI_K_637	Bird River-D	Confirmed hotspot	Commercial	Excavation equipment sales/repair	X						X
HSI_K_647	Bird River-D	Confirmed hotspot	Industrial	Construction materials/aluminum awnings	N/A						

Bird River Upland Assessments

Institutional Site Investigations (ISIs)

Site ID	Subshed	Name	Own-ership	Exterior	Waste Mngmt.	Vehicle Ops.	Outdoor Materials	Turf Land-scaping	Storm Drain Marking	Tree Planting	Down-spout Dis-connect	SW Retro fit	Impervious Cover Removal
ISI_K_101	Whitemarsh Run (N. Fork)	Perry Hall Middle School	Public			N/A			X	X		X	X
ISI_K_102	Whitemarsh Run (N. Fork)	Perry Hall High School	Public	X						X			
ISI_K_103	Whitemarsh Run (N. Fork)	White Marsh Baptist Church	Private		N/A	N/A	N/A		X	X	X	X	X
ISI_K_104	Whitemarsh Run (N. Fork)	Zion United Church of Christ	Private			N/A	N/A		X	X	X	X	
ISI_K_105	Whitemarsh Run (N. Fork)	Faith Fellowship Church of Baltimore	Private						X	X		X	
ISI_K_106	Whitemarsh Run (N. Fork)	Evangelical Cathedral Church of God	Private			N/A	N/A		X	X	X	X	X
ISI_K_107	Whitemarsh Run (N. Fork)	St. Michael's Church	Private			N/A	N/A		X	X		X	
ISI_K_108	Whitemarsh Run (N. Fork)	Perry Hall Methodist Church	Private			N/A	N/A			X	X	X	X
ISI_K_209	Whitemarsh Run	Parkville High School	Public						X	X		X	X
ISI_K_210	Whitemarsh Run	St. Ursula's Roman Catholic Church	Private				N/A		X	X	X		
ISI_K_213	Whitemarsh Run	Joppa Road Baptist Church	Private		N/A	N/A	N/A			X	X	X	X
ISI_K_215	Whitemarsh Run	St. John's Evangelical Lutheran Church	Private			N/A	N/A			X	X	X	
ISI_K_216	Whitemarsh Run	Morningside House Assisted Living	Private			N/A			X	X	X	X	
ISI_K_217	Whitemarsh Run	Parkville-Carney Library	Public			N/A				X			

Bird River Upland Assessments

Institutional Site Investigations (ISIs)

Site ID	Subshed	Name	Own-ership	Exterior	Waste Mngmt.	Vehicle Ops.	Outdoor Materials	Turf Land-scaping	Storm Drain Marking	Tree Planting	Down-spout Dis-connect	SW Retro fit	Impervious Cover Removal
ISI_K_218	Whitemarsh Run	Immanuel Baptist Church	Private			N/A	N/A			X	X	X	
ISI_K_219	Whitemarsh Run	Precinct 9 - White Marsh	Public						X	X		X	
ISI_K_221	Whitemarsh Run	American Cancer Society	Public			N/A			X				
ISI_K_222	Whitemarsh Run	Maryland Transportation Authority Lodge	Private				N/A			X			
ISI_K_223	Whitemarsh Run	Our Lady Queen of Peace Catholic Church & School	Private						X	X			X
ISI_K_224	Whitemarsh Run	Victory Villa Community Church	Private		N/A	N/A	N/A			X			
ISI_K_225	Whitemarsh Run	Harmony Freewill Baptist Chruch	Private		N/A	N/A	N/A			X			X
ISI_K_326	Whitemarsh Run (S. Fork)	Boumi Temple	Private						X			X	
ISI_K_327	Whitemarsh Run (S. Fork)	Franklin Square Nursing Home	Private						X	X			
ISI_K_328	Whitemarsh Run (S. Fork)	Franklin Square Hospital	Private						X				
ISI_K_329	Whitemarsh Run (S. Fork)	Essex Community College	Public						X	X		X	
ISI_K_330	Whitemarsh Run (S. Fork)	Chesapeake Conference of Seventh Day Adventists	Private			N/A			X	X			

Bird River Upland Assessments

Institutional Site Investigations (ISIs)

Site ID	Subshed	Name	Own-ership	Exterior	Waste Mngmt.	Vehicle Ops.	Outdoor Materials	Turf Land-scaping	Storm Drain Marking	Tree Planting	Down-spout Dis-connect	SW Retro fit	Impervious Cover Removal
ISI_K_331	Whitemarsh Run (S. Fork)	Central Christian Assembly	Private				N/A		X	X			
ISI_K_332	Whitemarsh Run (S. Fork)	Rosedale Baptist Church	Private				N/A		X				
ISI_K_333	Whitemarsh Run (S. Fork)	White Marsh Library	Public			N/A	N/A		X				
ISI_K_434	Honeygo Run	American Legion - Overlea Post	Private			N/A	N/A						
ISI_K_435	Honeygo Run	Camp Chapel United Methodist Church	Private				N/A		X	X			
ISI_K_436	Honeygo Run	Perry Hall Family Worship Center	Private		N/A	N/A	N/A		X				
ISI_K_437	Honeygo Run	Cowenton United Methodist Church	Private			N/A	N/A						
ISI_K_438	Honeygo Run	Perry Hall Library	Public			N/A	N/A		X				
ISI_K_539	Windlass Run	Vincent Elementary School	Public			N/A	N/A		X	X	X	X	
ISI_K_640	Bird River-D	Chapel Hill Elementary School	Public			N/A			X	X		X	
ISI_K_741	Bird River-B	VFW - Gunpowder Post	Private			N/A	N/A			X			
ISI_K_742	Bird River-B	St. John Apostolic Church	Private		N/A	N/A	N/A			X			
ISI_K_844	Railroad Creek_Bird River-A	Iglesia Evangelica Apostoles y Profetas	Private				N/A			X			
ISI_K_845	Railroad Creek_Bird River-A	Ebeneezer Methodist Church	Private				N/A						

Bird River Upland Assessments

Pervious Area Assessments (PAAs)

Site ID	Subshed	Site Name	Ownership	% Turf	Prep.	Notes
PAA_K_101	Whitemarsh Run (N. Fork)	County Open Space - A	Public	94	Minimal site prep	Very good candidate for planting, but small. Could plant hydrophytes around wet area.
PAA_K_102	Whitemarsh Run (N. Fork)	County Open Space - B	Public	100	Minimal site prep	Good site for tree planting - all open, easy access.
PAA_K_203	Whitemarsh Run	JHP Open Space	Private	99	Minimal site prep	A few small embankments with 8-10% slopes, but those could still be planted.
PAA_K_204	Whitemarsh Run	County Open Space - D	Public	98	Minimal site prep	Planting this site would likely require removal of existing playground.
PAA_K_205	Whitemarsh Run	Belmont Park	Public	80	Minimal site prep	Busy park - well-used. May have to balance existing park uses with planting.
PAA_K_206	Whitemarsh Run	Ridgely's Choice HOA	Private	30	Minimal site prep	Small area for planting but ti would be a worthwhile project.
PAA_K_207	Whitemarsh Run	SHA - A	Public	15	Good candidate	Good candidate for natural regeneration; do some intensive invasive species management initially and follow-up with bi-annual treatments. Leave rip-rap road, as is.
PAA_K_208	Whitemarsh Run	SHA - C	Public	40	Minimal site prep	Good candidate for planting. Not sure why this site would ever be maintained/mowed.
PAA_K_209	Whitemarsh Run	SHA - D	Public	40	Minimal site prep	Area along stream would be a good candidate for natural regeneration. Other areas of site are small, but a good candidate for planting.
PAA_K_210	Whitemarsh Run	County Open Space - G	Public	20	Minimal site prep	Current open turf areas would be good for planting. Some of the lowest turf areas behind houses are wetlands.
PAA_K_211	Whitemarsh Run	Glen Arbor North HOA	Private	100	Minimal site prep	Good, but small candidate for planting. Homeowners would have to agree to planting. Area is adjacent to 100 ft stream buffer zone.
PAA_K_212	Whitemarsh Run	County Open Space - H	Public	30	Minimal site prep	Long, narrow planting area behind houses. Would be a relatively easy, valuable planting project, if access can be worked out. Access is currently fenced off in most places.
PAA_K_313	Whitemarsh Run (S. Fork)	Nottingham Park	Public	70	Minimal site prep	Relatively small area to plant here, because most of open areas are baseball, soccer or other sports fields. Some planting could be done along edges.
PAA_K_314	Whitemarsh Run (S. Fork)	Winters Manor Community Association & County	Pub & Priv	80	Minimal site prep	Southern portion of parcel is already completely planted with new trees (still in tubes). Northern parcel appears to be used by adjacent residents for recreation. Planting here must be coordinated with them.
PAA_K_315	Whitemarsh Run (S. Fork)	County Open Space - F	Public	40	Minimal site prep	This would be a very good, but small, candidate for planting adjacent to existing forest preservation area and stream.
PAA_K_316	Whitemarsh Run (S. Fork)	Mayor & City Council Bureau of Engineering	Public	20	Minimal site prep	Good potential planting site; relatively small.

Bird River Upland Assessments

Pervious Area Assessments (PAAs)

Site ID	Subshed	Site Name	Ownership	% Turf	Prep.	Notes
PAA_K_417	Honeygo Run	Honeygo Park	Public	90	Minimal site prep	Best areas to plant are in the SE end of the park, near artificial turf field. Area to E of parking lot is on 6-8% slope. The rest of the area is relatively flat.
PAA_K_418	Honeygo Run	North Gate Hall Community Association - A	Private	80	Minimal site prep	Good opportunity for tree planting, but would have to clear with North Gate Community Association; they may not want it.
PAA_K_419	Honeygo Run	North Gate Hall Community Association - B	Private	99	Minimal site prep	Would be a good site for tree planting and would eliminate the need for a lot of mowing.
PAA_K_420	Honeygo Run	Perry Hall Crossing II HOA & County	Pub & Priv	0	Good candidate	Good candidate for natural regeneration; these are all existing county Forest Conservation Areas, with invasives control. Should check with county to see what existing plans prescribe.
PAA_K_421	Honeygo Run	Perry Hall Crossing I HOA	Private	0	Good candidate	This is an existing County Forest Conservation Area. All it needs is invasives management throughout.
PAA_K_622	Bird River-D	Gunpowder Falls State Park	Public	95	Extensive site prep	Mapped as part of Gunpowder Falls State Park, but Is reclaimed landfill. Need to review health and safety plan for restrictions prior to planting. What are goals of GFSP? Apparently this is reclaimed landfill that GFSP acquired.
PAA_K_623	Bird River-D	Cowenton Avenue Park	Public	60	Minimal site prep	Existing forest restoration parcel needs some invasive species management!! Area on N side is 15% slope.
PAA_K_624	Bird River-D	County Open Space - C	Public	95	Minimal site prep	Good site for tree planting (former peach orchard). Few or no site constraints.
PAA_K_825	Railroad Creek_Bird River-A	SHA - B	Public	0	Minimal site prep	Parts of site are good for planting; other areas should be naturally regenerated. "Stream buffer" is actually along a ditch.

Bird River Upland Assessments
Neighborhood Source Assessments (NSAs)

Site ID	Subshed	Name	Acres	PSI	ROI	Downspt. Disco-nnect	Rain Barrel	Rain Garden	Storm Drain Marking	Bay-Scape	Fertilizer Reduc.	Pet Waste	Trash Mgmt.	Trees to Plant.
NSA-K-69	Bird River-B	Bird River Beach	33.11	Mod.	Mod.	X	X	X		X				0
NSA-K-39	Bird River-D	Perry Hall Meadows/ Orchard Crossing	17.44	Mod.	Mod.	X	X	X	X	X				26
NSA-K-40	Bird River-D	Williams Field & Perry Hall	17.13	Mod.	Mod.	X	X		X	X				60
NSA-K-41	Bird River-D	Fields @ Perry Hall	33.29	Mod.	Mod.				X	X				340
NSA-K-68	Bird River-D	Moore's Orchard/ Forge Landing	42.93	Mod.	Mod.	X	X	X	X	X				20
NSA-K-72	Bird River-D	Bird River Beach, Lorely Beach, Mt. Ararah Shores.	45.73	Mod.	Mod.		X			X				0
NSA-K-90	Bird River-D	Moores Meadow, Moores Meadow II, Misty Meadow, Honeybrook Farms	55.36	Mod.	Mod.	X	X	X	X	X				280
NSA-K-107	Bird River-D	Rosewood Trailer Park	7.44	High	High		X			X				0
NSA-K-23	Honeygo Run	Tremper Farm	16.07	Mod.	Mod.				X	X				80
NSA-K-32	Honeygo Run	North Gate	7.30	High	High				X					8
NSA-K-35	Honeygo Run	The Meadows	13.77	Mod.	High			X	X					160
NSA-K-67	Honeygo Run	Honeygo Village Condos	19.61	Mod.	Mod.	X			X					0
NSA-K-103	Honeygo Run	Parkside	34.23	Mod.	Mod.	X	X		X	X				720
NSA-K-104	Honeygo Run	Perry Hall Farms	10.22	Mod.	Mod.				X					0
NSA-K-42	Railroad Creek_Bird River-A	Woods at Bay Country	17.71	Low	Mod.	X	X	X	X	X		X		0
NSA-K-43	Railroad Creek_Bird River-A	Cunningham Cove & Oliver Beach	73.49	Mod.	Mod.	X	X		X	X				0
NSA-K-93	Railroad Creek_Bird River-A	Harewood Park, Twin River Beach	218.29	Mod.	Mod.	X	X	X		X				100
NSA-K-5	Whitemarsh Run	Greenbriar at Whitemarsh	9.90	High	High	X	X		X	X				28
NSA-K-6	Whitemarsh Run	Golden Acres	21.46	Mod.	Mod.				X	X		X		0
NSA-K-9	Whitemarsh Run	Sleepy Hollow	41.42	Mod.	Mod.				X	X				0
NSA-K-10	Whitemarsh Run	Fielder Property	15.41	Mod.	Mod.	X	X		X	X				0
NSA-K-11	Whitemarsh Run	Glen Arbor North	16.67	Mod.	Mod.	X	X	X	X	X	X			74
NSA-K-13	Whitemarsh Run	Southfield I and II	29.96	High	Mod.				X		X			208

Bird River Upland Assessments
Neighborhood Source Assessments (NSAs)

Site ID	Subshed	Name	Acres	PSI	ROI	Downspt. Disco-nnect	Rain Barrel	Rain Garden	Storm Drain Marking	Bay-Scape	Fertilizer Reduc.	Pet Waste	Trash Mgmt.	Trees to Plant.
NSA-K-14	Whitemarsh Run	Neely Property	15.38	Mod.	Mod.				X	X	X			116
NSA-K-15	Whitemarsh Run	Silver Gate/ Silver Hill Farm	21.47	Mod.	High	X	X		X	X				40
NSA-K-16	Whitemarsh Run	Necker Ave, Blue Stone Lane	16.42	Low	Mod.	X	X		X	X				0
NSA-K-18	Whitemarsh Run	Ridgelys Choice	16.21	Mod.	High				X	X		X		74
NSA-K-20	Whitemarsh Run	Maple Crest	20.90	High	High	X	X		X			X		72
NSA-K-20b	Whitemarsh Run	Miramar landing	11.49	Mod.	Mod.				X			X		0
NSA-K-21	Whitemarsh Run	The Commons at White Marsh	27.78	High	High	X			X			X		140
NSA-K-22b	Whitemarsh Run	Silver Woods	8.73	Mod.	Mod.	X			X			X		0
NSA-K-22	Whitemarsh Run	Tartan Hill	22.33	Mod.	Mod.	X	X		X					0
NSA-K-22c	Whitemarsh Run	Lawrence Hill	17.43	Mod.	Mod.	X	X							0
NSA-K-44	Whitemarsh Run	Hardwood Manor, Woodcroft, Harford Hills, Harford Dale, Joppa Manor, Joppa Springs, Ronleigh Heights	226.29	Mod.	Mod.	X	X		X	X				0
NSA-K-45	Whitemarsh Run	Featherhill@ Berryhill.	15.58	Mod.	Mod.									0
NSA-K-46	Whitemarsh Run	Edgewood Park	131.44	Mod.	Mod.	X	X		X	X				0
NSA-K-50	Whitemarsh Run	Thornwood Park, Ridge Grove, Ridge Terrace, Greenside Park.	83.04	Mod.	Mod.	X	X		X	X				0
NSA-K-51	Whitemarsh Run	Upton Village20.6	20.64	Mod.	High	X	X		X	X		X		0
NSA-K-52	Whitemarsh Run	Upton Village	34.49	Mod.	High				X					140
NSA-K-56	Whitemarsh Run	Belmont condos @ Still Meadow	54.81	High	High				X			X		200
NSA-K-57	Whitemarsh Run	Beldale Courts	8.59	Mod.	High				X					0
NSA-K-58	Whitemarsh Run	Belmont South	25.20	High	High				X					80
NSA-K-60	Whitemarsh Run	Carney Heights	23.44	Mod.	Mod.	X	X		X	X				0
NSA-K-61	Whitemarsh Run	Dunfield Townhomes	19.64	Mod.	High	X			X					80
NSA-K-71	Whitemarsh Run	Bird River Grove	28.31	Mod.	High	X	X		X	X				0
NSA-K-75	Whitemarsh Run	Timberbrooke	3.70	Mod.	High				X					147
NSA-K-76	Whitemarsh Run	Evergreen at Putty Hill	9.73	Mod.	Mod.				X		X			30
NSA-K-78	Whitemarsh Run	Maple Crest Apartments	45.84	High	High	X	X		X					150

Bird River Upland Assessments
Neighborhood Source Assessments (NSAs)

Site ID	Subshed	Name	Acres	PSI	ROI	Downspt. Disco-nnect	Rain Barrel	Rain Garden	Storm Drain Marking	Bay-Scape	Fertilizer Reduc.	Pet Waste	Trash Mgmt.	Trees to Plant.
NSA-K-79	Whitemarsh Run	White Marsh Farms II	17.29	Mod.	Mod.	X	X		X	X	X			56
NSA-K-85	Whitemarsh Run	Unknown.	37.94	Low	Mod.	X	X		X	X				0
NSA-K-86	Whitemarsh Run	Dunfield/ Dunhaven	43.49	Mod.	High	X			X					88
NSA-K-88	Whitemarsh Run	Upton, Village	34.63	Mod.	High				X					660
NSA-K-96	Whitemarsh Run	Dotty Rd, Goddard Farm Rd.	18.62	Low	Mod.				X	X				0
NSA-K-97	Whitemarsh Run	Olde Forge	26.51	High	High				X					80
NSA-K-98	Whitemarsh Run	Stillwood	20.85	Mod.	Mod.	X			X					20
NSA-K-99	Whitemarsh Run	Silver Hill	13.86	High	Mod.		X		X			X		40
NSA-K-105	Whitemarsh Run	Lincoln Woods Apartments	12.47	High	High				X					0
NSA-K-105b	Whitemarsh Run	Quail Ridge	9.80	Mod.	Mod.	X								0
NSA-K-106	Whitemarsh Run	Apple Hill Apartments	10.85	Mod.	Mod.				X					0
NSA-K-109	Whitemarsh Run	The Village of Southfield Condos	8.73	Mod.	Mod.	X								0
NSA-K-12	Whitemarsh Run (N. Fork)	Southfield at Whitemarsh	26.74	High	Mod.	X			X			X		0
NSA-K-17	Whitemarsh Run (N. Fork)	Hall field Manor	43.87	High	Mod.	X	X		X					0
NSA-K-17b	Whitemarsh Run (N. Fork)	Hallfield Manor, Silver Gate South	48.22	High	High	X	X		X	X	X			0
NSA-K-19	Whitemarsh Run (N. Fork)	Slater Ave, Link Ave.	8.16	Mod.	Mod.	X	X		X	X				0
NSA-K-24	Whitemarsh Run (N. Fork)	Darleigh Manor	18.06	Mod.	Mod.	X	X		X	X		X		0
NSA-K-26	Whitemarsh Run (N. Fork)	Silver Spring	29.84	Mod.	Mod.		X		X	X				0
NSA-K-27	Whitemarsh Run (N. Fork)	Silver Spring Station	12.83	High	High				X					32
NSA-K-28	Whitemarsh Run (N. Fork)	Brookhurst	7.45	Mod.	Mod.	X	X		X					0
NSA-K-29	Whitemarsh Run (N. Fork)	Ramblebrook	21.53	Mod.	High	X	X		X	X				0
NSA-K-30	Whitemarsh Run (N. Fork)	Perryvale	135.52	Mod.	Mod.				X	X				280
NSA-K-33	Whitemarsh Run (N. Fork)	Arbour Green	2.51	Mod.	Mod.	X			X					0

Bird River Upland Assessments
Neighborhood Source Assessments (NSAs)

Site ID	Subshed	Name	Acres	PSI	ROI	Downspt. Disco-nnect	Rain Barrel	Rain Garden	Storm Drain Marking	Bay-Scape	Fertilizer Reduc.	Pet Waste	Trash Mgmt.	Trees to Plant.
NSA-K-34	Whitemarsh Run (N. Fork)	Perry Hall Village	14.18	High	High		X		X	X				0
NSA-K-36	Whitemarsh Run (N. Fork)	Chapel Valley Townhomes	10.90	Mod.	Mod.				X					20
NSA-K-37	Whitemarsh Run (N. Fork)	Chapel Manor	25.70	Mod.	High				X					320
NSA-K-62	Whitemarsh Run (N. Fork)	Ambermill	34.46	High	Mod.	X	X					X		0
NSA-K-63b	Whitemarsh Run (N. Fork)	Heathermill	14.62	Mod.	Mod.		X							0
NSA-K-63	Whitemarsh Run (N. Fork)	Castlemill	20.23	High	Mod.	X			X			X		8
NSA-K-64	Whitemarsh Run (N. Fork)	Beaconswood	19.36	Mod.	High				X			X		0
NSA-K-65	Whitemarsh Run (N. Fork)	Village of Silver Hall	4.63	Mod.	Mod.				X					26
NSA-K-66	Whitemarsh Run (N. Fork)	Nottingham woods	64.50	High	Mod.	X	X					X		0
NSA-K-80	Whitemarsh Run (N. Fork)	Silver Spring Station	17.84	Mod.	Mod.	X			X					0
NSA-K-82	Whitemarsh Run (N. Fork)	Chapel Manor	25.28	Mod.	High		X		X	X				86
NSA-K-83	Whitemarsh Run (N. Fork)	Joppa View, Joppa Vale, Ramble Brook, Park Place, Silver Gate, Sharon Dale, Darnall Manor, Penn Grove.	178.68	Mod.	High	X	X		X	X				0
NSA-K-84	Whitemarsh Run (N. Fork)	Brookhurst & Oak dale II	18.34	Mod.	High		X		X		X			0
NSA-K-87	Whitemarsh Run (N. Fork)	Blakefield/ Likens Property	19.08	Mod.	Mod.	X	X		X	X				26
NSA-K-91	Whitemarsh Run (N. Fork)	Sharondale East & Jasper property	42.65	Mod.	High		X		X	X				230
NSA-K-102	Whitemarsh Run (N. Fork)	Perrybrook Condos & Silver Ridge Condos	19.66	Mod.	High	X			X					54
NSA-K-1	Whitemarsh Run (S. Fork)	Springhouse Station	12.95	High	Mod.	X	X	X	X	X				60
NSA-K-2	Whitemarsh Run (S. Fork)	Castlestone at White Marsh	27.54	Mod.	Mod.				X		X			15

Bird River Upland Assessments

Neighborhood Source Assessments (NSAs)

Site ID	Subshed	Name	Acres	PSI	ROI	Downspt. Disco-nnect	Rain Barrel	Rain Garden	Storm Drain Marking	Bay-Scape	Fertilizer Reduc.	Pet Waste	Trash Mgmt.	Trees to Plant.
NSA-K-3	Whitemarsh Run (S. Fork)	Cambridge ct and Castle Creek apts@ White Marsh	59.33	High	High				X		X			200
NSA-K-4	Whitemarsh Run (S. Fork)	Eaton Square	39.10	High	High				X		X			572
NSA-K-7	Whitemarsh Run (S. Fork)	Nottingham	36.33	Low	High	X	X	X	X	X				0
NSA-K-73	Whitemarsh Run (S. Fork)	Kings Court Condos	19.44	High	High	X			X					147
NSA-K-74	Whitemarsh Run (S. Fork)	Kings, ct.	49.14	High	Mod.				X		X			0
NSA-K-77	Whitemarsh Run (S. Fork)	Kings Ct.	38.49	High	High				X		X			574
NSA-K-81	Whitemarsh Run (S. Fork)	Canterbury Apartments	39.45	Mod.	High	X			X					260
NSA-K-108	Whitemarsh Run (S. Fork)	Kings Manor/ Ridge Manor	46.29	Mod.	Mod.	X	X	X	X	X				0
NSA-K-110	Whitemarsh Run (S. Fork)	Kings Court Condos	8.71	Mod.	Mod.		X							340
NSA-K-8	Windlass Run	Rohe Farm	12.16	Low	Mod.				X	X				0
NSA-K-70	Windlass Run	Gambrills Vincent Farm	52.22	Mod.	Mod.	X	X		X	X				0

APPENDIX H: SUPPORTING CALCULATIONS FOR NSA ANALYSES

Supporting Calculations for NSA Analyses

Downspout Disconnection

Table 4-2 in the Bird River watershed characterization report summarizes rooftop acres addressed by downspout redirection for the recommended neighborhoods. The method by which this column was calculated is described below.

Rooftop Acres Addressed

NSAs not recommended for downspout disconnection contribute 0 acres to this analysis. Rooftop acres addressed by disconnecting downspouts in a recommended neighborhood were calculated as follows:

Acres of Buildings x %Connected Downspouts

For example, NSA_K_1 was recommended for downspout redirect and has a total of 4.19 acres of buildings (i.e., rooftop) based on Baltimore County's GIS buildings layer. During the uplands survey, it was estimated that 40% of the downspouts in NSA_K_1 were connected. Therefore, the total rooftop acres addressed by disconnecting downspouts in NSA_K_1 would be 4.19 acres x 0.40 = 1.68 acres.

% of Subwatershed Rooftop Area Addressed

For a given subwatershed, the % of subwatershed rooftop area addressed was calculated as:

ΣIndividual NSA Rooftop Acres Addressed / Total Subwatershed Rooftop Acres

The total acres of rooftop within a subwatershed were determined using Baltimore County's GIS buildings layer.

Fertilizer Reduction/Education

Table 4-3 in the Bird River watershed characterization report summarizes the acres of lawn addressed by fertilizer reduction for the recommended neighborhoods. The method by which this column was calculated is described below.

Acres of Lawn Addressed

NSAs not recommended for fertilizer reduction (i.e., have less than 20% high maintenance lawns) contribute 0 acres to this analysis. Acres of lawn addressed by fertilizer reduction/education in a recommended neighborhood were calculated as follows:

(NSA Total Acres - NSA Road Acres) x %Lot Grass Cover x %High Maintenance Lawns

The first expression in parentheses in the equation above represents the total acres of individual lots in an NSA. Multiplying this by the % of grass cover estimated for a typical lot in the NSA yields the total acres of lawn in an NSA. Finally, multiplying this result by the % of lawns using

high management lawn practices yields the acres of lawn that would be addressed via fertilizer reduction.

For example, NSA_K_11 was recommended for fertilizer reduction and has a total area of 16.67 acres. Based on Baltimore County's GIS roads layer, there are approximately 5.3 acres of roads in this NSA. This means NSA_K_11 consists of approximately 16.67 - 5.3 = 11.37 acres for individual lots. During the uplands survey, it was estimated that the average lot in NSA_K_11 consists of 35% grass cover which equates to 11.37 acres x 0.35 = 3.98 total acres of lawn. It was also noted that about 20% of the lawns in NSA_K_11 were employing high maintenance practices. So there are approximately 3.98 acres x 0.20 = 0.80 acres of high maintenance lawn that could be addressed by fertilizer reduction in NSA_K_11.

<u>% of Subwatershed Area Addressed</u>

For a given subwatershed, the % of the total subwatershed area addressed was calculated as:

$$\Sigma \text{Individual NSA Lawn Acres Addressed} / \text{Total Subwatershed Acres}$$

BayScaping

Table 4-4 in the Bird River watershed characterization report summarizes the acres of land addressed by BayScaping for the recommended neighborhoods. The method in which this column was calculated is described below.

<u>Acres of Land Addressed</u>

NSAs not recommended for BayScaping contribute 0 acres to this analysis. According to CWP, the minimum recommended proportion of BayScaping is 25% of an individual lot. To determine the percent of the lots available, the current landscaping percentage was subtracted from the current percentage of the lot covered in grass:

$$\%\text{Lot Available for BayScaping} = \%\text{Lot Grass Cover} - \%\text{Lot Landscaping}$$

Acres of land addressed by BayScaping in a recommended neighborhood were calculated as follows:

$$(\text{NSA Total Acres} - \text{NSA Road Acres}) \times \%\text{Lot Available for BayScaping}$$

The first expression in parentheses in the equation above represents the total acres of individual lots in an NSA.

Multiplying these two factors yields the total acres of land in an NSA recommended/available for BayScaping. NSA_K_24 was 18.06 acres and was recommended for BayScaping. It has approximately 2.3 acres of roads. This means NSA_K_24 consists of approximately 18.06 – 4.63 = 15.76 acres for individual lots. During the uplands survey, it was estimated that the average lot in NSA-A-1022 consists of 47% grass cover and 3% landscaping, which means 44% would be recommended for BayScaping. This equates to 15.76 acres x 0.44 = 6.93 acres of land that could be addressed by BayScaping in this NSA.

For a given subwatershed, the % of the total subwatershed area addressed was calculated as:

ΣIndividual NSA Land Acres Addressed / Total Subwatershed Acres

Storm Drain Marking

Table 4-5 in the Bird River watershed characterization report summarizes the number of inlets and % of subwatershed inlets addressed by storm drain marking for the recommended neighborhoods. The method in which these two columns were calculated is described below.

Approximate Number of Inlets Addressed

NSAs not recommended for storm drain marking contribute 0 inlets to this analysis. The approximate number of inlets addressed in a neighborhood recommended for storm drain marking was calculated as follows:

NSA # of Inlets x NSA % of Inlets Not Marked

For example, NSA_K_60 was recommended for storm drain marking and has a total of 47 inlets. 50% of the inlets in NSA_K_60 were determined to have no storm drain markings. Therefore, 47 inlets x 0.50 = 24 storm drain inlets need to be addressed in this NSA.

% of Subwatershed Inlets Addressed

For a given subwatershed, the % of the total subwatershed inlets addressed was calculated as:

ΣIndividual NSA Inlets Addressed / Total Subwatershed Inlets

APPENDIX J: STORMWATER MANAGEMENT FACILITY ASSESSMENT PHOTOGRAPHS

Pond 349

Pond 379

Pond 380

Pond 399

Pond 529

Pond 610

Pond 611 – No pond was located. Appears to be a dewatering area for construction waste.

Pond 790

Pond 876

Pond 877

Pond 878

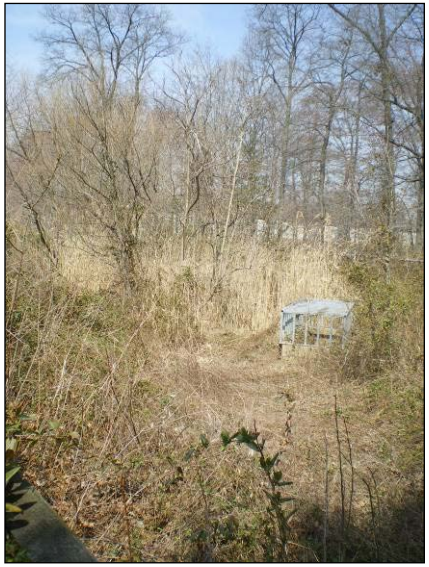
Pond 883

Pond 919

Pond 951

Pond 1039

Pond 1040



Pond 1041

Pond 1166

Pond 1633

Pond 1850

APPRENDIX K: ACCESS DATABASES AND OTHER ELECTRONIC DOCUMENTS

(Available on CD)

APPENDIX I: WATER QUALITY ANALYSIS (WQA) FOR THE TIDAL BIRD RIVER AND THE CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD (TMDL)

Water Quality Analysis for the Tidal Bird River:

http://www.mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Pages/Programs/WaterPrograms/TMDL/approvedfinaltmdl/wqa_final_birdriver_eutro.aspx

Chesapeake Bay TMDL:

http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html

Water Quality Analysis of Eutrophication for the Tidal Bird River, Baltimore County, Maryland

FINAL

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U.S. Environmental Protection Agency, Region III
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List of Abbreviations

BOD	Biochemical Oxygen Demand
COMAR	Code of Maryland Regulation
CWA	Clean Water Act
DNR	Department of Natural Resources
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
MDP	Maryland Department of Planning
MDE	Maryland Department of the Environment
mg/l	Milligrams Per Liter
mi^2	Square miles
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
WQLS	Water Quality Limited Segment
μg/l	Micrograms Per Liter

EXECUTIVE SUMMARY

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency (EPA)'s implementing regulations direct each State to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. This list of impaired waters is commonly referred to as the "303(d) list". For each WQLS, the State is to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate that water quality standards are being met.

Bird River (basin code 02-13-08-03) was identified on the State's 1996 list of WQLSs as impaired by nutrients and sediments. This document addresses the nutrient impairment in the tidal portion of Bird River; the sediment impairment will be addressed at a future date.

An analysis of recent monitoring data shows that the dissolved oxygen criterion and designated uses associated with nutrients are being met in Bird River. This analysis supports the conclusion that a TMDL for nutrients is not necessary to achieve water quality in this case. Barring any contradictory future data, this report will be used as supporting material when Maryland Department of the Environment (MDE) proposes the revision of Maryland's 303(d) list for public review. Although the waters of Bird River do not display signs of eutrophication, the State reserves the right to require future controls in the Bird River watershed if evidence suggests nutrients from the basin are contributing to downstream water quality problems.

1.0 INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency (EPA)'s implementing regulations direct each State to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. This list of impaired waters is commonly referred to as the "303(d) list". For each WQLS, the State is to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate that water quality standards are being met.

In addition to the successful implementation of a TMDL, there are four other scenarios that may be used to address an impaired waterbody: 1) more recent data indicating that the impairment no longer exists (i.e., water quality standards are being met); 2) more recent and updated water quality modeling which demonstrates that the segment is now attaining standards; 3) refinements to water quality standards, or the interpretation of those standards, which result in standards being met; or 4) correction to errors made in the initial listing.

Bird River (basin code 02-13-08-03) was first identified on the 1996 303(d) list, submitted to EPA by the Maryland Department of the Environment (MDE), as being impaired by nutrients and sediments. This report provides more recent information that supports the removal of the nutrients listing for Bird River when the 303(d) list is revised; therefore, the aforementioned first scenario most closely applies, with the qualification that initial listing for nutrients was suspected due to the lack of data. The sediment impairment will be addressed at a future date.

The remainder of this report lays out the general setting of the waterbody within the Bird River watershed, presents a discussion of the water quality characteristics in the basin, and provides conclusions with regard to the current water quality characteristics and the current standards. The data will establish that the Bird River is achieving water quality standards.

2.0 GENERAL SETTING

Bird River is located in Baltimore County, Maryland in the tidal portion of the Gunpowder River watershed and flows south into the Chesapeake Bay. Bird River is approximately 7 miles in length, with a watershed area of approximately 25.9 mi^2 (non-water) or 16,600 acres (Figure 1). The land uses in the watershed are mixed agricultural (2,605 acres or 15.7% of the area), forest (6,285 acres or 37.9% of the area), and urban (7,195 acres or 43.4% of the area). Please refer to Figure 2 for a map of these land uses (MDP, 2000).

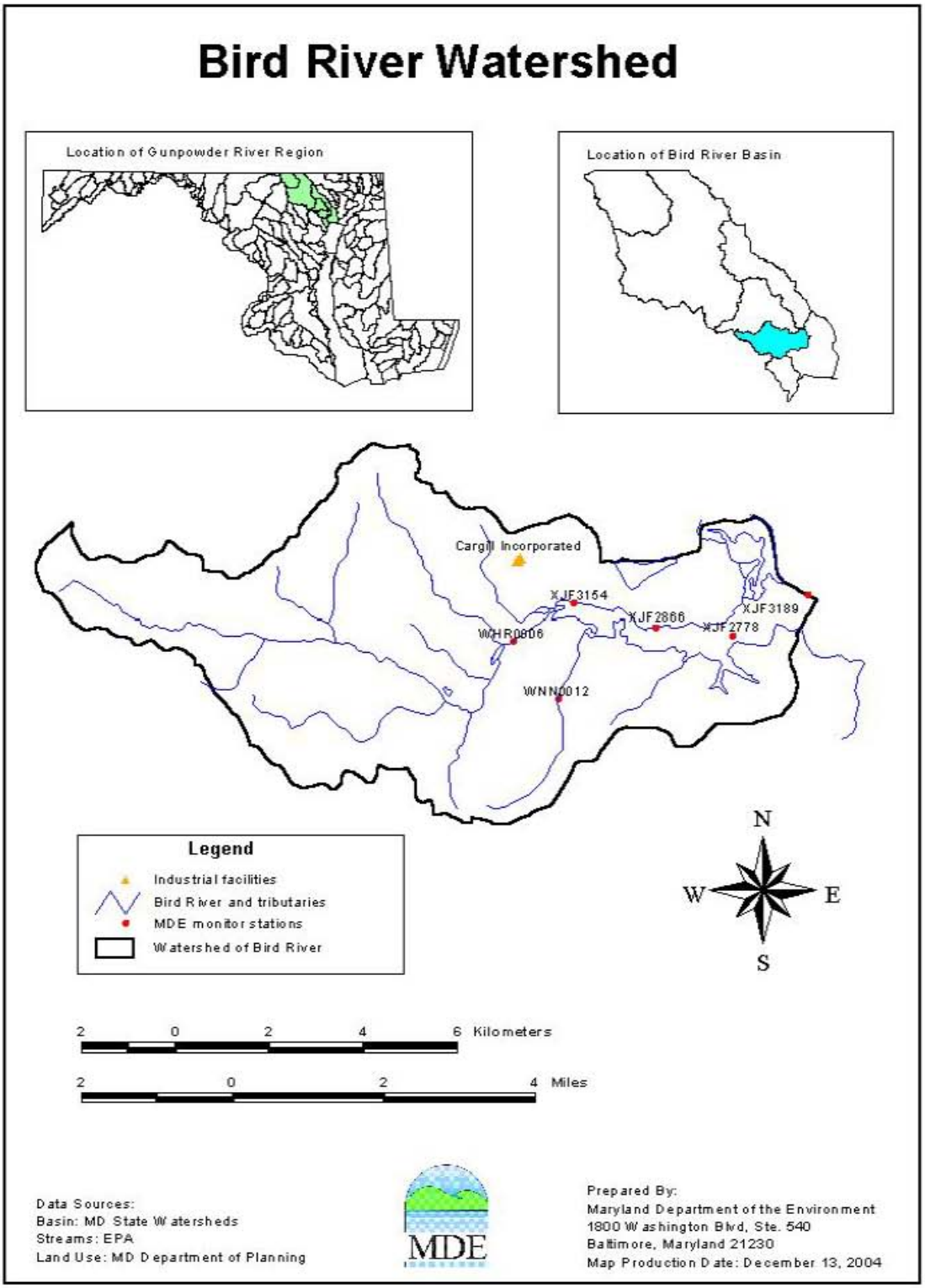

Figure 1: Bird River Location Map and Monitoring Stations

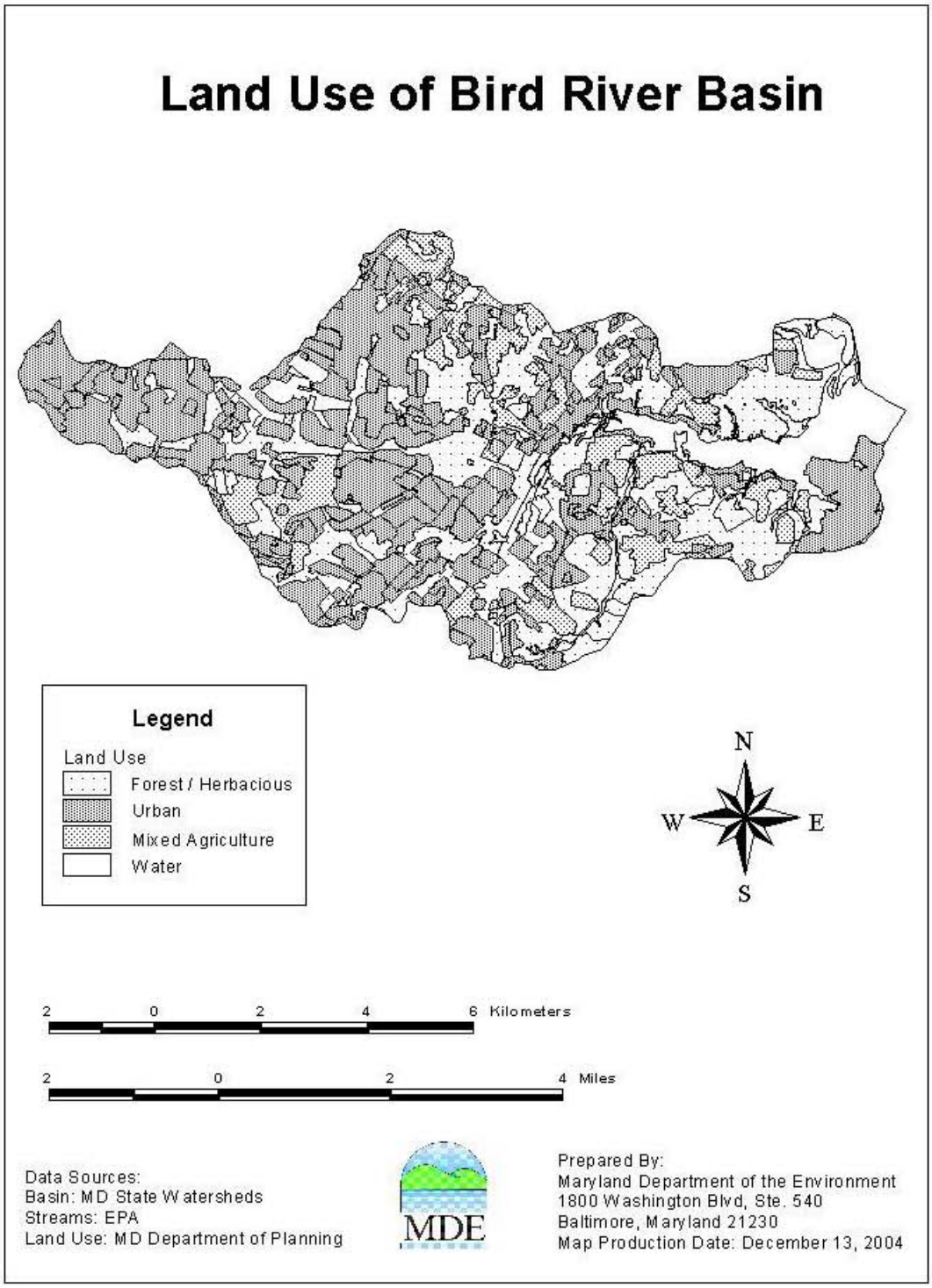

Figure 2: Land Use Map of the Bird River Watershed

3.0 WATER QUALITY CHARACTERIZATION

A water quality standard is the combination of a designated use for a particular body of water and the water quality criteria designed to protect that use. Designated uses include activities such as swimming, drinking water supply, and shellfish propagation and harvest. Water quality criteria consist of narrative statements and numeric values designed to protect the designated uses. Criteria may differ among waters with different designated uses.

Maryland's water quality standards presently do not impose a limit on the concentration of nutrients in the water column[1]. Rather, Maryland manages nutrients indirectly by limiting their effects expressed in terms of excess algal growth and low dissolved oxygen (DO). Because biochemical oxygen demand (BOD) also consumes DO, this potentially confounding factor must be considered in the analysis if low DO is observed.

The Maryland Surface Water Use Designation (Code of Maryland Regulations (COMAR) 26.08.02.07) for the tidal portion of Bird River is Use II – w*ater used for shellfish harvesting*. According to Maryland's numeric criterion for DO, concentrations may not be less than 5.0 mg/l at any time (COMAR 26.08.02.03-3C(2)), unless resulting from natural conditions (COMAR 26.08.02.03.A(2)). The water quality data presented in this section will show the designated use of this water body is being met as it relates to nutrients.

Maryland's general water quality criteria prohibit pollution of waters of the State by any material in amounts sufficient to create nuisance or interfere with designated uses (COMAR 26.08.02.03B(2)). Excessive eutrophication, indicated by elevated levels of chlorophyll *a*, can produce nuisance levels of algae and interfere with designated uses such as fishing and swimming; therefore, a desired peak chlorophyll a level of 50 µg/l has been established for tidal waters. The chlorophyll *a* level is based on the designated use, guidelines set forth by Thomann and Mueller (1987) and by the EPA Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1 (1997).

All readily available water quality data for the last five years pertaining to the tidal portion of Bird River were considered for this analysis. Water quality data from MDE surveys conducted at four stations along Bird River during October 1999 through August 2000 (which covers both the high-flow and the low-flow conditions) were used to perform this analysis. Other available resources (USGS, Bay Program data) were also investigated to determine if there were other available stations in the Bird River watershed. No data from other sources were found. Table 1 shows the list of MDE stations with their geographical coordinates and descriptive location in the Bird River watershed. Figure 3 provides graphical representation of the collected data for the parameters discussed below.

1 Maryland does limit the ammonia form of nitrogen from the Waste Water Treatment Plants due to its toxic effects on some aquatic organisms.

Table 1: Locations of Water Quality Stations Monitored During 1999-2000 in Bird River.

Station Code	Latitude Degrees	Longitude Degrees
XJF2778	39 22.729	76 22.221
XJF2866	39 22.830	76 23.354
XJF3154	39 23.121	76 24.568
XJF3189	39 23.185	76 21.112
WNR0006 *	39 22.678	76 25.466
WNN0012 *	39 21.990	76 24.812

* These are non-tidal stations presented here for informational purposes, but are not within the subject segment

3.1 Nutrients

During the October 1999 through August 2000 sampling period, total phosphorus (TP) concentrations in the tidal waters ranged from 0.047 mg/l to 0.177 mg/l and total nitrogen (TN) concentrations ranged from 0.631 mg/l to 2.071 mg/l. Please refer to Figure 3 for graphical representations of this data; data tables are presented in Appendix A.

3.2 Dissolved Oxygen

During the October 1999 through August 2000 sampling period, DO concentrations ranged from 5.4 mg/l to 11.0 mg/l. The data shows that none of the concentrations fell below the criterion of 5 mg/l during the entire sampling period. This data is summarized in Figure 3. Tabular data is presented in Appendix A.

3.3 Chlorophyll *a*

Chlorophyll *a* data was collected during the entire period from October 1999 through August 2000 covering algal growing season, when concentrations are at their peak. Observed chlorophyll *a* concentrations are low (< 35 µg/l) and do not reach levels higher than the water quality threshold of 50 µg/l in the tidal portion of Bird River.

The low chlorophyll *a* concentrations found in Bird River suggests that chlorophyll *a* photosynthesis and respiration will have no significant effect on observed DO values. Nothing out of the ordinary was observed during sampling event. This data is summarized in Figure 3. Tabular data is presented in Appendix A.

3.4 Biochemical Oxygen Demand (BOD)

Because BOD also consumes DO, this potentially confounding factor must be considered in the analysis if low DO is observed. During the October 1999 through August 2000 sampling period, BOD concentrations ranged from 2.8 mg/l to 6.1 mg/l. Again, please refer to Figure 3 for graphical representations of this data; data tables are presented in Appendix A. Please note that DO concentrations were always above 5 mg/l during the sampling period.

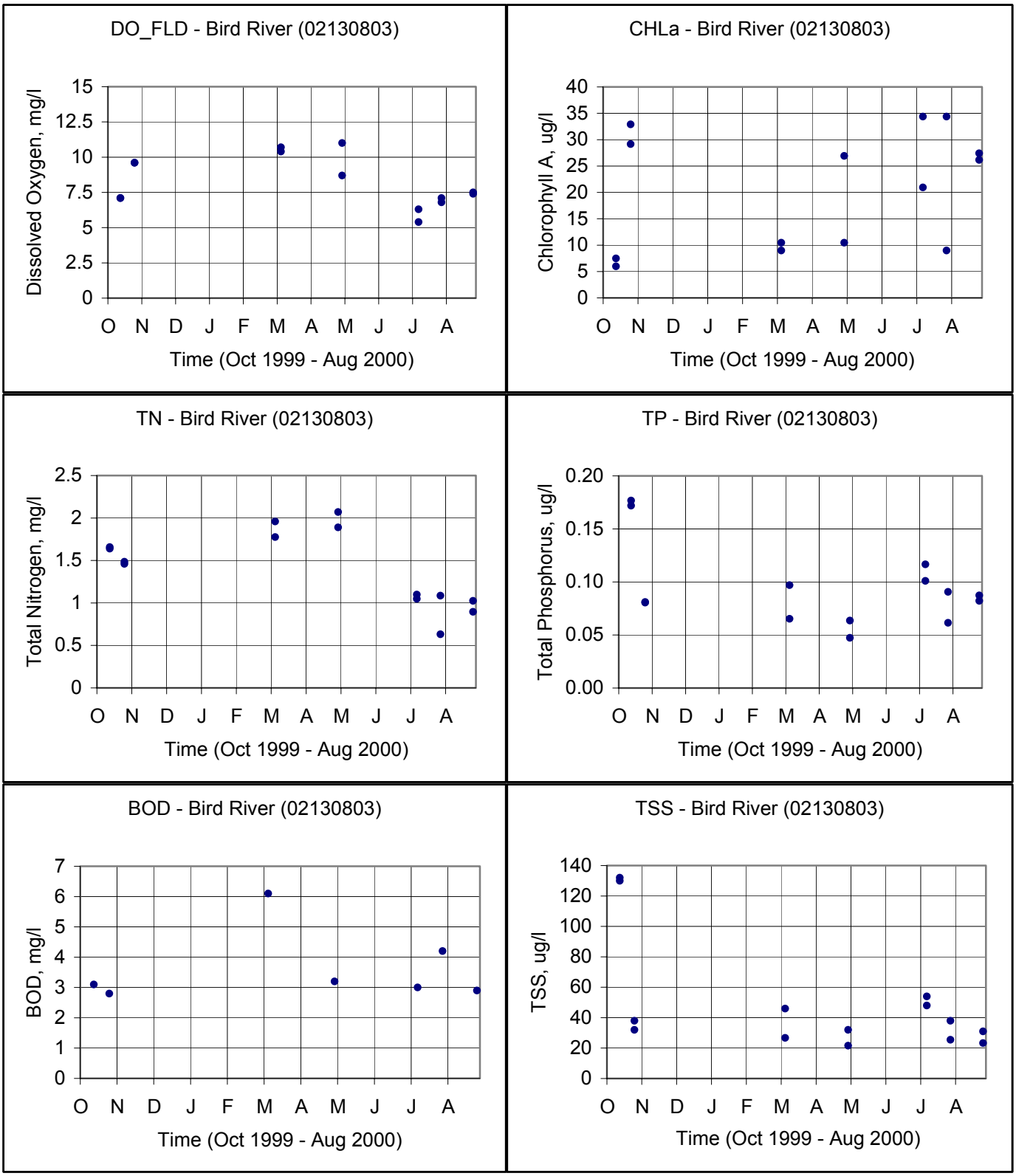

Figure 3: Bird River Water Quality Data from October 1999 through August 2000 (Tidal Stations only)

4.0 CONCLUSION

The data presented above clearly demonstrates that excessive algal growth does not exist in the tidal portion of Bird River, as indicated by low chlorophyll *a*. Similarly, DO concentrations are well above the criterion of 5.0 mg/l. Based on the synoptic surveys conducted during 1999-2000, the water quality data indicates that Bird River has no eutrophication-related water quality impairments. Barring any contradictory future data, this information provides sufficient justification to revise Maryland's 303(d) list to remove nutrients as an impairing substance in relation to Bird River.

REFERENCES

Code of Maryland Regulations, 26.08.02.07, 26.08.02.03-3C(2), 26.08.02.03A(2), 26.08.02.03B(2)

Maryland Department of Planning. Digital Land Use/Land Cover Data for Maryland. 2000.

Thomann, Robert V., John A. Mueller "Principles of Surface Water Quality Modeling and Control, " HarperCollins Publisher Inc., New York, 1987.

U.S. Environmental Protection Agency, "Technical Guidance Manual for Developing Total Maximum Daily Loads, Book2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/ Dissolved Oxygen and Nutrients/ Eutrophication," Office of Water, Washington D.C., March 1997.

Appendix A: Tabular Water Quality Data

STATION	DATE	BOD-5 MG/L	DO_FLD MG/L	TN, MG/L	TP, MG/L	TSS, MG/L	CHL A, µG/L	Tidal/Non-tidal
WHR0006	11/15/99	1.5	9.1	0.9	0.02	2.4	1.7	Non-tidal
WHR0006	11/29/99	4.2	10.6	1.1	0.04	14	2.5	Non-tidal
WHR0006	12/13/99		11.2	1.2	0.03	15	2.0	Non-tidal
WHR0006	1/12/00	1.1	11.7	1.4	0.04	22	2.5	Non-tidal
WHR0006	2/22/00	1.6	12.0	1.4	0.03	24.7		Non-tidal
WHR0006	2/28/00	5.2	10.7	1.6	0.13	113		Non-tidal
WHR0006	3/7/00	5.5	10.8	1.2	0.02	5.6	2.0	Non-tidal
WHR0006	4/5/00	2.4	9.4	1.4	0.05	22	5.5	Non-tidal
WHR0006	5/2/00	1.7	7.4	1.4	0.03	21	2.0	Non-tidal
WHR0006	5/23/00	2.1	7.4	1.5	0.07	33	3.4	Non-tidal
WHR0006	6/5/00	3.9	7.4	1.5	0.04	12.5	2.2	Non-tidal
WHR0006	7/11/00	2.0	5.6	1.5	0.05	13	7.2	Non-tidal
WHR0006	8/1/00	3.0	6.7	1.2	0.05	14	6.7	Non-tidal
WHR0006	8/30/00	2.3	7.8	1.3	0.09	38	7.5	Non-tidal
WNN0012	3/7/00		11.4	1.8	0.03	3.2		Non-tidal
WNN0012	4/5/00		10.2	1.3	0.05	10.5	10.5	Non-tidal
WNN0012	5/2/00		9.0	1.9	0.06	18.7	3.0	Non-tidal
WNN0012	7/11/00		6.2	2.0	0.08	11.5	3.0	Non-tidal
WNN0012	8/1/00		6.6	1.9	0.07	13		Non-tidal
WNN0012	8/30/00		7.0	1.6	0.07	11	1.5	Non-tidal
XJF2778	3/7/00	6.1	10.4	2.0	0.10	46	10.5	Tidal
XJF2778	5/2/00	3.2	11.0	1.9	0.06	32	26.9	Tidal
XJF2778	7/11/00	3.0	5.4	1.1	0.12	48	34.4	Tidal
XJF2778	8/1/00	4.2	7.1	1.1	0.09	38	34.4	Tidal
XJF2778	8/30/00	2.9	7.4	1.0	0.09	31	26.2	Tidal
XJF2866	10/25/99	2.8	9.6	1.5	0.08	38	29.2	Tidal
XJF2866	10/25/99		9.6	1.5	0.08	32	32.9	Tidal
XJF3154	10/12/99	3.1	7.1	1.7	0.18	132	7.5	Tidal
XJF3154	10/12/99		7.1	1.6	0.17	130	6.0	Tidal
XJF3189	3/7/00		10.7	1.8	0.07	26.7	9.0	Tidal
XJF3189	5/2/00		8.7	2.1	0.05	21.6	10.5	Tidal
XJF3189	7/11/00		6.3	1.0	0.10	54	20.9	Tidal
XJF3189	8/1/00		6.8	0.6	0.06	25.5	9.0	Tidal
XJF3189	8/30/00		7.5	0.9	0.08	23.3	27.4	Tidal

APPENDIX J: STORMWATER MANAGEMENT FACILITY ASSESSMENT PHOTOGRAPHS

Pond 349

Pond 379

Pond 380

Pond 399

Pond 529

Pond 610

Pond 611 – No pond was located. Appears to be a dewatering area for construction waste.

Pond 790

Pond 876

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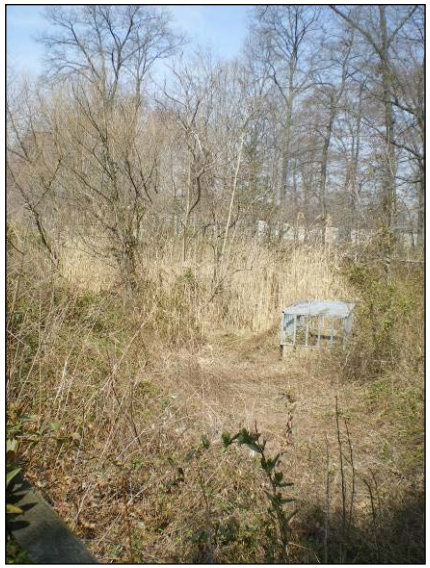
Pond 919

Pond 951

Pond 1039

Pond 1040



Pond 1041

Pond 1166

Pond 1633

Pond 1850