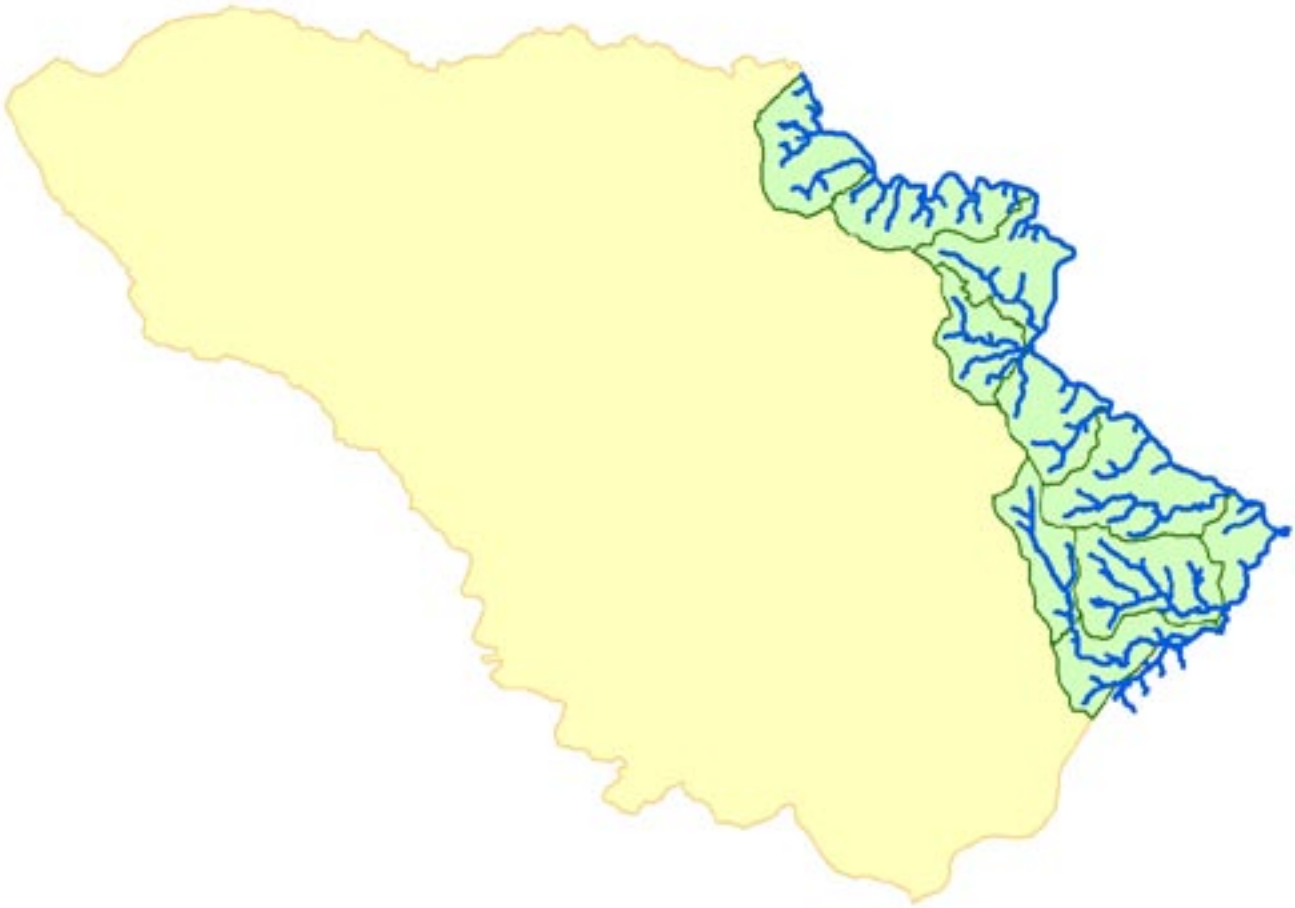
Characterization
Of The
Patapsco River Lower North Branch Watershed
In Howard County, Maryland

February 2005

In support of a
Watershed Restoration Action Strategy
by Howard County



Product of the
Maryland Department of Natural Resources
Watershed Services
In partnership with Howard County

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Executive Summary

The Patapsco River Basin is entirely in the State of Maryland. The River drains to the Baltimore Harbor area, then to the Chesapeake Bay and eventually to the Atlantic Ocean. One subwatershed within the Patapsco River Basin is known as the Lower North Branch (LNB). It encompasses 118 square miles in Baltimore City and four Counties: Anne Arundel, Baltimore, Carroll and Howard. About 38 square miles of the Patapsco LNB watershed is in Howard County. Howard County is receiving Federal grant funding to prepare a Watershed Restoration Action Strategy (WRAS) for their portion of the Patapsco LNB Watershed.

As part of the WRAS project, the Maryland Department of Natural Resources (DNR) is providing technical assistance, including preparation of a watershed characterization (compilation of available water quality and natural resources information and identification of issues), a stream corridor assessment (uses field data to catalog issues and rate severity) and a synoptic survey (analyzes benthic macroinvertebrates, fish and water samples with focus on nutrients). The County will consider the information generated in these efforts as it drafts the County Watershed Restoration Action Strategy.

Water Quality

All water bodies in the Patapsco LNB watershed have a designated use, which is to support water contact recreation and protection of aquatic life. Water quality impairments that affect these designated uses include nutrients, sediment, fecal coliform bacteria, biological impairment (poor or very poor ranking for fish or benthic macroinvertebrates based on in-stream assessments) and metals.

As a step toward eliminating nutrient-related impairments, a computer model was designed to support creation of a nutrient TMDL for the Baltimore Harbor. It can be anticipated that nutrient criteria for the Patapsco River's nontidal areas will be developed that will allow drafting of TMDLs for Patapsco River subwatersheds like the Lower North Branch. TMDLs for the other impairments can be anticipated.

In Patapsco River mainstem monitoring, a trend toward decreasing nutrient concentrations has been observed during the period 1986 through 2002.

During the period 1999 through 2003, total nitrogen concentrations averaged about 2 milligrams per liter (mg/l), which is considered high. For the same period total phosphorus averaged between 0.06 and 0.07 mg/l and total suspended solids (TSS) averaged between 8 and 9 mg/l. Several individual samples taken within this time frame appear to represent storm flows in which total phosphorus and TSS concentrations where much higher than the average: 9 and 1,200 mg/l respectively.

In Deep Run, which is a tributary to the Patapsco River, typical water quality conditions tended to be better than the mainstem based on year 2000 sampling. Average concentrations were about 0.8 mg/l for total nitrogen, 0.02 mg/l for total phosphorus and 5.4 mg/l for total suspended solids.

No significant point source discharges of nutrients were identified in Howard County's portion of the Patapsco LNB watershed. The primary reason for this finding is the current operation of the publicly operated sanitary sewer system that covers over 10,800 acres (44%) of the watershed. The majority of the collected flows in the system are piped to the Patapsco Wasterwater Treatment Plant in Baltimore where they are treated and discharged.

Nonpoint sources of pollution have not been quantified. However, nonpoint sources associated with land use are likely to dominate locally controllable factors that affect local stream water quality.

Natural Resources

The northern upstream area of the Patapsco LNB watershed in Howard County is in the Piedmont Province. This area is underlain by a complicated geology of metamorphic rock types. The southern downstream area of the watershed transitions to Coastal Plain. Here, typical characteristics are relatively unconsolidated sands and clays of the Potomac Group. In places where this formation intercepts the surface, some local groundwater recharges the Potomac Aquifer, which is a source of well water for Counties to the east and south.

About 19% of the watershed is prime agricultural soil. This soil group tends to be dispersed across the watershed but some concentration of it is in the headwaters of Deep Run and near Rockburn Branch. Stony soils tend to be concentrated along the Patapsco River and account for about 7% of the watershed. Hydric soils are only 4% of the watershed. They tend to be dispersed in the watershed but one concentration of hydric soil is in the vicinity of Tiber Branch.

Green Infrastructure is a network of natural areas identified by DNR that are ecologically important on a statewide or regional scale. The Green Infrastructure includes areas like large blocks of forest or wetlands, habitat for sensitive species and protected conservation areas. These areas are grouped into hubs that contain the bulk of these resources and corridors than link the hubs together. In Howard County's portion of the Patapsco LNB watershed, Green Infrastructure hubs encompass about 4,770 acres of forest and other natural vegetation. The greatest concentration of hubs is along the Patapsco River. Additionally, a smaller concentration of Green Infrastructure hubs is around Deep Run.

In recent years, efforts to enhance Green Infrastructure and local natural resources by restoring forested stream buffers have been tracked in a DNR Forest Service database. In the project area, 18 restoration projects covering 88 acres along four miles of streams were documented for the period 1999 through 2002.

In the Patapsco LNB watershed, wetlands are not common. Howard County's portion of the watershed includes about 150 acres of wetlands according to the DNR Wetland Inventory. These wetlands are generally concentrated in narrow floodplains along the Patapsco River and its tributaries.

Living Resources and Habitat

Spawning of anadromous fish including white perch, yellow perch and herring has been documented in two parts of the Patapsco LNB watershed in Howard County: in the Patapsco River mainstem downstream of Rockburn Branch and in Deep Run as much as one mile upstream from the Patapsco River.

Nontidal fish populations assessed by the Maryland Biological Stream Survey were rated as either good or fair.

A fish consumption advisory issued by the Maryland Department of Environment is in affect for six fish species that may be caught in the watershed. Consumption of these fish should be limited to avoid potential health problems. In the Patapsco River channel catfish, white perch and American eel are listed due to contamination from PCBs and/or pesticides. Large and small mouth bass from any water body and bluegill from impoundments are listed due to contamination by methylmercury.

Assessments of benthic macroinvertebrates using Maryland Biological Stream Survey techniques have tended to rate most sites that have been assessed in the Patapsco LNB watershed as fair, poor or very poor. Sites rated as poor or very poor are listed for biological impairment on the State's list of impaired waters.

The State of Maryland tracks 40 sensitive species, mostly plants, in the Patapsco LNB watershed. In Howard County's portion of the watershed, these species are found in at least eleven ecologically significant areas (ESAs) mapped by the DNR Natural Heritage program. Some of these species inhabit Wetlands of Special State Concern that tend to be along the Patapsco River between I-70 and Route 40. These wetlands receive a greater level of State regulatory protection than most other wetlands.

Land Use

Developed lands cover about 49% of Howard County's portion of the Patapsco LNB watershed. Forest covers about 41% of the watershed and tends to be concentrated along the Patapsco River and to a lesser extent along Deep Run. Agriculture uses cover the remaining 10% of the watershed. Overall, there is a tendency for developed land to be in headwaters and other upstream locations while forestlands tend to be in downstream areas. About 78% the Patapsco LNB watershed is in private ownership. A small amount of this private land has some form of easement that limits or prohibits conversion of agriculture, natural resources or historic areas for new development. The remaining 22% of the watershed is publicly owned. The majority of this public ownership is by the Maryland Department of Natural Resources in the Patapsco Valley State Park (about 4,450 acres). Additionally, Howard County manages over 800 acres of parkland in the watershed.

Average impervious cover for subwatersheds in the Patapsco LNB watershed was estimated Howard County. Generally, impervious cover includes rooftops and roads that prevent stormwater from infiltrating in the ground. Significant water quality and habitat impacts are observed in streams in watersheds with average impervious cover of about 10% or greater.

The lowest average impervious area is in the Davis Branch subwatershed (between 2% and 4% average imperviousness). The Davis Branch subwatershed is located in the uppermost reach of the WRAS watershed and it is the only subwatershed located predominately outside of Howard County's Planned Water and Sewer Service Area.

Three subwatersheds have average imperviousness between 25% and 30%. These subwatersheds include the Tiber-Hudson, which contains the historic County seat Ellicott City, and the Deep Run subwatersheds, which contain Elkridge and the I-95 highway corridor.

Overall, it appears that most streams in Howard County's Patapsco LNB drainage, with the exception of the Davis Branch area, have sufficient average imperviousness to impact local streams.

Introduction

Watershed Planning Background

As a foundation for watershed monitoring, analysis and planning, the State of Maryland defined over 130 watersheds that cover the entire State in the 1970s. In 1998, the Maryland Clean Water Action Plan presented an assessment of water quality conditions in each of these watersheds. Based on these assessments, it also established State priorities for watershed restoration and protection.

In 2000, the Maryland Department of Natural Resources (DNR) initiated the Watershed Restoration Action Strategy (WRAS) Program as one of several new approaches to implementing water quality and habitat restoration and protection. The WRAS Program solicits local governments to focus on priority watersheds for restoration and protection. Since inception of the program, local governments have received grants and technical assistance from DNR for 20 WRAS projects in which local people identify local watershed priorities for restoration, protection and implementation.

Patapsco Lower North Br. WRAS Project

The Patapsco River Lower North Branch watershed covers about 118 square miles in Maryland as shown in Map1 Location. The watershed, designated "02130906" is one of Maryland's "8-digit" watersheds that are used for statewide analysis. About 32% of this watershed, about 38 square miles, is in Howard County, Maryland.

In the Maryland Clean Water Action Plan the Patapsco River Lower North Branch watershed is designated Category 1 for restoration and Category 3 for protection. These State designations mean that both water quality impairments that need restoration and resources that require protection are found in this watershed. For Howard County's portion of the watershed, the County is working on a WRAS project to be completed in 2005. In the WRAS, Howard County will identify and prioritize local restoration and protection needs associated with water quality and habitat. To support the County's effort, the Maryland Department of Natural Resources (DNR) is supplying grant funding and technical assistance, which includes production of this Watershed Characterization.

Map 2 WRAS Project Area shows the Patapsco River Lower North Branch watershed with Howard County's portion of the watershed highlighted. The map identifies subwatersheds defined by Howard County that are used for analytical purposes throughout the Watershed Characterization. The County subwatersheds are subsets within the "8-digit" watersheds used by Maryland for statewide analysis. The Watershed Characterization focuses primarily on Howard County's WRAS project area. For convenience, this area will be referred to as the WRAS Project Area or the Patapsco LNB in Howard County. Information on portions of the Patapsco LNB in other local jurisdictions is occasionally presented when it is immediately available and useful for providing context for Howard County's WRAS project.

Purpose of the Characterization

In support of the WRAS project, the Watershed Characterization helps to meet several objectives:

- Summarize immediately available information and issues
- Provide preliminary findings based on this information
- Identify sources for more information or analysis
- Suggest opportunities for additional characterization and restoration work.
- Provide a common base of knowledge about the watershed for government, citizens, businesses and other interested groups.

The Watershed Characterization adds to other efforts that are important for the County's WRAS project:

- Local investigation by the County
- Stream Corridor Assessment, in which DNR personnel physically walk the streams and catalogue important issues
- Synoptic water quality survey, i.e. a program of water sample analysis, that can be used to focus on local issues like nutrient hot spots, point source discharges or other selected issues. This is also part of the technical assistance offered by DNR
- Technical assistance and assessment by partner agencies or contractors

Moving Beyond The Characterization

In addition to the information presented in this document, it is important to identify gaps in available watershed knowledge and to gauge the importance of these gaps. As new information becomes available, the Watershed Characterization and other components of the WRAS should be updated and enhanced as needed.

Here are some examples of issues for potential additional work:

- Habitat: physical structure, stream stability, biotic community (incl. the riparian zone)
- Water Quantity: high water–storm flow and flooding; low water–baseflow problems from dams, water withdrawals, reduced infiltration
- Water Quality: water chemistry; toxics, nutrients, sediment, nuisance odors/scums, etc.
- Cumulative effects associated with habitat, water quantity and water quality.

Restoration and natural resource protection is an active evolving process. The information that supports the Watershed Restoration Action Strategy, including the Watershed Characterization, should be maintained as living documents within an active evolving restoration process. These documents will need to be updated periodically as new, more relevant information becomes available and as the watershed response is monitored and reassessed.

More Information Sources

The WRAS Program Internet home page has additional information on the program and an index of available electronic copies of WRAS-related documents that can be downloaded free of charge. Available documents include detailed program information, completed WRAS strategies, stream corridor assessments, synoptic surveys and watershed characterizations. Please visit the WRAS Home Page at: http://www.dnr.state.md.us/watersheds/wras/

Additional information on over 130 watersheds in Maryland is available on DNR's Internet page Surf Your Watershed at: http://www.dnr.state.md.us/watersheds/surf/index.html

The Maryland Clean Water Action Plan is available at: www.dnr.maryland.gov/cwap/

Water Quality

Water quality is in many respects the driving condition in the health of Maryland's streams. Historically, efforts to protect water quality have focused on chemical water quality. More recently, additional factors are being considered like measurements of selected biological conditions and physical conditions that affect habitat quality in streams and estuaries. This expanded view is reflected in current approaches to stream monitoring, data gathering, and regulation as reflected in this watershed characterization.

Designated Uses For Streams

All streams and other surface water bodies in Maryland are assigned a "designated use" in the Code of Maryland Regulation (COMAR) 26.08.02.08, which is associated with a set of water quality criteria necessary to support that use. In Howard County's portion of the Patapsco Lower North Branch (LNB) watershed, all streams and other surface waters are designated Use 1 for Water Contact Recreation and Protection of Aquatic Life.

Use Impairments

Some streams or other water bodies in the WRAS project area cannot be used to the full extent envisioned by their designated use in Maryland regulation. In these water bodies, water quality or habitat impairments are generally the cause. These areas, known as "impaired waters", are tracked by the Maryland Department of the Environment under Section 303(d) requirements of the Federal Clean Water Act as summarized below. Each listing for water body impairment remains on the list until either correction of the impairment is demonstrated or the listing is proven to be in error.

Overall, the impairments listed for the Patapsco River LNB are common among comparable suburban watersheds in Maryland's Piedmont region.

<u>Bacteria</u>
Patapsco River LNB (02130906) was listed in 2002 for impairment by with fecal coliform bacteria. However, the draft 2004 3003(d) list recommends dropping that listing because monitoring at two stations show that the State standard being met. (Geometric mean 87 and 118 MPN/100ml at stations PAT0285 and PAT0176 compared to the State standard of 200 MPN/100ml.)

<u>Biological</u>
The 2002 303(d) list included the Patapsco River LNB for biological impairment based on assessment of fish and benthos by the Maryland Biological Stream Survey (MBSS) in their indices of biological integrity. The assessment of this information in the draft 2004 303(d) list indicates that the findings are not conclusive and recommends dropping the listing of biological impairment for the watershed.

Specific sites listed for biological impairment in Howard County's portion of the Patapsco LNB watershed include Deep Run and unnamed tributaries, Rockburn Branch, Tiber Run and unnamed tributaries of the Patapsco

River. More information on this finding in the Biological Monitoring section and the maps associated with it.

Sites listed in the Patapsco LNB watershed that are not in Howard County include Cooper Branch, Deep Run and several unnamed tributaries, Falls Run, Herbert Run (and its west branch), Soapstone Branch, Stoney Run and unnamed tributaries to the Patapsco River.

Metals
Patapsco River LNB was listed in 1996 for impairment associated with metals from nonpoint and natural sources.

Nutrients
Patapsco River LNB was listed in 1996 for impairment by nutrients from nonpoint and natural sources.

Sediment
Patapsco River LNB was listed in 1996 for impairment by sediment from nonpoint and natural sources.

Total Maximum Daily Loads

In Maryland, the Department of the Environment (MDE) uses the 303(d) list of impaired water bodies to determine the need for establishing Total Maximum Daily Loads (TMDLs). A TMDL is the amount of pollutant that a water body can assimilate and still meet its designated use. The purpose of issuing a TMDL is to establish a maximum pollutant load (a cap) for the water body and to require reduction of pollutants below that cap. A water body may have multiple impairments and multiple TMDLs designed to correct and prevent reoccurrence the impairments. MDE is responsible for establishing TMDLs. In general, TMDLs have two key parts:

- Maximum pollutant load that the water can accept while still allowing the water body to meet its intended use.
- Allocation of the maximum pollutant load to specific pollutant sources.

As of July 2004 in the Patapsco watershed, a computer model has been designed to support creation of a nutrient TMDL for the Baltimore Harbor. It can be anticipated that nutrient criteria for the Patapsco River's nontidal areas will be developed that will allow drafting of TMDLs for Patapsco River subwatersheds like the Lower North Branch. (1)

Water Quality Monitoring And Analysis

The Patapsco Lower North Branch (LNB) watershed in Howard County is a fresh nontidal water system. Map 3 Water Quality Monitoring shows the relative locations of the sampling sites identified in the watershed and referenced in the following assessment. Addition detail is available in Appendix B – Water Quality Summary. As of December 2004, Maryland does not have standards for nutrients so the determination of acceptable levels must be determined by local/regional water quality needs.

Patapsco Mainstem
Several baseflow sampling stations in the Patapsco River mainstem in the WRAS project area offer a picture of water quality conditions there. Among these are two long term monitoring stations as summarized below. (2)

Some additional findings from the other stations shown on the map are based on samples taken from 1999 through 2003 considering multiple sampling sites unless otherwise noted. See Appendix B - Water Quality Summary for additional details: (3)

- Dissolved oxygen and pH are consistently in the satisfactory range.
- Total nitrogen concentration averaged over 2 milligrams per liter (mg/l) and is always greater than 1 mg/l.(4) In general, concentrations over 1 mg/l are considered high.
- Total phosphorus (TP) concentration averaged 0.06 to 0.07 mg/l. In general, concentrations over 0.1 mg/l may be considered high. However, samples were generally taken during base flow conditions and phosphorus tends to move down river with sediment during storm flows. At least one sample taken near Deep Run during this period may be more representative of storm flow in the mainstem with TP measured at nearly 0.8 mg/l.
- Total suspended solids (TSS) averaged in the 8 to 9 mg/l range excluding two probable storm flow samples. The individual TSS samples that appear to represent storm flow were 658 mg/l for PAT0176 and 1,217 mg/l for PAT0285. These samples appear to demonstrate that sediment moves down river in pulses that tend to be associated with storms.

Station PAT0285 **Patapsco River Mainstem Near I-70, Patapsco State Park at Holofield**		
Parameter	**Status 2000-2002**	**Trend 1986-2002**
Total Nitrogen	Between 1.7 and 2.6 mg/l	Decreasing
Total Phosphorus	Between 0.036 and 0.073 mg/l	Decreasing
Suspended Solids	Less than 5.4 mg/l	Decreasing

Station PAT0176 **Patapsco River Mainstem Near Route 1, up stream of Deep Run**		
Parameter	**Status 2000-2002**	**Trend 1986-2002**
Total Nitrogen	Between 1.7 and 2.6 mg/l	Decreasing
Total Phosphorus	Between 0.036 and 0.073 mg/l	Decreasing
Suspended Solids	Less than 5.4 mg/l	No Trend

Tributary Monitoring

One station located in Deep Run, which drains both Howard and Anne Arundel Counties, provides an indication of local conditions relative to the Patapsco mainstem. Based on several samples collected in 2000, it appears that conditions are significantly better in the tributary than in the mainstem. Additional monitoring data details appear in Appendix B - Water Quality Summary:

- Dissolved oxygen and pH are consistently in the satisfactory range.
- Total nitrogen averaged about 0.8 mg/l and always less than 0.9 mg/l.
- Total phosphorus averaged about 0.02 mg/l.
- Total suspended solids averaged 5.4 mg/l.

Point Sources

Discharges from pipes or other "discrete conveyances" are called "point sources." Point sources may contribute pollution to surface water or to groundwater. For example, wastewater treatment discharges may contribute nutrients or microbes that consume oxygen (measured as Biochemical Oxygen Demand (BOD)) reducing oxygen available for other aquatic life. Industrial point sources may contribute various forms of pollution. Some understanding of point source discharges in a watershed can be useful in helping to identify and prioritize potential restoration measures.

Many point sources operate under permits issued by the Maryland Department of the Environment (MDE). A listing of permits for the WRAS project area extracted from MDE's database is summarized below. The Appendix C - MDE Permits lists additional details and Map 4 MDE Permits and Local Sewer Service shows the distribution of permits across the watershed. Characteristics of these permitted discharges (volume, temperature, pollutants, etc.) are tracked by MDE and most is accessible to the public.

- The map shows that public sewer serves more than 10,800 acres in the Patapsco LNB in Howard County. Many remaining areas that lack sewer service are planned for future service. However, the map also shows that there is no discharge of treated sewage effluent to the Patapsco River or its tributaries within Howard County. The local sewer system collects and transfers the majority of these flows to the Patapsco Wastewater Treatment Plant in Baltimore.
- The map shows 23 general permits in the watershed that involve greatly divergent purposes including surface water discharges and groundwater discharges. Most of these are discharges associated with swimming pool cleaning/backwashing. Several other types of permits are shown on the map using the same symbol: a concrete plant; a permit for the Newcut Landfill for flushing of lines in the groundwater remediation system; a permit for a "general terminal discharge" involving surface drainage from the land used by a fuel oil dealer, and; a permit for "general oil contamination groundwater remediation" involving the pumping and treating of contaminated groundwater with the cleansed water then being discharged.
- 13 stormwater permits in the watershed involve surface drainage from various facilities.
- Two industrial surface discharge permits involve very different types of discharge: noncontact cooling water (Baltimore Aircoil, 25 gpd), and discharge of treated groundwater from Newcut Landfill,
- One permit discharge of sewage effluent for the inactive Deep Run Wastewater Treatment Plant that provides 1.25 million gallons per day of standby capacity.

Natural Resources

Water quality and quantity in surface waters and groundwater are greatly influenced by natural resources. Physical factors like geology and soils largely determine local topography, hydrology and potential for erosion. Variation of vegetation types in riparian areas and throughout the watershed produces additional influences that determine potential for stormwater infiltration or runoff and habitat quality. This chapter presents immediately available natural resource information for the Patapsco River Lower North Branch (LNB) watershed.

Geology

Map 5 Geology shows that this part of Maryland is complicated geologically. The map presents the entire Patapsco River valley in the Lower North Branch watershed to show how the differing bedrock types cut across the valley. The Patapsco LNB watershed is situated in the transition from the Piedmont in upstream areas to the Coastal Plain in the down stream areas. In Howard County's portion of the watershed, about 72% of the watershed is in the Piedmont, which is underlain by various types of metamorphic rock. The outcrops of these rocks are readily seen in the Patapsco Valley State Park along the mainstem of the Patapsco River.

The Coastal Plain portion of the watershed is represented by Potomac Group on the map, which covers about 28% of Howard County's portion of the watershed. Compared to the Piedmont, this geology is relatively unconsolidated sands and clays. Where the Potomac Group intercepts the surface, recharge to deeper aquifers may occur. In general, the water that percolates downward away from the near-surface groundwater into deeper aquifers also carries dissolved pollutants with it that may eventually affect well water withdrawals in Counties to the east and south.

Soils

Soil type and moisture conditions greatly affect how land may be used and the potential for vegetation and habitat on the land. Soil conditions are one determining factor for water quality in streams and rivers. Local soil conditions vary greatly from site to site, as published information in the Soil Survey for Howard County shows. Map 6 Soils shows the distribution of soils using Maryland Department of Planning's natural soil groups. This information has been aggregated to highlight features important to watershed planning in Howard County's portion of the Patapsco LNB watershed: (5)

- Prime agricultural soils account for about 19% of the watershed based on the mapped information. These soils are dispersed across the watershed. The largest concentration of this soil type is generally in the headwaters of Deep Run and near Rockburn Branch. On these soils that are already developed, soil disturbance during development may have caused local conditions that differ from that shown on

the map. Additionally, some other areas of these soils are also in planned sewer service areas where development is likely in the foreseeable future.

- Soils with generally favorable conditions but with slopes greater than 8% (B1b and B1c on the map) cover about one third of the watershed in Howard County.
- Stony soils and soils that have shallow bedrock account for about 7% of the watershed. They tend to be concentrated along the Patapsco River. The Patapsco Valley State Park encompasses large areas of these soils. The largest area of soils with shallow bedrock that are outside of the Park are immediately north of Bonnie Branch.
- Hydric soils account for about 4% of the watershed. They tend to be scattered in middle and southern portions of the watershed. The largest concentration appears to be in the vicinity of Tiber Branch.

Green Infrastructure

Forest and wetlands in the Patapsco River watershed, including extensive areas of contiguous natural lands, provide valuable water quality and habitat benefits. In general, actions taken to assure that forest cover will be maintained, to avoid fragmentation of forest, and to restore forest in areas that have been cleared will contribute significantly to improving the water quality in this watershed and to conserving the biodiversity of the State.

DNR has mapped a network of ecologically important lands, comprised of hubs and linking corridors, using several of the GIS data layers used to develop other indicators. Hubs 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, plus the 300 foot transition zone);
- Wetland complexes with at least 250 acres of unmodified wetlands;
- Streams or rivers with aquatic species of concern, rare coldwater or blackwater ecosystems, or important to anadromous fish, and their associated riparian forest and wetlands; and
- Conservation areas already protected by public (primarily DNR or the federal government) and private organizations like The Nature Conservancy or Maryland Ornithological Society.

Green Infrastructure corridors shown on the map where identified statewide using a computer GIS model. The model identified a "best fit" for corridors to link hubs by finding larger concentrations of forest and wetlands in between the hubs.

This "Green Infrastructure" provides the bulk of the state's natural support system. It provides ecosystem services, like cleaning the air, filtering and cooling water, storing and cycling nutrients, conserving and generating soils, pollinating crops and other plants, regulating climate, protecting areas against storm and flood damage, and maintaining hydrologic function. For more information on the Green Infrastructure identification project in Maryland, see www.dnr.maryland.gov/greenways/

Protection of Green Infrastructure lands may be addressed through various existing programs including Rural Legacy, Program Open Space, conservation easements and others. Within Program Open Space, the Green Print program helps to target funds to protect Green Infrastructure areas.

Map 7 Green Infrastructure shows that, from the statewide perspective that guided the analy-

sis, several Green Infrastructure features are found in the Patapsco LNB Watershed:

- Natural vegetation area in Green Infrastructure hubs totals about 4,770 acres in Howard County's portion of the watershed. These hubs are mostly large blocks of forest. They are concentrated along the Patapsco River where the Patapsco Valley State Park contributes to their protection. Smaller hubs are also found along Deep Run adjacent to Anne Arundel County.
- The corridors connecting the Green Infrastructure hubs are limited in this watershed to about three areas that contain around 840 acres of natural vegetation. The two corridors that run from the Patapsco River across the Deep Run drainage area connect to two small hubs southwest of the WRAS project area in the Dorsey Run drainage. Overall, large sections of these corridors are developed, so their value as habitat cannot be determined without field investigation.

Forest Habitat

Large blocks of forest provide habitat for species that are specialized for conditions with relatively little influence by species from open areas or humans. For example, forest interior dwelling birds require forest interior habitat for their survival and they cannot tolerate much human presence. Map 8 Forest Habitat and Stream Buffer Plantings shows blocks of contiguous forest that are at least 50 acres in size with at least 10 acres of forest interior (forest edge is at least 300 feet away) that may be important locally within the watershed. This size threshold was chosen to help ensure that the forest interior is large enough to likely provide locally significant habitat for sensitive forest interior dwelling species. The forest interior assessment map differs from the Green Infrastructure assessment in that forest interior areas are more numerous and more widely distributed because the forest interior size threshold is lower. Several findings on Patapsco LNB watershed forest interior can be seen on the map or interpreted in comparing it with the Green Infrastructure and protected lands maps:

- Nearly 5,000 acres of high quality forest habitat is identified in the watershed based on 1997 land cover data. Most of it is concentrated along the Patapsco River. The majority of this forest habitat is protected in DNR ownership but significant areas may be vulnerable to conversion to other land uses.
- One large block of high quality forest habitat is located along Deep Run. It is not protected from conversion to other land uses.
- About 40% of the forest in the watershed has either unknown quality or less than high quality forest habitat.
- The map shows the general locations of 18 forest restoration projects completed in the watershed according to the DNR Forest Service database for the period 1999 through 2002. In total they cover about 88 acres along four miles of stream. These projects were accomplished by both volunteers and contractors in a variety of project types, including the Conservation Reserve Enhancement Program (CREP) and required forest mitigation.

Wetlands

Wetlands are uncommon in the portion of Howard County that drains to the Patapsco River in the Lower North Branch watershed. According to the DNR Wetland Inventory, only about 150 acres of wetlands are identified. These wetlands represent about half of one percent of the total area in the watershed. These few wetlands tend to be concentrated in

relatively narrow floodplains near the Patapsco River and its tributaries. Map 9 Wetlands shows the distribution of wetlands in two areas where they are concentrated: along Deep Run and the Patapsco River in the Elkridge vicinity and along the Patapsco River near Woodstock. The Deep Run wetlands area probably contributes significantly to local fish habitat.

The following assessment of wetlands in the Patapsco River Lower North Branch watershed was contributed by the Maryland Department of Environment. Most of these wetlands are forested, dominated by oak, sweetgum, red maple, and in some places willow and alder. The type of wetlands found in the watershed is affected by local conditions. Most of the watershed is in the Piedmont Province. A small area near the Baltimore Harbor, Deep Run, and northern Anne Arundel County is in the Coastal Plain. Channel morphology changes near the boundary of the Piedmont/Coastal Plain physiographic regions. Significant sediment deposition normally occurs in the transition area downstream of the boundary as the material, which had been carried by the higher velocity flows from the Piedmont, settles out since it can no longer be transported by the slower flows of the flatter Coastal Plain province. (6)

The primary source of wetland hydrology in this watershed is high ground water. Overbank flooding, though it does occur, apparently is not of sufficient duration to be the primary source of hydrology in wetlands. The concentrated development in this part of Howard County has also often resulted in incised stream channels, further reducing the likelihood of overbank flooding. (7) Some wetlands are also supported by seepage of water from the bases of slopes adjacent to the floodplains. A few wetlands may be found in upland depressions. In the small Coastal Plain portion of the watershed in Howard County, wetlands may be found on relatively wide, flat landscapes in comparison with wetlands in the Piedmont region.

In comparison with the very poorly drained soils most often found on the lower Coastal Plain, soils in this watershed are seasonally wet for shorter periods of time, and have less organic matter. Wetlands in the Patapsco watershed are thus likely to have a lower capability to transform nutrients than wetlands with lengthy periods of saturation and inundation. However, vegetated wetlands on floodplains still may reduce flood flows and retain surface waters, allowing some sediments and nutrients to settle, providing some water quality improvement. The high ground water and seepage from slopes may also contribute to base flow maintenance and food chain support for streams. Wetlands that extend up the side of slopes, in contrast to depressions in floodplains, do not significantly retain water, thus providing only limited flood attenuation and water quality improvement functions.

In the Anne Arundel portion of the watershed, a nontidal Wetland of Special State Concern is located near Stony Run. This wetland contains some unusual plant communities for its location in the Upper Coastal Plain. It is a red maple/pitch pine swamp with herbaceous plants usually found in mountains or in the Piedmont region. In 1991, there was also a notable absence of invasive, non-native species. (8) Several plants are listed as being endangered or threatened in the State, one (swamp pink) is also designated as federally threatened.

Restoration

Several kinds of opportunities for potential wetland restoration that may be considered in this watershed are listed below. No voluntary

wetland restoration projects are confirmed in the Howard County portion of this watershed.

- Five retrofit projects were proposed in residential subdivisions in an assessment of stormwater management facilities completed in 1999. Projects included wetland creation as part of the retrofits. (9)
- Reforestation in undeveloped floodplain of Patapsco Valley State Park was recommended in the Park Master Plan. (10)
- Fish habitat/passage improvement.
- While wetland restoration in floodplains is beneficial in some areas, development and flooding concerns in the Ellicott City vicinity may limit potential.
- Wetlands in stormwater retrofits may present the best opportunity to re-create wetlands in the watershed. Permittees have found it difficult to locate mitigation sites to replace lost wetlands and some stream restoration projects have been proposed as an alternate form of mitigation.
- The Howard County Soil Survey reported in its 1968 report that some wetlands were drained to create pastureland. These areas would represent opportunities for restoration, though the extent of any converted pasture areas is probably very limited. There is a wetland on pasture formerly operated as a University of Maryland Horse Farm that may benefit from enhancement such as removal of multiflora rose and plugging of ditches (if present). (11) There appears to be limited areas to restore floodplain access in much of the watershed due to adjacent development.

Preservation

Based on the foregoing assessment, several existing wetlands areas present attributes that merit protection: Forested riparian corridors generally, the Deep Run in Howard County and the Stony Run nontidal Wetland of Special State Concern in Anne Arundel County.

Floodplains

Map 10 Floodplains And Hydric Soil shows that floodplains and hydric soils cover a roughly similar acreage in the Patapsco LNB watershed -- about 1,200 and 1,100 acres respectively. However, floodplains tend to be concentrated along major waterways while hydric soils are more dispersed. In the Piedmont portion of the watershed where stoney soil and shallow bedrock are common, floodplains are typically confined and narrow. In the Coastal Plain, floodplains are wider. The largest areas of floodplains on hydric soils are on the downstream portion of Deep Run near its confluence with the Patapsco River.

Living Resources and Habitat

Living resources, including all the animals, plants and other organisms require water to survive. They and their habitats are intimately connected to water quality and availability. Living resources respond to changes in water and habitat conditions in ways that help us interpret the status of water bodies and the effects of watershed conditions. In some cases, water quality is measured in terms of its ability to support specific living resources like trout or shellfish. Information on living resources is presented here to provide a gauge of water quality and habitat conditions in the watershed. It is also a potential measure of efforts to manage water quality and watersheds for the living resources that depend on them.

Fish

Some anadromous fish are known to use the Patapsco River for spawning. These fish species require fresh nontidal waters for spawning but live most of their lives in higher salinity water like Chesapeake Bay. Map 11 Fish Spawning, Blockages and MBSS Index shows that spawning of anadromous fish including herring, white perch and yellow perch has been documented in the Patapsco River as far upstream as the Rockburn Branch area. Spawning also was documented in Deep Run about one mile upstream from its confluence with the Patapsco River.

According to a database maintained by DNR Fisheries Service, there are several blockages to fish movement in the Howard County portion of the Patapsco River LNB watershed. On the Pataspco River, there are four dams: Bloede Dam (the furthest downstream), Simkins Dam, Union Dam and Daniels Dam. The database also lists three dams on Rockburn Branch that were originally identified in 1973. The map shows the locations of these blockages.

Some information is available on fish that are not anadromous. The Maryland Biological Stream Survey (MBSS) sampled fish populations in the Patapsco LNB watershed in 1995, 1996 and 2000.

The MBSS assessments focus on the condition and diversity of the fish community. In general, MBSS statistically measures fish populations and communities found on-site, rates each measurement on a scale developed for the index and then combines the individual ratings into a single index number. Their findings are reported using the “Fish Index of Biological Integrity” as summarized on the map. The sites on Deep Run and its tributaries and Rockburn Branch were ranked as good or fair. One site on Tiber Branch also ranked as fair.

Fish Consumption Advisory

In June 2004, MDE issued revised fish consumption advisories for Maryland. (12) Specific areas of the Patapsco River watershed are referenced in the advisory and also several statewide advisories affect portions of the watershed.

In the summary table below, the fish species listed were selected for the advisory because tissue testing for these fish in a specific geographic area show elevated concentrations of specific toxic compounds. For example, the advisories listed are for either the entire Patapsco River watershed or the entire State.

Also in the table, MDE's recommendations are listed in "meals per year". An easier way to consider the recommendation might be to think in terms of weekly menus. For example, it would be best to limit eating bluegill taken from ponds or lakes to less than two meals a week (about the same as 96 meals per year). For smallmouth and largemouth bass from ponds and lakes, the recommendation is to limit consumption to less than one meal per week for adults and less than one meal per month for children. (Children are more susceptible to effects of toxicity than adults.)

Contaminants identified in the table can be briefly described. The concern is that these toxic compounds accumulate over time in the bodily tissues of fish and people who eat them. Eventually levels of these compounds in a person could reach levels that would cause health problems. These compounds are long-lived, toxic and carcinogenic. PCBs, polychlorinated biphenols, were once widely used (now banned in the US) in electric transformers and other applications where heat resistance and electric insulation was needed. Pesticides, as referenced in the table, are various banned organochlorine pesticides like chlordane, DDT, dieldrin and heptachlor epoxide. Methyl mercury is the form of mercury that is most biologically active. It enters the atmosphere mostly from burning of coal and waste incineration and returns to land and water in dust and rain. Mercury is most commonly used in dry cell batteries, some switches and some lighting.

2004 Fish Consumption Advisories
Potentially Affecting The Patapsco Lower North Branch Watershed
Recommended Maximum Allowable Meals Per Year

Species	Area	General Population 8 oz meal	Women 6 oz meal	Children 6 oz meal	Contaminant
Channel Catfish	Patapsco River	Avoid	Avoid	Avoid	PCBs, Pesticides
White Perch	Patapsco River	5	Avoid	Avoid	
American Eel	Patapsco River	Avoid	Avoid	Avoid	
Smallmouth Bass & Largemouth Bass	Lakes, Impoundments	48	48	24	Methyl-Mercury
	Rivers and Streams	No advisory	96	96	
Bluegill	Lakes and Impoundments	96	96	96	

Biological Monitoring In Streams

The Maryland Biological Stream Survey (MBSS) sampled stream conditions in Howard County's portion of the Patapsco LNB watershed several times between in 1995, 1996 and 2000. As part of their work in addition to the fish assessment reported earlier, the condition of the benthic macroinvertebrates (stream bugs) was assessed. Additionally, in the year 2000, people working with the Stream Waders volunteer monitoring program assessed selected sites in the watershed using the same MBSS methods in abbreviated form. All of the findings for the watershed are summarized on Map 12 Benthos - MBSS Index.

Conditions that underlie the biological indices are complex and apply primarily to a local stream segment. The findings represent a combination of water quality conditions and habitat conditions. Typically, a stream segment ranks as a mix of good, fair, poor and/or very poor for the indices. There is a tendency for good/fair conditions to be associated with watersheds that have the most natural vegetation and forest. Similarly, there is a tendency for poor/very poor conditions to be associated with greater disturbance like impervious area, agriculture and construction sites.

In general, the map indicates that sites in the Patapsco LNB watershed in Howard County tended to rank fair, poor and very poor. These findings appear to show the affects of upstream development and other intensive land uses that generate significant impacts on stormwater flow quantity and quality.

Why Look at Benthos in Streams?

Unimpaired natural streams may support a great diversity of species like bacteria, algae, invertebrates like crayfish and insects to fish,birds, reptiles and mammals. All these groups of organisms have been extensively assessed relative to water quality and habitat quality. One group, benthic invertebrates, was found to serve as a good indicator of stream condition including water quality and habitat quality.

Benthic invertegrates are sometimes called "stream bugs" though that name overly simplifies the diverse membership of this group. This group includes mayflies, caddisflies, crayfish, etc., that inhabit the stream bottom, its sediments, organic debris and live on plant life (macrophytes) within the stream. Benthic macro-invertebrates are an important component of a stream's ecosystem.

The food web in streams relies significantly on benthic organisms. Benthos are often the most abundant source of food for fish and other small animals. Many benthic macroinvertebrates live on decomposing leaves and other organic materials in the stream. By this activity, these organisms are significant processors of organic materials in the stream. Benthos often provide the primary means that nutrients from organic debris are transformed to other biologically usable forms. These nutrients become available again and are transported downstream where other organisms use them.

Assessment of benthic organisms is a valuable tool for stream evaluation. This group of species has been extensively used in water quality assessment, in evaluating biological conditions of streams and in gauging influences on streams by surrounding lands. These organisms serve as good indicators of water resource integrity because they are fairly sedentary in nature and their diversity offers numerous ways to interpret conditions. They have different sensitivities to changing conditions. They

have a wide range of functions in the stream. They use different life cycle strategies for survival.

Sensitive Species

The State of Maryland tracks 40 sensitive species, mostly plants, in the Lower North Branch subwatershed of the Patapsco River Basin. A complete list is in Appendix D – Sensitive Species.

Sensitive species are generally recognized as being the plants or animals that are most at risk in regards to their ability to maintain healthy population levels. The most widely known are perhaps the State and Federally-listed Endangered or Threatened animals such as the bald eagle and Delmarva fox squirrel. In addition to charismatic animals such as these however, both the United States Fish and Wildlife Service and the Maryland DNR work through their respective Federal and State programs to protect a wide variety of declining non-game animals, rare plants, and the unique natural communities that support them.

For the purposes of watershed restoration, it is valuable to account for the known locations and areas of potential habitat for sensitive species in a given area. They are often indicators, and sometimes, important constituents, of the network of natural areas which form the foundation for many essential natural watershed processes. In fact, in addition to conserving biodiversity in general, protecting these species and/or promoting expansion of their habitats can be an effective component for a watershed restoration program.

DNR's Wildlife and Heritage Service identifies important areas for sensitive species conservation in different ways. Several sensitive species overlays are used by the State of Maryland to delineate habitat associated with these species. The purpose of utilizing these delineations is to help protect sensitive species by identifying the areas in which they are known to occur. Doing so allows DNR to work toward the conservation of these sensitive resources by evaluating potential impacts of proposed actions that may affect them. Specifically, working within an established procedural framework, the Wildlife and Heritage Service reviews projects and provides recommendations for activities falling within these overlays.

The geographic areas covered by these overlays are course filters. To allow for uncertainty pertaining to interpretation discrepancies, the polygons used on the map to depict these locations have been buffered. Accurate on the ground information regarding species locations and habitat delineations for a specific area can be obtained from DNR's Natural Heritage Program. It is also important to note that outside of the Chesapeake Bay Critical Area, DNR generally only places sensitive species conservation requirements on projects requiring a permit/approval or those that are utilizing State funds. However, there are more broadly applied State and Federal laws and regulations that address "takings" of listed species. In addition, many counties have incorporated safeguards for areas associated with sensitive species into their project and permit review processes as well as adopting specific ordinances in some cases to protect them. In all instances, property owners are encouraged to seek advice on protecting the sensitive species / habitat within their ownership.

Ecologically Sensitive Area (ESA)

At least 11 ESAs are identified in Howard County's portion of the Patapsco LNB Watershed, as shown in Map 13 Sensitive Species. Outside of Howard County, there are seven additional ESAs in other counties within the

watershed. Each ESA contains one or more sensitive species habitats. However, the entire ESA is not considered sensitive habitat. The ESA is an envelope identified for review purposes to help ensure that applications for permit or approval in or near sensitive areas receive adequate attention and safeguards for the sensitive species / habitat they contain. A complete list of rare species tracked by Maryland in the entire Patapsco LNB watershed is in the Appendix D - Sensitive Species. (13)

Wetlands of Special State Concern (WSSC)

There are several WSSCs designated in Howard County's portion of the Patapsco River LNB watershed. These WSSCs cover about three locations along the Patapsco River between I-70 and Route 40. Outside of the Howard County in the watershed there are at least two additional areas totaling over 80 acres. Overall, these selected wetlands, which generally represent the best examples of Maryland's nontidal wetland habitats, are afforded additional protection in State law beyond the permitting requirements that apply to wetlands generally. The Maryland Department of the Environment may be contacted for more information regarding these regulations. To help ensure that proposed projects that may affect a WSSC are adequately reviewed, an ESA is always designated to encompass each WSSC and the area surrounding it. For a listing of designated sites see COMAR 26.23.06.01 at www.dsd.state.md.us

Natural Heritage Area (NHA)

No NHAs are located in the Patapsco LNB Watershed. In general, NHAs are designated because they represent rare ecological communities. They are areas that provide important sensitive species habitat. They are designated in State regulation (COMAR 08.03.08.10) and are afforded specific protections in the Critical Area Law criteria. For proposed projects that could potentially affect a particular NHA, recommendations and/or requirements may be put in place during the permit or approval process. These would be specifically aimed at protecting the ecological integrity of the NHA itself. To help ensure that proposed projects that may affect a given NHA are adequately reviewed, an ESA is always designated to encompass each NHA and the area surrounding it.

Land Use And Land Cover

Water quality in streams and rivers is greatly influenced by riparian area land use, land use throughout the watershed, soils, vegetative cover and many other terrestrial factors. This chapter explores immediately available information that relates to land use in the Patapsco River Lower North Branch (LNB) watershed.

Land Use

Map 14 Land Use / Land Cover shows the distribution of major land use categories in Howard County's portion of the Patapsco River LNB watershed based on 2002 data produced by the Maryland Department of Planning.

Active land uses encompass about 59% of the watershed including developed land (49%) and agriculture (10%). The map shows that there is a tendency for these land use categories to be in the headwaters and uplands of drainage areas for many local streams. As used here, developed land includes all forms of residential, commercial, industrial and institutional lands. Similarly, agricultural land includes all forms of cropland, pasture, orchards, landscape nurseries and agricultural structures.

Forest and brush lands account for about 41% of the watershed. The map shows a tendency for these lands to be along the Patapsco River and downstream areas of local tributary streams.

The likely consequence of this land use / land cover distribution is for local streams to be impacted by upstream land uses. These impacts on water quality and aquatic habitat may be visible in downstream areas where the streams flow through natural areas. Consequently, streams in natural areas may reflect limitations or problems generated by upstream sources.

Viewing these generalized land use categories as potential nonpoint sources of nutrients, developed lands are likely to contribute the greatest overall loads to local waterways in this watershed.

Protected Lands

As used in the context of watershed protection and restoration, "protected land" includes any land with some form of long-term limitation on conversion to urban / developed land use. This protection may be in various forms: public ownership for natural resource or low impact recreational intent, private ownership where a third party (land trust) acquired the development rights or otherwise acquired the right to limit use through the purchase of an easement, etc. The extent of "protection" varies greatly from one circumstance to the next. Therefore, for some protected land, it may be necessary to explore the details of land protection parcel-by-parcel through the local land records office to determine the true extent of protection.

For purposes of watershed management, an understanding of existing protected lands can provide a starting point in prioritizing potential protection and restoration activities. In some

cases, protected lands may provide opportunities for restoration projects because owners of these lands may value natural resource protection or enhancement goals.

Map 15 Protected Land shows the status of protected lands in the Patapsco River LNB Watershed. On the map, some land parcels may be affected by more than one type of protection. For example, government-owned parkland may also have a conservation easement on it.

The largest category of protected land in the watershed is in public ownership. In this watershed, Patapsco River Valley State Park managed by the Maryland Department of Natural Resources encompasses about 4,450 acres. Also in this watershed, Howard County owns over 800 acres of land for park or conservation purposes. There is no Federal land in the watershed.

The second largest category of land protection in the watershed includes various kinds of easements for conservation purposes. The map shows one agricultural easement held by the Maryland Agricultural Land Preservation Foundation on about 79 acres of privately owned land. Maryland Environmental Trust and Howard County hold easements on about 351 acres of private land. These kinds of easement generally restrict use and development of the land in order to maintain agricultural, rural and/or natural character but their details differ. Also shown on the map are easements held by the Maryland Historical Trust that cover about 100 acres where cultural preservation is the primary purpose.

The distribution of protected land in the watershed may have some implications for watershed management:

- It appears that Rockburn Branch has the greatest amount of protected land along the stream and in the stream's drainage area compared to other tributary streams. Consequently, in the long term this stream may offer significant potential for stream protection-related activity.
- Streams in parkland are probably impacted by upstream land use. There may be a tendency for high stormwater flows from developed land upstream to cause stream bank erosion in parkland downstream in the absence of natural rocky conditions prevent it. This can occur even with stormwater management, particularly if properties were developed prior to stormwater management regulations. Even in streams with a rocky bed, increased stormwater flows may tend to flush out vulnerable aquatic species.

Impervious Area

Roads, parking areas, roofs and other human constructions are collectively called impervious surface. Impervious surface blocks the natural seepage of rain into the ground. Unlike many natural surfaces, impervious surface typically concentrates stormwater runoff, accelerates flow rates and directs stormwater to the nearest stream. Watersheds with small amounts of impervious surface tend to have better water quality and aquatic habitat in local streams than watersheds with greater amounts of impervious surface.

An assessment of impervious area was conducted by Howard County in 2001. This county-wide assessment involved dividing the jurisdiction into 64 subwatersheds ranging in size from 2 to 10 square miles. (14)

Based on the level of impervious cover in the County's 64 subwatersheds for existing and future conditions, each was ranked into one of

three categories and was prioritized for restoration to improve water quality:

- Sensitive watersheds have relatively low levels of impervious cover and are likely to have stream conditions that are good to excellent.
- Impacted watersheds have medium levels of impervious cover and are expected to have fair to good stream conditions but show clear signs of degradation.
- Non-supporting watersheds have relatively high levels of impervious cover and are expected to have poor to fair stream conditions, with significant degradation in aquatic habitat and water quality.
- Future conditions were predicted by projecting potential build-out based on zoning as it existing in 2001. Zoning changes since 2001, like those that recently occurred in the Route 1 corridor, are not reflected in the assessment's findings.

For the subwatersheds that cover the Patapsco River LNB watershed in Howard County, three were ranked as sensitive, five were ranked as impacted and three were ranked as non-supporting for existing conditions. For future conditions, two subwatersheds were ranked as sensitive, five were ranked as impacted and four were ranked as non-supporting. Overall, three of the Patapsco LNB subwatersheds were prioritized in the County's top ten for restoration: Rockburn Branch, Elkridge and the Deep Run Tributaries.

Map 16 Impervious Surface presents Howard County's findings for average imperviousness for existing condition local subwatersheds by color-coding each subwatershed. It also uses data developed by the University of Maryland's Regional Earth Sciences Application Center (RESAC) to show distribution of local impervious area within a subwatershed: lighter areas have the least impervious cover and darker areas have the greatest impervious cover.

The subwatershed with the least imperviousness is the Davis Branch subwatershed. On the map, its green color indicates its low average imperviousness and the relative absence of darkened areas indicates relatively few local impervious areas are present. This subwatershed's relatively low imperviousness reported by both measurements is associated with its rural character that includes relatively extensive agriculture, forest and brush land.

At the opposite end of the imperviousness spectrum, the map shows three subwatersheds in purple that have a relatively high average impervious area varying between 25 and 30%: Upper Deep Run, Lower Deep Run and Tiber-Hudson. In these subwatersheds, developed land uses are extensive (dark areas) and a relatively smaller percent of the subwatershed is naturally vegetated (light areas). In watersheds with this concentration of impervious area, negative impacts to water quality and aquatic habitat tend to become visible at the subwatershed scale.

The remaining subwatersheds show an average imperviousness between the two extremes. All of these subwatersheds along the Patapsco River mainstem have large areas of development and similarly large areas of natural vegetation (forest and brush). The developed relatively impervious areas (dark on the map) tend to be in upstream areas. The natural vegetation areas with little impervious area (light on the map) tend to be in downstream areas. In these subwatersheds, the average imperviousness varies between 5% and 24.9% because their large areas of forest and brush (pervious) counterbalance the developed areas (impervious) to varying degrees. In these cases, the use of averaging impervious area at the subwatershed scale masks likely impacts to local streams. In

these subwatersheds, the much higher imperviousness in headwaters and other upstream areas probably exerts a great influence on individual streams even as they flow into naturally vegetated areas downstream.

Average Impervious Area Summary By Subwatershed Patapsco Lower North Branch Watershed In Howard County						
Subwatershed	**Area (sq. miles)**	**% Existing Impervious**	**Existing Category**	**% Future Impervious**	**Future Category**	**Change % Imp.**
Davis Branch Woodstock	4.0	2.5	Sensitive	8.9	Sensitive	6.4
N Br Patapsco to Daniels Mill	4.1	10.7	Impacted	12.9	Impacted	2.2
Sucker Branch	4.2	17.9	Impacted	21.8	Impacted	3.9
Tiber-Hudson	3.0	27.7	Non-Supporting	31.8	Non-Supporting	4.1
Bonnie Branch	3.7	11.7	Impacted	18.6	Impacted	6.9
Rockburn Branch	5.8	9.9	Sensitive	11.9	Impacted	2.1
Elkridge	1.8	19.2	Impacted	23.2	Impacted	4.1
Deep Run Tribs.	5.2	22.2	Impacted	31.2	Non-Supporting	9.0
Deep Run on County Line *	0.0	2.2	Sensitive	2.2	Sensitive	0.0
Upper Deep Run	3.0	26.4	Non-Supporting	28.4	Non-Supporting	2.0
Lower Deep Run	3.1	28.2	Non-Supporting	37.0	Non-Supporting	8.8

Notes For Table:

1- Sensitive watersheds have impervious cover less than or equal to 10%.
2- Impacted watersheds have impervious cover greater than 10% and less than or equal to 25%.
3- Non-supporting watersheds have impervious cover greater than 25%.
4- Deep Run on County Line is 23 acres or 0.04 square miles and is predominantly within Patapsco Valley State Park.

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(10) Maryland Department of Natural Resources. 1981. Patapsco Valley State Park Master Plan. 1981.

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(12) MDE. Fish consumption advisory issued June 2004 and posted on the Internet. http://www.mde.state.md.us/Programs/WaterPrograms/Fish%20Shellfish%20Programs/index.asp

(13) Davidson, Lynn. DNR Wildlife and Heritage Service. Personal communication 2004.

(14) Overstreet, Susan. Personal communication. Howard County Department of the Planning and Zoning. 2004.

Appendix A - GLOSSARY	
303(d)	A section of the federal Clean Water Act requiring the states to report waters impaired for the uses for which they have been designated, and the reasons for the impairment. Waters included in the "303(d) list" are candidates for having TMDLs developed for them.
305(b)	A section of the federal Clean Water Act that requires periodic assessment of the status of waters in a State or similar jurisdiction.
319	A section of the federal Clean Water Act dealing with non-point sources of pollution. The number is often used alone as either a noun or an adjective to refer to some aspect of that section of the law, such as grants.
8-digit watershed	Maryland has divided the state into 138 watersheds, each comprising an average of about 75 square miles, that are known as 8-digit watersheds because there are 8 numbers in the identification number each has been given. These nest into the 21 larger 6-digit watersheds in Maryland which are also called Tributary Basins or River Basins. Within the Chesapeake Bay drainage, 8-digit watersheds also nest into 10 Tributary Team Basins.
Anadromous Fish	Fish that live most of their lives in salt water but migrate upstream into fresh water to spawn.
Benthos	Organism that live on the bottom of a body of water.
BMP	Best Management Practice. As used here refers to on-the-ground approaches to control erosion, sedimentation, or stormwater movement.
CBNERR	The Chesapeake Bay National Estuarine Research Reserve in a federal, state and local partnership to protect valuable estuarine habitats for research, monitoring and education. The Maryland Reserve has three components: Jug Bay on the Patuxent River in Anne Arundel and Prince Georges' Counties, Otter Point Creek in Harford County and Monie Bay in Somerset County.
COMAR	Code Of Maryland Regulations (Maryland State regulations)
CREP	Conservation Reserve Enhancement Program, a program of MDA. CREP is a federal/state and private partnership which reimburses farmers at above normal rental rates for establishing riparian forest or grass buffers, planting permanent cover on sensitive agricultural lands and restoring wetlands for the health of the Chesapeake Bay.
CRP	Conservation Reserve Program, a program of Farm Service Agency in cooperation with local Soil Conservation Districts. CRP encourages farmers to take highly erodible and other environmentally-sensitive farm land out of production for ten to fifteen years.
CWAP	Clean Water Action Plan, promulgated by EPA in 1998. It mandates a statewide assessment of watershed conditions and provides for development of Watershed Restoration Action Strategies (WRASs) for priority watersheds deemed in need of restoration.

Appendix A - GLOSSARY	
CWiC	Chesapeake 2000 Agreement watershed commitments. CWiC is a shorthand phrase used in the Chesapeake Bay Program.
CZARA	The Coastal Zone Reauthorization Amendments of 1990, intended to address coastal non-point source pollution. Section 6217 of CZARA established that each state with an approved Coastal Zone Management program must develop and submit a Coastal Non-Point Source program for joint EPA/NOAA approval in order to "develop and implement management measures for NPS pollution to restore and protect coastal waters".
CZMA	Coastal Zone Management Act of 1972, establishing a program for states and territories to voluntarily develop comprehensive programs to protect and manage coastal resources (including the Great Lakes). Federal funding is available to states with approved programs.
Conservation Easement	A legal document recorded in the local land records office that specifies conditions and/or restrictions on the use of and title to a parcel of land. Conservation easements run with the title of the land and typically restrict development and protect natural attributes of the parcel. Easements may stay in effect for a specified period of time, or they may run into perpetuity.
DNR	Department of Natural Resources (Maryland State)
EPA	Environmental Protection Agency (United States)
ESA	Ecologically Significant Area, an imprecisely defined area in which DNR has identified the occurrence of rare, threatened and/or endangered species of plants or animals, or of other important natural resources such as rookeries and waterfowl staging areas.
GIS	Geographic Information System, a computerized method of capturing, storing, analyzing, manipulating and presenting geographical data.
MBSS	Maryland Biological Stream Survey, a program in DNR that samples small streams throughout the state to assess the condition of their living resources.
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
MET	Maryland Environmental Trust, an organization that holds conservation easements on private lands and assists local land trusts to do similar land protection work.
MGS	Maryland Geological Survey, a program in DNR
NHA	Natural Heritage Area, a particular type of DNR land holding, designated in COMAR
NOAA	National Oceanic and Atmospheric Administration, an agency of the US Department of Commerce that, among other things, supports the Coastal Zone Management program, a source of funding for some local environmental activities, including restoration work.

Appendix A - GLOSSARY	
NPS	Non-Point Source, pollution that originates in the landscape that is not collected and discharged through an identifiable outlet.
NRCS	Natural Resources Conservation Service, formerly the Soil Conservation Service, an agency of the US Department of Agriculture that, through local Soil Conservation Districts, provides technical assistance to help farmers develop conservation systems suited to their land. NRCS participates as a partner in other community-based resource protection and restoration efforts.
PDA	Public Drainage Association
RAS	Resource Assessment Service, a unit of DNR that carries out a range of monitoring and assessment activities affecting the aquatic environment.
Riparian Area	1. Land adjacent to a stream. 2. Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e. a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines. (National Research Council, *Riparian Areas: Functions and Strategies for Management*. Executive Summary page 3. 2002)
SAV	Submerged Aquatic Vegetation, important shallow-water sea grasses that serve as a source of food and shelter for many species of fin- and shell-fish.
SCA(M)	Stream Corridor Assessment is an activity carried out by DNR Watershed Services in support of WRAS development and other management needs, in which trained personnel walk up stream channels noting important physical features and possible sources of problems.
SCD	Soil Conservation District is a county-based, self-governing body whose purpose is to provide technical assistance and advice to farmers and landowners on the installation of soil conservation practices and the management of farmland to prevent erosion.
Synoptic Survey	A short term sampling of water quality and analysis of those samples to measure selected water quality parameters. A synoptic survey as performed by DNR in support of watershed planning may be expanded to include additional types of assessment like benthic macroinvertebrate sampling or physical habitat assessment.
TMDL	Total Maximum Daily Load, a determination by MDE of the upper limit of one or more pollutants that can be added to a particular body of water beyond which water quality would be deemed impaired.

Appendix A - GLOSSARY	
Tributary Teams	Geographically-focused groups, appointed by the Governor, oriented to each of the 10 major Chesapeake Bay tributary basins found in Maryland. The teams focus on policy, legislation, hands-on implementation of projects, and public education. Each basin has a plan, or Tributary Strategy.
USFWS	United States Fish and Wildlife Service, in the Department of Interior
USGS	United States Geological Survey
Water Quality Standard	Surface water quality standards consist of two parts: (a) designated uses of each water body; and (b) water quality criteria necessary to support the designated uses. Designated uses of for all surface waters in Maryland (like shell fish harvesting or public water supply) are defined in regulation. Water quality criteria may be qualitative (like "no objectionable odors") or quantitative (toxic limitations or dissolved oxygen requirements)
Watershed	All the land that drains to an identified body of water or point on a stream.
WRAS	Watershed Restoration Action Strategy, a document outlining the condition of a designated watershed, identifying problems and commiting to solutions of prioritized problems.
WSSC	Wetland of Special State Concern, a designation by MDE in COMAR.
WWTP	Wastewater Treatment Plant. Usually refers to sewage treatment facility.

Appendix B – Water Quality Summary
Patapsco River Lower North Branch Watershed
MDE Data Summarized By DNR Watershed Services
Stations included: DXC0004, BCN0003, DGW0002, NPA0026, PAT0176, PAT0222, PAT0285, PAT0347

Deep Run Station DXC0004, Draining Howard & Anne Arundel Co.

SAMPLE DATE	DO MG /L	CONDUCTIVITY µOMHOS /CM	pH	BOD MG /L	TN MG /L	TP MG /L	TSS MG /L	CHLOROPHYLL µG /L
3/15/2000	11	459	7.5	2.3	0.8746	0.0157	3.4	1.12
4/12/2000	10	350	6.9	0.6	0.7277	0.0159	7.4	1.4
5/10/2000	7.6	374	7.4	1.6	0.8411	0.0163	3.2	1.96
9/7/2000	8.6	339	7.4	1	0.7304	0.0204	7.6	0.7
AVERAGE	9.30	380.50	7.30	1.38	0.79	0.02	5.40	1.30

Brices Run Station BCN0003, Draining Baltimore Co.

SAMPLE DATE	DO MG /L	CONDUCTIVITY µOMHOS /CM	pH	BOD MG /L	TN MG /L	TP MG /L	TSS MG /L	CHLOROPHYLL µG /L
3/15/2000	12.1	209	7.8	1.9	2.7895	0.0267	2.8	4.2
4/12/2000	11.5	201	8.5	0.2	2.3339	0.0187	2.4	6.72
5/10/2000	9	214	7.6	1.2	2.4766	0.022	3.4	14.98
8/9/2000	8.6	216	7.8	1.3	2.5474	0.0564	4.9	1.86666667
9/7/2000	10.1	222	7.8	1	2.5926	0.0425	3.4	1.22181818
AVERAGE	10.26	212.40	7.90	1.12	2.55	0.03	3.38	5.80

Dogwood Run Station DGW0002, Draining Baltimore County

SAMPLE DATE	DO MG /L	CONDUCTIVITY µOMHOS /CM	pH	BOD MG/L	TN MG /L	TP MG /L	TSS MG/L	CHLOROPHYLL µG /L
3/15/2000	13	306	8.3		1.1664	1.006038	2.4	3.64
4/12/2000	11.7	283	8.6		1.037	1.003338	2.4	2.66
5/10/2000	8.6	284	7.6				2.4	4.34
8/9/2000	8.4	311	8.1		1.1686	0.0335	2.6	1.4
9/7/2000	9.9	306	8		1.1928	0.027	2.4	0.42
AVERAGE	10.32	298.00	8.12	--	1.14	0.52	2.44	2.49

North Branch Patapsco Station NPA0026								
SAMPLE DATE	**DO MG /L**	**CONDUCTIVITY µOMHOS /CM**	**pH**	**BOD MG /L**	**TN MG /L**	**TP MG /L**	**TSS MG /L**	**CHLOROPHYLL µG /L**
10/13/1999	7.2	166	7.4	1.2	0.352	0.0181	2.4	0
10/26/1999	8.1	185	7.1	1.7	0.2357	0.0132	2.4	0.84
11/16/1999	9.3	168	7.2	1	0.2078	0.0123	2.4	0.56
11/30/1999	9.8	163	8.5	0.5	0.3622	0.0188	2.4	0.588
12/14/1999	10.6	142	7.1		0.3109	0.0185	2.4	1.26
1/11/2000	11.4	117	7	3	0.377	0.0164	2.4	2.38
1/24/2000	12.3	143	7.9	0.5	0.3667	0.0081	2.4	1.4
2/23/2000	11.5	160	7.2	2.9	0.351	0.0122	2.4	2.24
2/29/2000	10.6	127	7.1	1.3	0.3071	0.0109	2.4	3.28363636
3/15/2000	11.2	163	7.5	2	0.2979	0.0096	2.4	2.8
4/12/2000	12.5	173	8	0.3	0.1767	0.0071	2.4	1.68
5/10/2000	6.9	210	7.4	4.7	0.432	0.0207	3.1	1.68
5/24/2000	6.7	150	7.1	2.1	0.3514	0.0177	2.4	0.72
6/20/2000	6.9	190	7.6	1.8	0.5171	0.0231	3	
8/9/2000	6.1	178	7.1	2.9	0.439	0.0268	4.9	1.96
9/7/2000	7.6	196	7.4	0.9	0.3137	0.0229	2.4	1.22181818
AVERAGE	9.29	164.44	7.41	1.79	0.34	0.02	2.64	1.51

Patapsco River Station PAT0176								
SAMPLE DATE	DO MG /L	CONDUCTIVITY µOMHOS /CM	pH	BOD MG /L	TN MG /L	TP MG /L	TSS MG /L	CHLOROPHYLL µG /L
10/13/1999	11	262	7.6	1.1	1.7566	0.0602	2.4	0.68727273
10/26/1999	10.5	300	8	2	1.7946	0.0149	2.4	1.06909091
11/16/1999	10.9	311	8.1	0.8	2.0142	0.0217	4.6	4.2
11/30/1999	12.1	276	7.3	2.9			2.4	2.66
12/14/1999	12.2	219	7.7		1.896	0.1128	59	15.68
1/11/2000	12.1	253	7.7	4.8	2.81	0.0488	16.5	6.72
1/24/2000	13.5	343	7.5	0.5	3.1097	0.016	2.4	0.7
2/23/2000	13	288	7.4	1	2.471	0.0209	4	1.575
2/29/2000	11.3	235	7.5	1.5	2.946	0.096	15	6.44
3/15/2000	11.9	250	7.7	2.2	2.3395	0.0183	2.4	4.2
3/15/2000	11.9	250	7.7		2.2787	0.018	2.4	2.94
4/12/2000	10.9	240	7.3	1	2.0803	0.0164	3	5.18
4/12/2000	10.9	240	7.3		2.1085	0.0175	3.6	5.46
5/10/2000	8.1	249	7.7	2.1	2.094	0.0322	7.6	2.8
5/10/2000	8.1	249	7.7		2.0486	0.0333	8.3	3.5
5/24/2000	8.8	129	7.6	2.1	2.17	0.0604	18	4.2
6/20/2000	8.6	210	8.1	1.5	2.234	0.0647	15.6	
8/9/2000	7.5	265	7.6	1.5	2.0509	0.0551	10.4	1.4
8/9/2000	7.5	265	7.6		2.0862	0.0557	11.2	1.54
9/7/2000	8.9	260	7.7	1.3	2.2178	0.068	13.6	1.4
9/7/2000	8.9	260	7.7		2.2195	0.0689	12.8	1.82
10/2/2002	8.2	291	7.7		1.2685	0.0551	2.4	0.7
10/22/2002	10.5	329	7.7		1.9846	0.0518	2.4	0.42
11/13/2002	10.2	266	7.7		1.5869	0.0606	9.7	1.8
12/3/2002	13.1	309	7.5		2.5655	0.0335	3.9	0.56
12/17/2002	13.4	301	7.4		2.4134	0.0485	13.5	2.1
1/7/2003	13.2	670	7.4		2.582	0.0394	10.8	1.82
1/22/2003	13.6	345	7.4		3.4956	0.0227	2.4	0.56
2/4/2003	13.7	340	7.9		3.0031	0.0252	4.3	1.26
3/4/2003	13.7	353	7.3		2.485	0.0621	14.6	1.82
3/18/2003	11.7	265	8.1		2.3356	0.0221	4	3.15
3/31/2003	11	252	7.9		2.201	0.0332	9.6	16.24
4/22/2003	9.5	273	7.9		2.3859	0.0157	2.4	4.8
5/6/2003	10	280	7.7		2.401	0.0213	7	12.04
5/20/2003	9.8	230	7.6		2.299	0.0514	21.7	10.36
6/3/2003	8.8	222	7.5		2.37	0.0504	23.1	3.12
6/17/2003	8.6	223	7.8		2.3954	0.0472	18.6	3.5
6/24/2003	8.9	216	7.6		2.538	0.0542	23.7	4.76

Patapsco River Station PAT0176								
SAMPLE DATE	**DO MG /L**	**CONDUCTIVITY µOMHOS /CM**	**pH**	**BOD MG /L**	**TN MG /L**	**TP MG /L**	**TSS MG /L**	**CHLOROPHYLL µG /L**
7/8/2003	8	239	7.9		2.3064	0.029	6.3	2.94
7/22/2003	8	256	7.8		2.4861	0.0327	2.6	1.4
8/5/2003	7.6	257	7.7		2.4154	0.0375	4.9	1.68
8/19/2003	8.7	229	7.8		2.0947	0.0315	5	0.84
8/26/2003	7.9	274	7.9		2.1723	0.0254	2.4	2.268
9/9/2003	8.3	238	7.9		2.3418	0.0296	4.3	0.98
9/23/2003	8.6	135	7.4		3.83	0.7662	658	12.6
10/7/2003	9.9	239	7.6		2.5947	0.0222	2.4	1.96
10/21/2003	10.1	235	7.7		2.3812	0.0241	2.4	3.36
AVERAGE	10.29	268.53	7.67	1.75	2.34	0.06	22.98	3.72

Patapsco River Station PAT0222								
SAMPLE DATE	DO MG /L	CONDUCTIVITY µOMHOS /CM	pH	BOD MG /L	TN MG /L	TP MG /L	TSS MG /L	CHLOROPHYLL µG /L
3/15/2000	12.1	258	7.6	2.8	2.4353	0.016	2.4	4.62
4/12/2000	11.9	243	7.1	0.7	2.0958	0.0136	2.4	3.78
5/10/2000	7.9	249	8	3.9	2.142	0.0323	6.2	3.64
8/9/2000	7.7	257	7.8	1.3	2.2185	0.0627	10.3	1.68
9/7/2000	9.2	250	7.8	1.6	2.341	0.092	22.8	2.1
10/2/2002	8.3	283	8.2		1.3446	0.0713	3.8	1.82
10/22/2002	10.4	322	7.7		2.127	0.0479	4	0.84
11/13/2002	10.3	267	8		1.7129	0.0628	11	1.68
12/3/2002	12.8	298	7.5		2.5838	0.0276	2.4	0.42
12/17/2002	13.3	285	7.5		2.4149	0.0373	5.8	1.68
1/7/2003	13.3	600	7.4		2.7462	0.0412	8.7	2.24
1/22/2003	13.7	340	7.4		3.6889	0.0215	2.4	0.42
2/4/2003	13.8	317	7.8		3.0931	0.0256	2.4	1.54
3/4/2003	14.3	329	7.7		2.5608	0.0632	11.7	1.82
3/18/2003	10.9	250	8.2		2.463	0.0206	3.2	3.78
3/31/2003	10.6	249	7.8		2.2862	0.0349	9	14.56
4/22/2003	8.8	259	7.6			0.0156	2.4	5.04
5/6/2003	10.5	265	7.8		2.587	0.0187	5.1	9.24
5/20/2003	10	223	7.6		2.364	0.0485	18.9	9.24
6/3/2003	9.1	215	7.5		2.282	0.0474	20.6	2.88
6/17/2003	8.7	217	7.9		2.432	0.0454	17.7	3.92
6/24/2003	9.2	214	7.7		2.371	0.0459	18.6	4.34
7/8/2003	7.9	237	8		2.4174	0.0297	5	3.57
7/22/2003	7.8	249	7.9		2.6204	0.0351	2.9	0.98
8/5/2003	7.8	247	7.8		2.5371	0.04	5.4	1.56
8/19/2003	8.7	224	7.9		2.1224	0.0331	9.3	0.98
8/26/2003	8.1	265	7.9		2.287	0.0288	2.4	1.848
9/9/2003	9.2	233	8.1		2.4256	0.028	3	1.12
9/23/2003	8.9	130	7.4		4.67	1.085	957.5	16.8
10/7/2003	10.1	232	7.7		2.6987	0.0233	2.4	2.66
10/21/2003	10.2	228	7.6		2.4845	0.0249	2.4	3.99
AVERAGE	10.18	265.65	7.74	2.06	2.49	0.07	38.13	3.70

Patapsco River Station PAT0285 Holofield Section of Patapsco State Park								
SAMPLE DATE	**DO MG /L**	**CONDUCTIVITY µOMHOS /CM**	**pH**	**BOD MG /L**	**TN MG /L**	**TP MG /L**	**TSS MG /L**	**CHLOROPHYLL µG /L**
1/11/2000	12.6	212	7.9	4.2	2.7054	0.056	19.6	4.9
1/24/2000	14.8	212	8.2	0.1	3.4902	0.0165	2.4	0.84
2/23/2000	13	232	7.5	0.1	2.8214	0.0212	2.4	1.68
2/29/2000	12	203	8.2	2.3	2.665	0.0813	15.6	6.44
3/15/2000	12	225	8	2.3	2.5878	0.0193	2.4	3.64
4/12/2000	11.3	206	7.9	0.3	2.3158	0.016	2.4	1.68
5/10/2000	7.4	217	7.7	1.4	2.4542	0.0315	6	3.64
5/24/2000	9.3	202	7.4	1.9	2.597	0.0532	14.8	3.84
6/20/2000	9	210	8	1	2.658	0.0656	18.4	
8/9/2000	7.8	231	7.8	1.3	2.3733	0.0745	6.9	1.56
9/7/2000	8.7	224	7.7	1.3	2.3013	0.0799	23.2	2.1
10/2/2002	7.3	263	7.5		1.6092	0.0782	5.2	1.96
10/22/2002	10	305	7.6		2.3592	0.0474	3	1.54
11/13/2002	10.1	256	7.6		1.789	0.0613	12.3	2.64
12/3/2002	13.2	266	7.4		2.8793	0.03	2.5	0.56
12/17/2002	13.4	250	7.3		2.629	0.0394	6.2	1.68
1/7/2003	13.7	380	7.3		2.8677	0.0453	8.2	2.66
1/22/2003	13.2	283	7.3		3.7134	0.0275	3.5	0.98
2/4/2003	13.7	274	7.8		3.1993	0.0353	7.7	1.96
3/4/2003	14.1	297	7.6		2.5967	0.0509	8.2	1.96
3/18/2003	11.7	213	8.1		2.6816	0.0234	4.2	4.2
3/31/2003	12.5	224	7.9		2.2887	0.0332	8.6	12.6
4/22/2003	11	236	8.2		2.6202	0.0147	2.4	4.8
5/6/2003	10.8	232	7.8		2.7799	0.019	4.3	7.92
5/20/2003	9.8	210	7.5		2.382	0.0431	17.1	8.54
6/3/2003	9	206	7.6		2.4557	0.0433	17.1	2.64
6/17/2003	8.7	207	7.7		2.4763	0.0416	15.7	4.06
6/24/2003	9.4	206	7.7		2.418	0.0454	21.4	5.04
7/8/2003	8.1	217	7.8		2.4707	0.0337	4	2.835
7/22/2003	7.8	227	7.7		2.7379	0.0367	2.9	1.96
8/5/2003	7.7	226	7.7		2.8253	0.0426	7.1	1.68
8/19/2003	8.4	215	7.8		2.3121	0.0324	4.5	1.12
8/26/2003	7.8	245	7.8		2.4649	0.0326	2.5	2.772
9/9/2003	8.5	221	7.9		2.545	0.0279	2.8	1.4
9/23/2003	8.5	123	7.5		4.87	1.1839	1217.5	16.8
10/7/2003	10.2	220	7.6		2.756	0.0251	2.4	3.08
10/21/2003	10	214	7.5		2.5362	0.0247	2.4	3.99
AVERAGE	10.45	232.16	7.72	1.47	2.65	0.07	40.75	3.66

Patapsco River Station PAT0347								
SAMPLE DATE	DO MG /L	CONDUCTIVITY µOMHOS /CM	pH	BOD MG /L	TN MG /L	TP MG /L	TSS MG /L	CHLOROPHYLL µG /L
10/13/1999	10.1	224	7.7	2	2.4213	0.0649	3.7	0.7
10/26/1999	10.8	257	7.4	3.9	2.5945	0.0266	2.4	0.924
11/16/1999	11.1	188	7.3	1.5	1.943	0.0305	4.6	11.9
11/30/1999	11.8	277	8.2	1	2.559	0.0275	2.4	2.59
12/14/1999	11.8	208	7.3		2.6967	0.0645	7	8.96
1/11/2000	12.5	186	7	3.6	3.093	0.07	17	5.88
1/24/2000	14.5	199	8	0.1	3.6774	0.0166	2.4	0.924
2/23/2000	12.9	227	7.9	3.8	3.0058	0.0258	2.4	2.52
2/29/2000	12.1	191	7.2	2	2.7557	0.0497	9.2	5.04
3/15/2000	13.3	214	8.2	3.6	3.0969	0.0216	2.6	4.34
4/12/2000	11.8	202	8.2	0.4	2.6646	0.0152	2.4	3.92
5/10/2000	8.6	221	7.8	4.2	2.72	0.0283	9.1	6.86
5/24/2000	9	194	7.5	1.9	2.78	0.0563	17.6	6.24
6/20/2000	9	80	7.8	2.1	2.803	0.0605	22	
8/9/2000	7.4	237	7.6	2.6	2.47	0.092	14	1.96
9/7/2000	9.1	233	7.7	1.2	2.6956	0.0771	22	1.96
10/2/2002	7.9	291	7.6		1.9415	0.1016	3.2	1.12
10/22/2002	10.4	314	7.5		2.9844	0.0419	2.5	1.575
11/13/2002	10.1	242	7.4		2.168	0.0695	12.7	6.96
12/3/2002	13.7	269	7.5		3.1279	0.0297	2.4	0.56
12/17/2002	13.4	242	7.1				4.2	1.54
1/7/2003	13.4	300	7.1		3.0577	0.0587	7.4	2.24
1/22/2003	13.6	273	7.1		3.9773	0.0297	4.3	0.84
2/4/2003	12.8	247	7.7		3.722	0.0364	4	4.48
3/4/2003	14.1	248	7.6		2.9681	0.0495	8.9	1.96
3/18/2003	11.8	205	7.8		2.9603	0.0273	5	3.465
3/31/2003	12.6	214	7.7		2.547	0.0372	9	14
4/22/2003	9.4	221	8.2		3.0046	0.016	2.4	6.24
5/6/2003	10.8	223	7.8		3.1951	0.0227	5.1	7.8
5/20/2003	9.8	203	7.5		2.47	0.0376	14.9	7
6/3/2003	9.1	200	7.6		2.4477	0.0404	16	2.4
6/17/2003	8.6	199	7.6		2.5995	0.0358	12.6	4.06
6/24/2003	9.1	192	7.5		2.602	0.0399	17.7	4.9
7/8/2003	8	208	7.5		2.7491	0.0478	7	2.415
7/22/2003	7.7	221	7.5		3.0422	0.0369	2.4	1.96
8/5/2003	7.8	224	7.5		3.1513	0.035	3.4	1.68
8/19/2003	8.4	210	7.6		2.4947	0.0276	4.5	0.98
8/26/2003	8	247	7.6		3.0582	0.0408	2.4	3.024

Patapsco River Station PAT0347								
SAMPLE DATE	**DO MG /L**	**CONDUCTIVITY µOMHOS /CM**	**pH**	**BOD MG /L**	**TN MG /L**	**TP MG /L**	**TSS MG /L**	**CHLOROPHYLL µG /L**
9/9/2003	8.8	219	7.8		2.8212	0.0321	4.8	1.82
9/23/2003	8.2	117	7.5		4.63	1.0993	1250	15.12
10/7/2003	9.9	214	7.5		3.0519	0.0316	2.4	3.5
10/21/2003	10.1	210	7.4		2.7852	0.0244	2.4	3.99
AVERAGE	10.55	221.21	7.60	2.26	2.87	0.07	36.96	4.15

Appendix C - MDE Permits, June 2004
Patapsco Lower North Branch In Howard County

FACILITY TYPE	NAME	MD PERMIT	NPDES	CITY
GENERAL OIL CONTAM GW REM PER	BP STATION #00809	2004-OGR-6947	MDG916947	ELLICOTT CITY
GENERAL TERMINAL DISCHARGE	PARKER FUEL CO. INC.	2003-OGT-2564	MDG342564	ELLICOTT CITY
SURFACE INDUSTRIAL DISCHARGE	BALTIMORE AIRCOIL COMPANY	00DP1967	MD0059374	JESSUP
	NEW CUT LANDFILL	02DP3262	MD0068039	ELLICOTT CITY
	DEEP RUN WWTP	01DP1589	MD0056618	ELKRIDGE
GENERAL PERMITS	BELMONT CONFERENCE CENTER	01SI6607	MDG766007	ELKRIDGE
	BON SECOURS SPIRITUAL CENTER	01SI6687	MDG766687	MARRIOTTSVILLE
	CHARLESTON MANOR	01SI6673A	MDG766673	ELLICOTT CITY
	DEEP RUN MOBILE HOME PARK	01SI6768	MDG766768	ELKRIDGE
	DOMINION GREAT OAKS	01SI6484	MDG766484	ELLICOTT CITY
	FOREST HILL SWIM & TENNIS CLUB	01SI6744	MDG766744	ELLICOTT CITY
	GROVES AT ORCHARD CLUB CONDOMINIUM	01SI6734A	MDG766734	ELKRIDGE
	HOWARD COUNTY FAMILY YMCA	01SI6003	MDG766003	ELLICOTT CITY
	MARYLAND SCHOOL FOR THE DEAF - COLUMBIA	01SI6063	MDG766063	COLUMBIA
	NEW CUT LANDFILL	00HT9428		ELLICOTT CITY
	NORTH ST. JOHNS SWIM & TENNIS CLUB	01SI6340	MDG766340	ELLICOTT CITY
	ORCHARD CLUB APARTMENTS	01SI6311	MDG766311	ELKRIDGE
	ROCKVILLE FUEL & FEED COMPANY - PLANT 5	00MM9770	MDG499770	ELKRIDGE
	ROGER CARTER RECREATION CENTER POOL	01SI6801	MDG766801	ELLICOTT CITY
	SHERWOOD CROSSING APARTMENTS	01SI6772	MDG766772	ELKRIDGE
	THE HEARTLANDS SENIOR LIVING VILLAGE	01SI6052	MDG766052	ELLICOTT CITY
	TOWN & COUNTRY - GREENSVIEW	01SI6407	MDG766407	ELLICOTT CITY
	TOWN & COUNTRY - WEST	01SI6406	MDG766406	ELLICOTT CITY
	VILLAGE OF MONTGOMERY RUN CONDO	01SI6611	MDG766611	ELLICOTT CITY
	WATERMONT SWIM CLUB	01SI6385	MDG766385	ELKRIDGE
	WOODLAND RECREATION CENTER	01SI6642	MDG766642	ELLICOTT CITY

Appendix C - MDE Permits, June 2004
Patapsco Lower North Branch In Howard County

FACILITY TYPE	NAME	MD PERMIT	NPDES	CITY
GENERAL INDUSTRIAL STORMWATER	ABF FREIGHT SYSTEM, INC.	02SW0559		ELKRIDGE
	BALTIMORE REGIONAL YARD DEBRIS COMPOSTING	02SW1291		JESSUP
	BELT'S DISTRIBUTION CENTER	02SW0996		ELKRIDGE
	C. R. DANIELS, INC.	02SW0023		ELLICOTT CITY
	CALTON CARS & PARTS	02SW1446		ELKRIDGE
	EUROPARTS EXPRESS	02SW1723		JESSUP
	HANSON PIPE & PRODUCTS, INC.	02SW0992		JESSUP
	MARYLAND RECYCLE CO. OF ELKRIDGE, INC.	02SW1256		ELKRIDGE
	MAYER BROTHERS, INC.	02SW0881		ELKRIDGE
	OLD DOMINION FREIGHT LINE, INC.	02SW1791		ELKRIDGE
	OVERNITE TRANSPORTATION COMPANY	02SW0985		BALTIMORE
	PJAX, INC.	02SW0616		ELKRIDGE
	WASTE MANAGEMENT OF MARYLAND - BALTIMORE	02SW0619		ELKRIDGE

Appendix D - Sensitive Species
Patapsco River Lower North Branch Watershed In Maryland

EXPLANATION OF RANK AND STATUS CODES

As of January 2003, the global and state ranking system is used by all 50 state Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species as well as the status within portions of the species' range. The primary criterion used to define these ranks are the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the state as well as regional level.

Blank means that no rank or status is assigned – all categories.

GLOBAL RANK

- G1 Highly globally rare. Critically imperiled globally because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
- G2 Globally rare. Imperiled globally because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
- G3 Either very rare and local throughout its range or distributed locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; typically with 21 to 100 estimated occurrences.
- G4 Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.
- G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.
- GH No known extant occurrences (i.e., formerly part of the established biota, with the expectation that it may be rediscovered).
- GU Possibly in peril range-wide, but its status is uncertain; more information is needed.
- GX Believed to be extinct throughout its range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.
- G? The species has not yet been ranked.
- _Q Species containing a "Q" in the rank indicates that the taxon is of questionable or uncertain taxonomic standing (i.e., some taxonomists regard it as a full species, while others treat it at an infraspecific level).
- _T Ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

STATE RANK

S1 Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation. Species with this rank are actively tracked by the Natural Heritage Program.

S2 State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Species with this rank are actively tracked by the Natural Heritage Program.

S3 Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by the Natural Heritage Program.

S3.1 A species that is actively tracked by the Natural Heritage Program because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long term security of the species. Therefore, its status in the State is being monitored.

S4 Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.

S5 Demonstrably secure in Maryland under present conditions.

SA Accidental or considered to be a vagrant in Maryland.

SE Established, but not native to Maryland; it may be native elsewhere in North America.

SH Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.

SP Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).

SR Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).

SRF Reported falsely (in error) from Maryland, and the error may persist in the literature.

SU Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the State. Uncertainty spans a range of 4 or 5 ranks as defined above.

SX Believed to be extirpated in Maryland with virtually no chance of rediscovery.

SYN Currently considered synonymous with another taxon and, therefore, not a valid entity.

SZ A migratory species which does not inhabit specific locations for long periods of time.

S? The species has not yet been ranked.

-B This species is migratory and the rank refers only to the breeding status of the species. Such a migrant may have a different rarity rank for non-breeding populations.

-N This species is migratory and the rank refers only to the non-breeding status of the species. Such a migrant may have a different rarity rank for breeding populations.

STATE STATUS

This is the status of a species as determined by the Maryland Department of Natural Resources, in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

- E Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.
- I In Need of Conservation; an animal species whose population is limited or declining in the State such that it may become threatened in the foreseeable future if current trends or conditions persist.
- T Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the State.
- X Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.
- * A qualifier denoting the species is listed in a limited geographic area only.
- PE Proposed Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.
- PT Proposed Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the State.
- PX Proposed Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.
- PD Proposed to be deleted or removed from the State Threatened & Endangered Species list.

FEDERAL STATUS

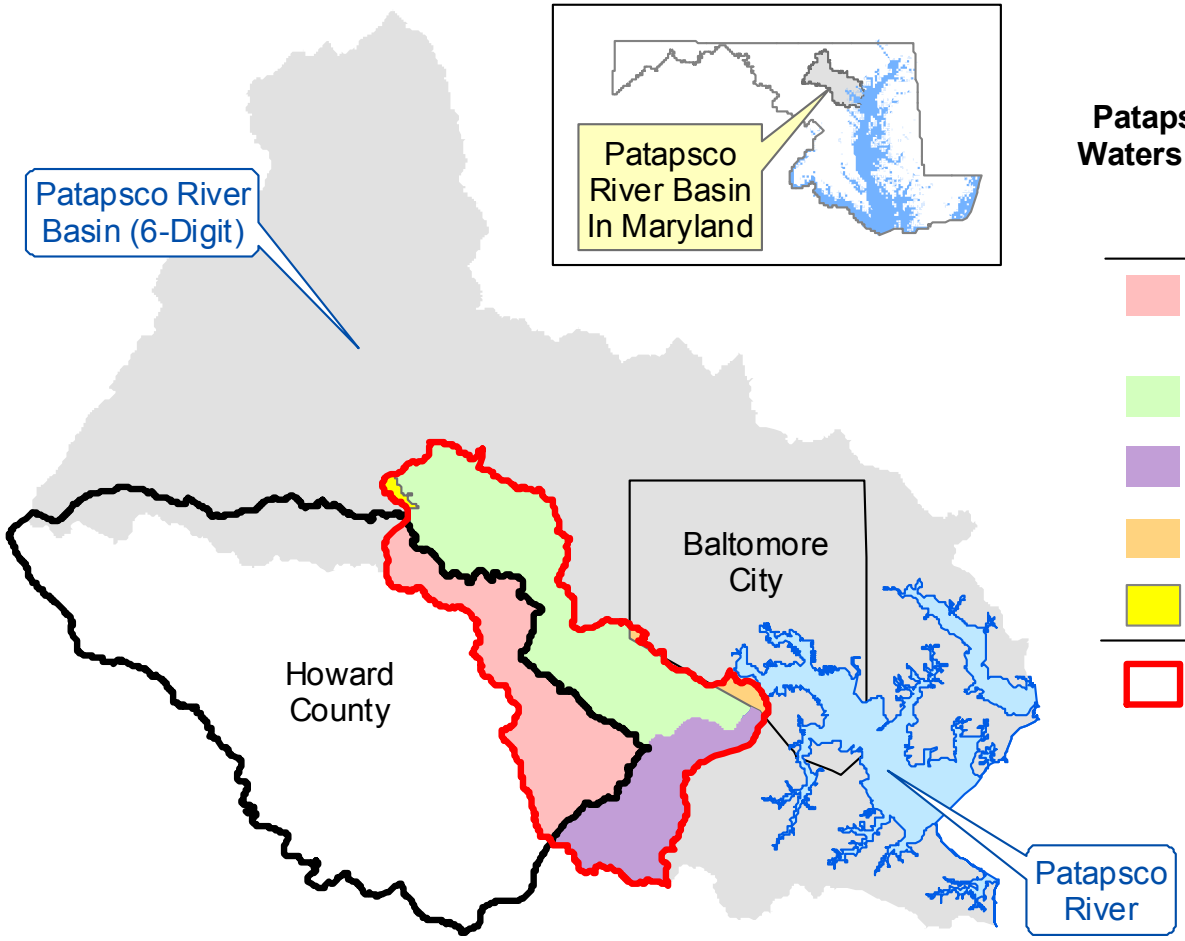
This is the status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CRF 17.

- LE Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.
- LT Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
- PE Taxa proposed to be listed as endangered.
- PT Taxa proposed to be listed as threatened.
- C Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

Sensitive Species, Patapsco River Lower North Branch 02130906 – January 2004
Current/Historical Rare, Threatened, and Endangered Species, DNR Natural Heritage Prog.

Scientific name	Common name	G-rank	S-rank	MD	US
Agastache scrophulariifolia	Purple giant hyssop	G4	S1S2	T	
Agrimonia microcarpa	Small-fruited agrimony	G5	SU		
Arabis missouriensis	Missouri rockcress	G4G5Q	S1	E	
Aristida lanosa	Woolly three-awn	G5	S1	E	
Arundinaria gigantea	Giant cane	G5	S2		
Bromus latiglumis	Broad-glumed brome	G5	S1	E	
Carex sparganioides	Burr-reed sedge	G5	S1S2		
Chenopodium standleyanum	Standley's goosefoot	G5	S1	E	
Desmodium pauciflorum	Few-flowered tick-trefoil	G5	S1	E	
Diplazium pycnocarpon	Glade fern	G5	S2	T	
Dirca palustris	Leatherwood	G4	S2	T	
Dryopteris celsa	Log fern	G4	S3.1	T	
Gentiana villosa	Striped gentian	G4	S1	E	
Geum aleppicum	Yellow avens	G5	S1	E	
Helianthus microcephalus	Small-headed sunflower	G5	S1	E	
Helonias bullata	Swamp pink	G3	S2	E	LT
Hydrastis canadensis	Goldenseal	G4	S2	T	
Juglans cinerea	Butternut	G3G4	S2S3		
Juncus torreyi	Torrey's rush	G5	S1	E	
Lygodium palmatum	Climbing fern	G4	S2	T	
Matelea obliqua	Climbing milkweed	G4?	S1	E	
Matteuccia struthiopteris	Ostrich fern	G5	S2		
Phlox pilosa	Downy phlox	G5	S1	E	
Platanthera peramoena	Purple fringeless orchid	G5	S1	T	
Polanisia dodecandra	Clammyweed	G5	S1	E	
Polygala senega	Seneca snakeroot	G4G5	S2	T	
Potamogeton foliosus	Leafy pondweed	G5	S1	E	
Prunus pumila	Eastern dwarf cherry	G5	SU		
Pycnanthemum torrei	Torrey's mountain-mint	G2	S1	E	
Saccharum alopecuroidum	Woolly beardgrass	G5	S1?		
Scutellaria galericulata	Common skullcap	G5	S1		
Scutellaria leonardii	Leonard's skullcap	G4T4	S2	T	
Smilax pseudochina	Halberd-leaved greenbrier	G4G5	S2	T	
Solidago speciosa	Showy goldenrod	G5	S2	T	
Stygobromus pizzinii	Pizzini's amphipod	G2G4	S1		
Thaspium trifoliatum	Purple meadow-parsnip	G5	S1	E	
Thelypteris simulata	Bog fern	G4G5	S2	T	
Trillium flexipes	Drooping trillium	G5	S1	E	
Triosteum angustifolium	Narrow-leaved horse-gentian	G5	S1	E	
Vitis cinerea	Graybark	G4G5	SU		

Map 1 Location: Patapsco River Lower North Branch WRAS Project Area In Howard County



Patapsco River Lower North Branch Watershed Area By Local Jurisdiction

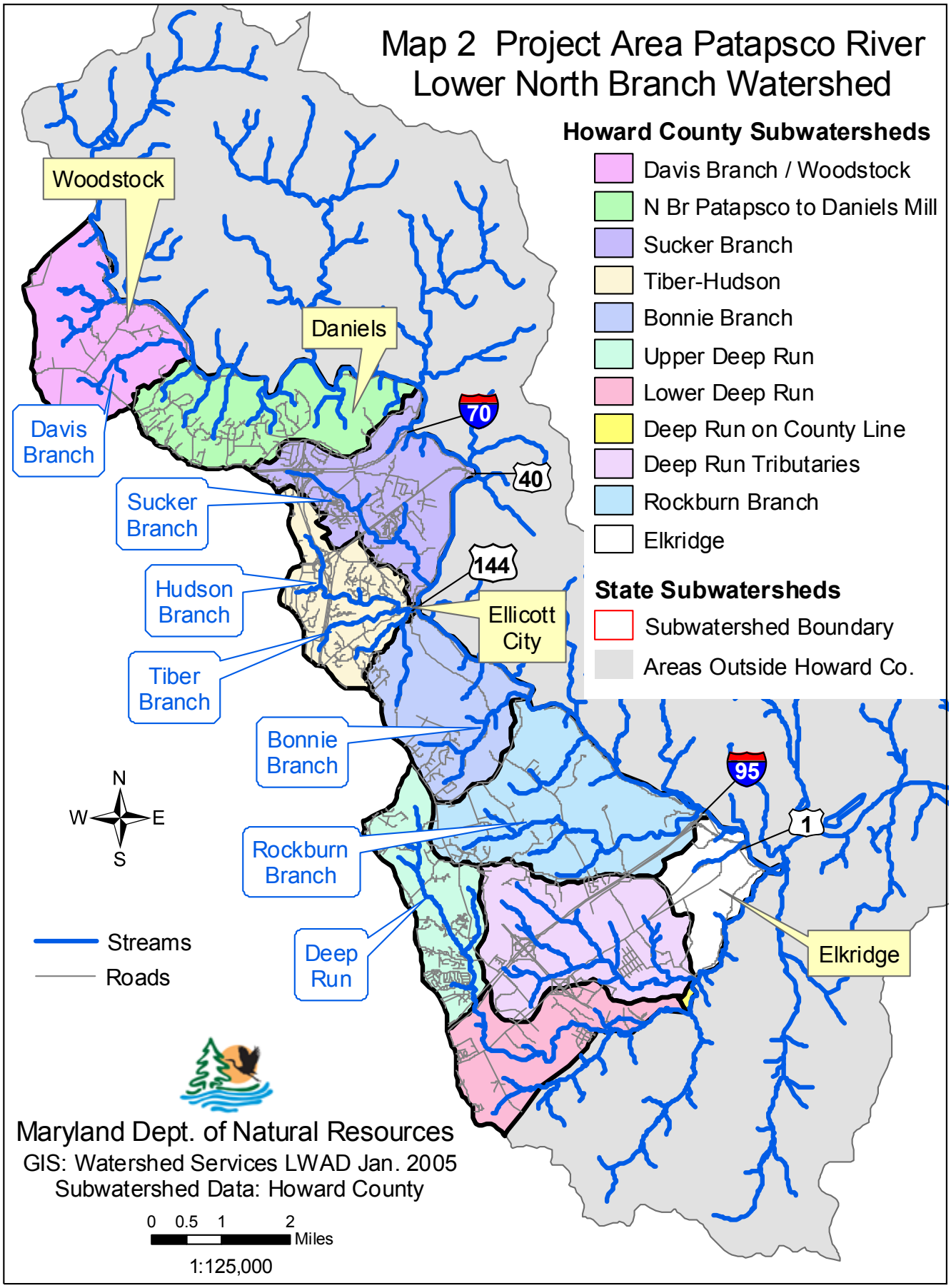
Location	Square Miles
Howard County WRAS Project Area	38.
Baltimore County	53.7
Anne Arundel County	23.7
Baltimore City	2.
Carroll County	0.6
Patapsco River Lower North Branch Total Watershed	118.

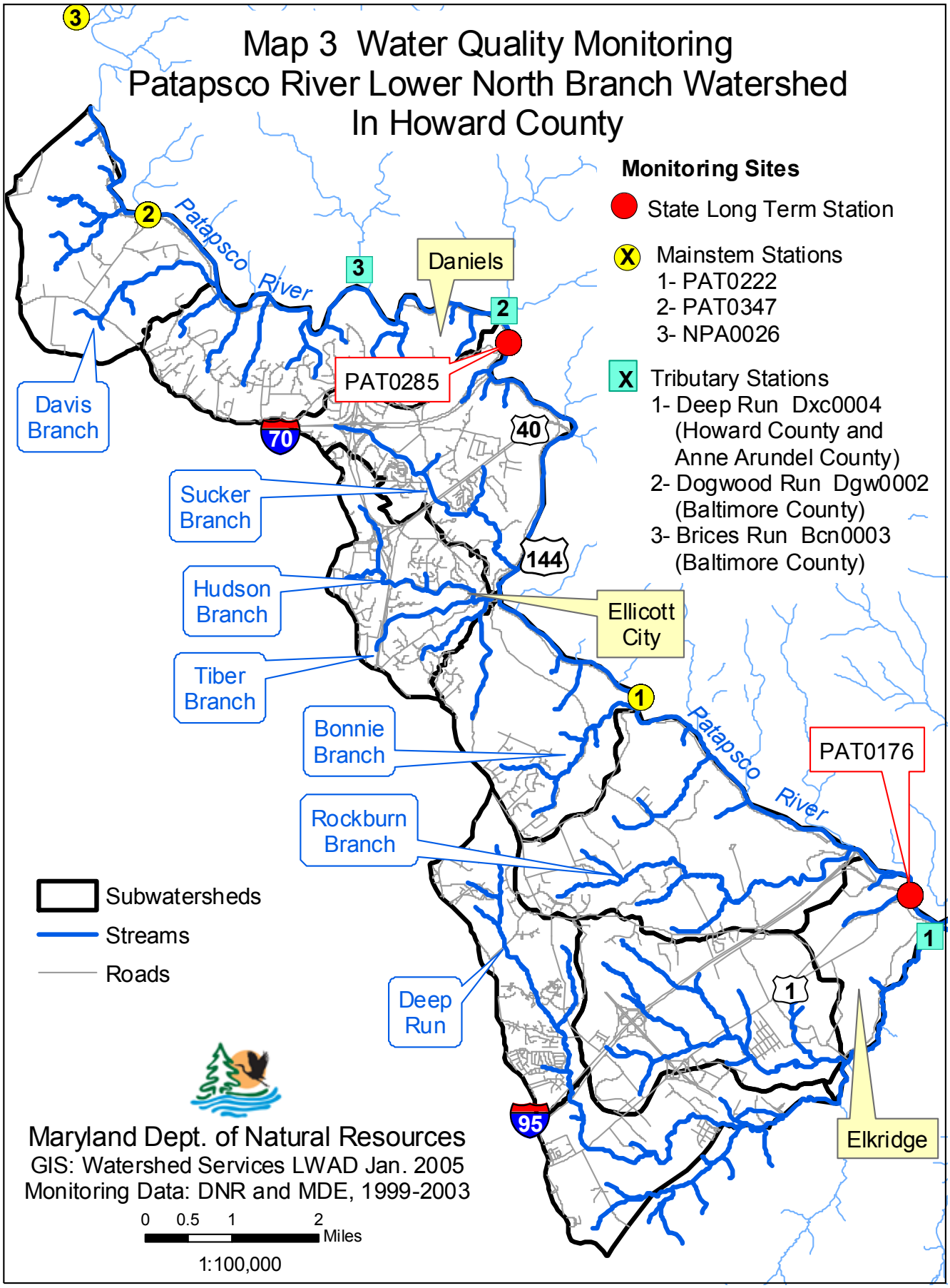
N
W E
S

0 2 4 8 12 16 Miles

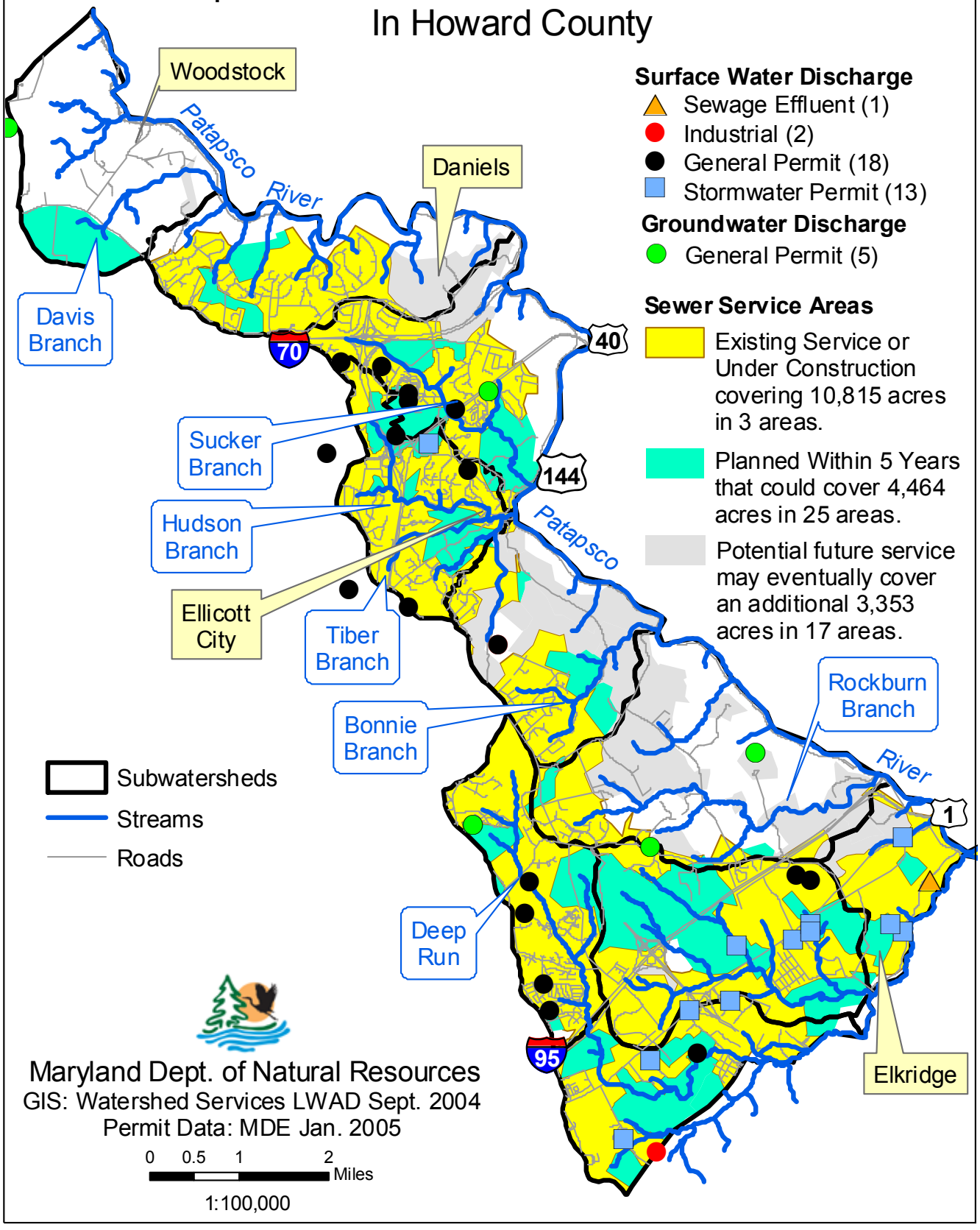
1:500,000

Maryland Dept. of Natural Resources
Watershed Services LWAD
January 2005


Map 2 Project Area Patapsco River
Lower North Branch Watershed
Howard County Subwatersheds
Davis Branch / Woodstock
N Br Patapsco to Daniels Mill
Sucker Branch
Tiber-Hudson
Bonnie Branch
Upper Deep Run
Lower Deep Run
Deep Run on County Line
Deep Run Tributaries
Rockburn Branch
Elkridge
State Subwatersheds
Subwatershed Boundary
Areas Outside Howard Co.
Woodstock
Daniels
Davis Branch
Sucker Branch
Hudson Branch
Tiber Branch
Bonnie Branch
Rockburn Branch
Deep Run
Ellicott City
Elkridge
70
40
144
95
1
N
W
E
S
Streams
Roads
Maryland Dept. of Natural Resources
GIS: Watershed Services LWAD Jan. 2005
Subwatershed Data: Howard County
0 0.5 1 2
Miles
1:125,000


Map 3 Water Quality Monitoring
Patapsco River Lower North Branch Watershed
In Howard County
Monitoring Sites
State Long Term Station
Mainstem Stations
1- PAT0222
2- PAT0347
3- NPA0026
Tributary Stations
1- Deep Run Dxc0004
(Howard County and
Anne Arundel County)
2- Dogwood Run Dgw0002
(Baltimore County)
3- Brices Run Bcn0003
(Baltimore County)
Patapsco River
Daniels
PAT0285
Davis Branch
Sucker Branch
Hudson Branch
Tiber Branch
Bonnie Branch
Rockburn Branch
Deep Run
Ellicott City
PAT0176
Elkridge
70
40
144
95
1
Subwatersheds
Streams
Roads
Maryland Dept. of Natural Resources
GIS: Watershed Services LWAD Jan. 2005
Monitoring Data: DNR and MDE, 1999-2003
0 0.5 1 2
Miles
1:100,000

Map 4 MDE Permits And Local Sewer Service Patapsco River Lower North Branch Watershed In Howard County

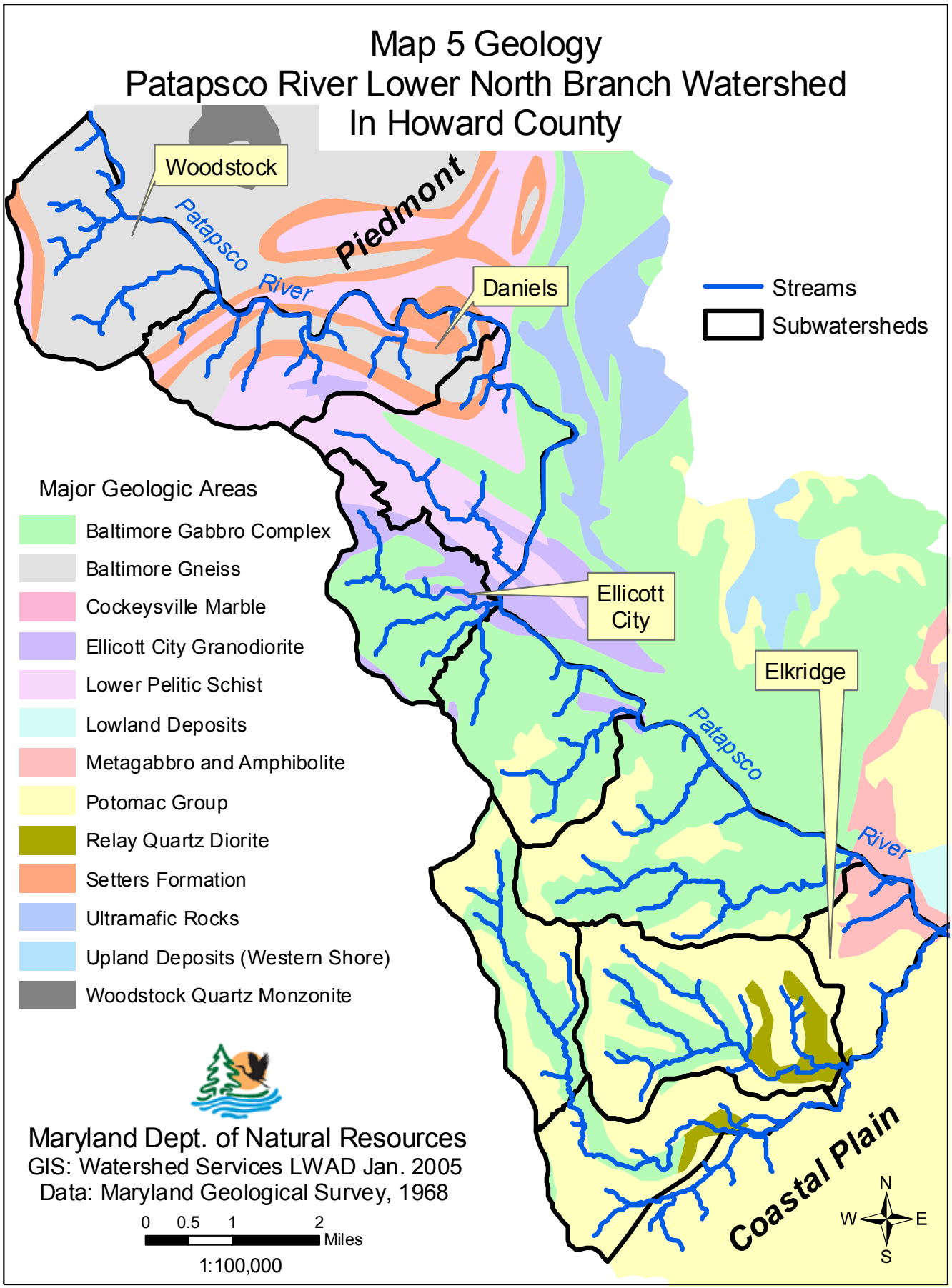


Maryland Dept. of Natural Resources
GIS: Watershed Services LWAD Sept. 2004
Permit Data: MDE Jan. 2005

0 0.5 1 2 Miles

1:100,000

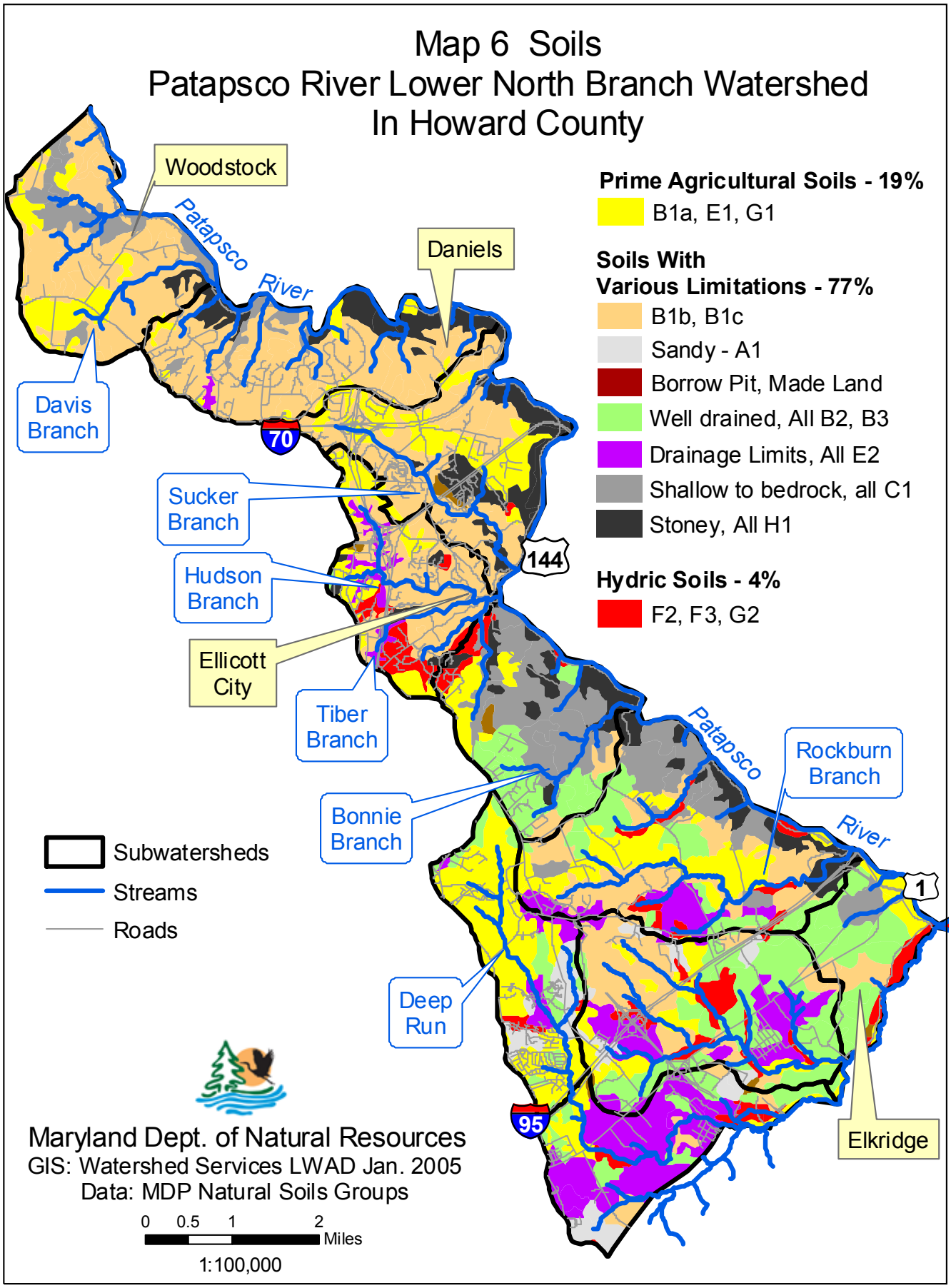
Map 5 Geology
Patapsco River Lower North Branch Watershed
In Howard County



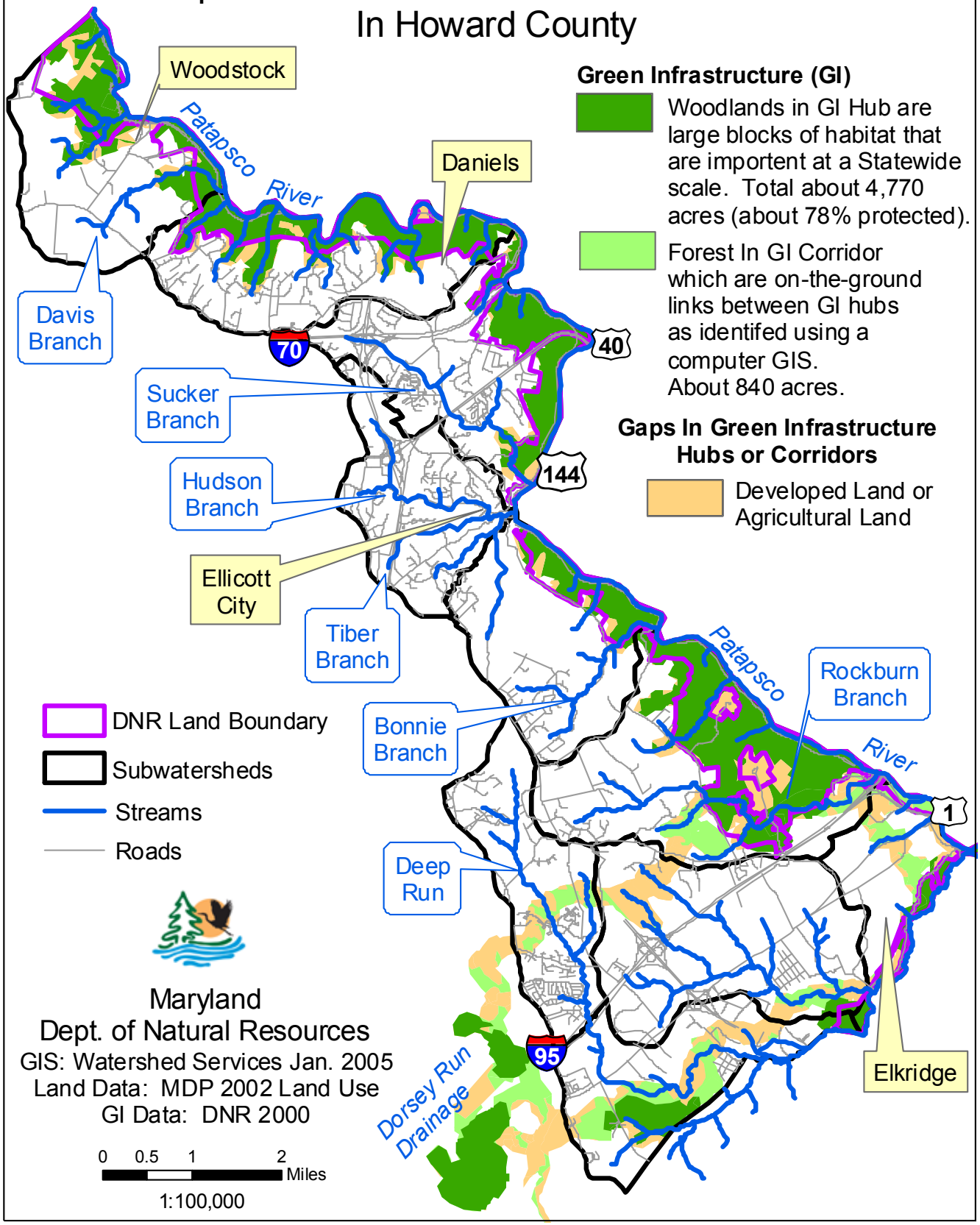
Maryland Dept. of Natural Resources
GIS: Watershed Services LWAD Jan. 2005
Data: Maryland Geological Survey, 1968

0 0.5 1 2 Miles

1:100,000


Map 6 Soils
Patapsco River Lower North Branch Watershed
In Howard County
Woodstock
Patapsco River
Daniels
Davis Branch
70
Sucker Branch
Hudson Branch
144
Ellicott City
Tiber Branch
Patapsco River
Rockburn Branch
Bonnie Branch
1
Deep Run
95
Elkridge
Prime Agricultural Soils - 19%
B1a, E1, G1
Soils With Various Limitations - 77%
B1b, B1c
Sandy - A1
Borrow Pit, Made Land
Well drained, All B2, B3
Drainage Limits, All E2
Shallow to bedrock, all C1
Stoney, All H1
Hydric Soils - 4%
F2, F3, G2
Subwatersheds
Streams
Roads
Maryland Dept. of Natural Resources
GIS: Watershed Services LWAD Jan. 2005
Data: MDP Natural Soils Groups
0 0.5 1 2
Miles
1:100,000

Map 7 Green Infrastructure
Patapsco River Lower North Branch Watershed
In Howard County

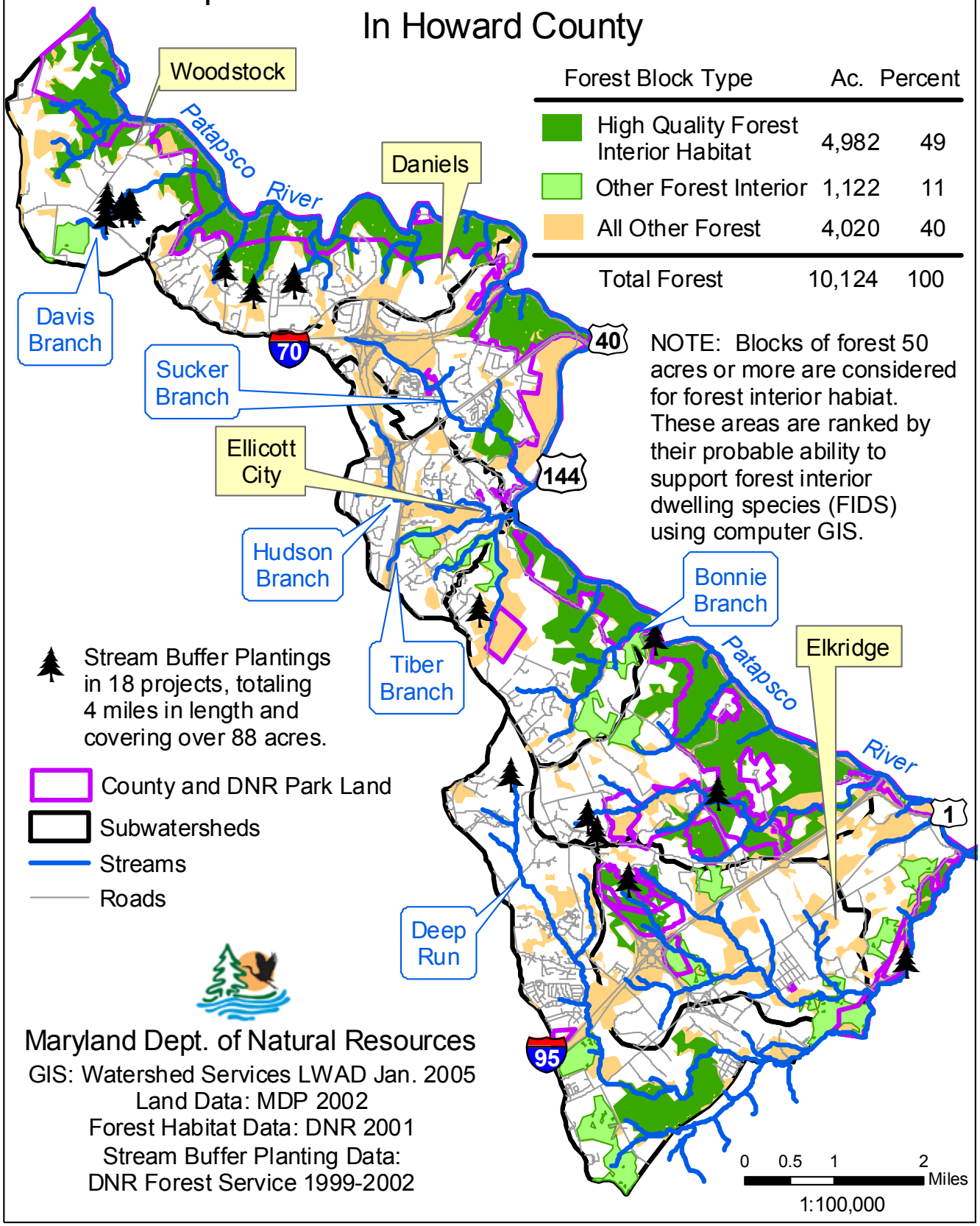


Maryland
Dept. of Natural Resources
GIS: Watershed Services Jan. 2005
Land Data: MDP 2002 Land Use
GI Data: DNR 2000

0 0.5 1 2 Miles

1:100,000

Map 8 Forest Habitat And Stream Buffer Plantings Patapsco River Lower North Branch Watershed In Howard County



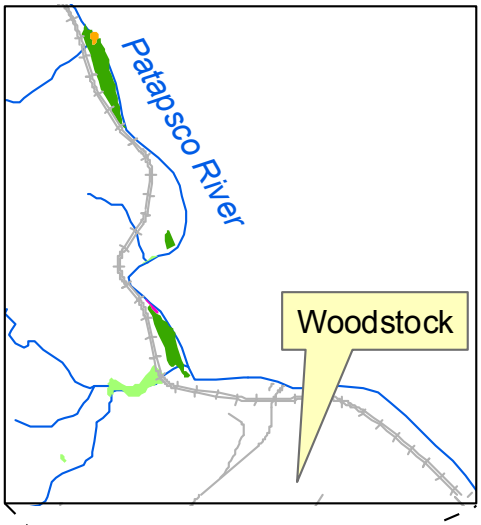
Forest Block Type	Ac.	Percent
High Quality Forest Interior Habitat	4,982	49
Other Forest Interior	1,122	11
All Other Forest	4,020	40
Total Forest	10,124	100

NOTE: Blocks of forest 50 acres or more are considered for forest interior habiat. These areas are ranked by their probable ability to support forest interior dwelling species (FIDS) using computer GIS.

Maryland Dept. of Natural Resources

GIS: Watershed Services LWAD Jan. 2005
Land Data: MDP 2002
Forest Habitat Data: DNR 2001
Stream Buffer Planting Data:
DNR Forest Service 1999-2002

Map 9 Wetlands
Patapsco River Lower North Branch Watershed
In Howard County



Current Wetlands Inventory (Acres)

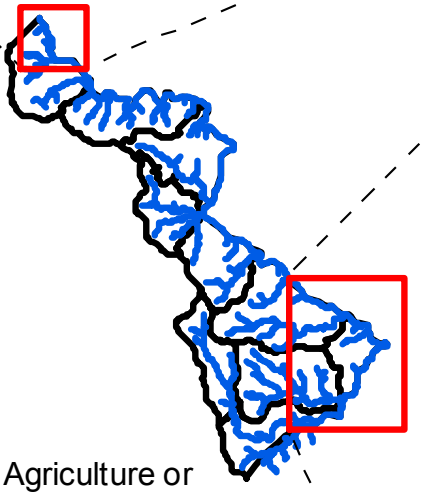
Palustrine Wetlands

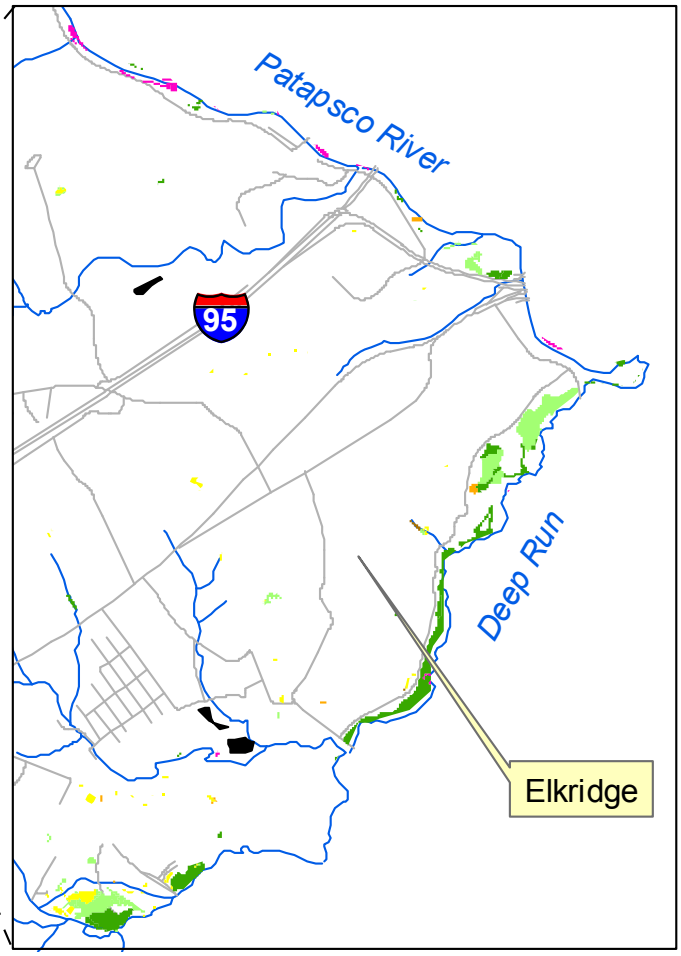
- Emergent (45)
- Forested (75)
- Scrub Shrub (4)
- Unconsolidated Bottom (20)
- Unconsolidated Shore (<1)

Riverine Wetlands

- Unconsolidated Shore (6)

Total - 150 Acres



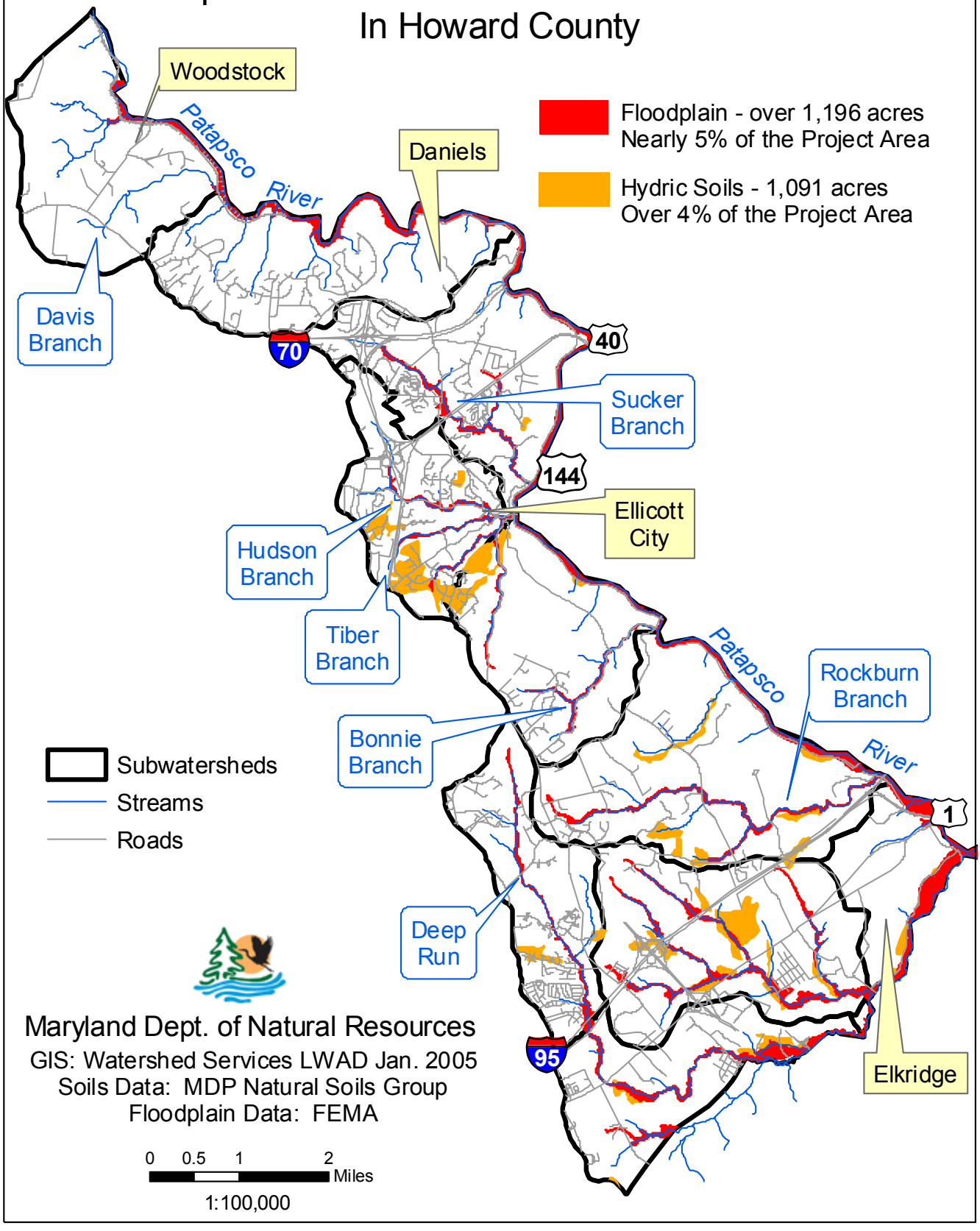


- Agriculture or Barren Land on Hydric Soil
- Subwatersheds
- Streams
- Roads

Maryland Department of Natural Resources

GIS: Watershed Services Jan. 2005
Wetlands Data: DNR Wetlands
Land Data: MDP 2002
Soil Data: MDP 1974

Map 10 Floodplain and Hydric Soils
Patapsco River Lower North Branch Watershed
In Howard County



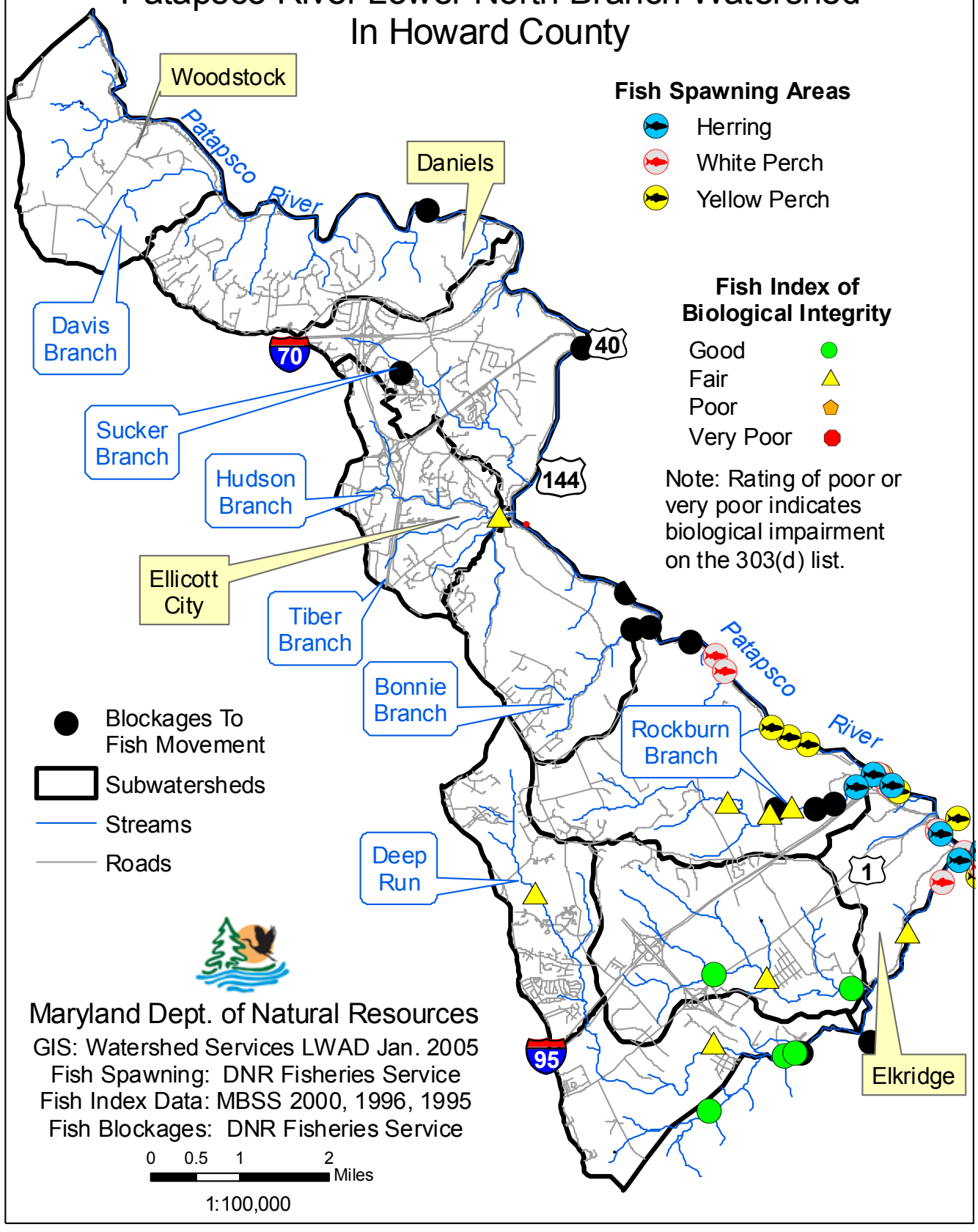
Maryland Dept. of Natural Resources

GIS: Watershed Services LWAD Jan. 2005
Soils Data: MDP Natural Soils Group
Floodplain Data: FEMA

0 0.5 1 2 Miles

1:100,000

Map 11 Fish Spawning, Blockages and MBSS Index
Patapsco River Lower North Branch Watershed
In Howard County



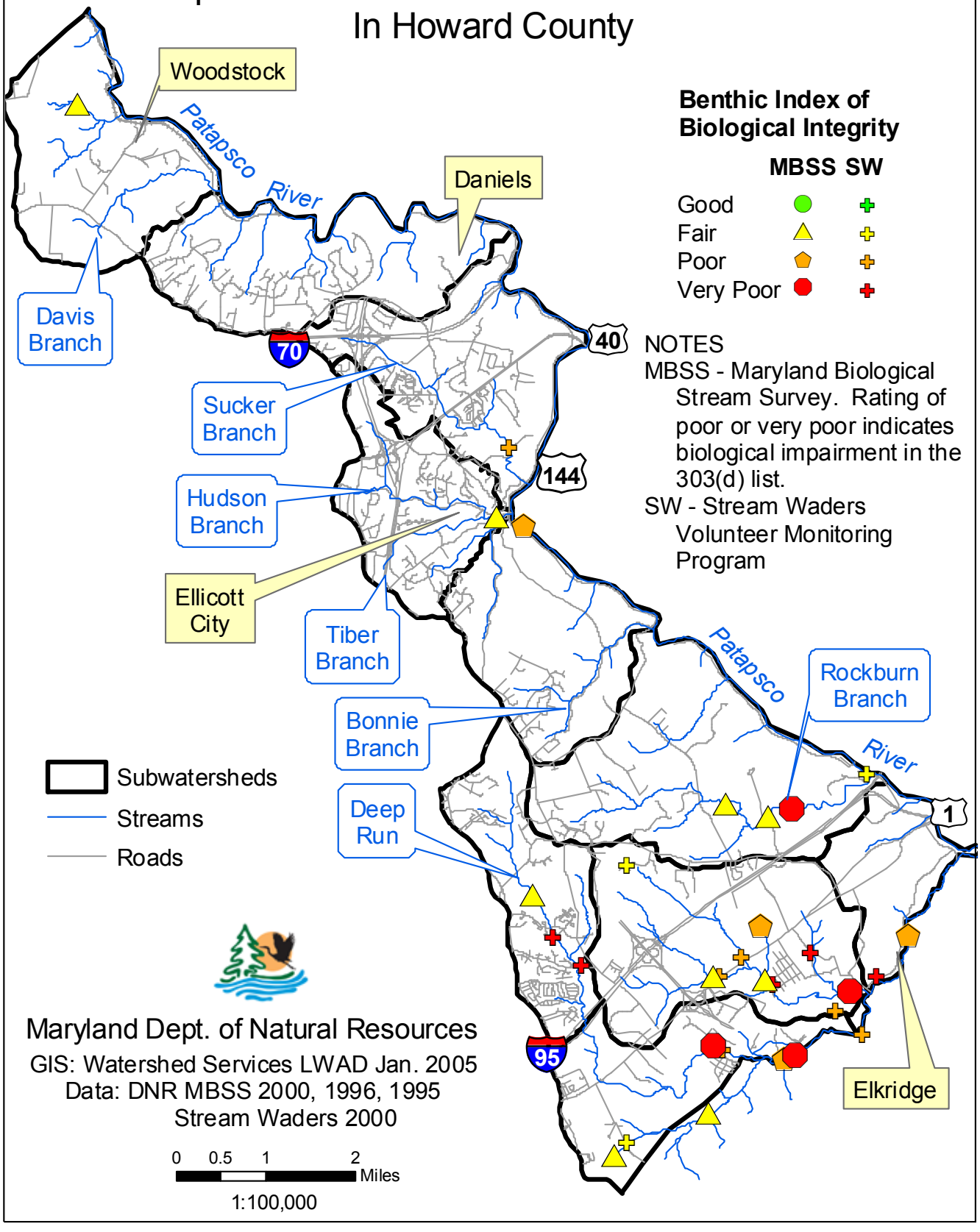
Maryland Dept. of Natural Resources

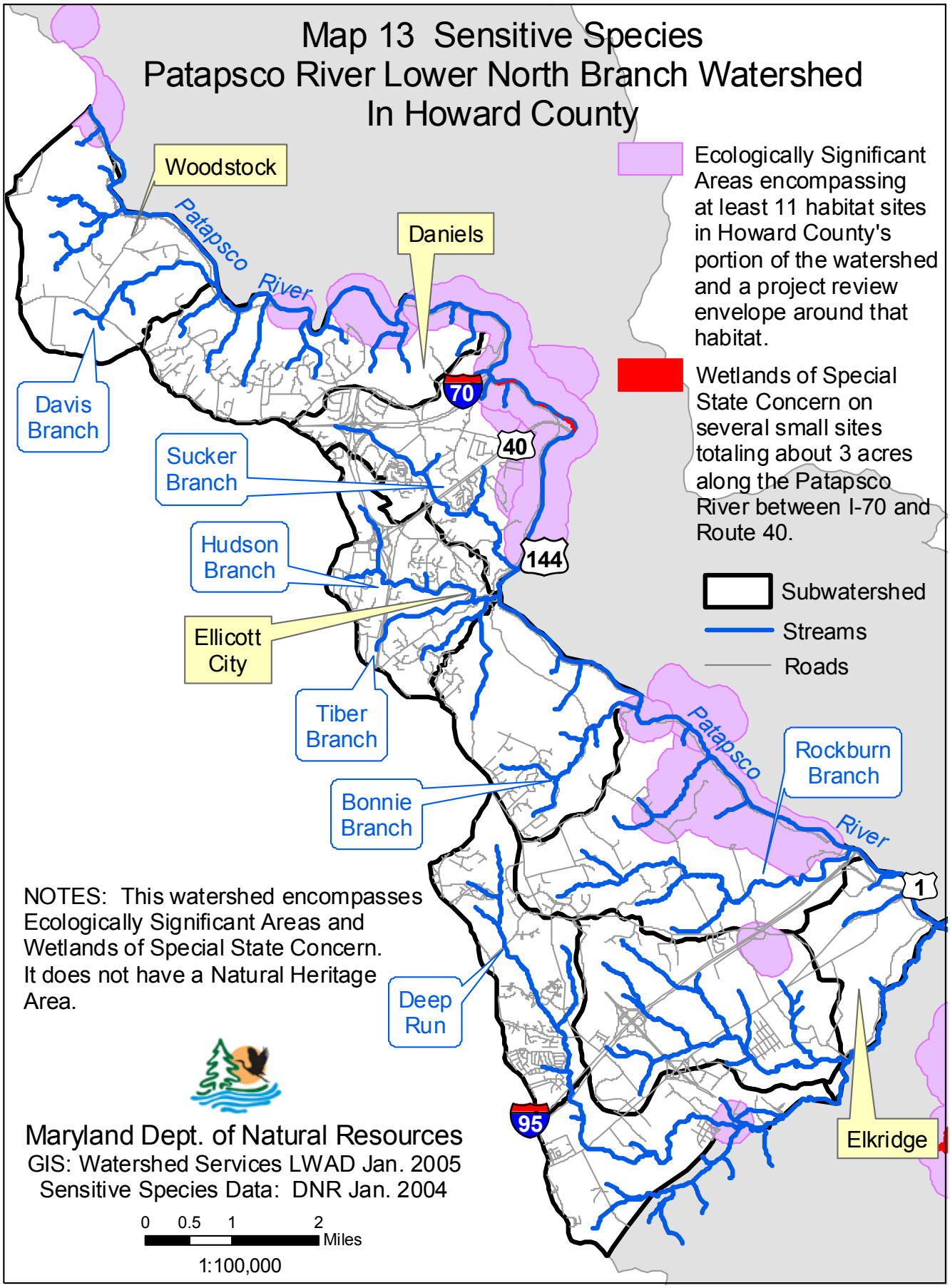
GIS: Watershed Services LWAD Jan. 2005
Fish Spawning: DNR Fisheries Service
Fish Index Data: MBSS 2000, 1996, 1995
Fish Blockages: DNR Fisheries Service

0 0.5 1 2 Miles

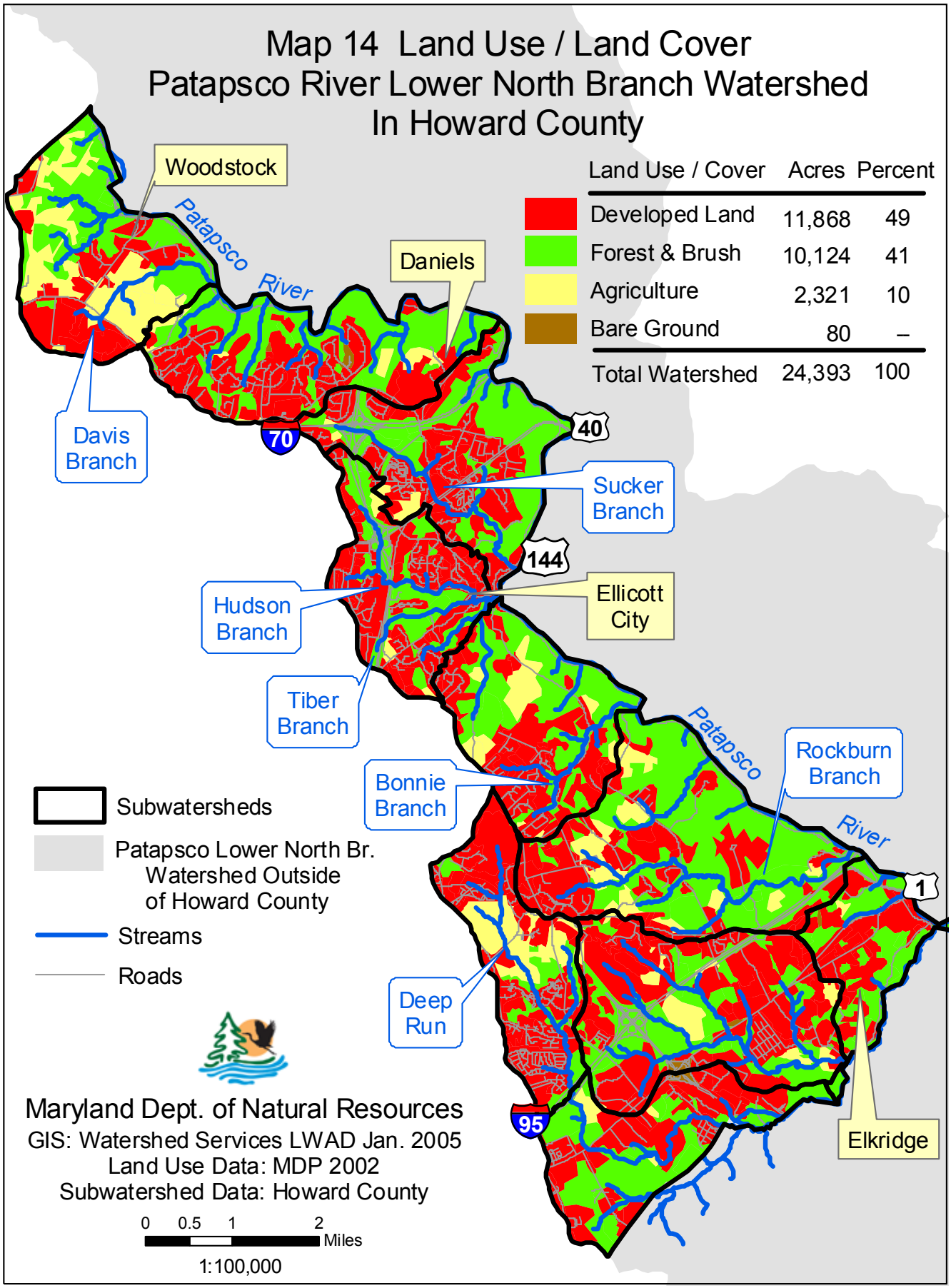
1:100,000

Map 12 Benthos - MBSS Index
Patapsco River Lower North Branch Watershed
In Howard County




Map 13 Sensitive Species
Patapsco River Lower North Branch Watershed
In Howard County
Woodstock
Patapsco River
Daniels
Davis Branch
Sucker Branch
Hudson Branch
Ellicott City
Tiber Branch
Bonnie Branch
Deep Run
Rockburn Branch
Patapsco River
Elkridge
70
40
144
1
95
Ecologically Significant Areas encompassing at least 11 habitat sites in Howard County's portion of the watershed and a project review envelope around that habitat.
Wetlands of Special State Concern on several small sites totaling about 3 acres along the Patapsco River between I-70 and Route 40.
Subwatershed
Streams
Roads
NOTES: This watershed encompasses Ecologically Significant Areas and Wetlands of Special State Concern. It does not have a Natural Heritage Area.
Maryland Dept. of Natural Resources
GIS: Watershed Services LWAD Jan. 2005
Sensitive Species Data: DNR Jan. 2004
0 0.5 1 2
Miles
1:100,000

Map 14 Land Use / Land Cover
Patapsco River Lower North Branch Watershed
In Howard County



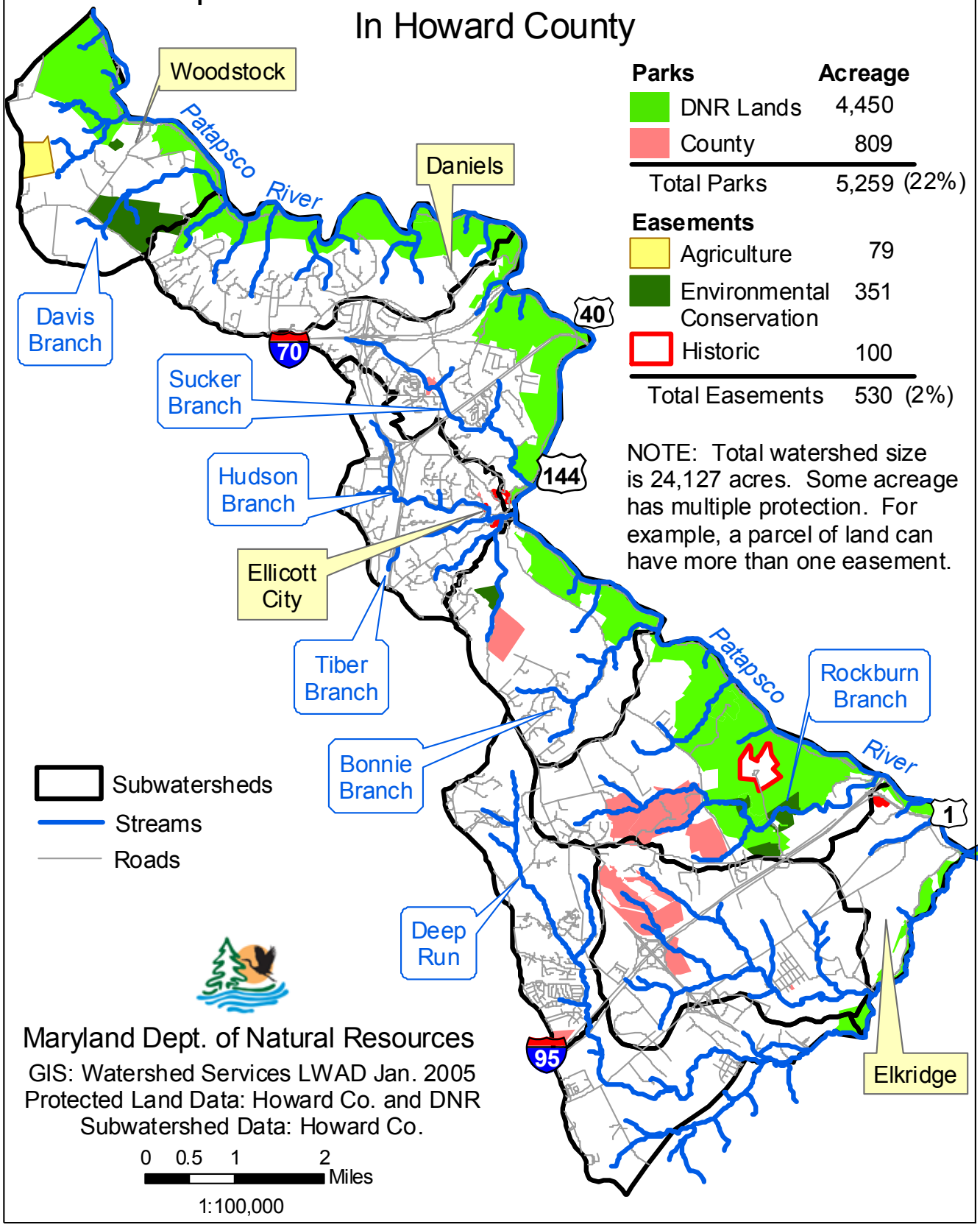
Land Use / Cover	Acres	Percent
Developed Land	11,868	49
Forest & Brush	10,124	41
Agriculture	2,321	10
Bare Ground	80	–
Total Watershed	24,393	100

Maryland Dept. of Natural Resources
GIS: Watershed Services LWAD Jan. 2005
Land Use Data: MDP 2002
Subwatershed Data: Howard County

0 0.5 1 2 Miles

1:100,000

Map 15 Protected Land
Patapsco River Lower North Branch Watershed
In Howard County



Parks	Acreage
DNR Lands	4,450
County	809
Total Parks	5,259 (22%)

Easements	
Agriculture	79
Environmental Conservation	351
Historic	100
Total Easements	530 (2%)

NOTE: Total watershed size is 24,127 acres. Some acreage has multiple protection. For example, a parcel of land can have more than one easement.

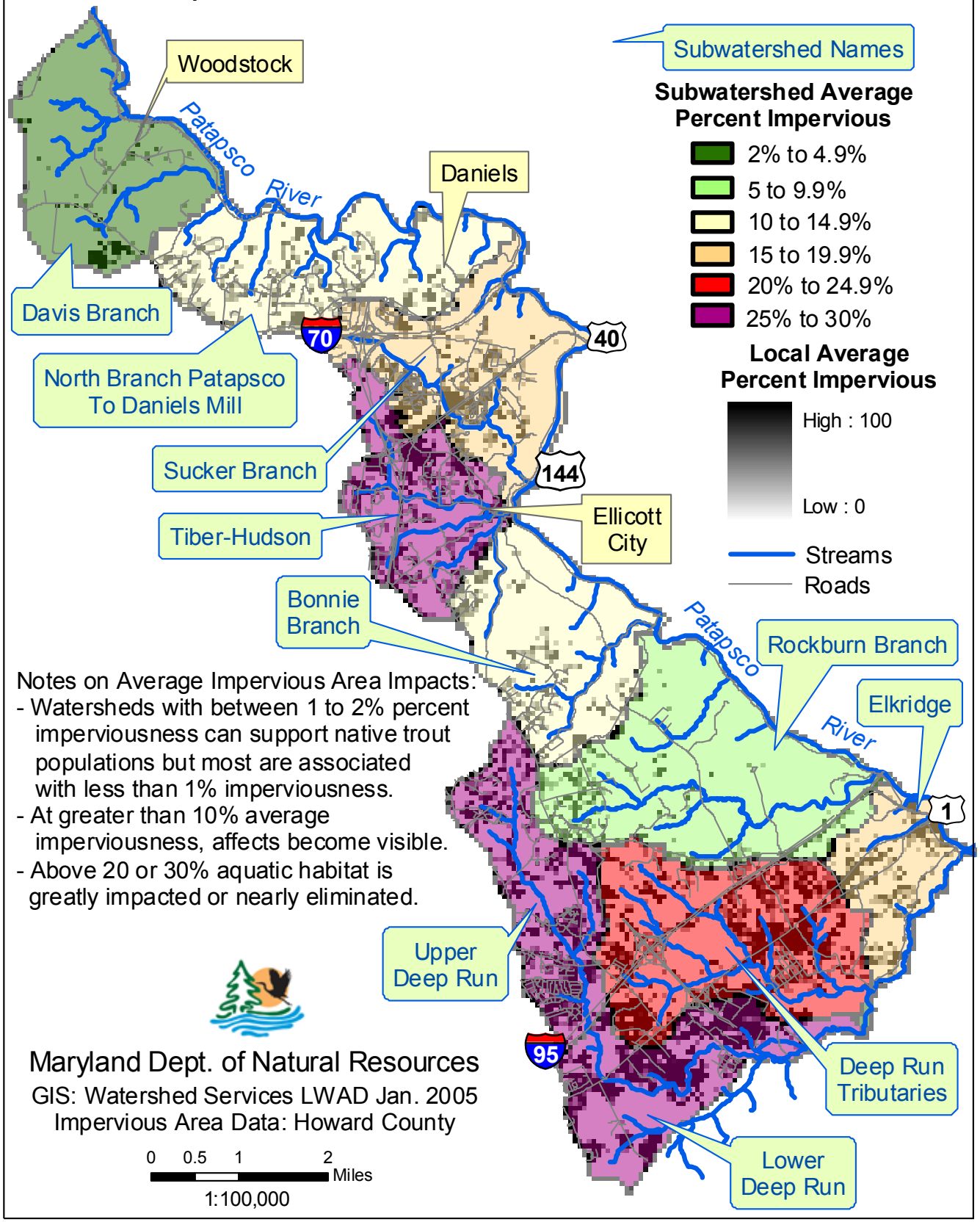
Maryland Dept. of Natural Resources

GIS: Watershed Services LWAD Jan. 2005
Protected Land Data: Howard Co. and DNR
Subwatershed Data: Howard Co.

0 0.5 1 2 Miles

1:100,000

Map 16 Impervious Area In Howard County's Patapsco River Lower North Branch Watershed



Notes on Average Impervious Area Impacts:
- Watersheds with between 1 to 2% percent imperviousness can support native trout populations but most are associated with less than 1% imperviousness.
- At greater than 10% average imperviousness, affects become visible.
- Above 20 or 30% aquatic habitat is greatly impacted or nearly eliminated.

Maryland Dept. of Natural Resources

GIS: Watershed Services LWAD Jan. 2005

Impervious Area Data: Howard County

0 0.5 1 2 Miles

1:100,000