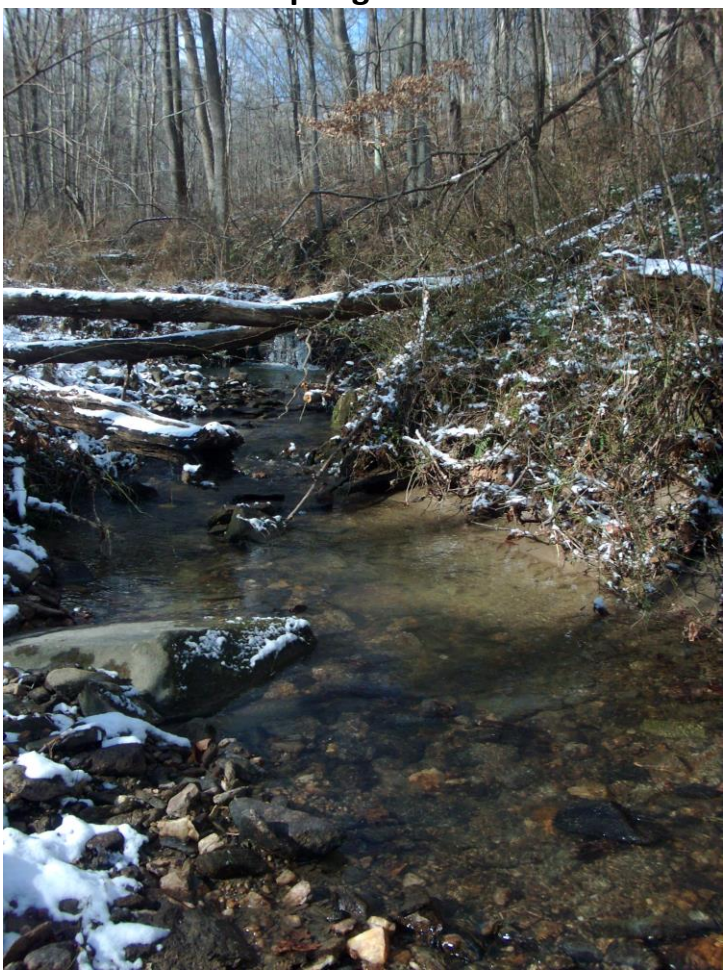
South Branch Patapsco River Watershed Characterization Plan

Spring 2016



Prepared by
Carroll County Bureau of Resource Management

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List of Acronyms

BMPs	best management practices
COMAR	Code of Maryland Regulations
DNR	Maryland Department of Natural Resources
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GIS	geographic information system
HSG	hydrological soil group
IBI	Index of Biotic Integrity
MBSS	Maryland biological stream survey
MDE	Maryland Department of the Environment
NLCD	National Land Cover Database
NPDES	national pollution discharge elimination system
PFA	priority funding area
RTE	rare, threatened or endangered
SW	stormwater
TMDL	total maximum daily load
TSS	total suspended sediments
USDA	United States Department of Agriculture
WLA	wasteload allocation

I. Characterization Introduction

A. Purpose of the Characterization

The South Branch Patapsco Watershed Characterization Plan is intended to provide a background on the hydrological, biological and other natural characteristics of the watershed as well as discuss human characteristics that may have an impact within the watershed. The information provided in this report as well as information gathered during the South Branch Patapsco Watershed stream corridor assessment (SCA) will be used as a tool to help direct the watershed implementation plan for the South Branch Patapsco Watershed. The implementation plan will be used to identify opportunities for water quality improvements within the watershed as required by the County's National Pollutant Discharge Elimination System (NPDES) permit, and is designed to meet approved Total Maximum Daily Loads (TMDLs) for the South Branch Patapsco Watershed.

B. Location and Scale of Analysis

The South Branch Patapsco Watershed is located in southern portion of Carroll County, Maryland. The South Branch Patapsco Watershed is within the Piedmont Plateau Province of Maryland. The Piedmont Plateau province is characterized by gentle to steep rolling topography, low hills, and ridges (MGS 2009). The watershed area within Carroll County covers 38,736 acres within eleven sub-watersheds. Figure 1-1 depicts the location of the South Branch Patapsco Watershed and the several subwatersheds within Carroll County. The South Branch Patapsco Watershed drains to the Patapsco River Lower North Branch, which is a tributary to the Chesapeake Bay. Table 1-1 displays the distribution of acreage between the subwatersheds within South Branch Patapsco Watershed. The analyses presented in this report are done at the subwatershed scale. This allows for restoration and preservation efforts to be focused on smaller drainage areas where efforts can be prioritized and more easily monitored.

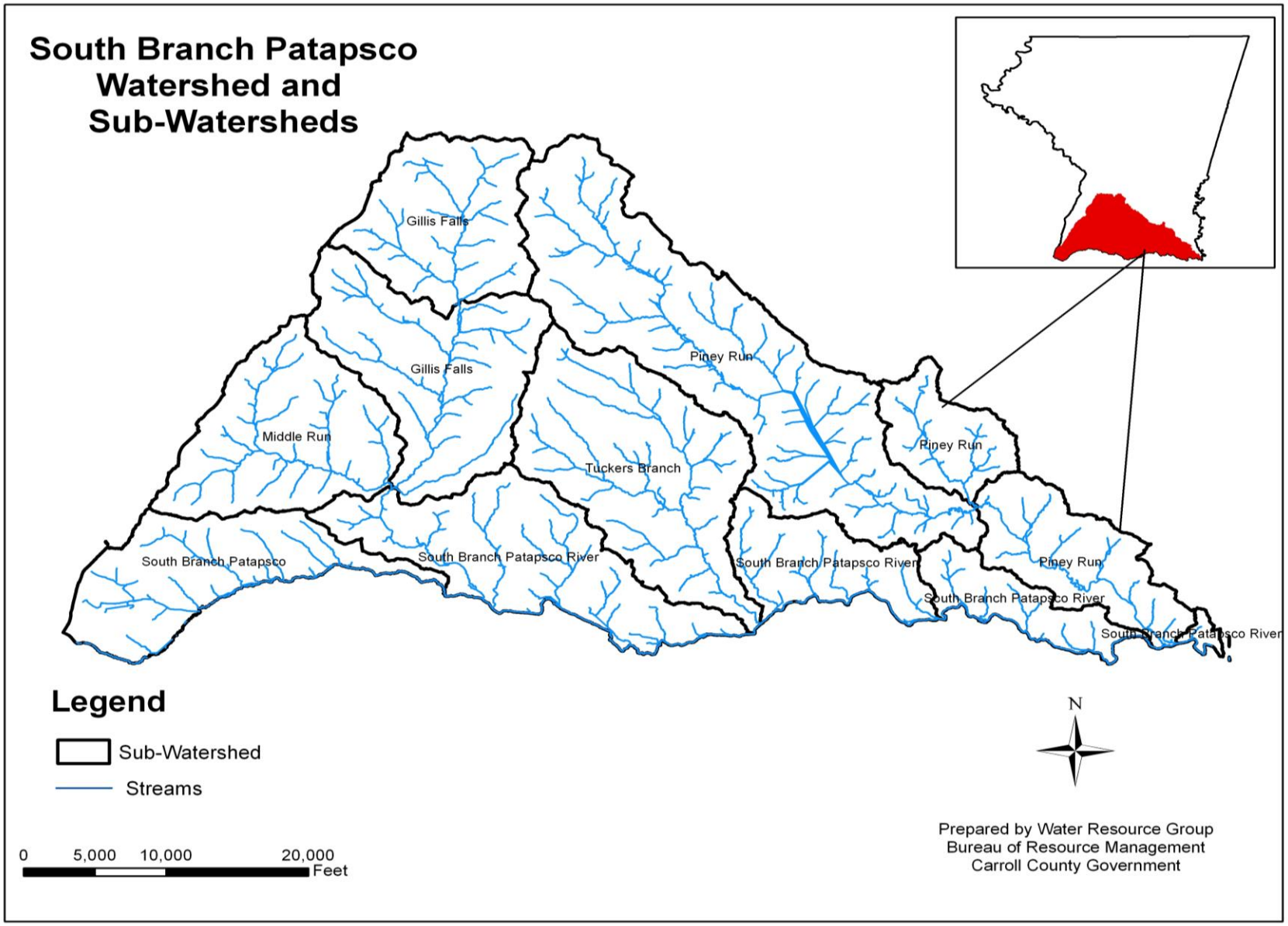

Figure 1-1: South Branch Patapsco Watershed Location Map

Table 1-1: South Branch Patapsco Watershed's Subwatershed Acreages

DNR 12-digit Scale	Subwatershed	Acres
021309081031	Gills Falls Upper	3,118.40
021309081030	Gills Falls Lower	4,243.17
021309081029	Middle Run	3,781.73
021309081021	Piney Run Lower	2,306.82
021309081023	Piney Run Main	8,007.30
021309081024	Piney Run Tributary	1,442.79
021309081028	South Branch Patapsco	3,169.38
021309081025	South Branch Patapsco River	4,116.38
021309081022	South Branch Patapsco River	1,953.15
021309081020	South Branch Patapsco River	1,430.57
021309081026	Tuckers Branch	5,166.27
South Branch Patapsco Watershed Total		**38,735.95**

C. Report Organization

This report is organized into six different chapters:

Chapter 1 presents the purpose of the characterization plan, shows a general location of the watershed within the County and lists the acreage distribution among the subwatersheds.

Chapter 2 presents background information on the natural characteristics of the watershed. Natural characteristics discussed in this chapter include climate, topography, soils, geology, wetlands and forest cover.

Chapter 3 focuses on anthropogenic influence within the watershed. The human component focuses on land use/land cover, impervious surface area, storm drain systems, drinking water and wastewater systems, and other point source locations. Chapter 3 will also discuss best management practices (BMPs) that have been installed in the watershed as well as any lands that have been protected through various programs.

Chapter 4 focuses on water quality. This chapter will discuss the stream designations, water quality data collected within South Branch Patapsco Watershed, and the total maximum daily loads (TMDLs) associated with the South Branch Patapsco Watershed.

Chapter 5 summarizes the living resources within the South Branch Patapsco Watershed including aquatic and terrestrial, as well as any rare, threatened or endangered (RTE) species.

Chapter 6 summarizes the purpose and use of the Characterization Plan and related work completed within the watershed. This plan will be used in developing the restoration plan for the watershed. This Chapter also lays out approximate cost in completion of this work.

II. Natural Characteristics

A. Introduction

The natural characteristics of a watershed provide the background for the biological and hydrological processes within the system. In this chapter we look at these characteristics in detail, which provides a foundation for the later chapters on human characteristics, water quality, and living resources. The natural characteristics to be covered in this chapter include: climate; physical location characteristics such as topography, soils and geology; and surface water resource characteristics such as wetlands, floodplains and forest cover. This chapter will also take a look at ecologically important areas and groundwater resources. Potential sources of degradation and the actions needed to address impacted areas can be evaluated by an inventory of these features within the watershed. Each watershed is unique, and the process of gathering information about the watershed may reveal key issues that will influence the watershed restoration plan. The South Branch Patapsco Watershed and its subwatersheds are shown in Figure 2-1.

B. Climate

The climate of the region is characterized as a humid continental climate, with four distinct seasons modified by the proximity of the Chesapeake Bay and Atlantic Ocean (DEPRM, 2000). The average temperature during the warm summer months is approximately 74 degrees Fahrenheit; while the average temperature during the cooler winter months is 34 degrees Fahrenheit. Rainfall is evenly distributed through all months of the year, with most months averaging between 3.0 and 3.5 inches per month. Storms in the fall, winter, and early spring tend to be of longer duration and lesser intensity than summer storms, which are often convective in nature with scattered high-intensity storm cells. The average annual rainfall is approximately 42 inches per year. The average annual snowfall is approximately 36 inches per year, with the majority of accumulation in December, January, and February.

The climate of a region affects the rate of soil formation and erosion patterns, and by interacting with the underlying geology, influences the stream drainage network pattern and the resulting topography.

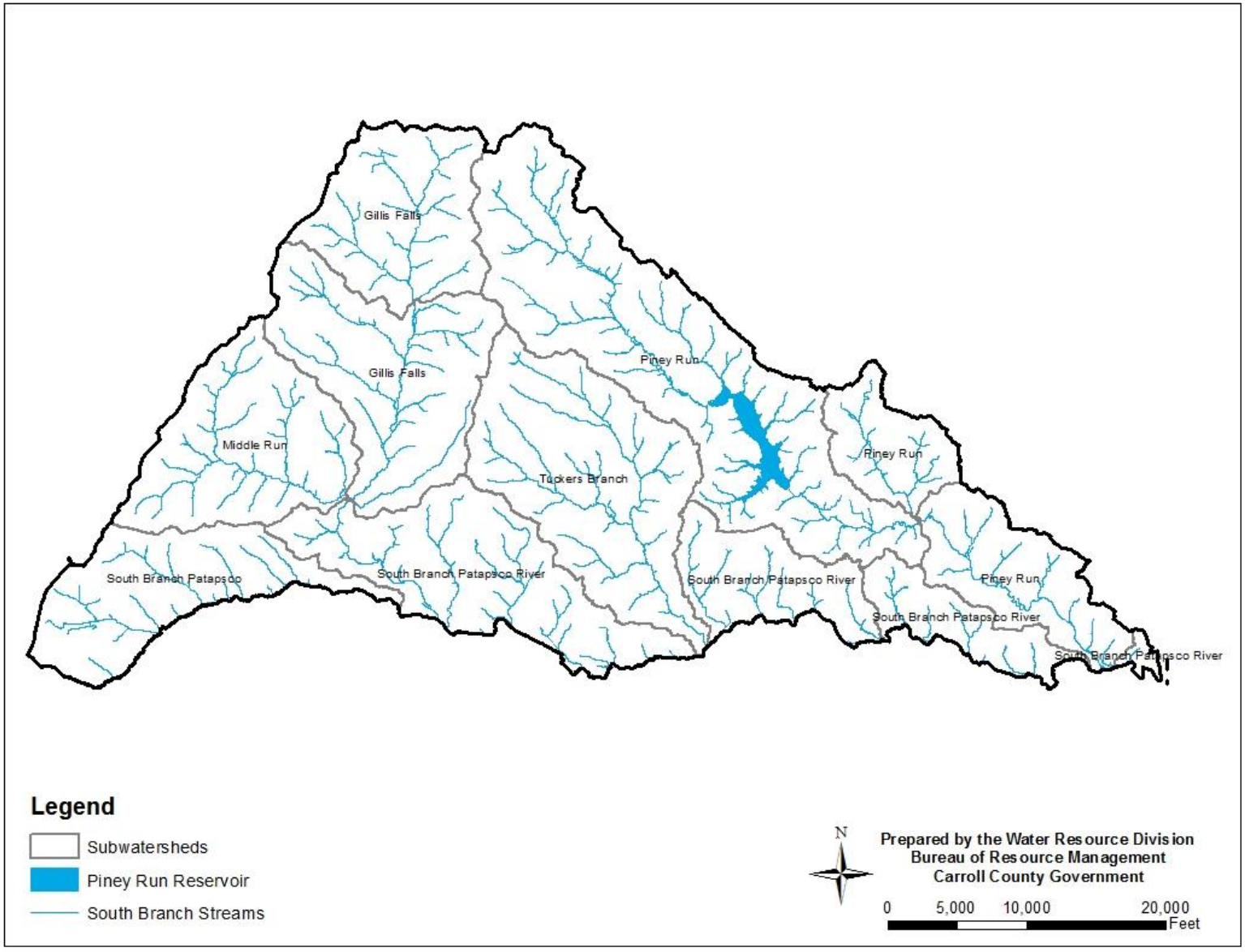

Figure 2-1: South Branch Patapsco Subwatershed Locations

C. Physical Location

The South Branch Patapsco Watershed lies entirely within the Piedmont Plateau Province, predominantly within the Upland Region of this physiographic province. The Piedmont Plateau Province is characterized by low rolling hills with clay-like moderately fertile soils, and complex geology of numerous rock formations consisting of different materials and ages intermingled with one another.

1. Topography

Topography of the land and nearby surrounding areas, including steepness and concavity affect surface water flows, potential for soil erosion, and development suitability. Lands with steep slopes are more prone to soil erosion and may contribute to the amount of pollutants released into a water system. For this watershed characterization we categorized slopes into three categories using soil data from the Carroll County Soil Survey: low slopes (0-8 %), medium slopes (8-15 %), and high slopes (>15 %). The Web Soil Survey produced by the National Cooperative Soil Survey and operated by the United States Department of Agriculture (USDA): Natural Resources Conservation Service provides soil data and slope information. Table 2-1 presents the subwatersheds' slopes and the percentages of each subwatersheds' slopes as part of the overall South Branch Patapsco Watershed. Figure 2-2 displays the slope categories and their distribution throughout the South Branch Patapsco Watershed.

There is a small percentage of South Branch Patapsco Watershed that is Udorthents (176.54 acres or 0.46% of the total watershed). Udorthents is a soil category consisting of variable slopes and is a result of soil material being excavated. Within this watershed, the Udorthents areas are highway and an area of refuse. There is also a small concrete dam (4.48 acres or 0.01% of the watershed) in the watershed located in the Piney Run Main subwatershed. There are also areas of water, including Piney Run Reservoir within the South Branch Patapsco Watershed totaling 360.22 acres or 0.93% of the watershed. Piney Run Reservoir consists of 303.84 acres of the total water acreage. The areas of Udorthents, water and the dam total approximately 541.24 acres or about 1.40% of the total South Branch Patapsco Watershed.

Piney Run Main is the largest subwatershed, and has the greatest percentage of all slope types contributing to the total topographic area. This subwatershed also contains Piney Run Reservoir, the largest water body within the South Branch Patapsco Watershed. South Branch Patapsco River subwatershed (1020) has the greatest cluster of high slopes, contributing to 36.16% of that subwatersheds land area. Piney Run Lower subwatershed has the second highest percent of high slope clusters with 28.12% of the subwatersheds land area. These two subwatersheds are adjacent to each other in the south eastern portion of the South Branch Patapsco Watershed, near the Patapsco River and tributaries.

Table 2-1: South Branch Patapsco Watershed Slope Categories

DNR 12-Digit Scale	Subwatershed	Slope Category (%)		
	Percent of overall total	Low	Medium	High
021309081031	Gills Falls Upper	63.69	28.08	8.23
	Percent of overall total	5.13	2.26	0.66
021309081030	Gills Falls Lower	46.30	36.47	17.23
	Percent of overall total	5.07	4.00	1.89
021309081029	Middle Run[1]	57.22	31.60	10.80
	Percent of overall total	5.59	3.08	1.05
021309081021	Piney Run Lower[1]	39.48	32.29	28.12
	Percent of overall total	2.35	1.92	1.67
021309081023	Piney Run Main[1,2]	53.72	31.93	10.40
	Percent of overall total	11.11	6.60	2.15
021309081024	Piney Run Tributary	71.06	20.75	8.19
	Percent of overall total	2.65	0.77	0.31
021309081028	South Branch Patapsco[1,3]	48.59	35.22	13.51
	Percent of overall total	3.98	2.88	1.11
021309081025	South Branch Patapsco River[1,3]	49.15	31.92	15.91
	Percent of overall total	5.22	3.39	1.69
021309081022	South Branch Patapsco River[1]	50.31	30.84	18.17
	Percent of overall total	2.54	1.55	0.92
021309081020	South Branch Patapsco River[1]	35.79	25.49	36.16
	Percent of overall total	1.32	0.94	1.34
021309081026	Tuckers Branch[1]	60.33	33.60	6.0
	Percent of overall total	8.05	4.48	0.80
South Branch Patapsco Watershed Total		53.01	31.87	13.59

Note: The top row of each subwatershed is the percent of each slope category within that subwatershed. The second grey row below is the percent of that subwatershed's slopes as part of the overall South Branch Patapsco Watershed.

[1]Subwatershed contains several acres of water not included in table percentages
[2]Subwatershed contains a concrete dam not included in table percentages
[3]Subwatershed contains several acres of Udorthents not included in table percentages

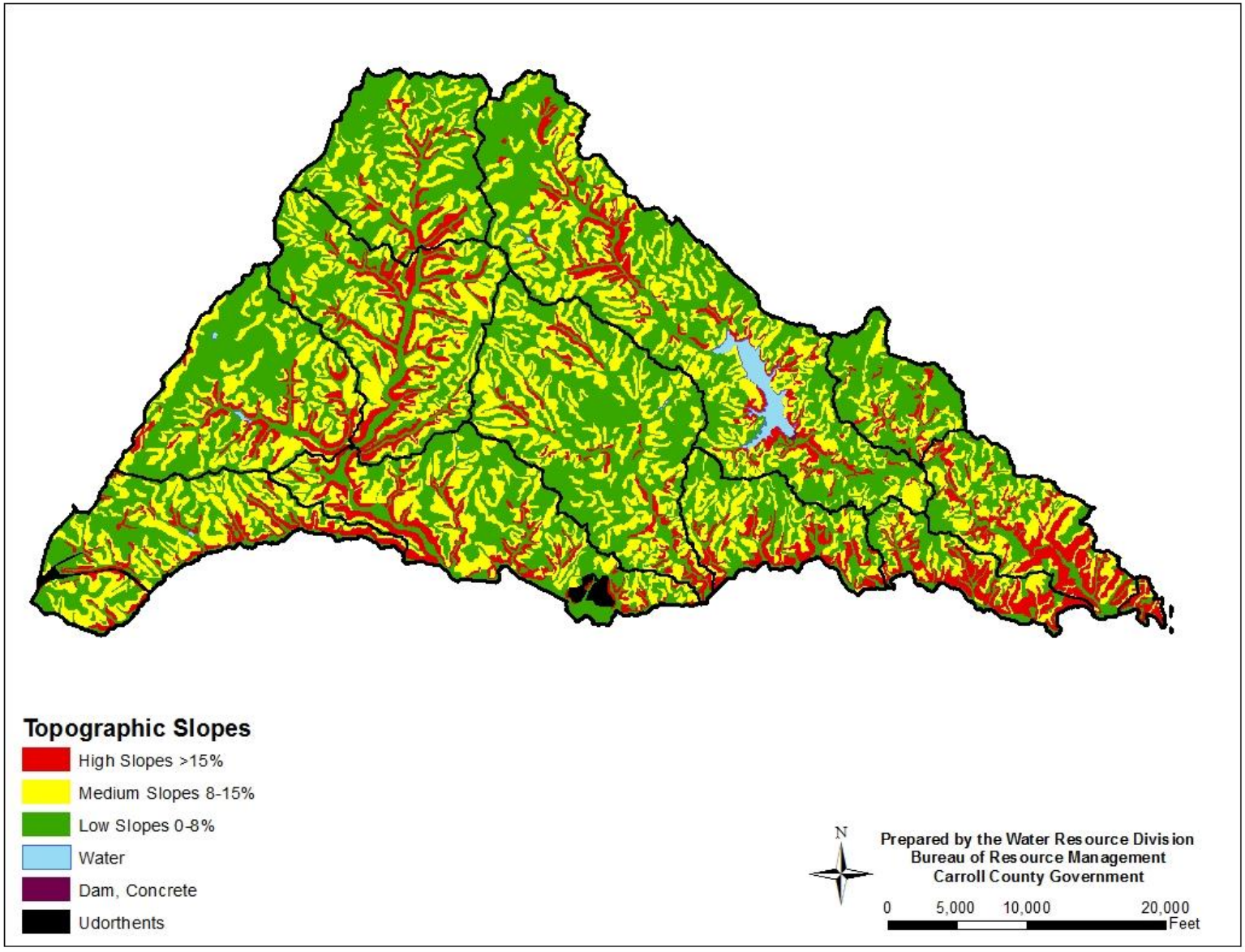

Figure 2-2: South Branch Patapsco Watershed Topography and Slope Categories

2. Soils

Independent of topographic slope, terrestrial systems within a watershed are greatly influenced by the type and condition of underlying soil. Soil factors such as drainage and permeability also greatly influence the amount of water present in a stream as well as water quality.

Soil composition is determined by factors including climate, organic matter, and type of parent material present. Within the Piedmont Plateau Province, highly metamorphosed schist, gneiss, and phyllite make up the vast majority of the parent material. Local soil conditions can vary greatly depending on organic matter and the localized climate. Chester and Manor soils are common in the Piedmont Plateau Province from Pennsylvania to North Carolina, including the South Branch Patapsco Watershed (Costa, 1975).

a. Hydrologic Soil Groups

The Natural Resource Conservation Service classifies soils into four Hydrological Soil Groups (HSG) based on runoff potential. Runoff potential is the opposite of infiltration capacity; soils with high infiltration capacity will have low runoff potential, and vice versa. The four HSG are A, B, C, and D; where group A generally has the smallest runoff potential and Group D has the greatest. Soils with low runoff potential will be less prone to erosion, and their higher infiltration rates result in faster flow-through of precipitation to groundwater (DEPRM, 2008).

The HSG classification was obtained from USDA technical release-55 'Urban Hydrology for Small Watersheds'.

Group A is composed of sand, loamy sand or sandy loam types of soil. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, excessively drained sands or gravels and have a high rate of water transmission.

Group B is composed of loam or silt loam. This group has a moderate infiltration rate when thoroughly wetted and consist mostly of deep to moderately deep, moderately well to well drained soils with moderately fine to moderately coarse textures.

Group C is composed primarily of sandy clay loam. These soils have low infiltration rates when thoroughly wetted and consist mostly of soils with a layer that impedes downward movement of water. These soils also have a moderately fine to fine structure.

Group D is composed of clay loam, silty clay loam, sandy clay, silty clay, or clay. This group has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist mostly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils lying over an impervious material.

The hydrologic soil data from the Carroll County Soil Survey is summarized in Table 2-2 and shown in Figure 2-3.

Table 2-2: South Branch Patapsco Subwatershed Hydrologic Soil Group Categories

DNR 12-digit scale	Subwatershed	Hydrologic Soil Group %			
	Percent of overall total	**A**	**B**	**C**	**D**
021309081031	Gills Falls Upper	0	81.32	10.85	7.83
	Percent of overall total	0	6.55	0.87	0.63
021309081030	Gills Falls Lower	0	83.66	10.36	5.98
	Percent of overall total	0	9.16	1.14	0.66
021309081029	Middle Run	0.38	84.20	13.65	1.77
	Percent of overall total	0.04	8.22	1.33	0.17
021309081021	Piney Run Lower	0.11	82.23	15.59	2.07
	Percent of overall total	0.01	4.90	0.93	0.12
021309081023	Piney Run Main	3.90	76.44	11.85	7.81
	Percent of overall total	0.81	15.80	2.45	1.61
021309081024	Piney Run Tributary	0	74.41	12.74	12.85
	Percent of overall total	0	2.77	0.47	0.48
021309081028	South Branch Patapsco	2.69	76.51	8.84	11.96
	Percent of overall total	0.22	6.26	0.72	0.98
021309081025	South Branch Patapsco River	0.40	76.75	15.05	7.80
	Percent of overall total	0.04	8.16	1.60	0.83
021309081022	South Branch Patapsco River	0.68	79.45	12.10	7.77
	Percent of overall total	0.04	4.01	0.61	0.39
021309081020	South Branch Patapsco River	2.55	79.47	16.31	1.67
	Percent of overall total	0.09	2.93	0.60	0.06
021309081026	Tuckers Branch	0.07	81.54	7.66	10.73
	Percent of overall total	0.01	10.88	1.02	1.43
South Branch Patapsco Watershed Total		**1.26**	**79.64**	**11.74**	**7.36**

Note: The top row of each subwatershed is the percent of each soil category within that subwatershed. The second grey row below is the percent of that subwatershed's soils as part of the overall South Branch Patapsco Watershed.

The majority of the subwatersheds have a similar, relatively high percentage of group B soils. The majority of group A soils are surrounding water bodies, including Piney Run Reservoir, and the Udorthents highway area. While the overall percentage of groups C and D soils are fairly low, these areas should be targeted when considering where the greatest potential for addressing soil conservation exists. The South Branch Patapsco River subwatershed (1020) contains the highest proportion of group C soils, with 16.31% of the subwatershed classified as group C soil, and 4% of the watershed classified as group D soil. Piney Run Tributary subwatershed (1024) contains the highest percentage of group D soils, making up 12.85% of that subwatershed.

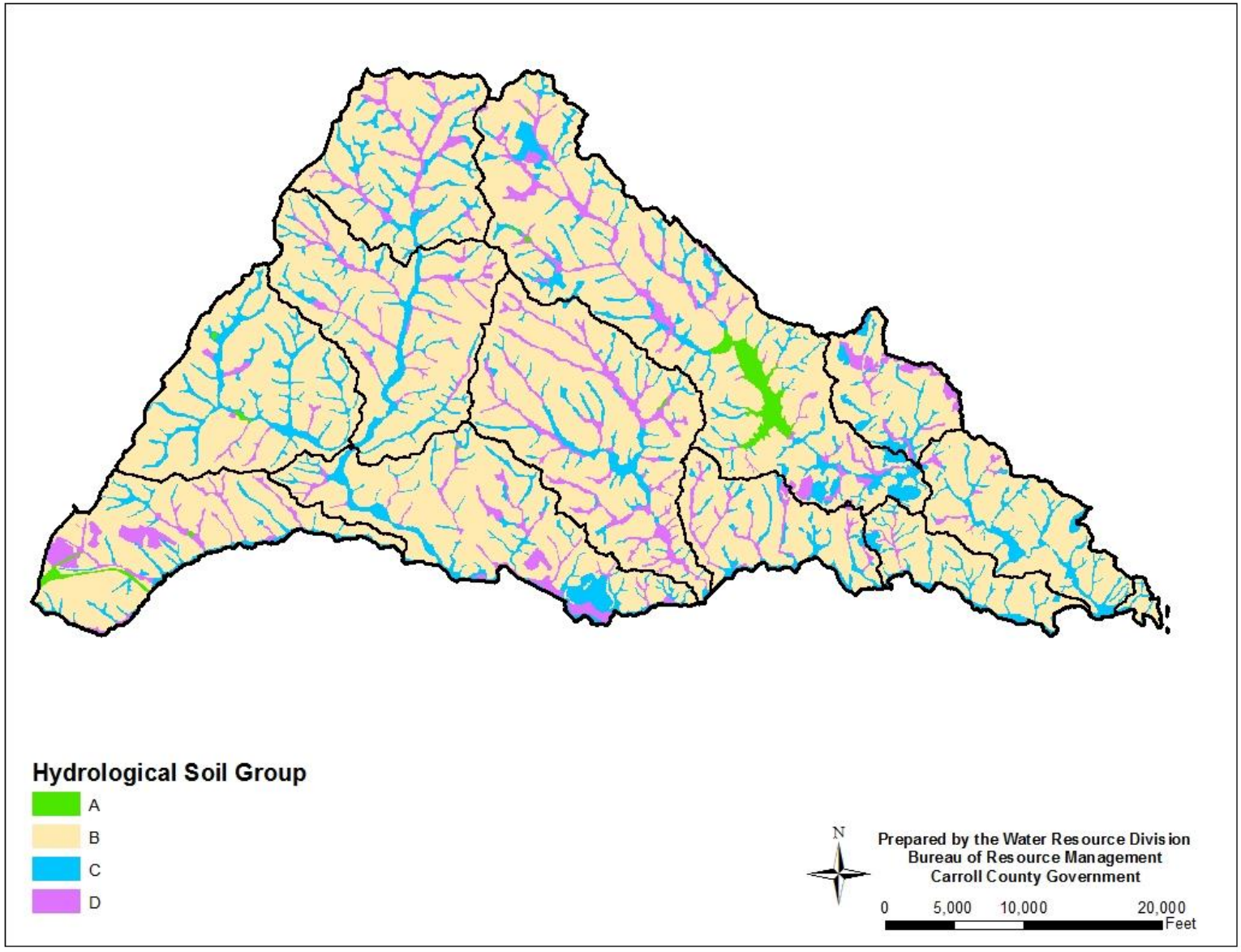

Figure 2-3: South Branch Patapsco Watershed Hydrological Soil Groups

3. Geology

The geological formations within the South Branch Patapsco Watershed are shown in Figure 2-4. Types of geological formations within a watershed can impact and alter the chemical composition of surface and groundwater, as well as the rate of recharge to groundwater. The underlying geology also determines soil formation. Intrinsically, the underlying geology can be closely correlated to the water quality within that system by affecting the buffering capacity.

The South Branch Patapsco Watershed, like most of the Piedmont Plateau Province, consists of metamorphic rock, mainly crystalline schists, gneiss and phyllite. These formations have moderate infiltration rates with average recharge to groundwater. However, the Calcerous Zone is composed of Marble and may be associated with karst environments. This formation has a higher infiltration rate and is highly susceptible to groundwater contamination due to the potential increased infiltration capacity.

In 1988, Carroll County initiated a water resource study. Part of this study focused on groundwater resource development in Carroll County. Aquifer type is the ultimate governing factor for groundwater development; however, natural factors like precipitation and topography play an important role in recharge. Carroll County has three distinct aquifer types: saprolite, carbonate rock, and triassic rock aquifers—all with varying rates of groundwater recharge. The carbonate rock aquifer has the highest recharge rate of the three types with an estimated drought recharge of 550,000 gallons per day per square mile (GPD/MI2). The triassic aquifer groundwater recharge under drought conditions is estimated at 220,000 GPD/MI2. The groundwater recharge rate for the saprolite aquifer varies widely depending on the hydrologic group (Carroll County Water Resource Study, 1998).

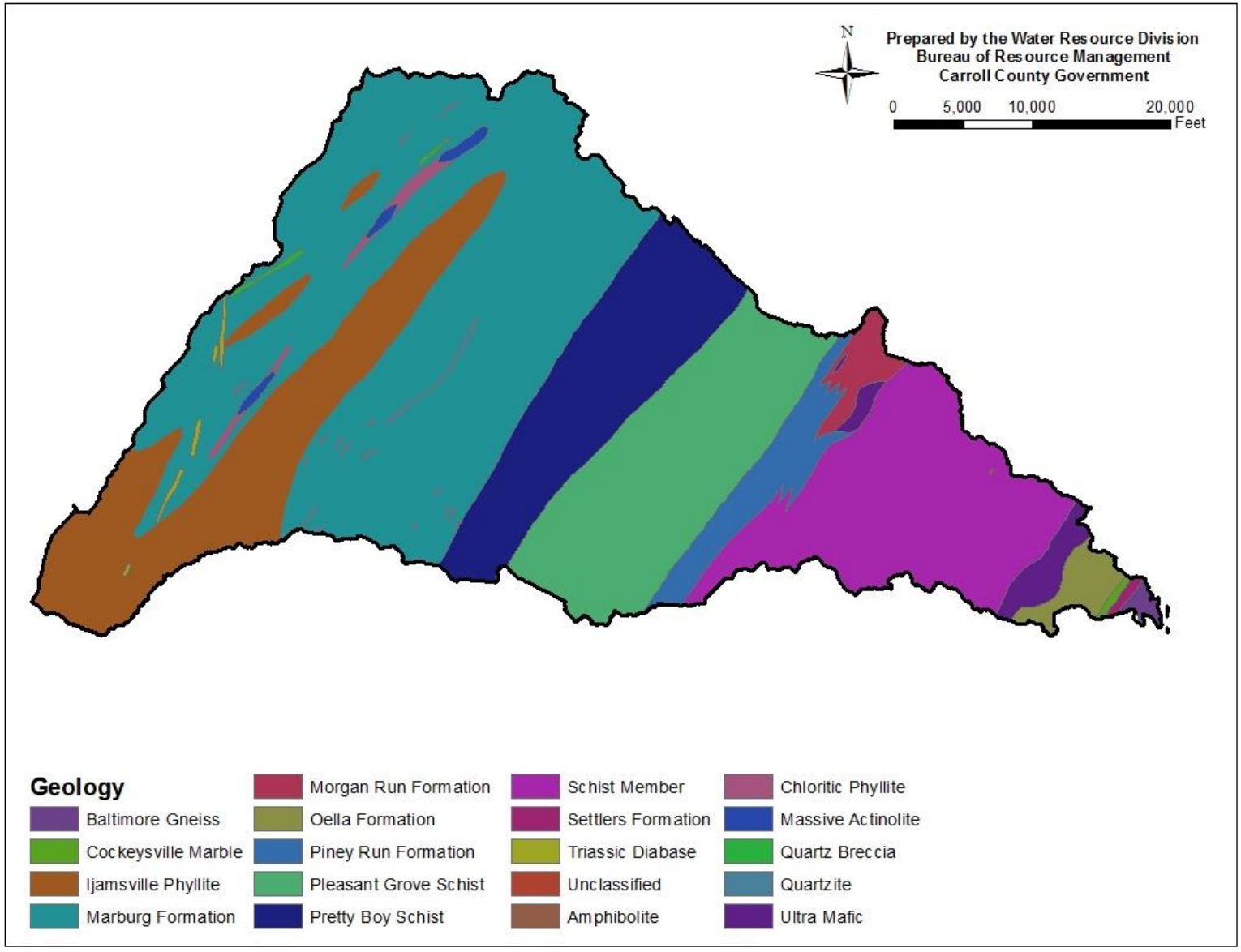

Figure 2-4: South Branch Patapsco Watershed Geology

D. Surface Water Resources

Physical resources within a watershed can greatly alter the hydrological process and can affect water quality. The following section will examine those resources that contribute in stabilizing stream flow as well as help with natural filtration.

1. Wetlands

Wetlands are a beneficial surface water resource. Wetlands provide downstream flood protection by absorbing and slowly releasing storm flows. Wetlands also naturally improve water quality with their filtering capability, nutrient uptake, and transformation.

Wetlands are defined by the US Army Corps of Engineers and the US Environmental Protection Agency (EPA) as: "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Wetlands in the South Branch Patapsco Watershed, as seen in Figure 2-5, can generally be found in low lying areas around streams. This is common of the Piedmont Plateau Province due to the relief in topography, geology, and depth to groundwater.

There are three main sources of wetland information available in Maryland. The first is the National Wetlands Inventory which covers the entire country. The second is the Maryland Department of Natural Resources (DNR) which has mapped wetlands for the State, and the third is the National Land Cover Database (NLCD). The statistical data in this report was based off of the delineations from the NLCD. Actual acreage may be greater when field verified. The estimated acreage of wetlands by subwatershed for the South Branch Patapsco Watershed can be found in Table 2-3.

Table 2-3: South Branch Patapsco Watershed Wetland Acreage

DNR 12-Digit Scale	Subwatershed	Wetland Estimates	
		Acres	%
021309081031	Gills Falls Upper	97.6	0.25%
021309081030	Gills Falls Lower	106.9	0.27%
021309081029	Middle Run	150.6	0.39%
021309081021	Piney Run Lower	65.1	0.17%
021309081023	Piney Run Main	138.8	0.36%
021309081024	Piney Run Tributary	0	0
021309081028	South Branch Patapsco	49.1	0.13%
021309081025	South Branch Patapsco River	179.6	0.46%
021309081022	South Branch Patapsco River	0.82	<0.01%
021309081020	South Branch Patapsco River	3.5	<0.01%
021309081026	Tuckers Branch	109.8	0.28%
South Branch Patapsco Watershed Total:		**901.8**	**2.33%**

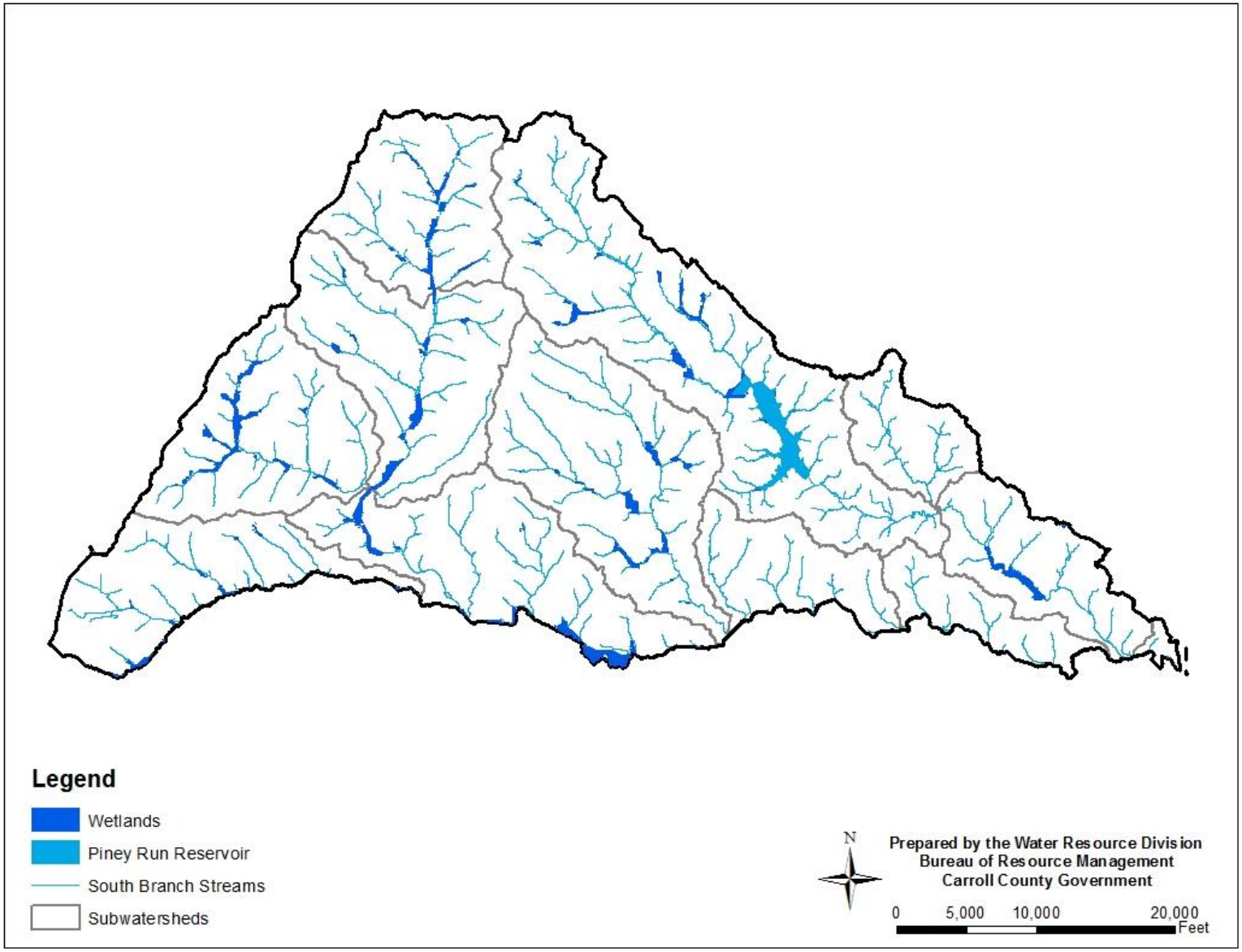

Figure 2-5: South Branch Patapsco Watershed Wetland Acreage

2. Floodplains

Floodplains in their natural state provide benefits to both human and natural systems. Benefits range from reducing the number and severity of floods to handling storm water runoff and minimizing non-point source pollutants. A natural floodplain will slow the velocity of water moving through a system, allowing sediment to settle out and nutrients to be taken up by the surrounding vegetation. Natural floodplains also contribute to groundwater recharge by allowing infiltration, which in turn will reduce the frequency of low surface flows, allowing for a healthier ecosystem.

Many floodplains are ideal locations for hike and bike paths, open spaces and wildlife conservation which in turn will make the community more ascetically appealing. By allowing a floodplain to remain in its natural state, people benefit from outdoor education and the scientific knowledge that comes from the undisturbed ecosystem.

The total floodplain area within the South Branch Patapsco Watershed is shown in Figure 2-6. The South Branch Patapsco Watershed contains about 2,379 acres of floodplain, which accounts for 6.1% of the total land area within the Watershed. The Federal Emergency Management Agency (FEMA) has updated flood risk identification using newer technology to establish flood risk zones and base flood elevations. Floodplain information obtained from FEMA 2015 effective mapped data.

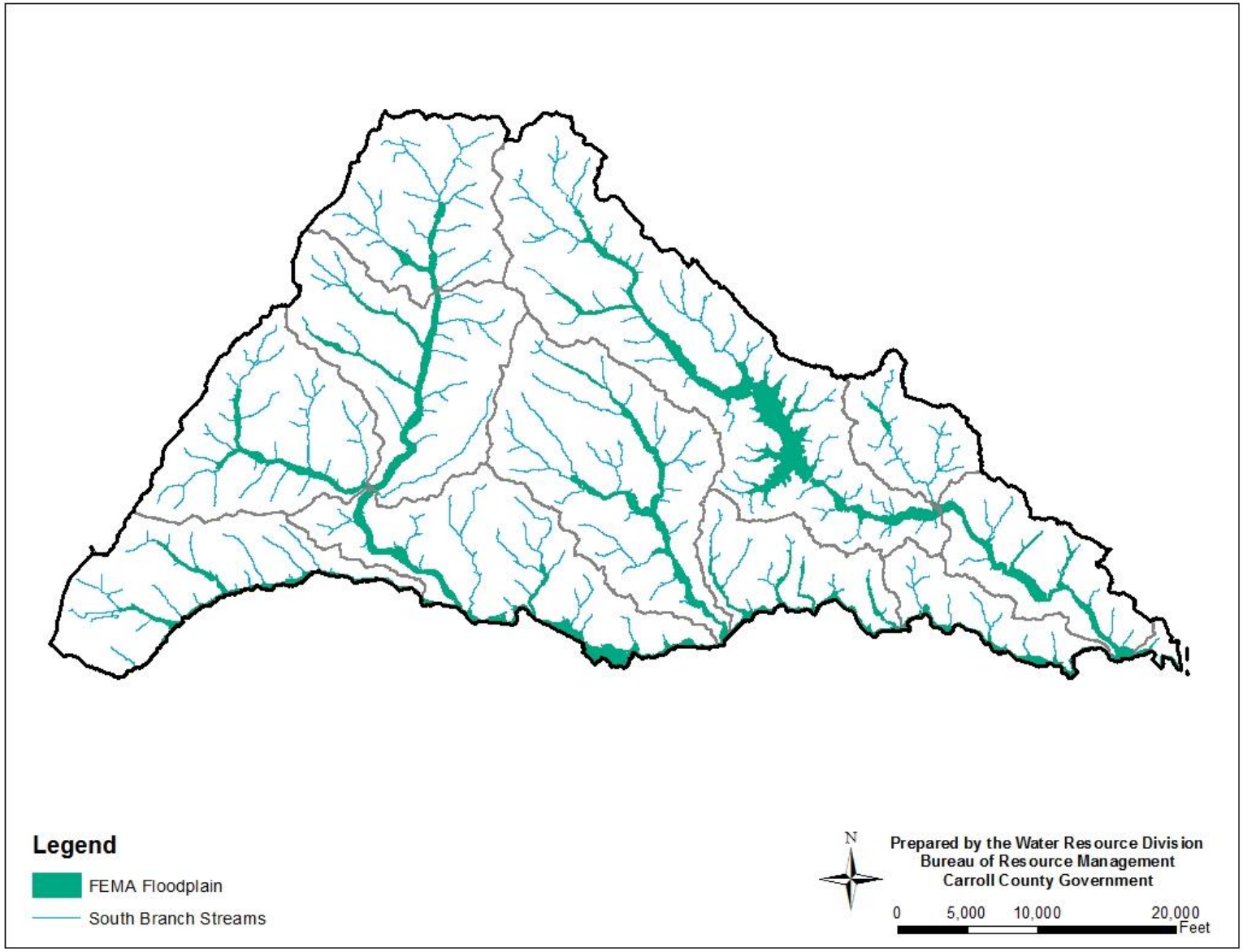

Figure 2-6: South Branch Patapsco Watershed Floodplains

3. Forest

Forests are home to many forms of life, and play an essential role environmentally including but not limited to climatic regulation, carbon cycling, biodiversity preservation, and soil and water conservation. Among land cover types, forest provides the greatest protection for soil and water quality. A healthy forest will hold soil in place which assists in reducing runoff, conserving nutrients and protecting streams from erosion. The riparian forest or corridor directly adjacent to a stream helps to moderate stream temperatures, which in many cases can support cold-water fisheries. In addition to supplying much needed shade for streams, the riparian forest is responsible for supplying detritus matter to the stream, which is natural food and energy input for streams in the Piedmont Plateau Province region.

a. Forest Cover

A healthy forest not only plays an important role environmentally, but can have great aesthetic and recreational benefits as well. Forest areas within the South Branch Patapsco Watershed today consist of secondary succession forest that have regrown and matured. Large forest blocks will provide greater ecological benefits than smaller blocks, because less fragmented landscapes benefit interior dwelling species.

South Branch Patapsco Watershed contains 11,143 acres of forest over multiple land uses, and covers about 29 percent of the land within the watershed. The forest cover within the South Branch Patapsco Watershed can be found in Figure 2-7 and is shown in Table 2-4.

Table 2-4: South Branch Patapsco Watershed Forest Cover

DNR 12-Digit Scale	Subwatershed	Total Acres	Forested Acres	% Forested
021309081031	Gills Falls Upper	3,118.40	632.1	20.3%
021309081030	Gills Falls Lower	4,243.17	1,326.1	31.3%
021309081029	Middle Run	3,781.73	1,007.1	26.6%
021309081021	Piney Run Lower	2,306.82	1,187.9	51.5%
021309081023	Piney Run Main	8,007.30	1,958.0	24.4%
021309081024	Piney Run Tributary	1,442.79	240.4	16.7%
021309081028	South Branch Patapsco	3,169.38	773.1	24.4%
021309081025	South Branch Patapsco River	4,116.38	1,264.0	30.7%
021309081022	South Branch Patapsco River	1,953.15	600.1	30.7%
021309081020	South Branch Patapsco River	1,430.57	939.8	65.7%
021309081026	Tuckers Branch	5,166.27	1,214.7	23.5%
South Branch Patapsco Watershed Total		**38,735.95**	**11,143.2**	**28.7%**

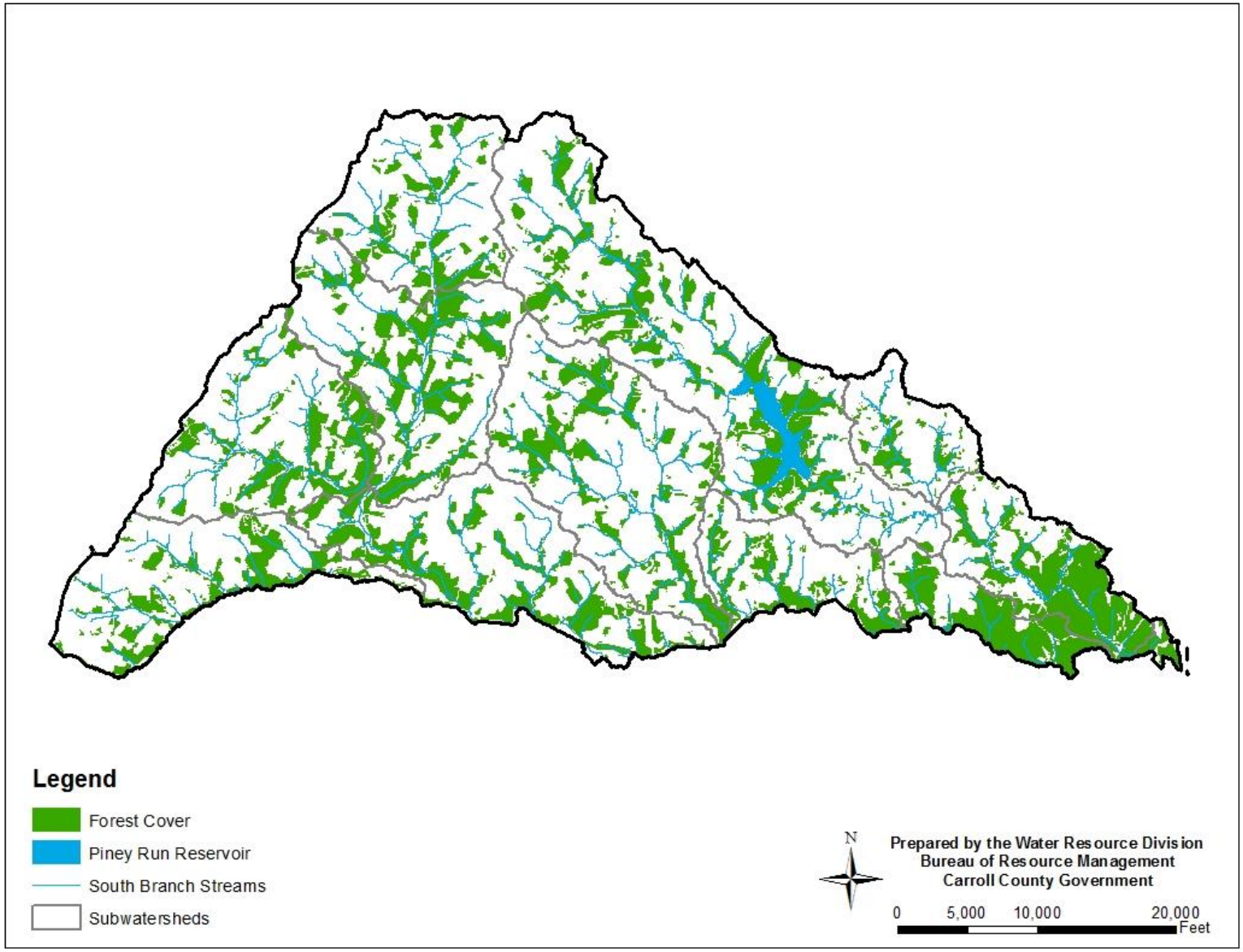

Figure 2-7: South Branch Patapsco Watershed Forest Cover

E. Ecologically Important Areas

The DNR has mapped a statewide network of ecologically important areas across the State called "Green Infrastructure". These areas are known as hubs and corridors. Hubs consist of large blocks of important natural resource land, and corridors connect one hub to the next. The large blocks of land that make up this green infrastructure consist primarily of contiguous forest land, but also may include wetlands and other naturally vegetated lands.

The DNR has mapped this network of ecologically important land by using several geographic information system (GIS) data layers to develop the areas that met specific parameters for green infrastructure. Hubs will contain one or more of the following:

- Areas containing sensitive plant or animal species;
- Large blocks of contiguous interior forest (at least 250 contiguous acres);
- Wetland complexes with at least 250 acres of unmodified wetlands;
- Streams or rivers with aquatic species of concern, rare cold-water or black-water ecosystems, or important to anadromous fish, and their associated riparian forest and wetlands; and
- Conservation areas already protected by public and private organizations (i.e. the DNR, The Nature Conservancy).

These "Green Infrastructure" areas comprise the bulk of the State's natural support system. As stated previously, forest systems are important resources that attribute to filtering and cooling water, storing and cycling nutrients, conserving soils, protecting areas from storm and flood damage, and maintaining the hydrologic function of the watershed. For more information on the Green Infrastructure identification project through the DNR, see:

http://dnr.maryland.gov/land/green_infra.asp

Lands identified through the "Green Infrastructure" project where protection is needed may be addressed through various programs, including rural legacy program, open space, or conservation easements.

Figure 2-8 shows the hubs and corridors within the South Branch Patapsco Watershed as identified through the DNR "Green Infrastructure" project.

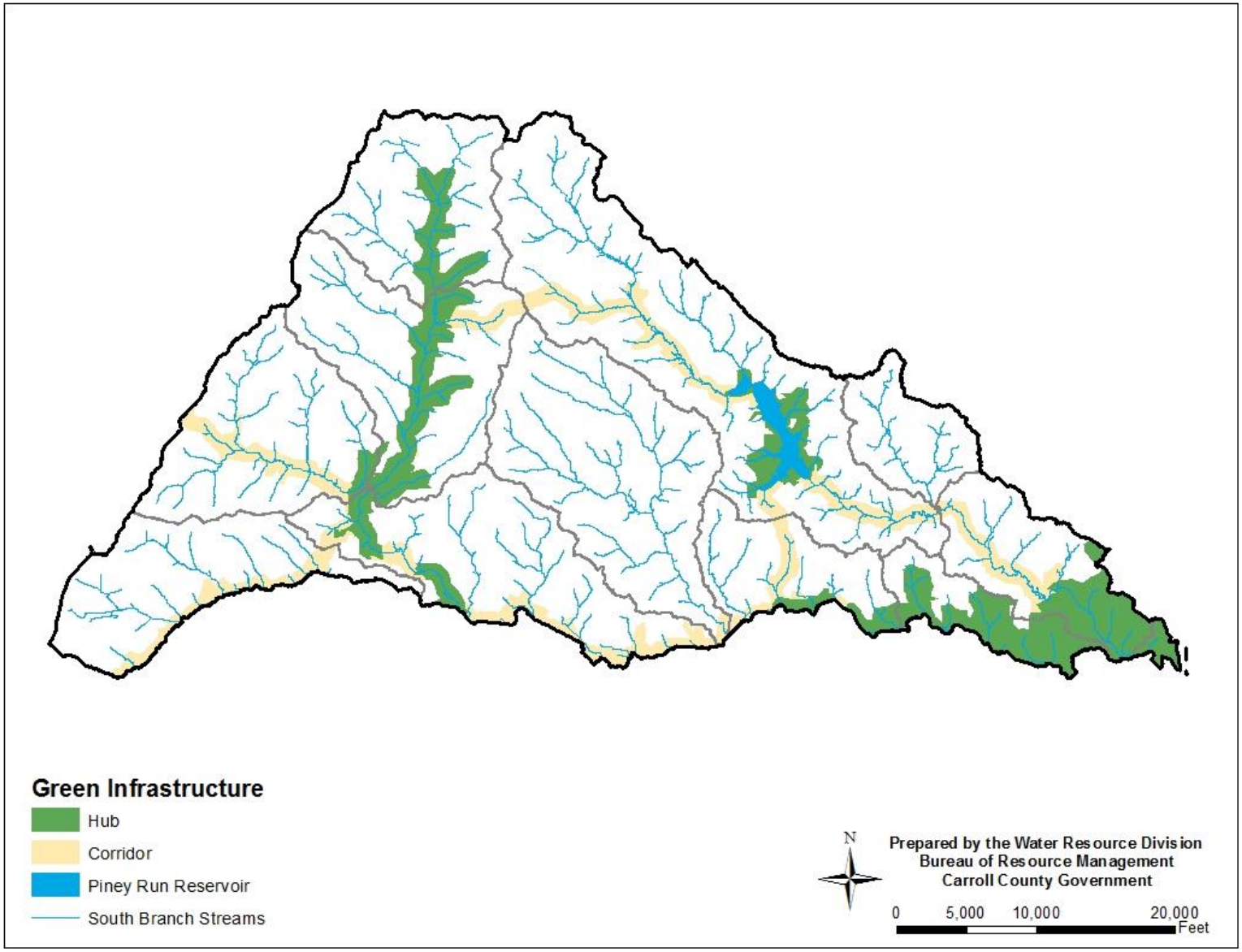

Figure 2-8: South Branch Patapsco Watershed Green Infrastructure

F. Groundwater Resources

Groundwater development potential in Carroll County is limited to the type of aquifer in the area. Of the aquifer types within Carroll County, each has unique water-bearing and yielding properties. The underlying bedrock units have minimal primary porosity and permeability. As such, groundwater occurs principally in interconnected joints, fractures, and faults within the rock mass, as well as in the relatively shallow weathered zone overlying the bedrock and beneath the soil horizon (Carroll County Water Resources Study, 1998).

Transmissivity indicates the ease at which groundwater moves through an aquifer in response to the water table gradient within the aquifer. Transmissivity is a governing factor in determining the amount of water which may be withdrawn in a given area. A highly transmissive aquifer will allow a greater volume of water to be withdrawn than an aquifer with low transmissivity, with a given water table drawdown. Low transmissivity will cause significantly less flow in the groundwater, and restricts withdrawal rates.

To obtain satisfactory well yield, well location is critical and must intersect a permeable fracture. Fracture trace zones are evident on aerial photographs as alignments of valleys and swales, contrasting soil tones, differences in vegetation type and growth along with the occurrence of springs and seeps.

Groundwater withdrawal, if ungoverned will ultimately lower the water table, affecting stream-flow. It is important to maintain a balance between biological needs of a stream and water withdrawal needs. Aquifers are replenished by the seepage of precipitation, but the amount that is absorbed is dependent on geologic, topographic, and human factors, which determine the extent and rate that aquifers are replenished.

The ground works as an excellent mechanism for filtering particulate matter, but natural occurring contaminants such as iron and manganese, as well as human induced contaminants such as chemicals and oil are easily dissolved and could be found in high concentrations within the water. Since underlying rocks have varying porosity and permeability characteristics, water quality will also vary greatly. Rock types with a higher rate of recharge generally have lower associated water quality.

III. Human Characteristics

The following chapter will look at human characteristics of the watershed, and how anthropogenic modifications could impact the natural ecosystem. Specifically, this chapter will examine the general land use and land cover of the watershed, as well as specific human modifications such as impervious surface cover, storm water systems, drinking water, and waste water systems.

A. Population

The natural landscape of the South Branch Patapsco Watershed has been modified for human use over time. Anthropogenic modifications have potential to degrade both the terrestrial and aquatic ecosystems. The South Branch Patapsco Watershed currently has an estimated population of approximately 40,894 persons, with greatest population densities within Freedom, and in the vicinity of the towns of Sykesville and Mount Airy. If you spread the population evenly across the entire Watershed it would equal about one person per 1.05 acres.

B. Baseline and Current Land Cover

As the land use of a watershed is modified over time it will ultimately influence the water quality within that watershed. Natural landscapes, like forests and grasslands allow for infiltration of stormwater while absorbing excess nutrients. Unmanaged impervious surfaces don't allow for infiltration, causing stormwater to concentrate. The increased runoff velocity will de-stabilize stream banks, causing potential sedimentation problems downstream. Within the South Branch Patapsco watershed, low-density residential is the dominant land cover at about 27 percent of the total land, followed by forest which accounts for 25 percent, and cropland, which accounts for about 21 percent of the total land cover.

The 2011 NLCD data was compared to current property data and existing land uses within the county in order to identify any gaps in urban land cover. Additional areas identified as urban were based on section II.4 (table 1) of MDE's accounting for SW WLA document, and consisted of rural residential lots less than three (3) acres that were listed as non-urban land uses within the NLCD database. This analysis showed a 7% increase in low-density residential land cover since 2011, which has been incorporated into Table 4. The NLCD performs land cover analysis on 5 year intervals, with the next round expected to be completed sometime in 2016.

The following table, Table 3-1 shows the current land cover data for the South Branch Patapsco watershed, as well as the changes in land cover over time since 2001. The current land cover, as of 2011, within the South Branch Patapsco Watershed can be found in Figure 3-1.

Table 3-1: South Branch Patapsco Watershed Baseline and Current Land Cover

Land Cover	Acres 2001	Percent 2001	Acres 2006	Percent 2006	Acres 2011	Percent 2011	Current Acres	Percent
Open Water	289.31	<1%	289.08	<1%	289.08	<1%	289.08	<1%
Low-Density Residential	6,101.55	15.8%	6,287.98	16.2%	7,629.91	19.7%	10,341.28	26.7%
Low-Density Mixed Urban	1,492.73	3.9%	1,635.29	4.2%	1,902.51	4.9%	1,660.10	4.3%
Medium-Density Mixed Urban	347.82	<1%	454.77	1.2%	540.31	1.4%	481.68	1.2%
High-Density Mixed Urban	48.81	<1%	79.58	<1%	91.05	<1%	86.44	<1%
Barren Land	11.04	<1%	16.17	<1%	20.75	<1%	10.77	<1%
Forest	11,307.70	29.2%	11,133.74	28.7%	11,143.46	28.8%	9,722.66	25.1%
Shrub/Scrub	311.61	<1%	298.71	<1%	315.38	<1%	245.58	<1%
Grassland	60.68	<1%	99.53	<1%	89.25	<1%	73.64	<1%
Pasture/Hay	8,456.01	21.8%	8,008.07	20.7%	8,200.84	21.2%	6,836.87	17.6%
Cropland	9,376.97	24.2%	9,505.51	24.5%	9,909.01	25.6%	8,111.94	20.9%
Wetland	906.19	2.3%	901.84	2.3%	909.10	2.3%	879.42	2.3%

Source: National Land Cover Database

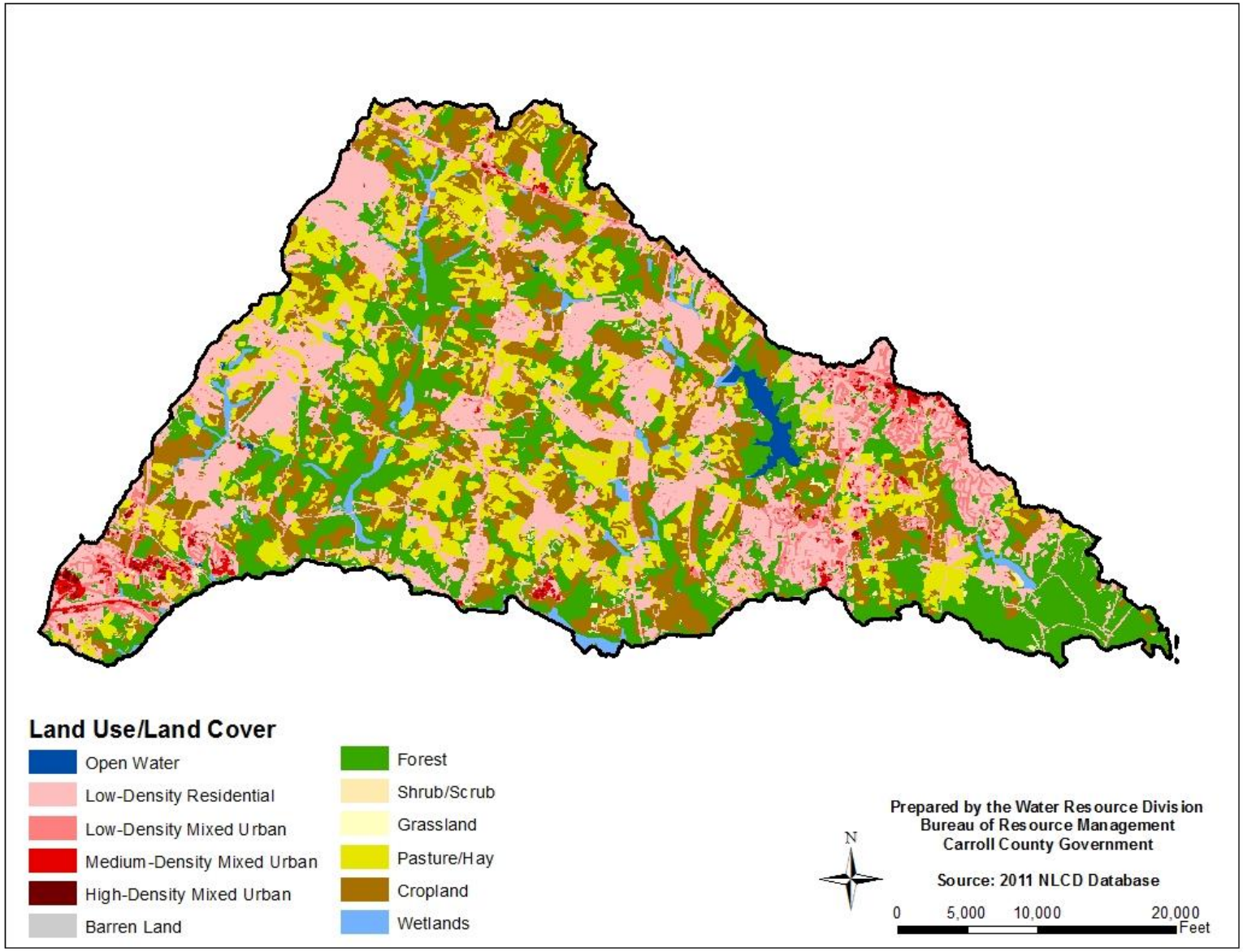

Figure 3-1: South Branch Patapsco Watershed Land Use and Land Cover

C. Priority Funding Areas, Zoning and Build Out

1. Priority Funding Areas

The Maryland Smart Growth Areas Act of 1997 introduced the concept of Priority Funding Areas (PFAs). The Maryland Planning Act and Smart Growth initiatives require that the local jurisdictions map specific growth areas to target infrastructure dollars from the State. Priority Funding Areas are existing communities and locations where State funding for future growth will be designated. Within the South Branch Patapsco Watershed, the towns of Mount Airy, and Sykesville as well as Freedom are designated PFAs. In addition to these PFAs, there are also four rural villages that are designated PFAs; these rural villages are Watersville, Taylorsville, Woodbine and Winfield. These designated areas have specific boundaries and are the focal area for employment, social, and commercial growth within the watershed. Figure 3-2 shows the designated PFAs within the South Branch Patapsco Watershed.

2. Zoning and Build-Out

Zoning refers to the regulation of land for the purpose of promoting compatible land uses. Typically zoning specifies the areas in which residential, industrial, recreational or commercial activities may take place. The current zoning for the South Branch Patapsco Watershed can be found in Figure 3-3. Carroll County does not regulate zoning within the municipalities. The majority of the South Branch Patapsco Watershed (44%) is zoned conservation.

Build-out analyzes the number of residential units in a given area that could be built based on the current zoning. Build out looks at existing development and, based on a yield calculation, determines how many more residential units can be built in the future. Within the South Branch Patapsco Watershed there are 2,053 parcels remaining with potential development on 12,310 acres for an estimated lot yield of 4,581 (build out data was provided by Carroll County Department of Land and Resource Management). This data is based on a medium range buildable land inventory estimate by land use designations. The medium range estimates have been determined to be the most accurate for build out. The full buildable land inventory report can be found at: http://ccgovernment.carr.org/ccg/compplanning/BLI/.

Figure 3-4 shows the remaining parcels in South Branch Patapsco Watershed where residential units could be built.

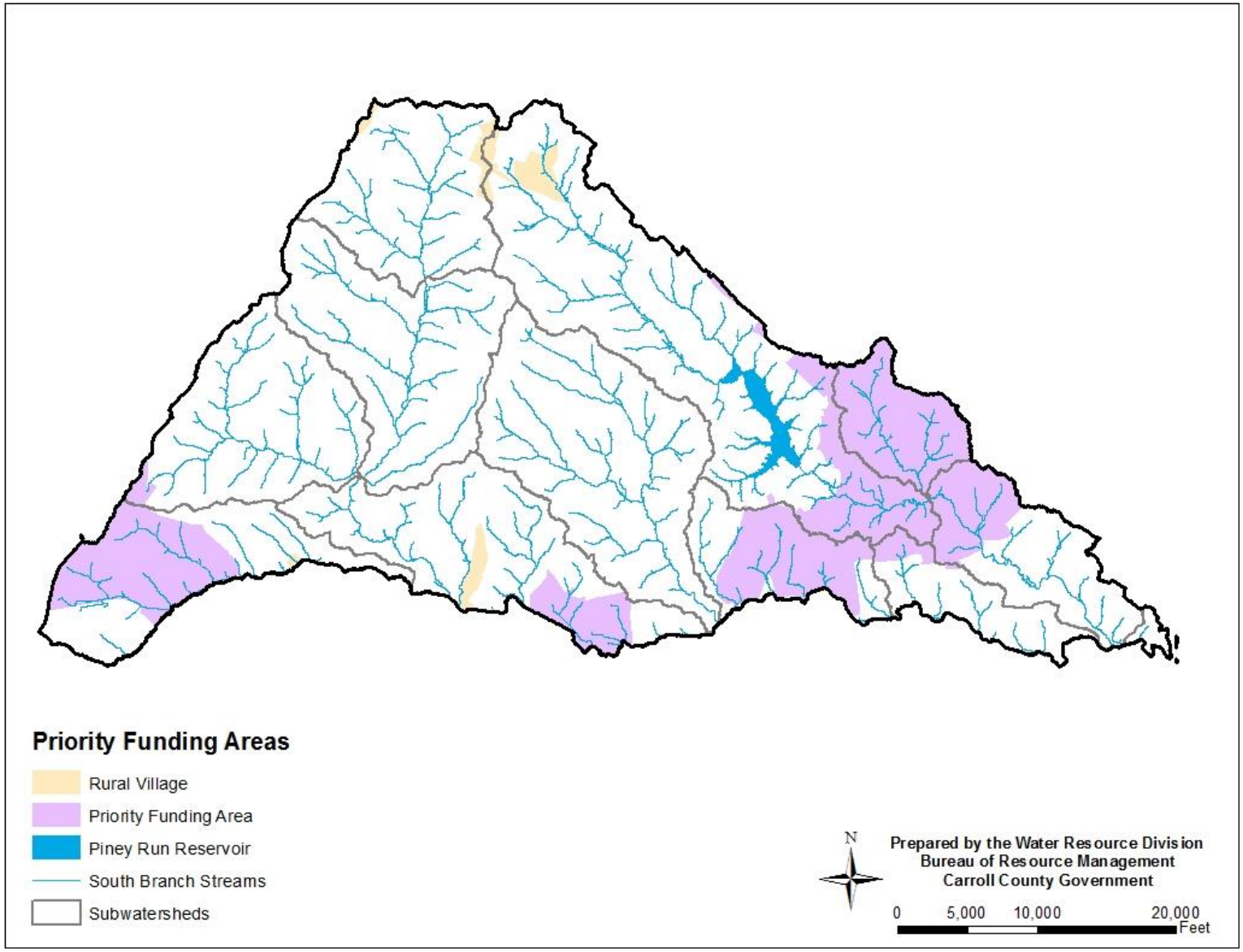

Figure 3-2: South Branch Patapsco Watershed Priority Funding Areas

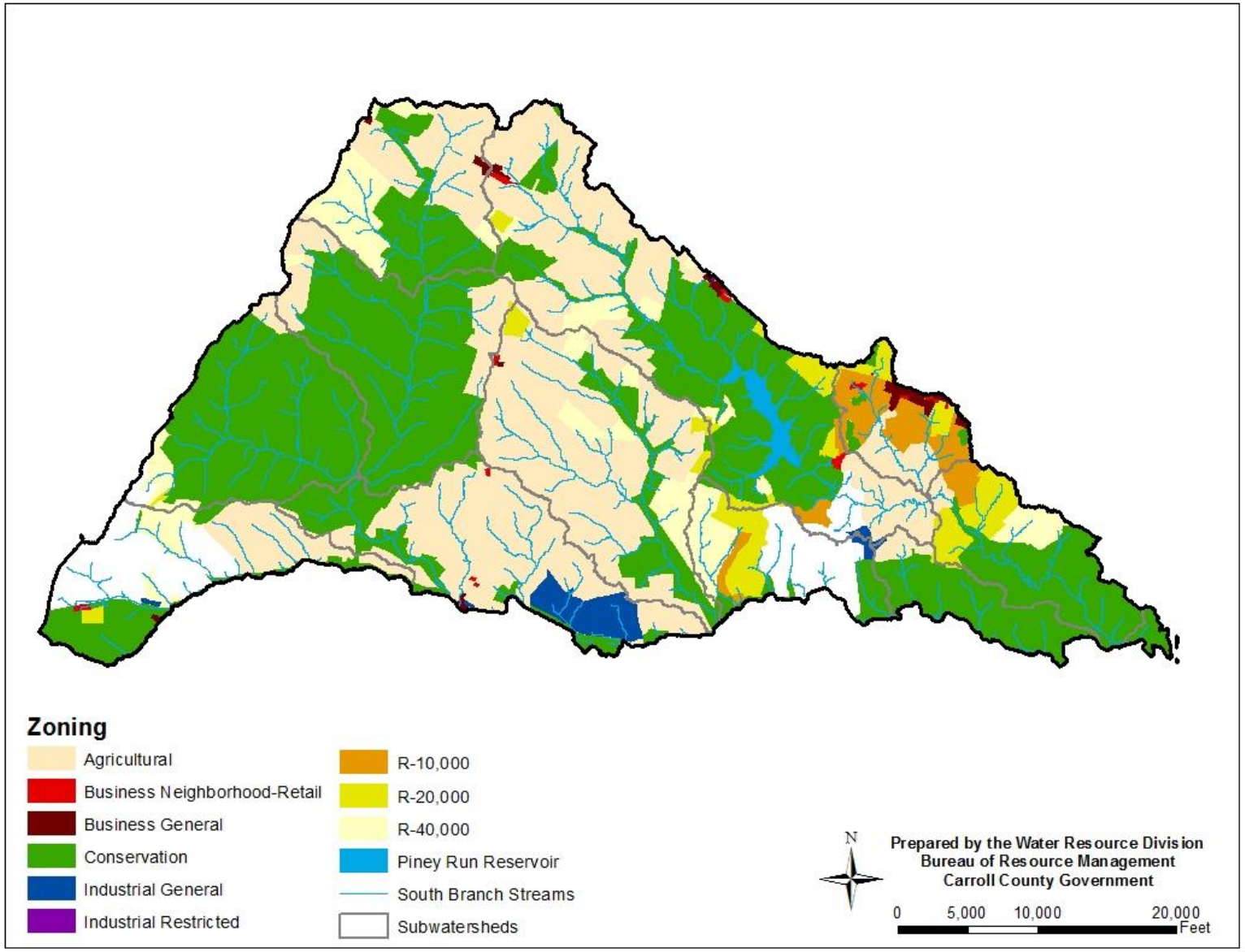

Figure 3-3: South Branch Patapsco Watershed Zoning

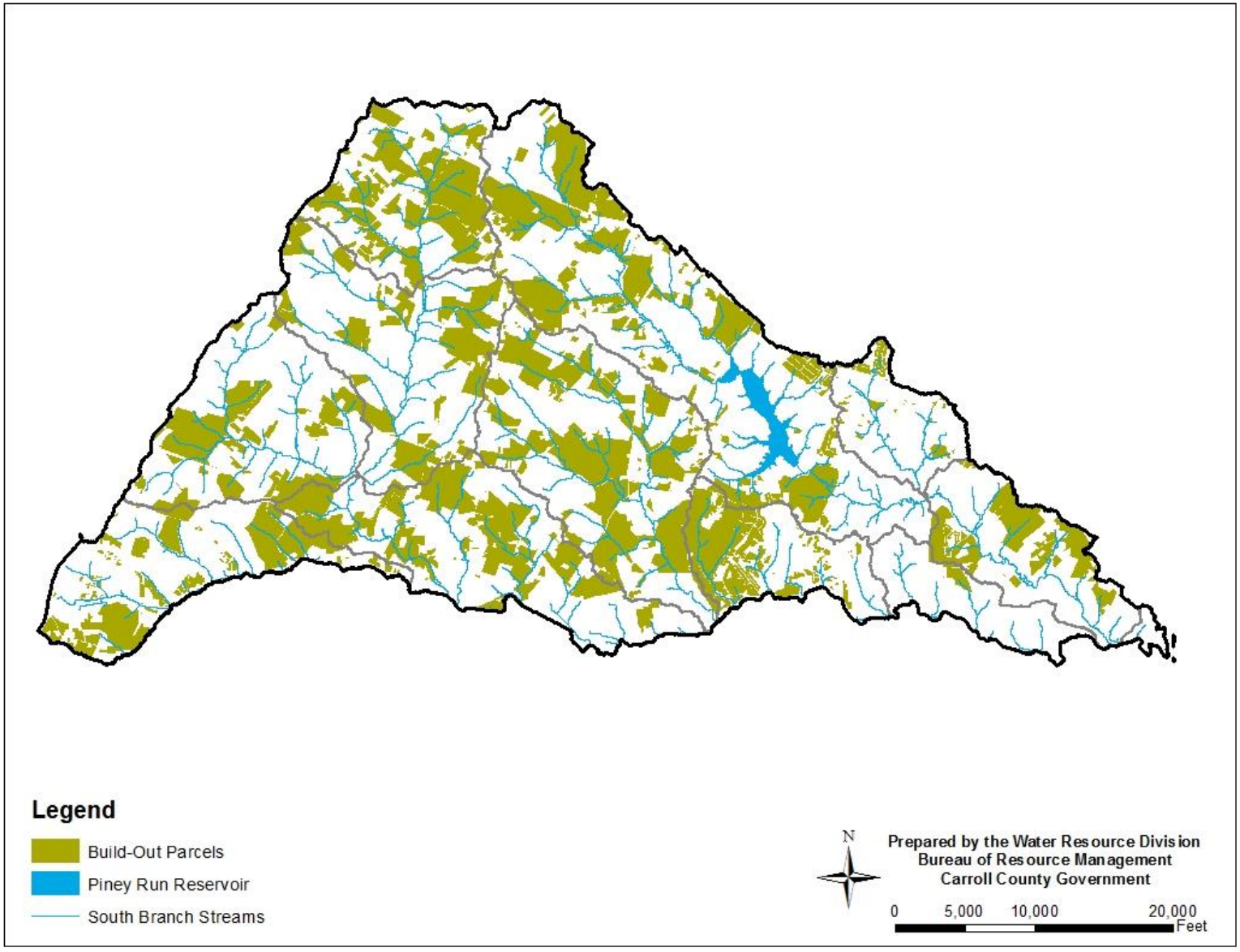

Figure 3-4: South Branch Patapsco Watershed Build-Out Parcels

D. Impervious Surfaces

Watershed and stream health have been tied, via various studies to the amount of impervious surface that lies within the system. Impervious surfaces such as roads, parking areas, and rooftops block the natural seepage of rainwater into the ground, resulting in concentrated stormwater runoff with an accelerated flow rate.

There are two general ways to quantify impervious cover: total impervious and effective impervious. Total impervious accounts for all impervious surfaces within a catchment, and effective impervious is the impervious area within the watershed that is directly connected to stream channels. Table 3-2 shows the estimated total impervious area by subwatershed for the South Branch Patapsco Watershed.

Table 3-2: South Branch Patapsco Watershed Estimated Impervious Surface Area

DNR 12-digit Scale	Subwatershed	Acres	Impervious Acres	Percent Impervious
021309081031	Gills Falls Upper	3,118.40	174.35	5.6%
021309081030	Gills Falls Lower	4,243.17	113.21	2.7%
021309081029	Middle Run	3,781.73	186.83	4.9%
021309081021	Piney Run Lower	2,306.82	151.76	6.6%
021309081023	Piney Run Main	8,007.30	504.27	6.3%
021309081024	Piney Run Tributary	1,442.79	316.29	21.9%
021309081028	South Branch Patapsco	3,169.38	419.50	13.2%
021309081025	South Branch Patapsco River	4,116.38	157.95	3.8%
021309081022	South Branch Patapsco River	1,953.15	228.86	11.7%
021309081020	South Branch Patapsco River	1,430.57	38.36	2.7%
021309081026	Tuckers Branch	5,166.27	230.55	4.5%
South Branch Patapsco Watershed Total		**38,735.95**	**2,521.93**	**6.5%**

The South Branch Patapsco Watershed is estimated to have 2,522 acres of total impervious within the catchment and accounts for approximately 6.5 percent of the total land area. Effective impervious was not calculated for this exercise because it is difficult to accurately determine without proper field verification, but it is a much lesser percent. The subwatershed of Piney Run Tributary (1024) drains a large portion of Freedom and had the highest percentage of total impervious for the entire watershed at (21.9%).

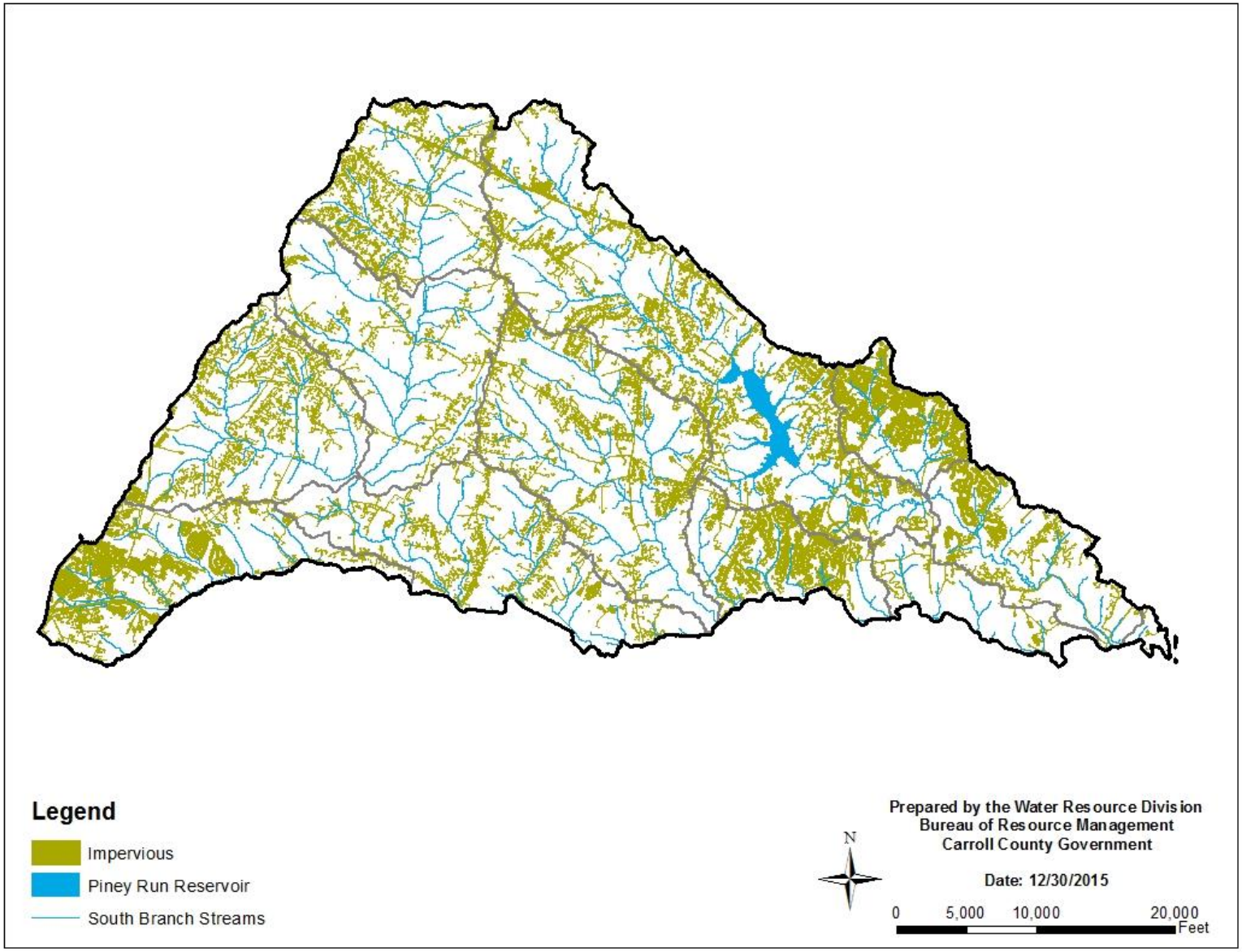

Figure 3-5: South Branch Patapsco Watershed Impervious Surface Area

E. Stormwater

Stormwater consists of runoff from precipitation and snowmelt that flows over the land or an impervious surface that is unable to infiltrate into the ground. As the runoff flows across a surface it can accumulate debris, chemicals, sediment and other pollutants that could adversely affect the water quality of a stream. An increased amount of unmanaged impervious surface within a watershed is likely to increase the amount of polluted stormwater reaching stream channels.

1. Stormwater Management Facilities

The State of Maryland began requiring stormwater management in the mid 1980's for new development to manage the quantity of runoff. These requirements were initially established for any subdivision with lots of less than 2 acres in size. For lots greater than 2 acres, stormwater management was only required to address road runoff. In 2000, MDE released a new design manual for stormwater (MDE, 2000). The new manual required greater water quality and quantity controls and included stormwater management for subdivisions with lots greater than 2 acres. The manual was then revised in 2009 to reflect the use of environmental site design practices.

There are different types of management facilities with varying degrees of pollutant removal capability. Facilities that infiltrate stormwater runoff have among the highest pollutant removal capability; while dry pond designs have the lowest pollutant removal efficiency, and were initially designed to control water quantity. In total there are 224 existing stormwater management facilities within the South Branch Patapsco Watershed, with the majority being in the Piney Run Tributary (1024) and South Branch Patapsco (1028) subwatersheds. Table 3-3 lists the facility type, number of structures and associated drainage acreage of the structures. Appendix A lists stormwater management facilities by subwatershed location, facility type, drainage area, and facility name. Appendix A also lists a definition of each facility and the pollutant removal capability. Figure 3-6 shows the location of the stormwater management facilities in the South Branch Patapsco Watershed.

Table 3-3: South Branch Patapsco Watershed Stormwater Facility Types

Facility Type	Number of Structures	Drainage Acreage
Detention Facility	40	627.2
Infiltration Facility	102	317.9
Filtration Facility	32	97.80
Sand Filters	23	417.6
Retention Facility	15	768.6
Shallow Marsh	9	198.1
Underground Tank	2	15.6
Grass Channel	1	13.4

Stormwater management facilities proposed for implementation to assist in addressing the stormwater wasteload allocation TMDLs are listed within the South Branch Patapsco Watershed TMDL restoration plan.

2. Storm Drain Systems

Storm drainage systems consist of either contoured drainage swales or a curb and gutter system with inlets and associated piping. Both systems function to efficiently remove water from impervious areas in order to prevent flooding, but have varying effects on water quality. The curb and gutter system can be directly connected to a stream through its piping network and deliver increased volumes of water, as well as untreated pollutants from the connected impervious surface to the stream. Contoured drainage swales do not allow water to move as efficiently as the curb and gutter system. Swales allow some water to infiltrate, which provides some filtering of pollutants, and reduces the amount of water delivered to a stream.

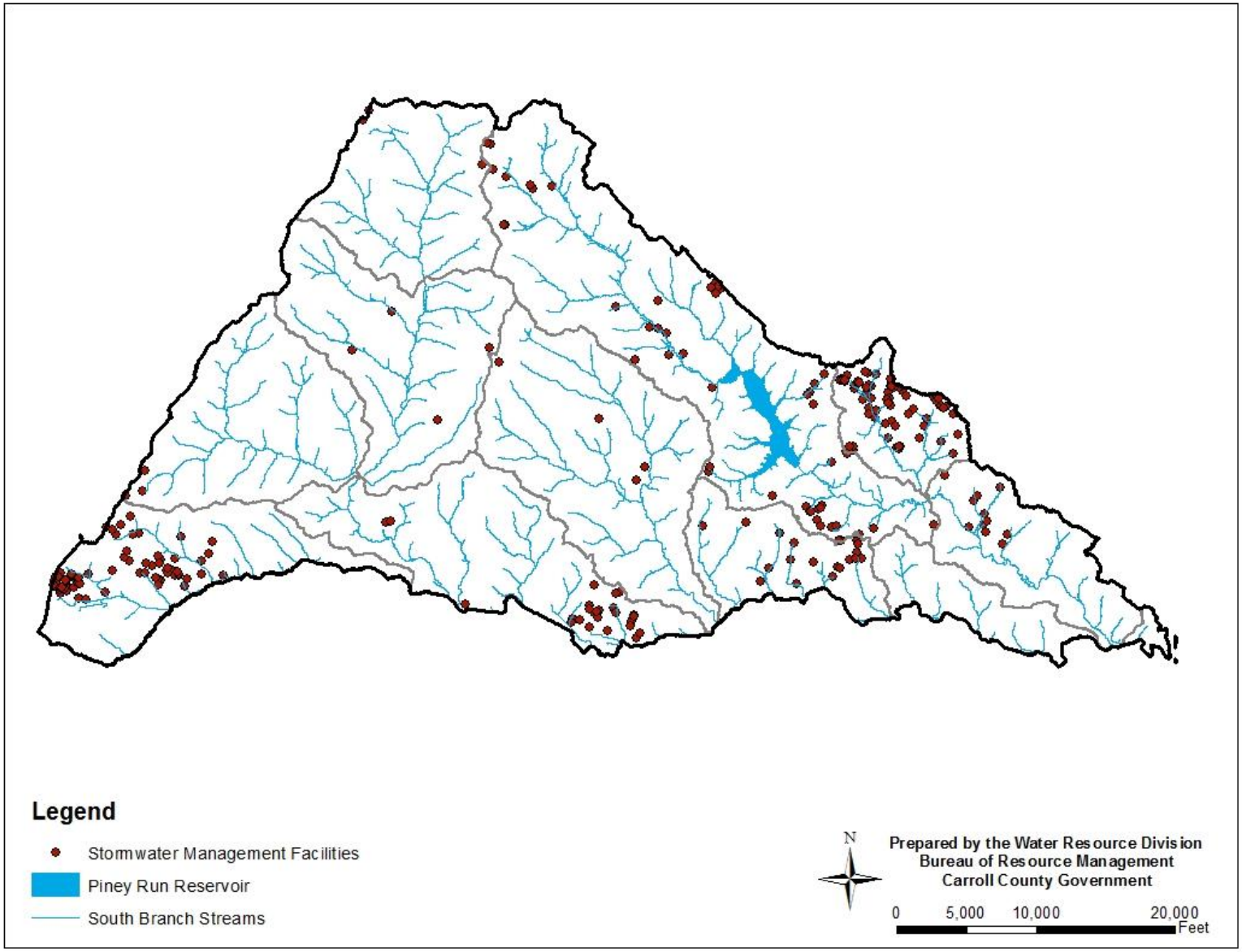

Figure 3-6: South Branch Patapsco Watershed Stormwater Management Facilities

F. Drinking Water

Having safe drinking water is fundamentally important to support human and livestock populations within a watershed. Within the South Branch Patapsco Watershed, drinking water comes from two main sources; public water systems and private wells.

1. Wellhead Protection Areas

Wellhead protection areas established under the Safe Drinking Water Act are surface and subsurface regulated land areas around public drinking water wells and/or well fields. Wellhead protection areas are regulated to prevent contamination of water supply. Ideally a wellhead protection area will encompass the entire recharge area for a well. Wellhead protection areas within the South Branch Patapsco Watershed are shown in Figure 3-6.

2. Public Water Service Area

Within the South Branch Patapsco Watershed, the towns of Mount Airy, Sykesville and Freedom provide residents with public water. Within the South Branch Patapsco Watershed, the Mount Airy area has 3 existing public wells, 2 storage tanks and a treatment plant. The Freedom and Sykesville areas has 3 existing public wells, 2 storage tanks and a pumping station.

A water use appropriation permit is required for any entity withdrawing more than 10,000 gallons of water a day from a single source. Appropriations are determined by the MDE water supply program, and are necessary to conserve and protect wells as a vital resource for the residents in the State of Maryland. At any given time these wells could either be online or offline depending on maintenance and demand. The community well locations and associated public service areas are shown in Figure 3-7.

3. Water Supply

Residents outside of the public water service area within the South Branch Patapsco Watershed obtain their water from private wells located on their property; within South Branch Patapsco Watershed there are about 7,431 private water wells. Since the underlying geology within the South Branch Patapsco Watershed consists mainly of New Oxford Formation and quartzite, the associated water withdrawals from these wells come from an unconfined aquifer. The fractured rock of the Piedmont Plateau Province allows surface water to pass through soil and into the underlying rock fractures; therefore, the source of the water is locally derived.

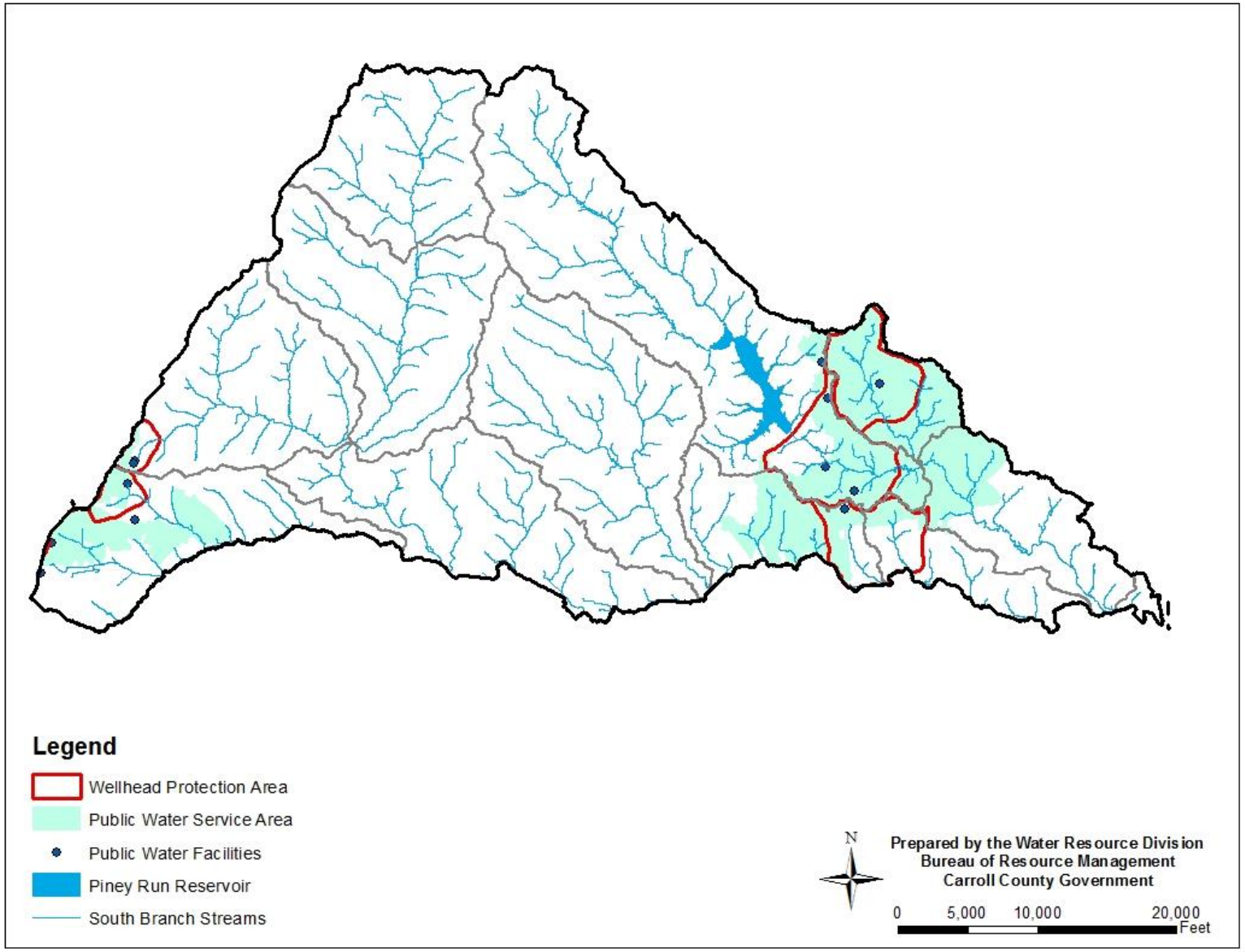

Figure 3-7: South Branch Patapsco Watershed Public Drinking Water Supply

G. Wastewater

Wastewater is any water consumed through human use that adversely affects water quality by anthropogenic influence, and must be properly contained and treated. Treatment and containment of wastewater can be accomplished by either on-site septic systems or through public conveyance to a community or private wastewater treatment plant. Treatment of wastewater is essential because any untreated wastewater, either from a residential or industrial operation, has the potential for carrying harmful contaminants to the natural environment.

1. Public Wastewater Service Area

Public service areas convey wastewater through a piping system from residences and businesses to a treatment facility prior to discharge. Each hookup to the sewer line has a cleanout in which the private landowner is responsible for maintaining. The main part of the system consists of gravity flow lines with manholes for access, pumping stations, and force mains. The public utility is responsible for maintenance on the main lines of the wastewater system. Within the South Branch Patapsco Watershed there are approximately 6,847 homes utilizing public service. Figure 3-8 shows the public wastewater service area for the South Branch Patapsco Watershed.

2. Wastewater Discharge Locations

Within the South Branch Patapsco Watershed, the town of Mount Airy and the Freedom/ Sykesville areas are served through a public wastewater system. There are a total of 1 wastewater treatment facility in each town area, and one in the Winfield-South Carroll High School area. There are 5 pumping stations for the Mount Airy area, 10 in the Freedom/Sykesville area and 1 for the High School. Each treatment facility is in the vicinity of an unnamed tributary that flows into Piney Creek, and treated effluent from the treatment plant is discharged into Piney Creek.

In total the Mount Airy sewer system includes eleven pumping stations, interceptors and collection lines, and a wastewater treatment plant. The wastewater treatment plant is located one mile east of MD 27 and south of Watersville Road. The plant discharges treated wastewater into the South Branch of the Patapsco River, and has a design capacity of 1.2 Mgd.

The Freedom Wastewater Treatment Plant is located near and discharges to the South Branch of the Patapsco River off Raincliffe Road, approximately 2,000 feet east of the Town of Sykesville. The Freedom treatment plant has a design capacity of 3.5 mgd, with a three-year average flow from 2008-2010 of approximately 1.25 mgd.

The community wastewater treatment facilities locations and associated public service areas are shown in Figure 3-8.

3. On-Site Septic Systems

On-site septic systems are the main source of waste disposal in rural and low density areas within South Branch Patapsco Watershed. When maintained and functioning properly, on-site septic systems are effective at treating nitrogen, but are not as effective at treating phosphorus. Improved treatment of nitrogen can be remedied by making sure the leach field is properly located to prevent wastewater effluent from directly entering a body of water. However when these systems fail or are inadequately maintained, excessive nutrients and bacteria can be released causing degradation of groundwater quality and nearby aquatic systems. There are currently approximately 7,720 septic systems within the South Branch Patapsco Watershed.

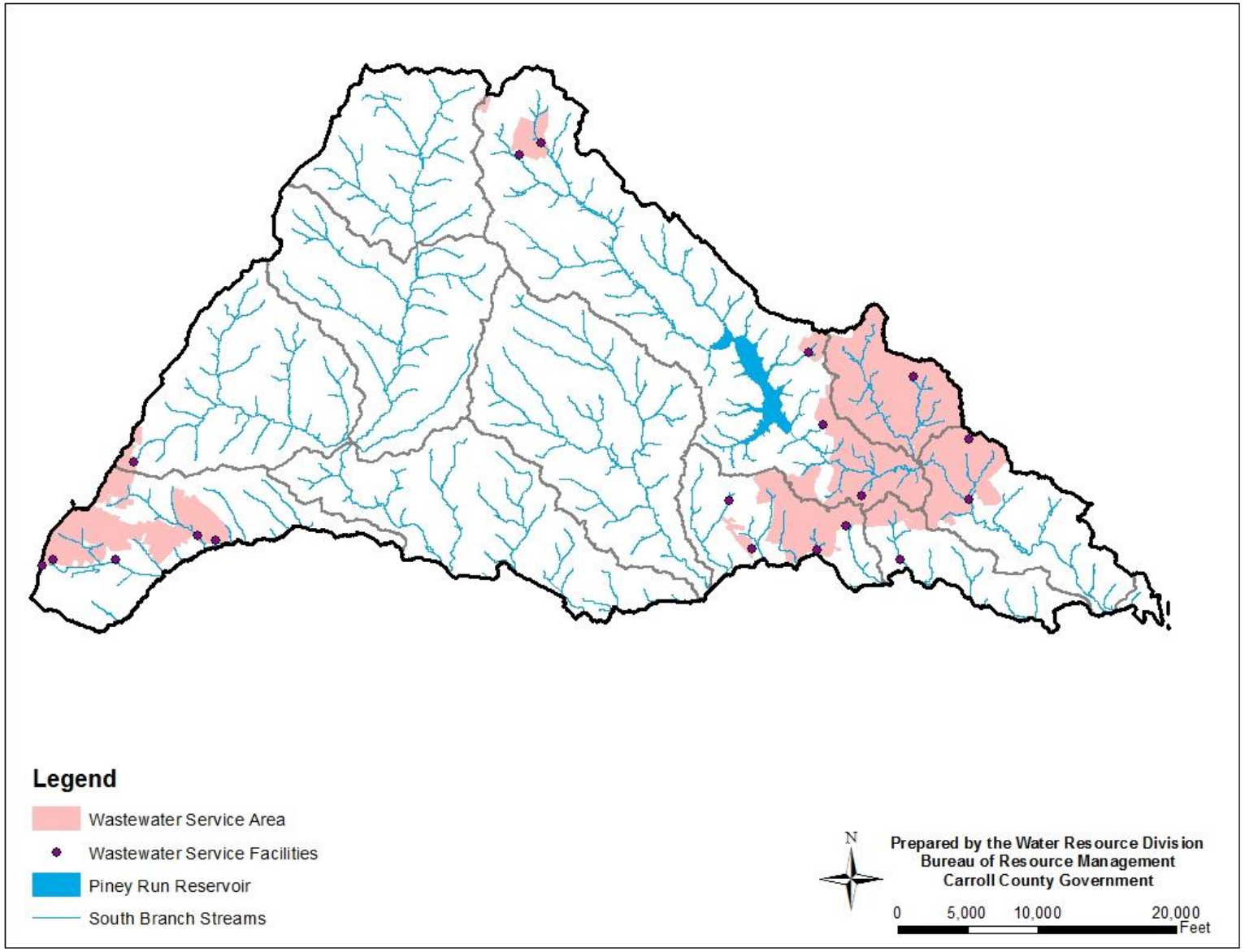

Figure 3-8: South Branch Patapsco Watershed Wastewater Service Area

H. NPDES Point Sources

Any facility that discharges wastewater, whether it is industrial or municipal, or any facility that performs activities that could have a negative impact on a waterway by introducing pollutants into the watershed must obtain a National Pollutant Discharge Elimination System (NPDES) permit. National Pollutant Discharge Elimination System permits implement restrictions on pollutant loads to be discharged from the source, as well as documenting potential pollutant spills, treatment to wastewaters and regulating pollutants before reaching a water body. Table 3-4 shows a list of NPDES permits within the South Branch Patapsco Watershed (information obtained from EPA.GOV Envirofacts).

Table 3-4: South Branch Patapsco Watershed NPDES Permits

Permit Holder	Permit Number	Subwatershed	Original Issue Date	Status
Gaither Manor Apartments WWTP	MD0022845	South Branch Patapsco River (1022)	27-FEB-1975	Effective
Pheasant Ridge Mobile Home Park, LLC (WWTP)	MD0024546	South Branch Patapsco (1028)	06-MAY-1975	Admin Continued
South Carroll High School WWTP	MD0024589	Piney Run Main (1023)	30-APR-1975	Expired
Mount Airy WWTP	MD0022527	South Branch Patapsco (1028)	18-APR-1975	Effective
Freedom District WWTP	MD0021512	South Branch Patapsco River (1020)	31-DEC-1974	Admin Continued
Liberty Crossing	MD3533H06	Gills Falls Upper (1031)	19-FEB-2010	Effective
Hoods Mill Landfill	MDR000661	South Branch Patapsco River (1025)	23-MAY-2003	Expired
Northrop Grumman Systems Corporation	MDR001005	Piney Run Main (1023)	13-MAR-2003	Expired
Crazy Rays	MDR002260	South Branch Patapsco (1028)	30-NOV-2007	Expired
Recycled Green Industries, LLC - Woodbine Rd	MDR002324	South Branch Patapsco River (1025)	06-MAR-2013	Effective
Ramblin Pines Campground	MDG766202	South Branch Patapsco River (1025)	16-JUL-2002	Expired
Patapsco Valley Overlook	MDG766500	South Branch Patapsco River (1022)	16-OCT-2002	Expired

I. Protected Lands

Protecting land ensures that non-urban land uses will remain intact over time on the specific parcel being protected. These lands are preserved through various programs, and the extent of protection can vary greatly from one property to the next. Preservation and protection include areas such as parks or watershed protection zones, as well as areas that are being intensively managed for agriculture. Protected lands may be preserved through direct public ownership or via public and private easement acquisition.

Table 3-5 lists the type of protected lands within the South Branch Patapsco Watershed along with the representative acreage. Over 7,263 acres or about 18.7% of the total land area within South Branch Patapsco Watershed has some sort of land protection. Open space and parks have the highest percentage of protection within the watershed at 8.6% with approximately 3,320 acres preserved. Figure 3-9 shows where the protected areas are located within the watershed.

Table 3-5: South Branch Patapsco Watershed Protected Lands

Type of Protection	Acres	Percentage
Agricultural Easement	2,649.06	6.8%
Open Space and Parks	3,320.73	8.6%
Forest Conservation Easement	805.24	2.1%
Water Resource Easement	352.01	<1%
Floodplain Easement	136.09	<1%
Total	**7,263.13**	**18.7%**

1. Rural Legacy Program

Maryland's Rural Legacy Program was created in 1997 to protect large, continuous tracts of land from sprawl development and to enhance natural resource, agricultural, forestry and environmental protection through cooperative efforts among state and local governments and land trusts. http://www.dnr.state.md.us/land/rurallegacy/index.asp

The goals of the rural legacy program are to:

- Establish greenbelts of forests and farms around rural communities in order to preserve their cultural heritage and sense of place;
- Preserve critical habitat for native plant and wildlife species;
- Support natural resource economies such as farming, forestry, tourism, and outdoor recreation, and;
- Protect riparian forests, wetlands, and greenways to buffer the Chesapeake Bay and its tributaries from pollution run-off.

The South Branch Patapsco watershed lies just south of the Little Pipe Creek Rural Legacy area, but is not within the Rural Legacy Area. The location of South Branch Patapsco watershed in relation of the Rural Legacy Area can be found in Figure 3-10.

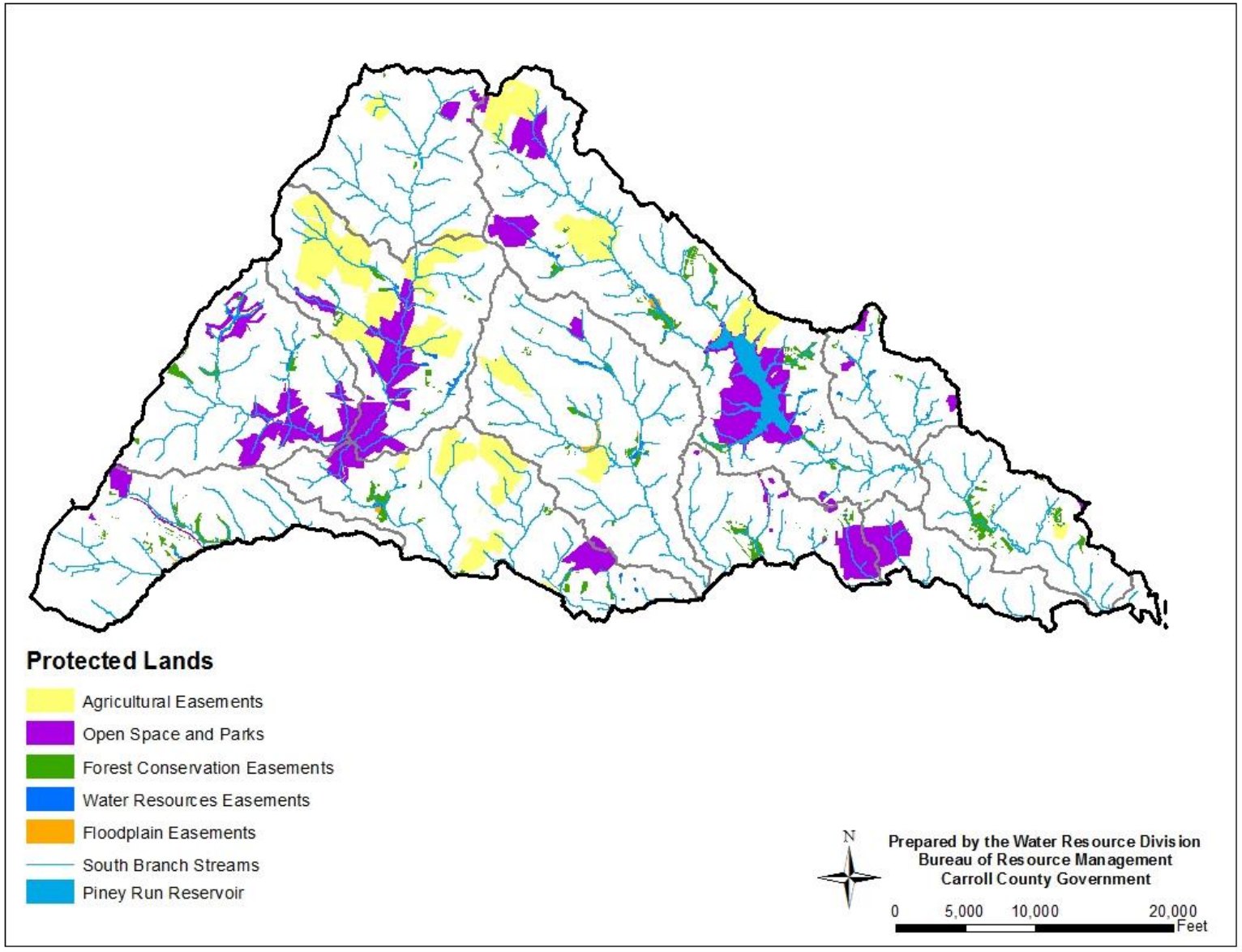

Figure 3-9: South Branch Patapsco Watershed Protected Lands

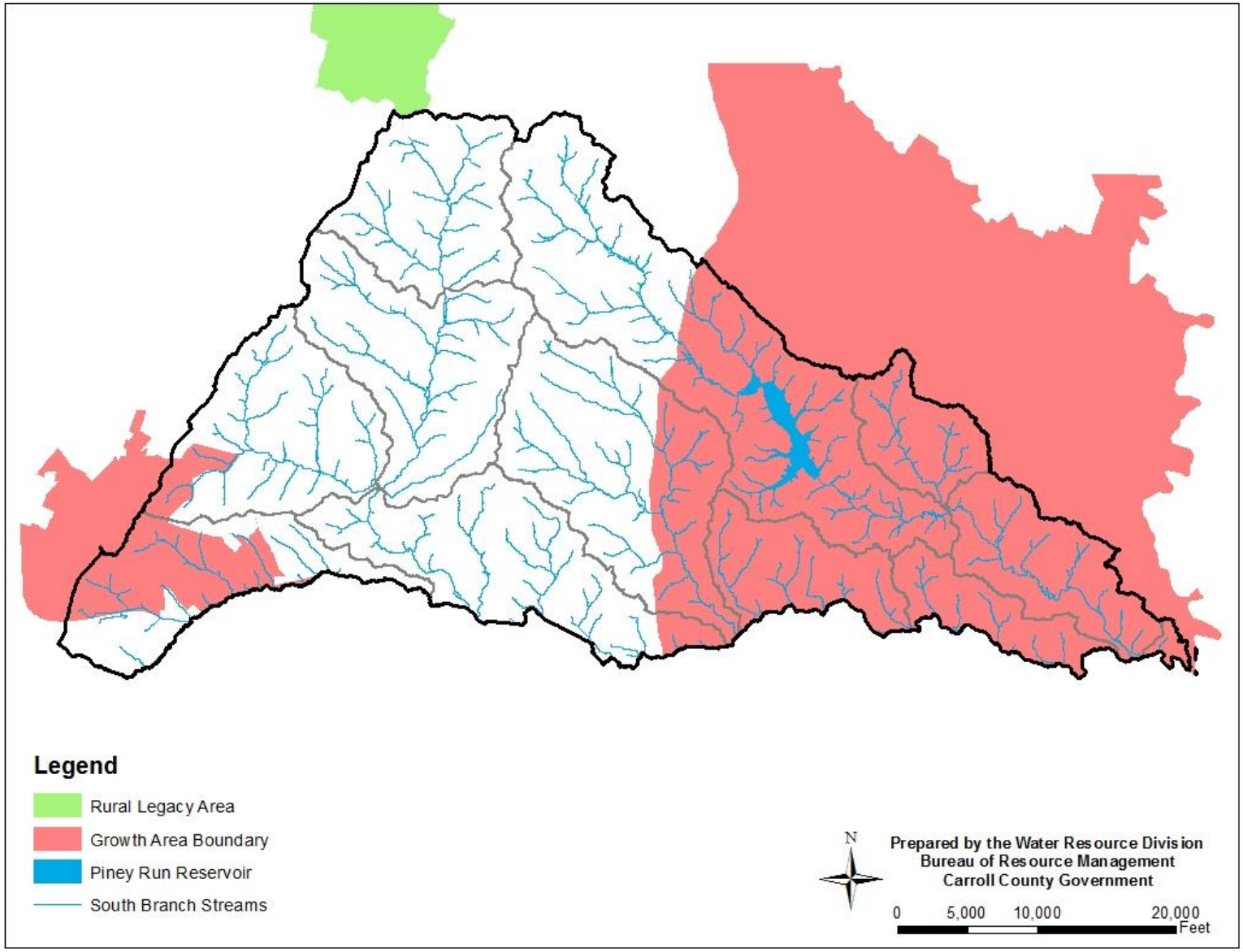

Figure 3-10: South Branch Patapsco Watershed Rural Legacy Area

J. Agricultural Best Management Practices

Agricultural BMPs are ground management practices that help minimize runoff and movement of pollutants into waterways. Agricultural BMPs can be categorized as soft BMP's such as streambank fencing and cover cropping, or hard BMP's like heavy use areas and waste storage structures. Appendix B lists the agricultural BMPs located in the South Branch Patapsco Watershed, and provides a detailed explanation of the types of practices used throughout Carroll County. Figure 3-11 shows the locations of agricultural BMPs within the South Branch Patapsco Watershed; each location may have several agricultural BMPs in place.

1. Farm Plan Acres

Farm conservation and nutrient management plans consist of a combination of agronomic, engineered, and management practices that protect and properly utilize the natural resources found on the operation in order to prevent deterioration of the surrounding soil and water. A conservation plan is written for each individual operation and dictates what management practices are necessary to protect and improve soil and water quality. A nutrient management plan is a plan written for the operator to manage the amount, timing, and placement of nutrients in order to minimize nutrient loss to the surrounding waterbodies while maintaining optimum fertilization for crop yield. The South Branch Patapsco Watershed has approximately 10,159 acres of agricultural land in farm management plans and 559 acres of agricultural land in comprehensive nutrient management plans.

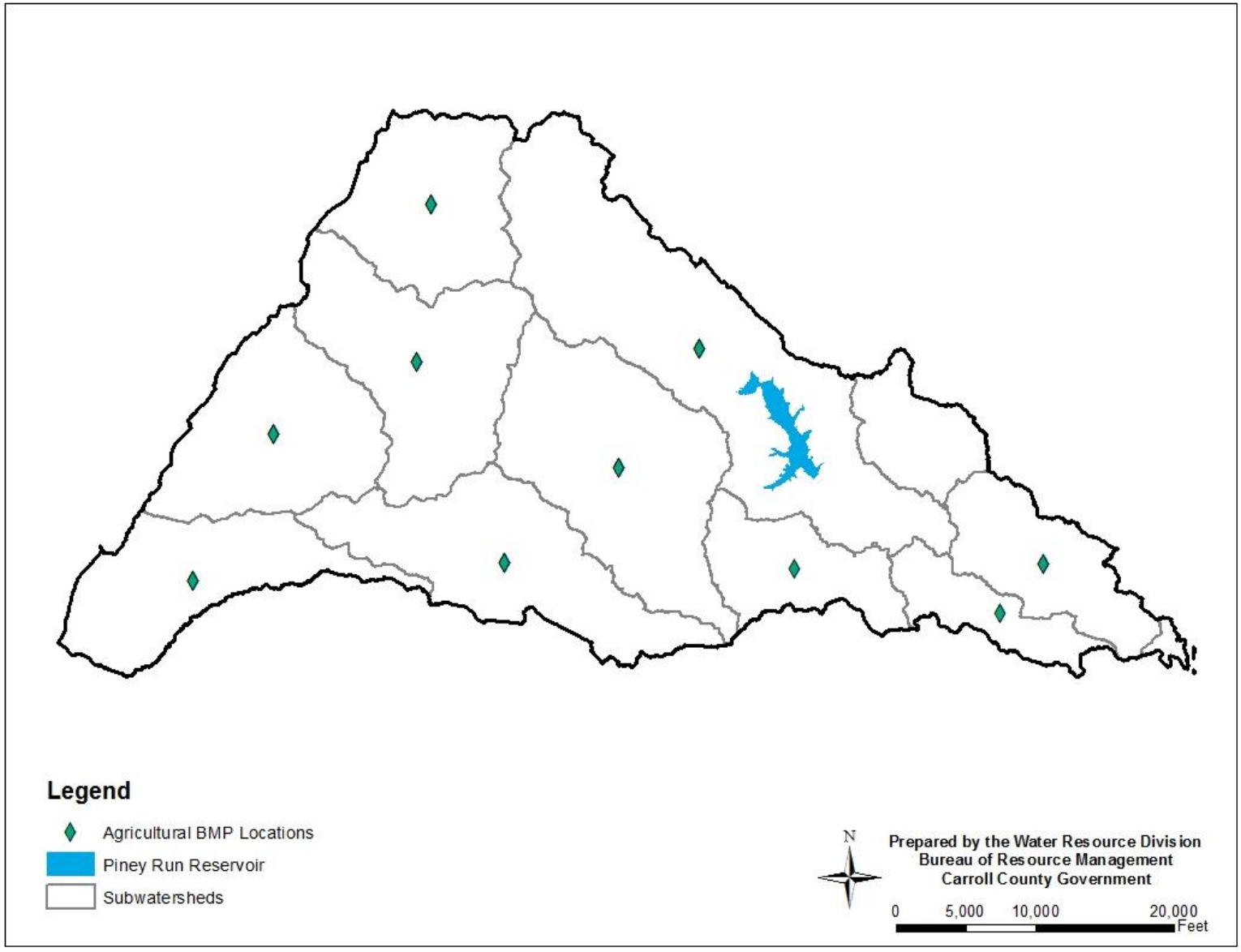

Figure 3-11: South Branch Patapsco Watershed Agricultural BMP Locations

IV. Water Quality

A. Introduction

Maryland water quality standards have been adopted from the Federal Clean Water Act, Section 101, "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters". Individual standards are established to support beneficial use of waterbodies such as fishing, aquatic life, drinking water supply, boating, water contact recreation and protection for terrestrial wildlife. Local monitoring allows for documenting the status of local waterbodies and where restoration or mitigation may be needed. This chapter will look at the designated uses within South Branch Patapsco Watershed, current water quality impairments that have been assigned and existing water quality data within the watershed. Water quality data is utilized along with identified impairments from the stream corridor assessment (Chapter 5) to prioritize preservation and restoration.

B. Designated Uses

All bodies of water, including streams within Maryland and all other states, are each assigned a designated use. Maryland's designated water uses are identified in the Code of Maryland Regulations (COMAR) 26.08.02.08. The designated use of a water body refers to its anticipated use and any protections necessary to sustain aquatic life. Water quality standards refer to the criteria required to meet the designated use of a water body. A listing of Maryland's designated water uses are as follows:

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

If the letter "P" follows the use class listing, that particular stream has been designated as a public water supply.

The South Branch Patapsco Watershed contains Use I, Use III, Use III-P and a small section of Use IV waters. The majority of waters in this watershed are Use I and Use III. Use I, Use III, Use III-P and Use IV waters within the State of Maryland allow for contact water sports and leisure activities that allow direct contact with waters, fishing, growth and propagation of non-trout fish and other aquatic and wildlife, and agricultural and industrial water supplies. Use III waters also allow for growth and propagation of trout, and Use III-P allows for use in public water supply. Use IV wasters are also capable of supporting adult trout for a 'put and take fishery'.

C. Tier II Waters

States are required by the federal Clean Water Act to develop policies, guidance, and implementation procedures to protect and maintain existing high quality waters and prevent them from degrading to the minimum allowable water quality. Tier II waters have chemical or biological characteristics that are significantly better than the minimum water quality requirements. All Tier II designations in Maryland are based on having healthy biological communities of fish and aquatic insects. Tier II designated stream segments for the South Branch Patapsco watershed can be found in Figure 4-1.

D. Total Maximum Daily Loads

Streams and other waterbodies that are unable to meet their designated use as defined by the COMAR are known as impaired waters. Impaired waters are placed on the 303(d) list, which is a section of the Clean Water Act that tracks impaired and threatened waterbodies.

The MDE uses the 303(d) list of impaired waters to establish TMDL's. A TMDL establishes the maximum amount of a pollutant or stressor that a waterbody can assimilate and still meet water quality standards for its designated use. Each TMDL addresses a single pollutant, whereas one waterbody may have multiple TMDL's. TMDL's are calculated by adding the sum of the allowed pollutant loads for point sources, non-point sources, projected growth, with a margin of safety built in. Load allocations are calculated through the use of watershed modeling using existing and historical data collected in the field.

More information on TMDL's and the 303(d) list can be found at: http://www.mde.maryland.gov/programs/Water/TMDL/Pages/Programs/WaterPrograms/tmdl/index.aspx

1. Current Impairments

There are current biological impairments within the South Branch Patapsco Watershed; however there is no assigned TMDL for the watershed at this point. Biological factors are discussed in greater detail in Chapter 5, Living Resources. While Piney Run Reservoir is within the South Branch Patapsco Watershed, the potential for water quality issues (sediments and phosphorus) within the Reservoir will be discussed in a separate document specific for the Reservoir.

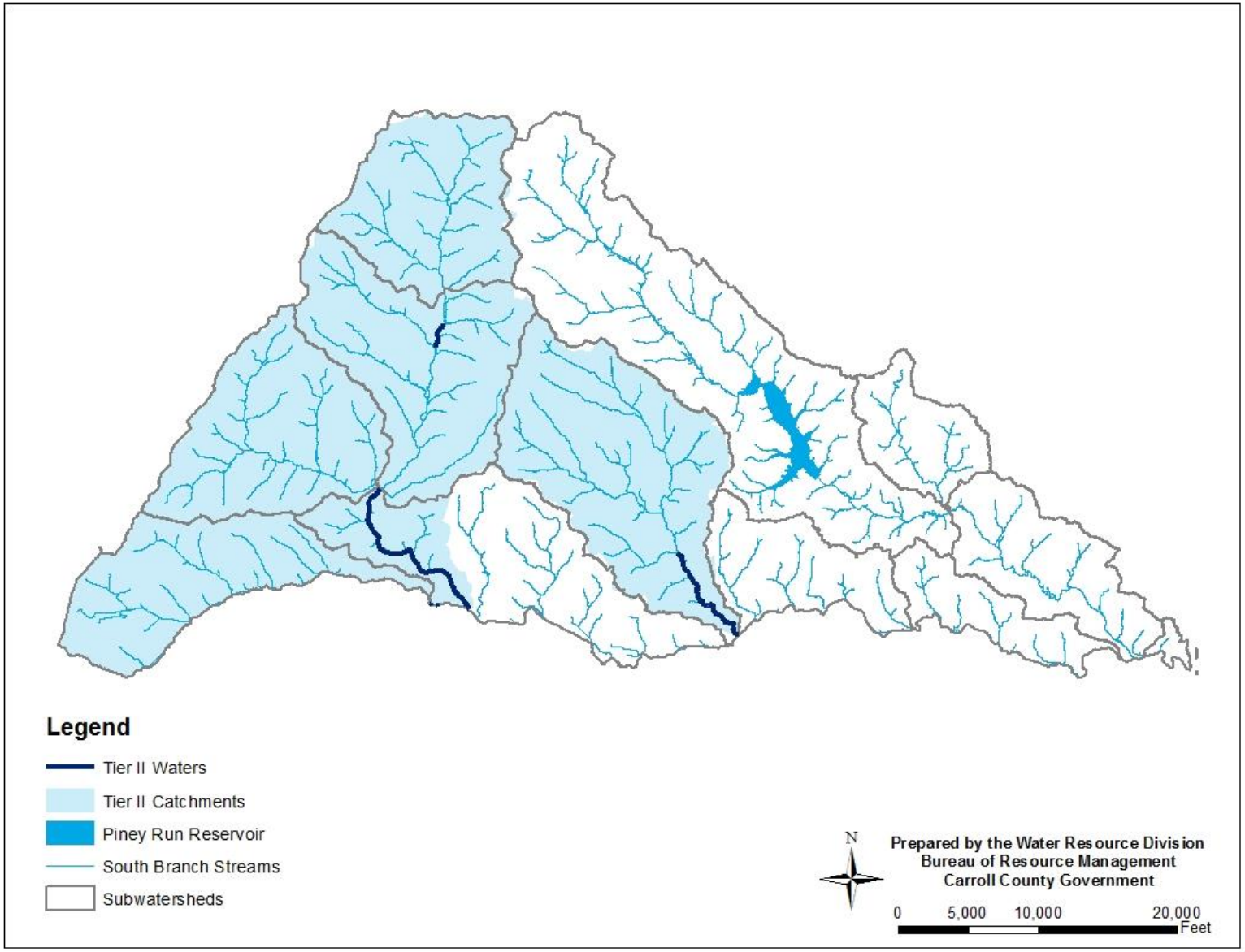

Figure 4-1: South Branch Patapsco Watershed Tier II Water Segments

E. Water Quality Data

Water quality data within the South Branch Patapsco Watershed has been collected and monitored throughout the years by varying agencies with different program goals. This section will focus on the current monitoring being performed by Carroll County, as well as monitoring results from DNR's MBSS program.

1. Current Monitoring

The County's current monitoring strategy is focused primarily around retrofit locations where reductions in loadings can be documented from the before and after study approach.

The Bureau of Resource Management currently monitors one location within the South Branch Patapsco watershed. The Shannon Run site, shown in Figure 4-2 is located within the South Branch Patapsco River (1022) subwatershed, and is almost entirely within the corporate limits of the Town of Sykesville.

The current facility is a wet pond that was built in 1994. The Shannon Run location is primarily low-density residential, which encompasses 57% of the land cover, followed by low-density mixed-urban at 31% of the land cover. The drainage area to the monitoring site is approximately 209 acres, of which, 42 acres or 20% is impervious.

Bi-weekly monitoring at the Shannon Run site began in January of 2015 and consists of chemical grab samples with corresponding discharge measurements in order to calculate loadings. The chemical monitoring parameters, methods, and detection limits for the Shannon Run site can be found in Table 4-1. Additional monitoring at this location includes spring macro-invertebrate collection, which are based upon protocols set by Maryland's MBSS program (Stranko et al, 2014).

Table 4-1: Water Quality Parameters and Methods

Parameter	Reporting Limit	Method
Total Suspended Solids	1 mg/l	SM 2540 D-97
Total Phosphorus	0.01 mg/l	SM 4500-P E-99
Ortho Phosphorus	0.01 mg/l	SM 4500-P E-99
Nitrate-Nitrite	0.05 mg/l	SM 4500-NO3 H00
Bacteria[1]		

[1] Due to the relative short holding time and complexity of the Bureau's retrofit monitoring program, bacteria is not included as part of the bi-weekly data collection.

Once construction to retrofit this existing facility is underway, monitoring at this location will temporarily be suspended. Following the as-built approval for this new facility, chemical and biological data collection will continue in order to document changes in stream health.

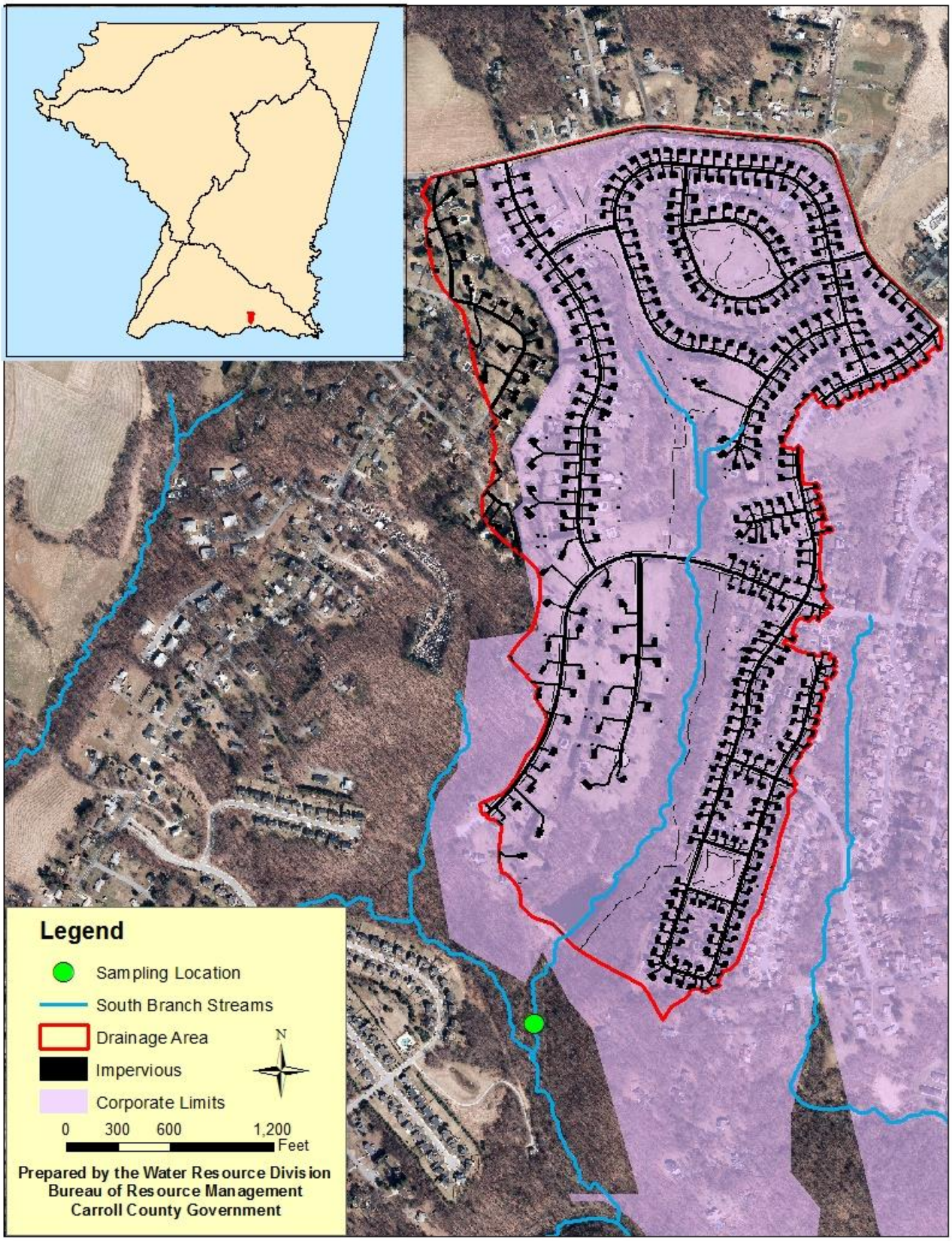

Figure 4-2: Shannon Run Monitoring Location

2. Maryland Biological Stream Survey

The Maryland biological stream survey (MBSS) was started by the DNR in 1993 and expanded statewide in 1994 to characterize the health of Maryland's 10,000+ miles of freshwater streams. The MBSS was Maryland's first stream sampling program intended to provide unbiased estimates of stream conditions. Data is collected at each site on the physical, chemical, and biological characteristics, and then combined into an overall assessment. In this chapter we will discuss the chemical data of the MBSS, and in Chapter 5 we will focus on the biological data of the MBSS. The MBSS goal is to provide the best possible information for the protection and restoration of Maryland's stream ecological resources. The MBSS's objectives to help meet this goal include:

- Assess the current condition of ecological resources in Maryland's streams and rivers;
- Identify the impacts of acidic deposition, climate change, and other stressors on ecological resources in Maryland's streams and rivers;
- Provide an inventory of biodiversity in Maryland's streams;
- Assess the efficacy of stream restoration and conservation efforts to stream ecological resources;
- Continue to build a long-term database and document changes over time in Maryland's stream ecological condition and biodiversity status; and
- Communicate results to the scientific community, the public, and policy makers.

a. Maryland's DNR Results

The DNR has conducted four rounds of MBSS: Round 1 in 1995-1997, Round 2 in 2000-2004 and Round 3 in 2005-2009, a targeted sampling in 2011 and Round 4 began in 2014. Each Round surveyed random and targeted stream reaches from first through fourth order streams. As the MBSS program has progressed, it has shifted to include more targeted sampling focused on a wide range of other program objectives such as TMDL and watershed delineation needs. Information on MBSS site surveys throughout the State can be seen here: http://www.streamhealth.maryland.gov/map.asp.

Site locations for the DNR MBSS are shown in Figure 4-3.

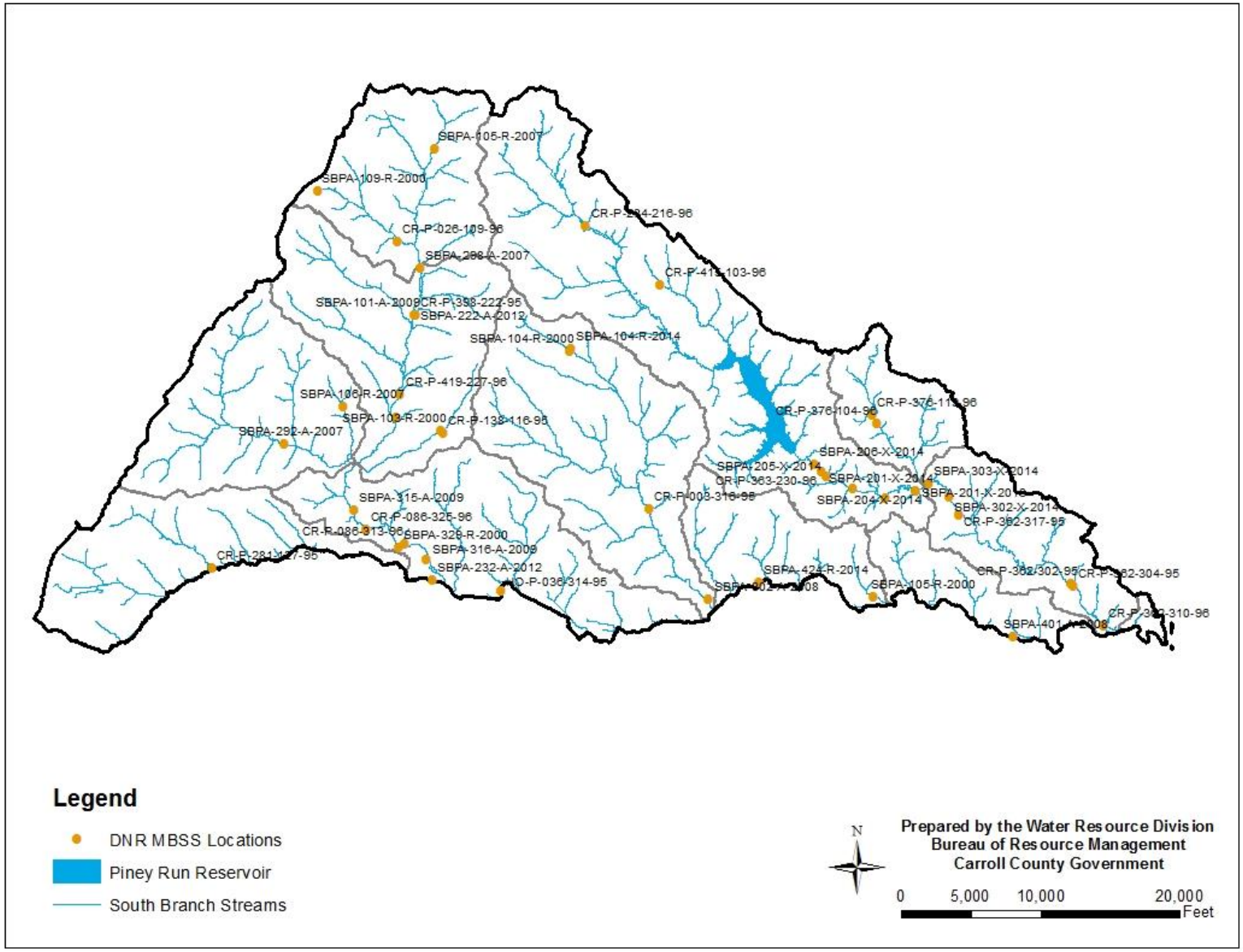

Figure 4-3: South Branch Patapsco Watershed DNR MBSS Locations

The chemical characteristics of a water body influence stream health impacting the habitat and biota. Stream acidification is known to have detrimental effects on aquatic animals. High acidity environments can affect animals' physiological functions, and influences the availability and toxicity of metals to aquatic animals. All streams contain a background level of nitrogen that is essential to the survival of the plants and animals in that stream; however the amount of nitrogen in many streams has increased as a result of anthropogenic influences. Agricultural runoff, wastewater discharge, and nonpoint sources are common culprits leading to an increased nitrogen load. Elevated levels of phosphorus in Maryland waters are usually associated with agricultural impacts. Elevated nitrogen and phosphorus concentrations can cause nutrient enrichment in aquatic systems which lead to decreased amounts of dissolved oxygen. Continued exposure to low dissolved oxygen environments can suffocate biota or lead to reduced spawning success. The COMAR states that dissolved oxygen concentrations greater than 5 mg/l are the standard and a level generally considered healthy for aquatic life. Increased nutrient loads are also linked toxic algal blooms. Conductivity is a measure of the ability of water to pass an electrical current, as affected by inorganic dissolved solids. Organic compounds like oil and phenol do not conduct electrical current very well and therefore have a low conductivity when in water. Discharges to streams can change the conductivity depending on the pollutant. A failing sewage system would raise the conductivity because of the presence of chloride, phosphate, and nitrate while an oil spill would lower the conductivity.

The chemical results obtained during DNR's MBSS sampling are listed in Table 4-2 and summarized in Table 4-3. Data included in this document were provided by the Maryland Department of Natural Resources Monitoring and Non-tidal Assessment Division.

Table 4-2: South Branch Patapsco Watershed DNR's MBSS Chemical Results

12-Digit Scale	Subwatershed	Field pH	Temperature (°C)	Dissolved Oxygen	Conductivity
Site Identification	Stream Segment				
21309081031	**Gills Falls Upper**				
CR-P-026-109-96	Gillis Falls Unnamed Tributary 2	6.74	15.7	10.4	122
SBPA-109-R-2000	Gillis Falls Unnamed Tributary 2	6.84	17.5	7.1	0.134
SBPA-298-A-2007	Gillis Falls	7.15	18.7	9.2	164
SBPA-105-R-2007	Gillis Falls	6.54	16.5	8.2	150
21309081030	**Gills Falls Lower**				
CR-P-419-214-95	Gillis Falls	7.24	18.4	8.6	124
CR-P-138-116-95	Gillis Falls Unnamed Tributary 1	7.46	18.4	8.1	186
CR-P-398-222-95	Gillis Falls	7.46	20.3	8.2	122
CR-P-419-227-96	Gillis Falls	7.2	17.7	9.6	128
SBPA-103-R-2000	Gillis Falls Unnamed Tributary 1	6.99	15.3	8.4	0.174
SBPA-101-A-2009	Gillis Falls	7.13	16.3	9	165

12-Digit Scale Site Identification	Subwatershed Stream Segment	Field pH	Temperature (°C)	Dissolved Oxygen	Conductivity
21309081029	**Middle Run**				
SBPA-292-A-2007	Middle Run	7.42	19.5	7.8	117
SBPA-106-R-2007	Middle Run Unnamed Tributary 1	7.5	22	7.2	214
21309081021	**Piney Run Lower**				
CR-P-362-304-95	Piney Run	7.86	24.1	8.8	202
CR-P-362-302-95	Piney Run	8.29	23.6	9.2	198
CR-P-362-317-95	Piney Run	7.05	23.5	7.6	216
CR-P-362-310-96	Piney Run	7.03	19.9	7.9	196
21309081023	**Piney Run Main**				
CR-P-234-216-96	Piney Run	6.86	19.1	9.2	177
CR-P-363-230-96	Piney Run	7.14	25.8	7.8	128
CR-P-415-103-96	Piney Run Unnamed Tributary 2	6.4	15.6	9.4	90
CR-P-363-212-96	Piney Run	7.09	23.1	7.9	161
21309081024	**Piney Run Tributary**				
CR-P-376-119-96	Piney Run Unnamed Tributary 1	7.31	17.3	9.6	318
CR-P-376-104-96	Piney Run Unnamed Tributary 1	7.36	16.5	9.1	321
21309081028	**South Branch Patapsco**				
CR-P-281-127-95	South Br Patapsco River Unnamed Tributary 1	7.78	28.9	5.7	206
21309081025	**South Branch Patapsco River**				
CR-P-086-313-96	Gillis Falls	7.17	20.2	9.2	124
CR-P-086-325-96	Gillis Falls	7.07	20.6	9.6	120
SBPA-329-R-2000	Gillis Falls	8.11	18.7	8.3	0.131
SBPA-316-A-2009	Gillis Falls	7.32	16.6	8.9	158
SBPA-315-A-2009	Gillis Falls	7.24	17.9	9.8	152
21309081022	**South Branch Patapsco River**				
SBPA-105-R-2000	South Branch Patapsco River Unnamed Tributary 5	7.42	17.8	7.7	0.096
21309081020	**South Branch Patapsco River**				
SBPA-401-A-2008	South Branch Patapsco River	7.6	21.3	7.6	267
21309081026	**Tuckers Branch**				
CR-P-003-316-95	Piney Branch	7.09	18.9	8.3	136
SBPA-104-R-2000	Piney Branch Unnamed Tributary 1	6.96	15.7	8.6	0.205
SBPA-302-A-2008	Piney Branch	7.6	19.2	8.1	183

Table 4-3: South Branch Patapsco Watershed DNR's MBSS Chemical Results Summary

	Field pH	Temperature (°C)	Dissolved Oxygen	Conductivity
Maximum	8.29	28.90	10.40	321
Minimum	6.40	15.30	5.70	0.10
Average	7.26	19.41	8.49	147

The South Branch Patapsco Watershed DNR MBSS data demonstrates there is sufficient dissolved oxygen to adequately support aquatic life. The lowest dissolved oxygen level measured during the DNR MBSS sampling events was 5.70 mg/l, which is greater than the COMAR standard of 5.0 mg/l, a level generally considered healthy for aquatic life. During most of the sampling events the water temperature was below 20°C, averaging around 19.4°C in the watershed. Stream waters below 20°C are generally considered optimal for fish and most other aquatic benthos. The pH of the water was relatively neutral, averaging 7.26, and ranging as acidic as 6.40 to a more alkaline pH of 8.29. The relatively low range of pH suggests overall pH stability with the areas around Piney Run and Gillis Falls having the most acidic environments. The DNR sampling year of 2000 yielded the lowest conductivity results throughout the sampling years.

V. Living Resources

A. Introduction

Living resources is the basic knowledge about how living things function and interact with one another and their environment. Water is an integral component of the habitat of all species. Living resources require water to survive, and will respond to changes not only in water availability but water quality as well. These responses allow us to gain a better understanding of how watershed conditions can have an effect on living habitats, and determine whether or not current water management practices are adequately providing for the needs of the natural communities. This Chapter will focus on the aquatic biology within the South Branch Patapsco Watershed, including any RTE species that may be present within the watershed.

B. Aquatic Biology

A number of programs and agencies regularly collect biological data from streams, including the DNR fisheries program in conjunction with MBSS, as well as individual efforts within the County. Biological indicators such as fish and benthic invertebrates are used to study watershed health. Metrics such as species diversity, percent abundance of pollution-sensitive or pollution-indicative organisms, and total organism abundance are used to determine if the benthic community shows signs of stress. Signs of stress in the watershed include poor species diversity, large abundances of a few organisms, and presence of pollution-tolerant organisms.

Signs of biological impairment are indicative of an environmental stressor within the watershed. Such stressors can be natural or anthropogenic in nature; and further analyses need to be conducted to determine the potential cause of environmental stress. Additional analyses to habitat, water quality and land use can help in finding indications of specific biological stressors or pollutants.

Biological data has become a critical component in assessing water quality, and has been incorporated into the Maryland water quality standards. The Biological Water Quality Standard states:

26.08.02.03-4 Biological Water Quality Criteria

A. Quantitative assessments of Biological communities in streams (biological criteria) may be used separately or in conjunction with the chemical and physical criteria promulgated in this chapter to assess whether water quality is consistent with purposes and uses in Regulations .01 and .02 of this chapter.

B. The results of the quantitative assessments of biological communities shall be used for purposes of water quality assessment, including, but not limited to, those assessments required by §§ 303(d) and 305 (b) of the federal Clean Water Act (33 U.S.C. §§ 1313 (d) and 1315(b)).

C. These assessments shall use documented methods that have been subject to technical review, produce consistent and repeatable results, and are objectively interpretable.

D. In using biological criteria to determine whether aquatic life uses are being met, the Department shall allow for the uncertainty and natural variability in environmental monitoring results by using established quantitative and statistical methodologies to establish the appropriate level of uncertainty for these determinations.

E. The Department shall determine whether the application and interpretation of the assessment method are appropriate. In those instances where the Department determines the assessment method is not appropriate, it will provide its justification for that determination.

1. Index of Biotic Integrity

The biological aspects of the MBSS include fish index of biotic integrity (IBI) and benthic IBI. The fish IBI is a quantitative rating of the health of the fish assemblage found at each site. Scores range from 1 (very poor) to 5 (good). No fish IBI were calculated for sites with a catchment area less than 300 acres. The benthic IBI scores are similar, but focus on benthic macroinvertebrates collected in the stream segment. The scores rate how the stream segments compare to reference streams that are considered minimally impacted. Low scores indicate significant deviation from reference conditions, indicating severe degradation; while high scores indicate the segment is comparable to reference streams and are minimally impacted.

a. Maryland's DNR Results

Locations of the specific sites sampled can be seen in Figure 4-2. Specific IBI information for fish and benthic macroinvertebrates from the sites surveyed within the South Branch Patapsco Watershed are listed in Table 5-1. Data included in this document were provided by the Maryland Department of Natural Resources Monitoring and Non-tidal Assessment Division.

Table 5-1: South Branch Patapsco Watershed DNR's MBSS Index of Biotic Integrity

12-Digit Scale	Subwatershed	Fish IBI			Benthic IBI		
Site Identification	Stream Segment	Good	Fair	Poor	Good	Fair	Poor
21309081031	**Gills Falls Upper**						
CR-P-026-109-96	Gillis Falls Unnamed Tributary 2	5.00				3.00	
SBPA-109-R-2000	Gillis Falls Unnamed Tributary 2			2.00			2.67
SBPA-298-A-2007	Gillis Falls	4.67				3.33	
SBPA-105-R-2007	Gillis Falls	4.67					2.00
21309081030	**Gills Falls Lower**						
CR-P-419-214-95	Gillis Falls	5.00				3.33	
CR-P-138-116-95	Gillis Falls Unnamed Tributary 1	4.33				3.00	
CR-P-398-222-95	Gillis Falls	5.00			4.33		
CR-P-419-227-96	Gillis Falls	4.33				3.00	
SBPA-103-R-2000	Gillis Falls Unnamed Tributary 1	4.00				3.67	
SBPA-101-A-2009	Gillis Falls	5.00				3.67	
SBPA-222-A-2012	Gillis Falls	5.00			4.00		

12-Digit Scale	Subwatershed	Fish IBI			Benthic IBI		
Site Identification	Stream Segment	Good	Fair	Poor	Good	Fair	Poor
21309081029	**Middle Run**						
SBPA-292-A-2007	Middle Run	4.33				3.67	
SBPA-106-R-2007	Middle Run Unnamed Tributary 1	5.00				3.67	
21309081021	**Piney Run Lower**						
CR-P-362-304-95	Piney Run	4.67				3.33	
CR-P-362-302-95	Piney Run	4.33				3.67	
CR-P-362-317-95	Piney Run	4.67				3.33	
CR-P-362-310-96	Piney Run	4.00					1.67
SBPA-302-X-2014	Piney Run	4.00					1.67
SBPA-303-X-2014	Piney Run	4.67					2.67
21309081023	**Piney Run Main**						
CR-P-234-216-96	Piney Run	4.67				3.67	
CR-P-363-230-96	Piney Run	4.00					2.33
CR-P-415-103-96	Piney Run Unnamed Tributary 2			2.33		3.67	
CR-P-363-212-96	Piney Run	4.33					1.33
SBPA-206-X-2014	Piney Run	4.00					2.33
SBPA-205-X-2014	Piney Run	4.00					2.33
SBPA-204-X-2014	Piney Run	4.00					2.67
SBPA-201-X-2013	Piney Run	4.67					2.00
SBPA-201-X-2014	Piney Run	4.67					2.67
21309081024	**Piney Run Tributary**						
CR-P-376-119-96	Piney Run Unnamed Tributary 1		3.00				1.33
CR-P-376-104-96	Piney Run Unnamed Tributary 1		3.00				2.33
21309081028	**South Branch Patapsco**						
CR-P-281-127-95	South Br Patapsco River Unnamed Tributary 1	4.33					2.00
21309081025	**South Branch Patapsco River**						
CR-P-086-313-96	Gillis Falls	4.67				3.67	
CR-P-086-325-96	Gillis Falls	4.33			4.00		
SBPA-329-R-2000	Gillis Falls	5.00			4.33		
SBPA-316-A-2009	Gillis Falls	4.67			4.00		
SBPA-315-A-2009	Gillis Falls	4.67			4.33		

12-Digit Scale	Subwatershed	Fish IBI			Benthic IBI		
Site Identification	Stream Segment	Good	Fair	Poor	Good	Fair	Poor
21309081022	**South Branch Patapsco River**						
SBPA-105-R-2000	South Branch Patapsco River Unnamed Tributary 5		3.67			3.67	
SBPA-424-R-2014	South Branch Patapsco River	4.33				3.33	
21309081020	**South Branch Patapsco River**						
SBPA-401-A-2008	South Branch Patapsco River		3.67			3.33	
21309081026	**Tuckers Branch**						
CR-P-003-316-95	Piney Branch	5.00				3.67	
SBPA-104-R-2000	Piney Branch Unnamed Tributary 1	4.00				3.00	
SBPA-302-A-2008	Piney Branch	4.67			4.00		
SBPA-104-R-2014	Piney Branch Unnamed Tributary		3.33			3.00	
South Branch Patapsco Watershed Total Counts:		**36**	**5**	**2**	**7**	**21**	**15**
South Branch Patapsco Watershed Average:		**4.52**	**3.33**	**2.17**	**4.14**	**3.41**	**2.13**

In total there are 43 samples contributing to the MBSS data set from 1995 to 2014. Within the South Branch Patapsco Watershed, 84% of the fish samples were in 'good' condition, with an overall average rating of 4.52. Of the benthic samples, 49% were in 'fair' condition with an overall average rating of 3.41. The IBI for fish throughout the years and locations sampled were mostly within the 'good' range, suggesting fish populations are, for the most part, similar to reference streams that are unaffected by pollutants. The benthic IBI for the South Branch Patapsco Watershed is for the most part within the 'fair' range, suggesting some adverse impacts to the benthic community within the watershed. The Piney Run Tributary subwatershed is noted as having the lowest overall IBI ratings. South Branch Patapsco River (1025) subwatershed is noted as having the highest overall IBI rating.

b. Carroll County Results

Carroll County's Bureau of Resource Management conducted MBSSs in South Branch Patapsco Watershed from 2010 – 2016. Site locations for the Carroll County MBSS sites specific for Benthic IBI are shown in Figure 5-1. Specific IBI information for benthic macroinvertebrates from the sites surveyed within the South Branch Patapsco Watershed are listed in Table 5-2.

Table 5-2: South Branch Patapsco Watershed Carroll County's MBSS Benthic IBI

12-Digit Scale	Subwatershed	Benthic IBI		
Sample Year	Site Identification	Good	Fair	Poor
21309081030	**Gills Falls Lower**			
2011	GFL09			2.33
2014	GFL09		3.00	

12-Digit Scale	Subwatershed	Benthic IBI		
Sample Year	Site Identification	Good	Fair	Poor
2016	GFL09	4.33		
2011	GFL10		3.67	
2014	GFL10	4.00		
2011	GFL01		3.67	
2014	GFL01		3.33	
21309081029	**Middle Run**			
2011	MRW01		3.67	
2014	MRW01		3.67	
21309081023	**Piney Run Main**			
2010	PRM34		3.33	
2010	PRM30		3.67	
2010	PRM28	4.00		
2010	PRM05	4.00		
2015	PRM05		3.00	
2010	PRM22	4.33		
2010	PRM35			2.33
2015	PRM35	4.00		
2010	PRM12			2.33
21309081024	**Piney Run Tributary**			
2011	PRT01		3.00	
2012	PRT01			2.67
2011	PRT02			2.67
2015	PRT02		3.33	
2015	PRT04			1.33
21309081025	**South Branch Patapsco River**			
2011	SBP01			2.00
2015	SBP01			2.00
2016	SBP01			2.00
South Branch Patapsco Watershed Total Counts:		**6**	**11**	**9**
South Branch Patapsco Watershed Average:		**4.11**	**3.39**	**2.18**

In total there are 26 samples contributing to the County's MBSS data set from 2010 to 2016. Within the South Branch Patapsco Watershed the overall benthic IBI rating was 3.14, putting the Watershed in 'fair' condition. The benthic IBI for the South Branch Patapsco Watershed is for the most part within the 'fair' to 'poor' range, suggesting some adverse impacts to the benthic community within the watershed. South Branch Patapsco River subwatershed is noted as having the lowest overall benthic IBI ratings. Piney Run Main and Gillis Falls Lower subwatersheds are noted as having the highest overall IBI rating.

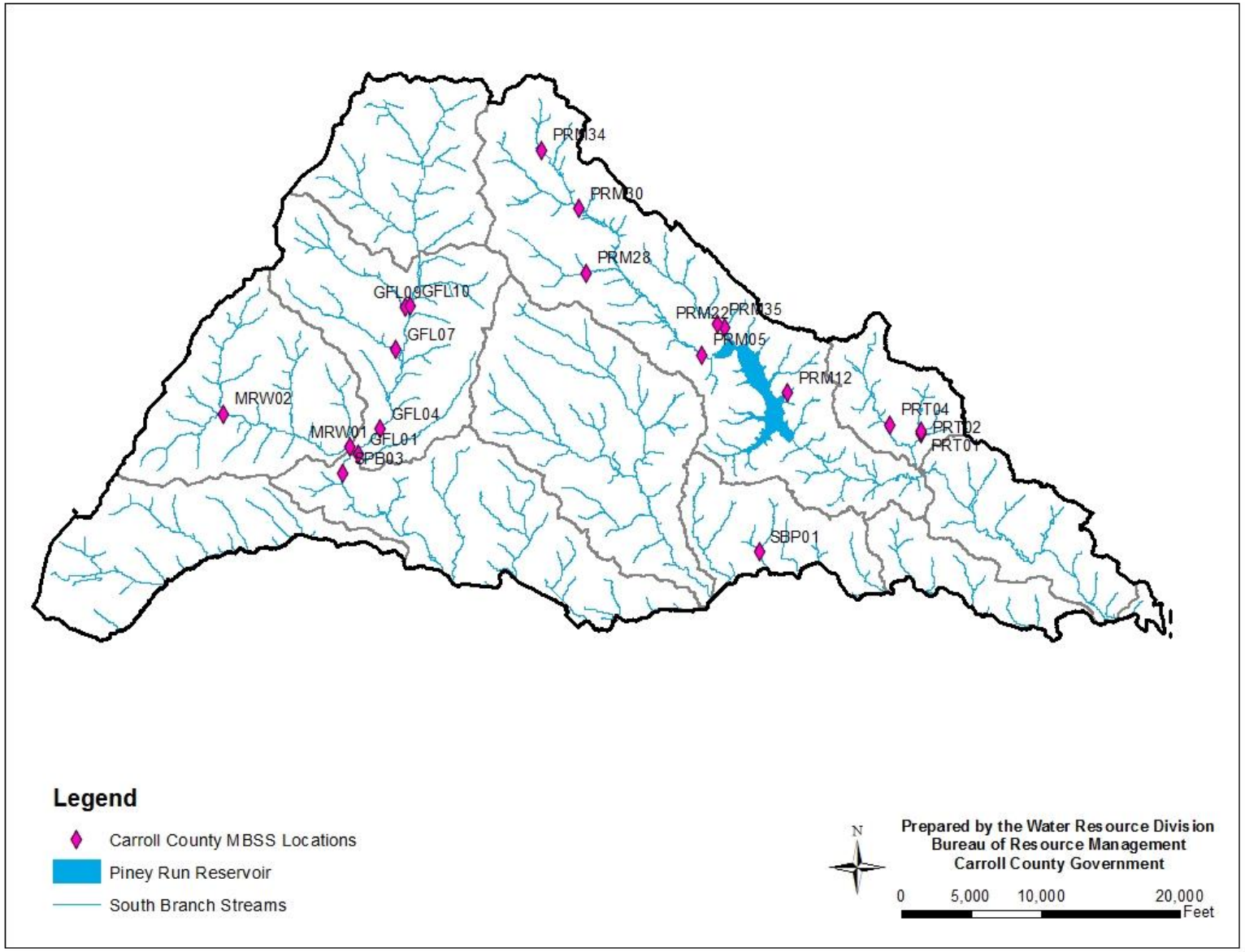

Figure 5-1: South Branch Patapsco Watershed Carroll County MBSS Locations

C. Sensitive Species

Sensitive species are those plants and animals that are among the rarest in Maryland and most in need of conservation efforts. These species are at the greatest risk of local extinction, and are generally the most sensitive to environmental degradation.

1. Rare, Threatened and Endangered Species

Rare, threatened and endangered species are those plants and animals that are the most at risk to maintain healthy populations. For watershed restoration purposes, it is important to know and account for the habitats of such sensitive species. Protecting and expanding these habitats help to preserve biodiversity and is a critical component in successfully restoring a watershed. The DNR's Wildlife and Heritage Program identifies important areas for sensitive species conservation known as stronghold watersheds. Stronghold watersheds are the places where RTE species have the highest abundance of natural communities. Within the South Branch Patapsco Watershed the South Branch Patapsco River (1025) and South Branch Patapsco River (1020) subwatersheds are identified as having sensitive state-listed species; and special protection is necessary to ensure the persistence of these communities. There is also approximately 2,716 acres of targeted ecological areas within the South Branch Patapsco watershed. Targeted ecological areas are a limited number of areas that rank exceptionally high for ecological criteria and that have a practical potential for preservation. A complete list of all rare, threatened, and endangered plants and animals within Carroll County and throughout the state of Maryland can be found at:
http://www.dnr.state.md.us/wildlife/espaa.asp.

Figure 5-2 shows targeted ecological areas for sensitive species within the South Branch Patapsco Watershed. Sensitive species areas where designated by the DNR.

D. Stream Corridor Assessment

A Stream Corridor Assessment (SCA) of the South Branch Patapsco Watershed was conducted during the winter of 2013 by Carroll County Bureau of Resource Management staff. The South Branch Patapsco SCA was based on protocols developed by the Maryland Department of Natural Resources watershed restoration division (Yetman, 2001). The goal of this assessment was to identify and rank current impairments within the watershed to assist in prioritizing locations for restoration implementation.

This assessment reached out to 1,359 landowners within the South Branch Patapsco Watershed whose property is intersected by a stream corridor. Landowner permission was obtained through a mailing that detailed the assessment, permission results can be found in Figure 5-3. A response card was also included for the landowner to send back with their permission response. Only properties with owner permission were assessed. Access was granted for approximately 156 of the 201 stream miles within the South Branch Patapsco watershed.

The most common impairments identified during the assessment are shown in Figure 5-4, and consisted primarily of erosion and inadequate streamside buffers. Table 5-2 presents a summary of the number of impacts identified in each subwatershed.

Table 5-2: Stream Corridor Assessment – Identified Impacts

DNR 12-Digit	In-Stream Construction	Erosion	Fish Barrier	Inadequate Buffer	Trash Dump	Channel Alteration	Pipe Outfall	Exposed Pipe	Total
1030	0	23	3	13	0	0	1	0	**40**
1031	0	11	1	18	0	0	0	0	**30**
1029	0	10	5	11	0	0	0	0	**26**
1021	0	16	3	10	2	0	5	0	**36**
1023	0	29	5	37	2	2	2	0	**77**
1024	0	0	0	1	1	0	1	0	**3**
1028	0	4	0	2	0	0	2	0	**8**
1020	0	5	2	1	0	0	0	1	**9**
1022	0	16	2	5	2	0	3	1	**29**
1025	0	3	2	7	0	0	0	0	**12**
1026	0	11	0	9	0	0	0	0	**20**
Total	**0**	**128**	**23**	**114**	**7**	**2**	**14**	**2**	**290**

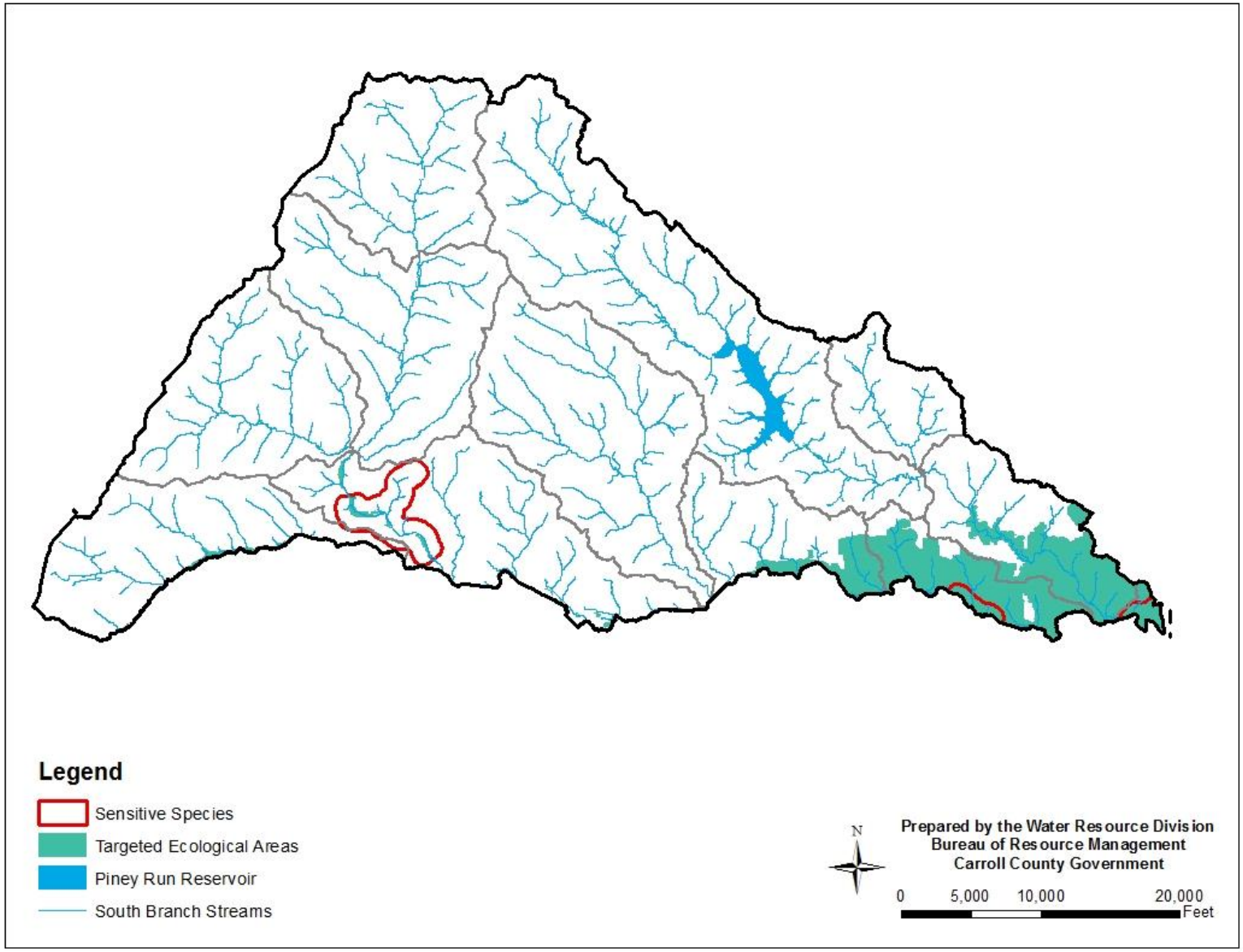

Figure 5-2: South Branch Patapsco Watershed Targeted Ecological Areas

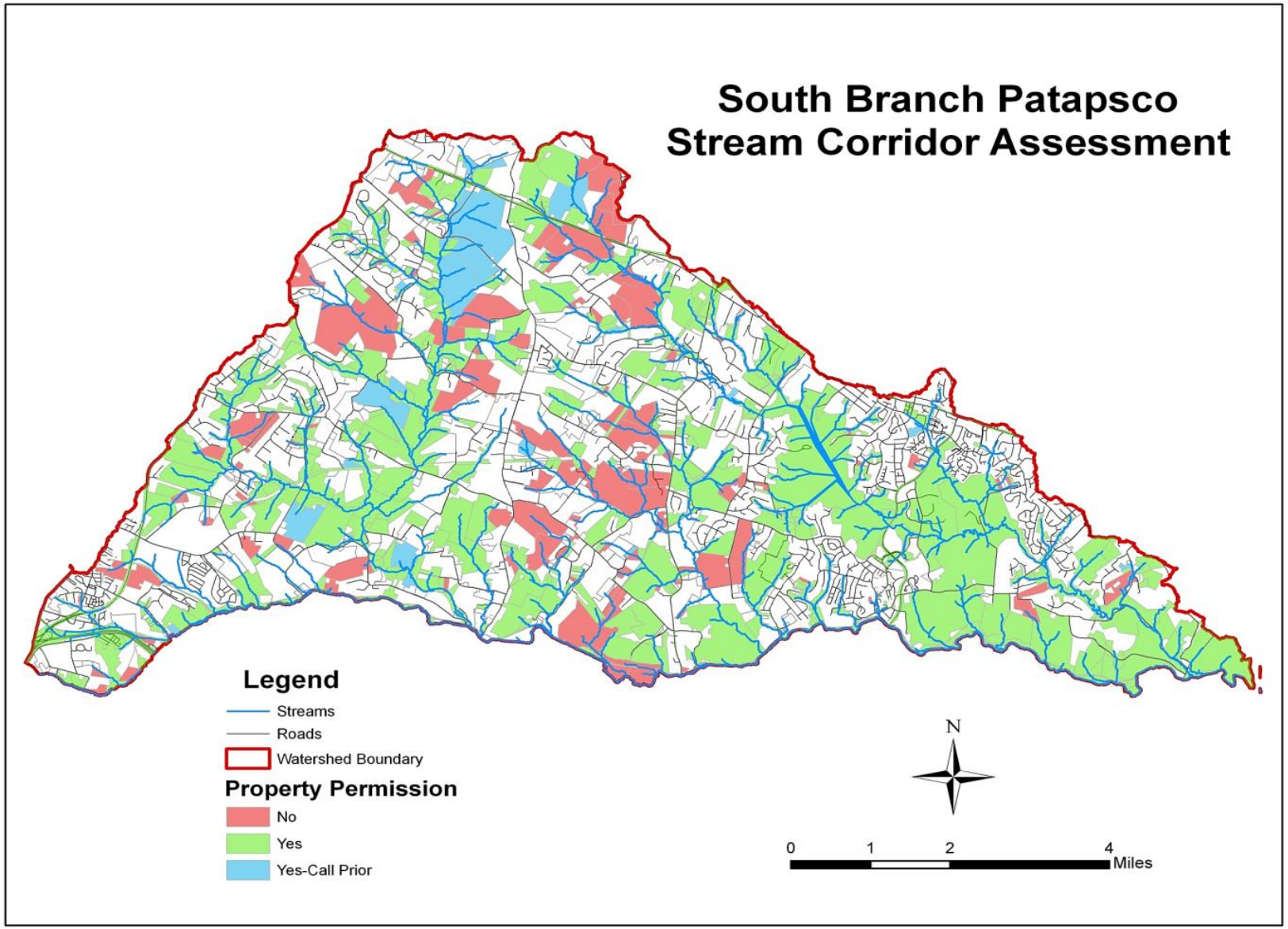

Figure 5-3: SCA Landowner Participation

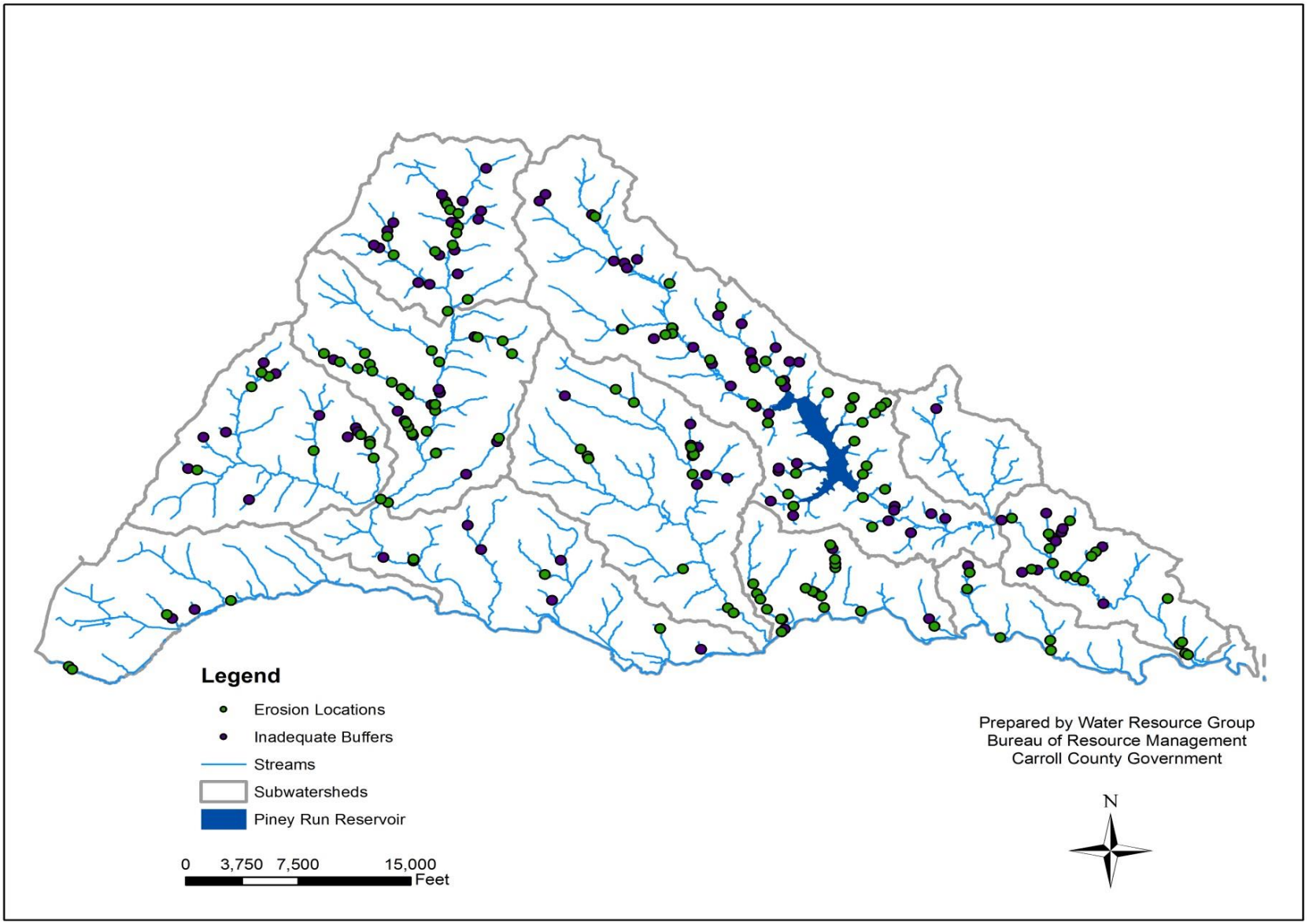

Figure 5-4: Most Commonly Identified Impacts

A total of 10.32 miles (7%) of the 156 miles assessed were found to have an erosion problem, with approximately 3 percent of the watershed categorized as having a severe erosion problem. Buffer areas were identified as inadequate along 8% of the streams assessed, with 3 percent of the entire watershed classified as severely un-buffered Table 5-4 shows the linear feet of streambank erosion and inadequate streamside buffers by subwatershed.

Table 5-4: Linear feet of Inadequate Buffer and Stream Erosion

Stream Segment (DNR 12-Digit)	Erosion	Inadequate Buffer*
1030	6,060	16,755
1031	4,100	20,425
1029	3,370	7,620
1021	5,170	6,100
1023	18,760	43,130
1024	0	300
1028	1,925	4,900
1020	1,190	1,120
1022	5,490	4,300
1025	2,400	8,175
1026	6,035	15,150
Total	**54,500**	**127,975**

*Linear footage includes both right and left banks of stream

1. **Subwatershed Summary**

Gillis Falls (1030): Erosion problems were identified along 6,060 linear feet (6%) of the stream channel, with 3,000 feet (50%) feet classified as severely eroded. Inadequate buffers were identified along 16,755 linear feet (8%) of the streambank, with 1,950 feet (12%) classified as severe.

Gillis Falls (1031): Erosion Problems were identified along 4,100 linear feet (5%) of the stream channel, with 1,350 feet (33%) classified as severely eroded. Inadequate buffers were identified along 20,425 linear feet (14%) of the streambank, with 13,200 feet (65%) classified as severe.

Middle Run (1029): Erosion Problems were identified along 3,370 linear feet (3%) of the stream channel, with none being classified as severely eroded. Inadequate buffers were identified along 7,620 linear feet (4%) of the streambank, with 3,875 feet (51%) classified as severe.

Piney Run (1021): Erosion Problems were identified along 5,170 linear feet (9%) of the stream channel, with 3,900 feet (75%) being classified as severely eroded. Inadequate buffers were identified along 6,100 linear feet (5%) of the streambank, with 3,300 feet (54%) classified as severe.

Piney Run (1023): Erosion Problems were identified along 18,760 linear feet (9%) of the stream channel, with 7,750 feet (41%) being classified as severely eroded. Inadequate buffers were identified along 43,130 linear feet (10%) of the streambank, with 16,250 feet (38%) classified as severe.

Piney Run (1024): No erosion problems were identified along this section of stream channel. Inadequate buffers were identified along 300 linear feet (<1%) of the streambank, with none being classified as severe.

South Branch (1028): Erosion Problems were identified along 1,925 linear feet (2%) of the stream channel, with none being classified as severe. Inadequate buffers were identified along 4,900 linear feet (3%) of the streambank, with 4,600 feet (94%) classified as severe.

South Branch (1020): Erosion Problems were identified along 1,190 linear feet (2%) of the stream channel, with 1,100 feet (92%) classified as severely eroded. Inadequate buffers were identified along 1,120 linear feet (1%) of the streambank, with none being classified as severe.

South Branch (1022): Erosion Problems were identified along 5,490 linear feet (9%) of the stream channel, with 1,100 feet (20%) classified as severely eroded. Inadequate buffers were identified along 4,300 linear feet (3%) of the streambank, with none being classified as severe.

South Branch (1025): Erosion Problems were identified along 2,400 linear feet (2%) of the stream channel, with 2,200 feet (92%) classified as severely eroded. Inadequate buffers were identified along 8,175 linear feet (3%) of the streambank, with 3,800 feet (46%) classified as severe.

Tuckers Branch (1026): Erosion Problems were identified along 6,035 linear feet (5%) of the stream channel, with 4,000 feet (66%) classified as severely eroded. Inadequate buffers were identified along 15,150 linear feet (6%) of the streambank, with 7,600 feet (50%) classified as severe.

VI. Characterization Summary

A. Summary

This Characterization Plan was developed to describe the unique background of the South Branch Patapsco Watershed. The contents and data presented in this plan will be used by the Carroll County Bureau of Resource Management to develop a Watershed Restoration Plan that will lay out the Bureau's goals for addressing environmental impacts within the watershed. The purpose of the Watershed Restoration Plan will be to focus on identified impacts discovered during stream corridor assessments and to prioritize projects at a subwatershed scale based on the water quality data collected by the MDE as well as County staff initiatives. The Watershed Restoration Plan will also be used by the Bureau as a document to track project implementation in each subwatershed in order to track progress towards meeting applicable goals within the watershed.

B. Cost Summary

The following breakdown shows an approximate cost summary for the completion of the South Branch Patapsco Watershed stream corridor assessment, as well as the development of this South Branch Patapsco Watershed Characterization Plan.

Field Time: Assessment was completed over a span of 6 weeks; field crew averaged 3 days per week for a total of 18 field days.

Field Hours: Field crew averaged 4 hours/day over the 18 days for a total of 72 hours. Field crew varied from 2-3 people performing the assessment for a cumulative total of 180 field hours. Total cost of staff time in field was roughly $5,400 (180 hours at an average of $30/hour).

Plan Development: Watershed plan development took approximately 2 months ($6,700 staff time) and consisted of a full analysis of the stream corridor assessment as well as a complete characterization of the watershed.

Cost: Total estimated cost to complete the South Branch Patapsco stream corridor assessment and the Watershed Characterization Plan was approximately $12,100.

VII. References:

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Appendix A:
South Branch Patapsco Watershed
Stormwater Management Facilities

South Branch Patapsco Watershed Stormwater Management Facilities

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1028 South Branch Patapsco	Detention Facility	19.85	5.35	Nottingham Village	SWM-001
1024 Piney Run Tributary	Infiltration Facility	1.50	1.22	Carrolltown Medical	SWM-003
1024 Piney Run Tributary	Infiltration Facility	11.00	3.99	Hunter Crossing #1	SWM-005
1024 Piney Run Tributary	Infiltration Facility	23.50	5.43	Hunter Crossing #2	SWM-006
1023 Piney Run Main	Infiltration Facility	4.95	0	Winfield Elementary	SWM-046
1023 Piney Run Main	Infiltration Facility	1.40	0	Winfield Elementary	SWM-047
1024 Piney Run Tributary	Infiltration Facility	2.47	1.6	Benjamins Claim	SWM-050
1024 Piney Run Tributary	Detention Facility	3.47	2.87	Benjamins Claim	SWM-051
1024 Piney Run Tributary	Sand Filter	47.10	15.78	Benjamins Claim Retrofit Pond	SWM-052
1022 South Branch Patapsco River	Retention Facility	215.74	57	Shannon Run Phase II	SWM-053
1023 Piney Run Main	Detention Facility	15.85	5.01	Copper Ridge	SWM-063
1024 Piney Run Tributary	Sand Filter	3.77	1.1	Eldersburg Estates	SWM-066
1024 Piney Run Tributary	Sand Filter	3.85	1.46	Eldersburg Estates	SWM-067
1024 Piney Run Tributary	Sand Filter	21.02	7.98	Eldersburg Estates	SWM-068
1029 Middle Run	Infiltration Facility	8.86	2.87	Mt Airy Manors	SWM-072
1024 Piney Run Tributary	Infiltration Facility	0.70	0.44	Harper Kitchen	SWM-081
1021 Piney Run Lower	Detention Facility	36.00	0	Clipper Hill Pond #2	SWM-089
1024 Piney Run Tributary	Detention Facility	0.00	0	Piney Ridge Village	SWM-091
1021 Piney Run Lower	Retention Facility	53.36	13.5	Harvest Farm, Phase IA	SWM-093

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1022 South Branch Patapsco River	Detention Facility	0.00	0	School House Road	SWM-097
1021 Piney Run Lower	Sand Filter	34.69	16.129	Brimfield Subdivision	SWM-100
1022 South Branch Patapsco River	Infiltration Facility	6.12	0.57	Carmae Acres	SWM-110
1023 Piney Run Main	Retention Facility	51.17	5.136	Arthur Ridge, Sec 2	SWM-114
1024 Piney Run Tributary	Retention Facility	94.23	18.2	Parrish Park Retrofit	SWM-116
1024 Piney Run Tributary	Detention Facility	12.78	2.55	Piney Ridge Elementary School	SWM-117
1028 South Branch Patapsco	Infiltration Facility	1.02	0	Stauffer Funeral Home	SWM-123
1024 Piney Run Tributary	Detention Facility	0.90	0.9	Piney Ridge Village 7	SWM-126
1024 Piney Run Tributary	Detention Facility	11.27	4.5	Eldersburg Estates Sec 1,2	SWM-132
1028 South Branch Patapsco	Infiltration Facility	0.97	0	106 East Ridgeville Blvd	SWM-144
1024 Piney Run Tributary	Retention Facility	118.47	43.45	Piney Ridge Village Sec 4	SWM-146
1023 Piney Run Main	Infiltration Facility	1.00	0.5	Klee Mill Center	SWM-148
1022 South Branch Patapsco River	Detention Facility	99.40	10	Lexington Run Sec 1	SWM-151
1022 South Branch Patapsco River	Detention Facility	102.60	38.9	Lexington Run Sec 2	SWM-152
1024 Piney Run Tributary	Infiltration Facility	0.55	0.35	Meineke Muffler Eldersburg	SWM-156
1024 Piney Run Tributary	Detention Facility	2.64	1.97	Elders Baptist Church	SWM-167
1028 South Branch Patapsco	Infiltration Facility	2.50	2.06	Mt Airy Post Office	SWM-169
1028 South Branch Patapsco	Detention Facility	0.28	0.2	Marlane Division Lot 2	SWM-177
1023 Piney Run Main	Infiltration Facility	5.14	0.35	Robert W Seal	SWM-180
1023 Piney Run Main	Infiltration Facility	1.87	1.63	Kleins Office Facility	SWM-186
1028 South Branch Patapsco	Detention Facility	14.17	9.13	Peacock Center	SWM-195
1022 South Branch Patapsco River	Infiltration Facility	13.61	4.13	Patapsco Valley Overlook	SWM-205
1024 Piney Run Tributary	Underground Tank	1.50	0.47	Exxon Liberty Road	SWM-206
1025 South Branch Patapsco River	Detention Facility	34.10	1.71	Hoods Mill Landfill Closure	SWM-207
1028 South Branch Patapsco	Infiltration Facility	9.25	6.66	Becks Subdivision	SWM-211
1025 South Branch Patapsco River	Shallow Marsh	4.73	0	TJ Angelozzi Inc	SWM-217

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1031 Gillis Falls Upper	Detention Facility	1.15	0	Winfield Mini Storage	SWM-223
1024 Piney Run Tributary	Shallow Marsh	1.35	0	St Joseph Catholic Community	SWM-235
1025 South Branch Patapsco River	Shallow Marsh	2.70	1.64	Cannery Row	SWM-243
1023 Piney Run Main	Infiltration Facility	1.48	1.28	Messiah Evangelical Church	SWM-249
1024 Piney Run Tributary	Infiltration Facility	2.60	0.875	Caroll Square Office Park	SWM-250
1024 Piney Run Tributary	Infiltration Facility	2.60	1.315	Caroll Square Office Park	SWM-250
1022 South Branch Patapsco River	Retention Facility	14.90	2.1	Northrup Grumman Corporation	SWM-252
1024 Piney Run Tributary	Detention Facility	0.50	0.31	Highs Dairy Store Freedom	SWM-253
1023 Piney Run Main	Detention Facility	1.25	0.65	Highs Dairy Store Freedom	SWM-254
1024 Piney Run Tributary	Infiltration Facility	1.78	1.384	Pizza Hut Eldersburg	SWM-258
1028 South Branch Patapsco	Shallow Marsh	68.50	31.24	Fields of Nottingham	SWM-259
1028 South Branch Patapsco	Infiltration Facility	2.09	1.77	Ridgeville Plaza	SWM-264
1025 South Branch Patapsco River	Retention Facility	14.60	0	Hoods Mill Borrow Area	SWM-274
1025 South Branch Patapsco River	Retention Facility	14.60	0	Hoods Mill Borrow Area	SWM-274
1025 South Branch Patapsco River	Retention Facility	14.60	0	Hoods Mill Borrow Area	SWM-274
1025 South Branch Patapsco River	Retention Facility	14.60	0	Hoods Mill Borrow Area	SWM-274
1028 South Branch Patapsco	Underground Tank	14.10	0	Walmart Mt Airy Shopping	SWM-275
1024 Piney Run Tributary	Shallow Marsh	24.60	0	Tydings Acres	SWM-277
1023 Piney Run Main	Filtration Facility	0.80	0	Sykesville Middle School	SWM-280
1023 Piney Run Main	Filtration Facility	0.80	0	Sykesville Middle School	SWM-280
1028 South Branch Patapsco	Shallow Marsh	24.89	19.9	Twin Arch Bus Park Sec 1,3	SWM-281
1028 South Branch Patapsco	Infiltration Facility	2.00	1.7	Ridgeville Bus CTRLot 10	SWM-298
1024 Piney Run Tributary	Filtration Facility	2.90	2.9	Benjamins Claim Condos	SWM-301
1021 Piney Run Lower	Shallow Marsh	15.37	4.484	Jenna Estates Sec 2 Ph 1	SWM-303
1024 Piney Run Tributary	Filtration Facility	2.76	1.793	Piney Ridge Village 5/6	SWM-309
1024 Piney Run Tributary	Filtration Facility	2.07	1.205	Piney Ridge Village 5/6	SWM-310

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1024 Piney Run Tributary	Filtration Facility	17.13	7.893	Piney Ridge Village 5/6	SWM-311
1024 Piney Run Tributary	Filtration Facility	3.55	0.96	Piney Ridge Village 5/6	SWM-312
1022 South Branch Patapsco River	Retention Facility	7.73	0	Village House	SWM-316
1023 Piney Run Main	Shallow Marsh	49.70	0	Woodsyde Estates	SWM-320
1023 Piney Run Main	Filtration Facility	1.83	0	Woodsyde Estates	SWM-321
1021 Piney Run Lower	Shallow Marsh	6.22	2.174	Jenna Estates 2 Ph 2	SWM-332
1021 Piney Run Lower	Filtration Facility	1.99	1.99	Jenna Estates 2 Ph 2	SWM-333
1028 South Branch Patapsco	Filtration Facility	1.75	1.75	Allegheny Power Twin Arch	SWM-335
1028 South Branch Patapsco	Filtration Facility	1.75	1.75	Allegheny Power Twin Arch	SWM-335
1023 Piney Run Main	Filtration Facility	1.78	0.785	Fairhaven 17 Cottages	SWM-338
1024 Piney Run Tributary	Infiltration Facility	8.96	8.249	Princess Shopping Center	SWM-345
1023 Piney Run Main	Filtration Facility	6.32	2.1	Church of Latter Day Saints	SWM-352
1028 South Branch Patapsco	Filtration Facility	1.08	0.74	Ridgeville Gas & Go	SWM-359
1028 South Branch Patapsco	Filtration Facility	1.89	0	Woodlands Nottingham	SWM-367
1028 South Branch Patapsco	Filtration Facility	1.56	0	Woodlands Nottingham	SWM-368
1028 South Branch Patapsco	Filtration Facility	1.21	1.21	Larel Estates	SWM-376
1023 Piney Run Main	Detention Facility	8.04	0	Fairhaven	SWM-380
1023 Piney Run Main	Filtration Facility	0.23	0.23	Golden Pond Overlook	SWM-382
1028 South Branch Patapsco	Detention Facility	1.28	0	Church of Latter Day Saints	SWM-384
1025 South Branch Patapsco River	Infiltration Facility	1.74	0.18	Arbor Valley Landscaping	SWM-391
1025 South Branch Patapsco River	Infiltration Facility	1.74	0.28	Jenna Estates Sec 2 Ph 3	SWM-391
1021 Piney Run Lower	Filtration Facility	3.92	0	Jenna Estates Sec 2 Ph 3	SWM-392
1021 Piney Run Lower	Filtration Facility	3.92	0	Jenna Estates Sec 2 Ph 3	SWM-392
1023 Piney Run Main	Filtration Facility	0.69	0	Avon Shire Woods	SWM-396
1023 Piney Run Main	Filtration Facility	1.06	0	Avon Shire Woods	SWM-396
1023 Piney Run Main	Filtration Facility	0.15	0	Avon Shire Woods	SWM-396

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1026 Tuckers Branch	Filtration Facility	1.62	0	Fannie Ridge	SWM-398
1025 South Branch Patapsco River	Detention Facility	11.44	0	Modern Foundations	SWM-400
1025 South Branch Patapsco River	Detention Facility	11.44	0	Modern Foundations	SWM-400
1023 Piney Run Main	Filtration Facility	1.27	0	Flower Valley	SWM-404
1023 Piney Run Main	Filtration Facility	1.27	0	Flower Valley	SWM-404
1024 Piney Run Tributary	Infiltration Facility	1.32	0	Piney Ridge Village 5	SWM-405
1025 South Branch Patapsco River	Infiltration Facility	0.26	0	Omnipoint Com Cap Op	SWM-408
1025 South Branch Patapsco River	Infiltration Facility	0.26	0	Omnipoint Com Cap Op	SWM-408
1024 Piney Run Tributary	Infiltration Facility	1.30	0	Sykesville Bldg & Loan	SWM-417
1023 Piney Run Main	Detention Facility	7.85	0	Fairhaven, Uplands Hall	SWM-422
1023 Piney Run Main	Infiltration Facility	1.27	0	Twenty One Liberty Place	SWM-425
1025 South Branch Patapsco River	Infiltration Facility	46.26	0	TT&C Expansion Station	SWM-431
1031 Gillis Falls Upper	Infiltration Facility	0.00	0.18	Oxford Town	SWM-441
1024 Piney Run Tributary	Infiltration Facility	1.20	0.325	Sykesville Fire Dept	SWM-454
1024 Piney Run Tributary	Infiltration Facility	1.20	0.325	Sykesville Fire Dept	SWM-454
1024 Piney Run Tributary	Infiltration Facility	1.20	0.37	Sykesville Fire Dept	SWM-454
1024 Piney Run Tributary	Retention Facility	36.14	9.5	Carrolltown Sec 2B	SWM-455
1028 South Branch Patapsco	Infiltration Facility	0.68	0.68	Century Ford/Chvy Mt Airy	SWM-456
1028 South Branch Patapsco	Infiltration Facility	0.68	0.68	Century Ford/Chvy Mt Airy	SWM-456
1024 Piney Run Tributary	Detention Facility	0.97	1	Eldersburg Medical Center	SWM-460
1030 Gills Fall Lower	Infiltration Facility	11.00	0.27	Addition to Harrison Hill	SWM-462
1024 Piney Run Tributary	Infiltration Facility	0.58	0.35	Kindercare Learning Center	SWM-474
1028 South Branch Patapsco	Infiltration Facility	1.57	0	Twin Arch Bus Park Lot 22	SWM-481
1023 Piney Run Main	Filtration Facility	2.17	0.24	Hollenberry Road	SWM-487
1024 Piney Run Tributary	Detention Facility	36.28	25.32	Freedom Village Shopping Center	SWM-492
1028 South Branch Patapsco	Infiltration Facility	0.70	0	Twin Arch Bus. Park Lot 7	SWM-496

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1023 Piney Run Main	Detention Facility	28.90	4.15	Braddock Manor West Sec 3	SWM-497
1030 Gilll Fall Lower	Grass Channel	13.40	0.2	American Tower at Sam Creek	SWM-499
1028 South Branch Patapsco	Infiltration Facility	0.54	0.32	Mt Airy Professional Center	SWM-500
1024 Piney Run Tributary	Sand Filter	0.45	0	Sykesville Freedom Fire	SWM-501
1028 South Branch Patapsco	Infiltration Facility	0.52	0	Twin Arch Industrial Park Lot 3	SWM-504
1023 Piney Run Main	Infiltration Facility	0.02	0.024	Fairhaven Chapel Office	SWM-512
1028 South Branch Patapsco	Sand Filter	0.00	0	Merridale Gardens Par D	SWM-516
1028 South Branch Patapsco	Sand Filter	0.00	0	Merridale Gardens Par D	SWM-516
1028 South Branch Patapsco	Sand Filter	0.00	0	Merridale Gardens Par D	SWM-516
1028 South Branch Patapsco	Sand Filter	0.00	0	Merridale Gardens Par D	SWM-516
1028 South Branch Patapsco	Sand Filter	0.00	0	Merridale Gardens Par D	SWM-516
1028 South Branch Patapsco	Sand Filter	0.00	0	Merridale Gardens Par D	SWM-516
1028 South Branch Patapsco	Sand Filter	6.20	5.5	Merridale Gardens Par D	SWM-516
1023 Piney Run Main	Infiltration Facility	2.27	1.68	Highs Dairy Store Klees	SWM-521
1023 Piney Run Main	Infiltration Facility	2.27	1.68	Highs Dairy Store Klees	SWM-521
1023 Piney Run Main	Infiltration Facility	0.64	0.64	Fairhaven Res Apartments	SWM-522
1024 Piney Run Tributary	Infiltration Facility	0.06	0	Tabler Professional Center	SWM-524
1023 Piney Run Main	Infiltration Facility	0.08	0.08	Buckhorn North	SWM-528
1026 Tuckers Branch	Infiltration Facility	1.00	0.51	Picketts Corner	SWM-531
1024 Piney Run Tributary	Detention Facility	3.67	0.94	Grand View Resub Lot 38A	SWM-533
1024 Piney Run Tributary	Infiltration Facility	0.55	0.46	New York JP Pizza	SWM-545
1028 South Branch Patapsco	Filtration Facility	1.65	0	Vansant Plumbing Heating	SWM-554
1022 South Branch Patapsco River	Detention Facility	1.36	1.15	Gillis Corner	SWM-556
1023 Piney Run Main	Infiltration Facility	1.89	1.9	Fairhaven Life Care	SWM-559
1024 Piney Run Tributary	Filtration Facility	0.54	0.41	Southern Automotive Trans	SWM-563
1026 Tuckers Branch	Filtration Facility	16.00	3.2	Freedom Hills Farm	SWM-565

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1026 Tuckers Branch	Filtration Facility	11.10	2.2	Freedom Hills Farm	SWM-567
1028 South Branch Patapsco	Infiltration Facility	0.25	0.22	Pizza Hut add Parking	SWM-572
1022 South Branch Patapsco River	Detention Facility	24.27	3.71	O'Brecht Est. Plat C	SWM-573
1028 South Branch Patapsco	Infiltration Facility	0.72	0.72	Illiano Gennaro Plaza II	SWM-578
1023 Piney Run Main	Infiltration Facility	0.21	0.21	Northrup Grumman Corporation	SWM-580
1028 South Branch Patapsco	Infiltration Facility	12.76	4.87	Parrs Ridge Elementary School	SWM-585
1024 Piney Run Tributary	Sand Filter	0.52	0	Eldersburg Library	SWM-591
1028 South Branch Patapsco	Infiltration Facility	6.40	1.55	Ridge Swim Club	SWM-600
1024 Piney Run Tributary	Infiltration Facility	0.78	0.286	Rippels Rainbow	SWM-606
1024 Piney Run Tributary	Infiltration Facility	0.44	0.22	Liberty Station Road Improvement	SWM-619
1023 Piney Run Main	Infiltration Facility	2.00	0.73	Jehovah Witness	SWM-624
1031 Gillis Falls Upper	Infiltration Facility	0.52	0	Weston's Kitchen Design	SWM-627
1025 South Branch Patapsco River	Retention Facility	26.16	12.13	South Carroll Gateway	SWM-628
1025 South Branch Patapsco River	Detention Facility	2.31	1.34	Greater Carroll Industrial Park	SWM-632
1023 Piney Run Main	Infiltration Facility	0.22	0.22	Winfield Volunteer Fire Department	SWM-640
1024 Piney Run Tributary	Detention Facility	0.00	0	Carrolltowne Elementary School	SWM-649
1028 South Branch Patapsco	Detention Facility	16.40	0	Merridale Gardens	SWM-651
1028 South Branch Patapsco	Detention Facility	1.90	1.61	McDonalds Mt Airy	SWM-657
1028 South Branch Patapsco	Detention Facility	2.87	2.43	Mt Airy Trade Center	SWM-658
1028 South Branch Patapsco	Infiltration Facility	0.49	0.41	Ridgeville Bus CTR	SWM-663
1028 South Branch Patapsco	Detention Facility	12.45	4.88	Conestoga Heights	SWM-664
1028 South Branch Patapsco	Infiltration Facility	1.15	0.84	Chevy Chase Bank (Bob's)	SWM-673
1028 South Branch Patapsco	Infiltration Facility	0.34	0	203 Ridgeville Blvd	SWM-679
1028 South Branch Patapsco	Detention Facility	24.30	0	Twin Arch Shopping Center	SWM-680
1022 South Branch Patapsco River	Retention Facility	26.30	4.55	Carroll Fields	SWM-684
1028 South Branch Patapsco	Detention Facility	31.98	0	Twin Arch Industrial Park	SWM-689

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1028 South Branch Patapsco	Detention Facility	31.98	0	Twin Arch Industrial Park	SWM-689
1022 South Branch Patapsco River	Retention Facility	66.00	21.23	Hawk Ridge Farms Sec 1	SWM-693
1021 Piney Run Lower	Detention Facility	0.00	0	Melstone Valley	SWM-704
1021 Piney Run Lower	Sand Filter	80.17	18.54	Clipper Hill - Hilltop Retrofit	SWM-709
1028 South Branch Patapsco	Infiltration Facility	0.93	0	Twin Arch Park Lot 27	SWM-719
1030 Gilll Fall Lower	Infiltration Facility	0.18	0.18	Whitetail Run Estates	SWM-733
1023 Piney Run Main	Sand Filter	1.40	0.7	Pine Brook Farm Sec 1	SWM-734
1023 Piney Run Main	Sand Filter	1.40	0.7	Pine Brook Farm Sec 1	SWM-734
1023 Piney Run Main	Sand Filter	89.50	1.76	Pine Brook Farm Sec 2	SWM-735
1023 Piney Run Main	Sand Filter	89.50	1.76	Pine Brook Farm Sec 2	SWM-735
1029 Middle Run	Infiltration Facility	12.17	2.89	Vestry of St James Church	SWM-745
1023 Piney Run Main	Infiltration Facility	3.14	1.37	Carroll Co Drug Treatment	SWM-749
1028 South Branch Patapsco	Infiltration Facility	1.25	0	Providential Enterprises	SWM-753
1023 Piney Run Main	Infiltration Facility	0.90	0.711	H R Collins and Company	SWM-759
1028 South Branch Patapsco	Infiltration Facility	0.10	0.1	Bank of America	SWM-764
1024 Piney Run Tributary	Infiltration Facility	0.62	0.1154	Piney Ridge Parkway - Expan	SWM-774
1024 Piney Run Tributary	Infiltration Facility	0.62	0.1154	Piney Ridge Parkway - Expan	SWM-774
1024 Piney Run Tributary	Infiltration Facility	0.62	0.1154	Piney Ridge Parkway - Expan	SWM-774
1024 Piney Run Tributary	Infiltration Facility	0.62	0.1154	Piney Ridge Parkway - Expan	SWM-774
1024 Piney Run Tributary	Infiltration Facility	0.62	0.1154	Piney Ridge Parkway - Expan	SWM-774
1029 Middle Run	Infiltration Facility	1.25	0.25	Hilltop LLC	SWM-775
1028 South Branch Patapsco	Infiltration Facility	0.80	0	Twin Arch Business Parking Lot 30	SWM-777
1024 Piney Run Tributary	Filtration Facility	1.05	0	Wesley Freedom United Meth	SWM-785
1024 Piney Run Tributary	Infiltration Facility	1.05	0.82	Wesley Freedom United Meth	SWM-785
1024 Piney Run Tributary	Infiltration Facility	1.05	0.12	Wesley Freedom United Meth	SWM-785
1024 Piney Run Tributary	Infiltration Facility	1.05	0.03	Wesley Freedom United Meth	SWM-785

Subwatershed	Facility Type	Drainage Area (acres)	Impervious Acres (acres)	Project Name	Site Number
1024 Piney Run Tributary	Infiltration Facility	1.34	1.34	Freedom Village Shopping Center	SWM-793
1028 South Branch Patapsco	Infiltration Facility	0.90	0	Mt Airy Collision Center	SWM-794
1028 South Branch Patapsco	Infiltration Facility	1.50	1.26	Center Street Prof Center	SWM-804
1028 South Branch Patapsco	Infiltration Facility	2.20	1.85	Illiano Main St Plaza	SWM-805
1025 South Branch Patapsco River	Infiltration Facility	0.60	0.14	SES Americom Inc	SWM-806
1028 South Branch Patapsco	Infiltration Facility	0.28	0	Twin Arch Bus Park Lot 5	SWM-811
1028 South Branch Patapsco	Infiltration Facility	1.38	0.28	6 East Ridgeville Blvd	SWM-813
1023 Piney Run Main	Sand Filter	24.22	12.94	South Carroll High School Fine Arts	SWM-824
1028 South Branch Patapsco	Infiltration Facility	0.47	0.32	Damascus Community Bank	SWM-827
1028 South Branch Patapsco	Infiltration Facility	1.03	0.88	Mt Airy Inn	SWM-829
1028 South Branch Patapsco	Infiltration Facility	0.20	0.08	6 East Ridgeville Blvd	SWM-864
1028 South Branch Patapsco	Infiltration Facility	0.31	0.1	6 East Ridgeville Blvd	SWM-865
1025 South Branch Patapsco River	Infiltration Facility	3.62	0.83	Ramblin Pines Campground RV Park	SWM-870
1028 South Branch Patapsco	Infiltration Facility	1.39	0	Twin Arch Bus Park Lot 34	SWM-882
1024 Piney Run Tributary	Sand Filter	6.04	0	Piney Ridge Village Sec 8	SWM-911
1025 South Branch Patapsco River	Sand Filter	3.78	0	Southern States Bulk Fuel Site	SWM-913
1025 South Branch Patapsco River	Detention Facility	11.30	0	Hoods Mill Mulch Processing Facility	SWM-923
1023 Piney Run Main	Infiltration Facility	7.71	1.5	MD RT 851 and RT32	SWM-931
1023 Piney Run Main	Infiltration Facility	6.88	1.12	MD RT 851 and RT32	SWM-932
1023 Piney Run Main	Infiltration Facility	5.30	1.48	MD RT 851 and RT32	SWM-933
1021 Piney Run Lower	Infiltration Facility	28.23	7.57	Clipper Hills Hilltop Retrofit	SWM-972
1023 Piney Run Main	Sand Filter	3.97	1.39	South Carroll High School with Parking	SWM-974
1028 South Branch Patapsco	Infiltration Facility	0.60	0.32	102 East Ridgeville Blvd	

Urban Best Management Practices (BMPs): are structural, vegetative, or managerial approaches designed to reduce stormwater runoff volume, maximize natural groundwater recharge, and treat, prevent, or reduce degradation of water quality due to stormwater runoff.

Dry Detention Ponds: These are stormwater design features that provide a gradual release of water in order to increase the settling of pollutants and protect downstream channels from frequent storm events. This type of facility will remain dry between storm events.

Dry Extended Detention Ponds: Stormwater management structures that provide a gradual release of a specific volume of water in order to increase the settling of pollutants in the pond and to protect downstream channels from frequent storm events. They are often designed with small pools at the inlet and outlet of the pond. These BMPs can also be used to provide flood control by including additional detention storage above the extended-detention level.

ESD and Microscale Treatment Practices: A diverse group of on-site techniques that capture, store and partially treat rooftop runoff in residential areas and highly urban landscapes. These practices include drywells, rain barrels, rain gardens, green rooftops, and permeable pavers.

Filtering Practices: BMPs which capture and temporarily store the water quality volume and pass it through a filter of sand, organic matter and vegetation, promoting pollutant treatment and groundwater recharge.

Infiltration Practices: These facilities are used to capture and temporarily store the water quality volume before allowing it to infiltrate into the soil, promoting pollutant treatment and groundwater recharge.

Impervious Surface Reduction: A practice which reduces the total area of impervious cover as well as features that capture stormwater and divert it to a previous area, subsequently encouraging stormwater infiltration.

Riparian Forest Buffer: Riparian forest buffers are area of trees usually accompanied by other vegetation, that are adjacent to a body of water and which: maintain the integrity of stream channels; reduce the impact of upland pollution sources by trapping, filtering, and converting sediments, nutrients, and other chemicals; and supply food, cover, and thermal protection to fish and other wildlife. The recommended width of riparian forest buffers is 100 feet with a 35-foot minimum.

Stream Restoration: This BMP is used to restore the stream ecosystem by restoring the natural hydrology and landscape of a stream. Stream restoration is used to help improve habitat and water quality conditions in degraded streams. The objectives of using this practice include, but are not limited to, reducing stream channel erosion, promoting physical channel stability, reducing the transport of pollutants downstream, and working towards a stable habitat with a self-sustaining, diverse aquatic community.

Urban Nutrient Management: A BMP that reduces fertilizer applied to grass lawns and other urban areas. This practice is based on public education and awareness, targeting suburban residences and businesses, with emphasis on reducing excessive fertilizer use.

Wetponds and Wetland Practices: Facilities which collect and increase the settling of pollutants in the structure and protect downstream channels from frequent storm events. Wetponds retain a permanent pool of water.

Appendix B:
Agricultural Best Management Practices

South Branch Patapsco Watershed Agricultural Best Management Practices

Best Management Practice	Extent	Unit
313 - Waste Storage Structure	4	ST
327 - Conservation Cover	24.4	AC
328 - Conservation Crop Rotation	586.5	AC
342 - Critical Area Planting	4.3	AC
192 / 1923 – Farm Plan	10,158.7	AC
393 - Filter Strip	2.4	AC
511 - Forage Harvest Management	40.4	AC
412 - Grassed Waterway	5.3	AC
516 - Livestock Pipeline	1,860	FT
590 - Nutrient Management	558.9	AC
391 - Riparian Forest Buffer	47.11	AC
558 - Roof Runoff Structure	5	NO
574 - Spring Development	1	NO
382 – Fencing	8,652	FT
606 - Subsurface Drain	460	FT
620 - Underground Outlet	260	FT
614 - Watering Facility	9	NO

Practices which are used by farmers to minimize soil loss, trap nutrients, and minimize the amounts of nutrients and pesticides used on the land. The following definitions related to best management practices used throughout Carroll County:

Access Control: The temporary or permanent exclusion of animals, people, vehicles, and/or equipment from an area.

Conservation Cover: Establishing and maintaining permanent vegetative cover to protect soil and water resources.

Conservation Cropping: Growing crops in a planned sequence on the same field.

Contour Farming: Tillage, planting, and other farming operations performed on or near the contour of the field slope.

Critical Area Planting: Planting vegetation, such as trees, shrubs, vines, grasses, or legumes on highly erodible or critically eroding areas.

Diversion: A diversion is an earthen embankment similar to a terrace that directs runoff water from a specific area.

Fencing: A constructed barrier to livestock, wildlife or people.

Filter Strip: A strip or area of herbaceous vegetation that removes contaminants from overland flow.

Forage and Biomass Planting: is the establishment of adapted and/or compatible species, varieties, or cultivars of herbaceous species suitable for pasture, hay, or biomass production

Forage Harvest Management: The cutting and removal of forages from the field as hay, greenchop, or ensilage.

Grassed Waterway: A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation.

Heavy Use Area: The stabilization of areas frequently and intensively used by people, animals or vehicles by establishing vegetative cover, surfacing with suitable materials, and/or installing needed structures.

Lined Waterway or Outlet: an erosion resistant lining of concrete, stone, or other permanent material. Vegetative or rock cover protects the drainageway from erosion.

Livestock Pipeline: A pipeline and appurtenances installed to convey water for livestock or wildlife. Provides a safe, reliable method of conveying water to a watering facility.

Mulch Till: Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round, while limiting the soil-disturbing activities used to grow crops in systems where the entire field surface is tilled prior to planting.

No-Till: Managing the amount, orientation, and distribution of crop and other plant residues on the soil surface year-round, while limiting soil disturbing activities to only those necessary to place nutrients, condition residue and plant crops.

Nutrient Management Plan: Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments for each field or management unit.

Pond: A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.

Prescribed Grazing: Involves managing the harvest of vegetation with grazing and/or browsing animals to improves or maintain quantity and quality of forage for grazing and browsing animals' health and productivity.

Riparian Forest Buffer: An area of predominately trees and/or shrubs located adjacent to and up-gradient from water bodies.

Riparian Herbaceous Cover: Establishment and maintenance of grasses, grass-like plants and forbs that are tolerant of intermittent flooding or saturated soils and that are established or managed in the transitional zone between terrestrial and aquatic habitats.

Roof Runoff Management: Structures that collect, control, and transport precipitation from roofs.

Spring Development: Collection of water from springs or seeps to provide water for a conservation need.

Stream Crossing: A stabilized area or structure constructed across a stream to provide a travel way for people, livestock, equipment, or vehicles.

Subsurface Drain: A conduit, such as corrugated plastic tubing, tile, or pipe, installed beneath the ground surface to collect and/or convey drainage water.

Underground Outlet: A conduit or system of conduits installed beneath the surface of the ground to convey surface water to a suitable outlet.

Upland Wildlife Habitat Management: Creating, maintaining, or enhancing areas to provide food, cover and habitat connectivity for upland wildlife.

Waste Facility Closure: The closure of waste facilities (treatment lagoons and liquid storage facilities), that are no longer used for their intended purpose, in an environmentally safe manner.

Waste Storage Structure: A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

Wastewater Treatment Strip: An area of vegetation designed to remove sediment, organic matter, and other pollutants from wastewater.

Watering Facility: A watering trough or tank that provides livestock with drinking water at planned locations to protect vegetative cover.