Anne Arundel County Greenways Master Plan

Adopted October 15, 2002

Winner of 2002 Smart Growth Award for Government Innovation
Maryland Economic Growth, Resource Protection and Planning Commission

2002 Award for Outstanding Plan for a Jurisdiction Over 100,000 Population
Maryland Chapter of the American Planning Association

Note

This plan with larger scale color maps and a photographic base can be viewed on Anne Arundel County's internet site at www.aacounty.org. Follow links from the Hot Topics, Department of Recreation and Parks, or from the Office of Planning and Zoning pages.

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Cover picture of Red Fox from the Bay Journal, Alliance for the Chesapeake Bay.

Executive Summary

The purpose of the Anne Arundel County Greenways Master Plan (the Plan) is to provide an identification, decision making, implementation, and management tool for the County's future greenways network. The Plan has a long range, 50 plus year time frame.

Anne Arundel County enjoys a very attractive location on the Chesapeake Bay close to Washington and Baltimore. This location continues to attract many people to live and work and enjoy the high quality of life that is available in the County. Future growth in Anne Arundel County threatens the loss of ecologically valuable land including unspoiled, high-quality landscapes and open space.

The scattered pattern of modern development tends to consume large amounts of land and fragments landscapes. Fragmentation has adverse ecological effects but also has negative effects on the quality of life through the loss of landscape character and scenic beauty, loss of open spaces for people to enjoy, loss of recreational opportunities, and reduced air and water quality. The most effective way to prevent these negative effects in a developed area such as Anne Arundel County is to create an interconnected network of protected open space corridors or greenways. Anne Arundel County's goal for its greenways network, therefore, is to:

> **Create an interconnected network of greenways in Anne Arundel County that protects ecologically valuable lands for present and future generations and provides open space, recreational, and transportation benefits and opportunities for people.**

The benefits of Anne Arundel County's greenways network will be to:

- Enhance the beauty of the County's landscape by reducing the fragmenting effects of development and preserving valuable open space;
- Provide adequate habitat to support healthy populations of a diversity of naturally occurring plant and animal species;
- Help guide the location of development so that negative effects on ecologically valuable lands are minimized;
- Link communities to a countywide network of open space;
- Provide off-road transportation opportunities;
- Increase recreational opportunities;
- Improve water and air quality;
- Improve the economy by maintaining and increasing property values and by attracting visitors;
- Encourage the ethic of stewardship of the land in the County; and
- Help achieve the recommendations of county, regional and state plans and programs including Anne Arundel County's General Development Plan, Land Preservation and Recreation Plan, and Small Area Plans, the Chesapeake 2000 Agreement, and Maryland's Greenprint program.

Three key factors came together and led Anne Arundel County to prepare this Plan:

- The State of Maryland's green infrastructure initiative; a statewide effort by the Maryland Department of Natural Resources (DNR) to identify and protect large, contiguous blocks of ecologically significant natural areas (hubs) and to link them with natural corridors;

- Anne Arundel County's General Development Plan and the recommendations from 12 completed "Small Area" land use and community plans for different parts of the County that included recommendations for greenways and additional bicycle and walking opportunities; and
- Anne Arundel County's land preservation and recreation planning program, especially the recommendations of the current Land Preservation and Recreation Plan.

The Plan takes a primarily ecological approach to defining greenways, but also includes in the proposed greenways network countywide multi-use trails including the East Coast Greenway and the American Discovery Trail.

Greenways were identified by analyzing different mapped information, studies, databases, and aerial photographs of Anne Arundel County to identify areas currently meeting the criteria or areas where greenways could, potentially, be created in the future. The County used five criteria in assessing land as potential greenways: habitat value; size; connections to other land with ecological value; future potential, that is the potential to create greenways where they do not currently exist; and national and countywide trails. Based on the habitat requirements of selected locally occurring native bird, mammal, and amphibian species, a "hub" is defined in the Plan as an ecologically significant natural area of at least 250 acres with a high ratio of interior versus edge habitat. A corridor is a natural area at least 200 feet wide. Under the criteria, hubs and corridors must connect and "dead end" corridors are not included in the network unless the dead end is a large enough to serve as a hub (i.e. at least 250 acres).

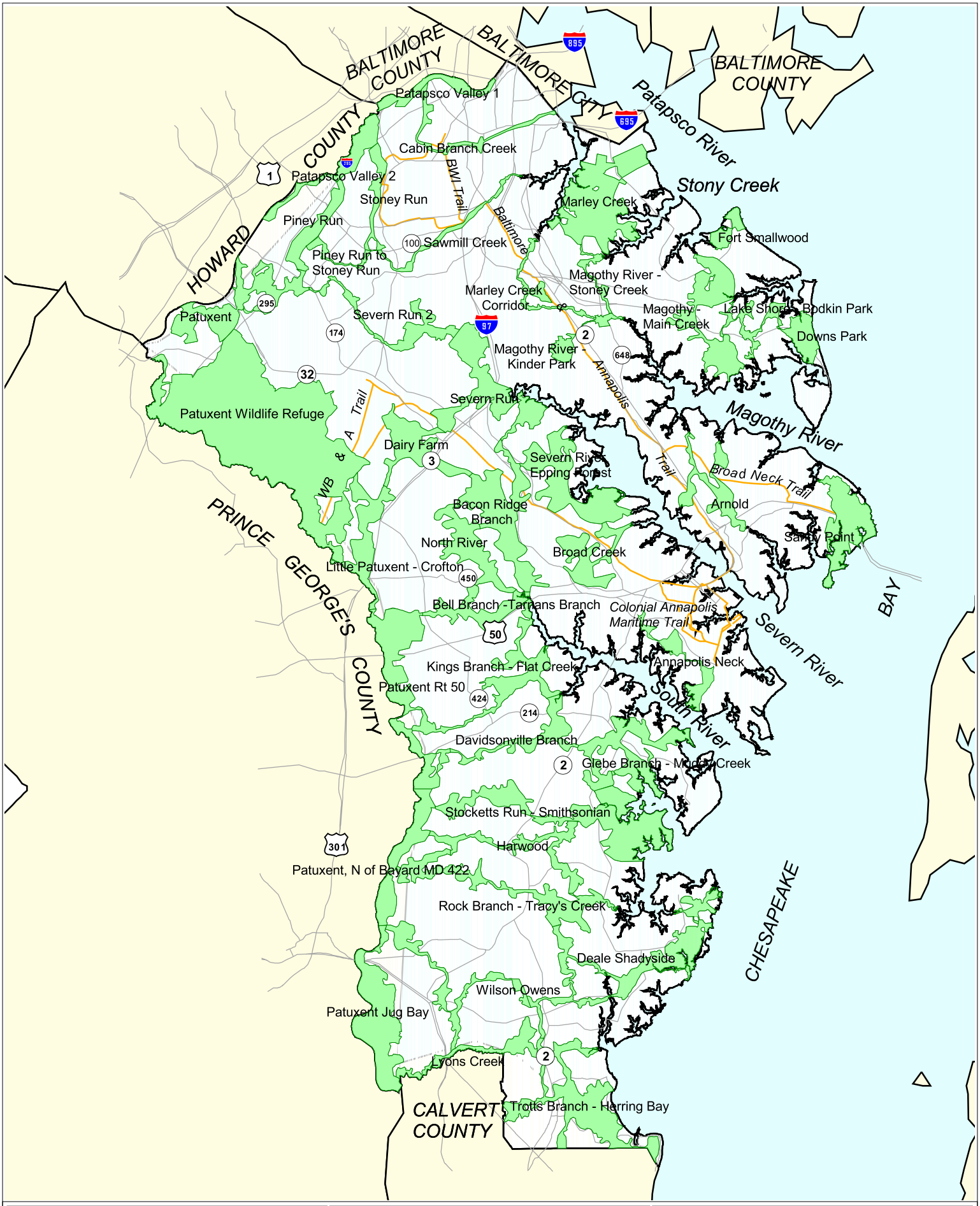
The proposed greenways network is shown on Figure 5 of the Plan (see next page). The network covers approximately 71,700 acres, equivalent to 27 percent of Anne Arundel County's total land area. Greenways are distributed in all parts of the County. Approximately 36,900 acres, or 51 percent of the proposed network, are currently protected as one or more of the following: state, federal, county and City of Annapolis owned lands; agricultural and environmental easements; private conservation lands; and land that is in the County's Open Space zoning district. The network is divided into 41 greenway segments each of which has been given a name, generally based on streams (see Figure 5). For purposes of implementation and management some of these segments could be combined and the Plan does group the 41 segments into 13 geographic groups.

The proposed greenways network incorporates most of the greenways recommendations of the Small Area Plans, Maryland Atlas of Greenways, and Anne Arundel County Land Preservation and Recreation Plan. The proposed greenways network does not, however, include all land in the County that is ecologically sensitive or otherwise worthy of protection. The fact that such lands are not included in the greenways network is not intended to diminish their importance or to imply that they should not be protected. A variety of laws and programs exist to protect sensitive areas that lie outside the greenways network.

Although desirable, it may not be possible to protect all land within the proposed greenways network. If because of development the entire area within a greenway cannot be protected, the Plan recommends that the County, through proactive planning and protection measures including the development approval process, seek to protect that portion of the developable land that would be needed to preserve the "integrity" i.e., the wholeness and continuity of the greenway.

The greenways network identifies approximately 100 "critical connections"; areas where if a connection cannot be made, a greenway segment will be incomplete and be unable to serve its functions in the network. The largest category of critical connections is where greenways cross roads.

Public use of greenways will range from no use to quite heavy use. The Plan does not, however, identify which greenways should or should not have public use. This question is to be determined on a case by case basis in developing implementation/management plans for individual greenways.



Legend:

Proposed Greenways with Segment Names

Regional Trails

N W E S

Scale in Miles

0 2 4

Anne Arundel County Greenways Master Plan

Figure 5

Proposed Greenways Network With Segment Names

Four key strategies are recommended for implementing the proposed greenway network, each strategy serving as an umbrella for activities that should be undertaken in the future. The strategies describe organization and outreach, planning, land protection and enhancement, and financing. All the strategies emphasize a strong public/private partnership to implement the Plan. The key recommended implementation actions are:

- Establish a greenways program within the Department of Recreation and Parks headed by a greenways program manager;
- Create a strong public involvement program, including creating a Greenways Advocacy Committee that would advise the County Executive on greenway issues, and, working closely with local land trusts, local communities, and greenway advocacy organizations, provide a regular public forum for greenways;
- Develop detailed greenway implementation/management plans for individual greenways. The Plan's appendix contains detailed case studies of two greenways in the network illustrating different approaches to preparing these plans;
- Prioritize greenway "target areas" for protection including critical connections, and initiate immediate planning on six high priority greenways;
- Integrate the greenways network into county regulations, planning, capital improvements programming, and development review procedures, allowing for changes in the greenways network based on new research and planning;
- Create an Anne Arundel County greenways fund from a range of sources. The fund would be used to acquire properties and easements; match monies from other sources; and build infrastructure including trails and wildlife crossings;
- Create an Advanced Land Protection Revolving Fund to enable the County to act quickly to protect land when unforeseen opportunities arise; and
- Make maximum use of related federal, state, and local programs to increase funding for greenways.

Table of Contents

Executive Summary ES-1

Introduction

Purpose 1
Definitions 2
Plan Preparation 3

Chapter 1 Background for the Plan 5

Green Infrastructure 5
Anne Arundel County's Comprehensive Plan and Small Area Planning Program 10
Anne Arundel County's Land Preservation and Recreation Planning Program 10

Chapter 2 Approach and Methodology 13

Application to Anne Arundel County 15
The Selected Criteria for Greenways 19
Selection of Greenways 21

Chapter 3 Proposed Greenways Network 23

Description of the Network 23
Protected and Unprotected Sections 26
Greenway Names, Segments, and Groups 26
Map Scale 26
Greenway Boundaries 28
Sensitive Areas Outside the Greenways Network 29
Critical Connections 29
Relation to Green Infrastructure 31
Public Use Of Greenways 33
Recommendations of Small Area Plans 35

Chapter 4 Implementation 39

Strategy 1: Organization and Outreach 39
Strategy 2: Detailed Planning 42
Strategy 3: Land Protection and Enhancement 45
Strategy 4: Financing the Greenway Network 49

Appendix – Case Studies

Patuxent River Greenway A-1
Dairy Farm Greenway A-7

List of Tables

Page

Table 1 Summary of Existing and Recommended Greenways from the Small Area Plans, Maryland Atlas of Greenways 2000 edition, and 1998 Anne Arundel County Land Preservation and Recreation Plan....8
Table 2 Acreage of Greenway Segments....25
Table 3 Greenway Segment Groups....28
Table 4 Summary of Master Plan Recommendations Regarding Recommended Greenway from the Maryland Atlas of Greenways 2000 edition, Small Area Plans, and 1998 Anne Arundel County Land Preservation and Recreation Plan....35
Table 5 Priority Greenways....45
Table A-1 Suitability Index Values, Winter Cover/Food Indices, and HSI Scores for Eastern Cottontail Rabits.... A-16

List of Figures

Page

Figure 1 Maryland's GreenPrint Program....6
Figure 2 Green Infrastructure in and Near Anne Arundel County....7
Figure 3 Summary of Existing and Recommended Greenways from Small Area Plans, MD Atlas of Greenways, and Anne Arundel County Land Preservation and Recration Plan....11
Figure 4 Green Infrastructure in Anne Arundel County....14
Figure 5 Proposed Greenways Network with Segment Names....24
Figure 6 Proposed Greenways Network, Protected and Unprotected Sections....27
Figure 7 Critical Connections....30
Figure 8 Proposed Greenways and Green Infrastructure....32
Figure A-1 Dairy Farm Greenway Location.... A-7
Figure A-2 Dairy Farm Greenway Features.... A-9
Figure A-3 Gambrill Heights Area.... A-12

List of Charts

Page

Chart 1 Summary of Information Sources for Selection of Greenways....21
Chart 2 Proposed Organizational Levels....39
Chart 3 Implementing Greenway Projects - Taking the Next Steps....43
Chart 4 References for Additional Information and Assistance....44
Chart 5 Designing Wildlife Crossings....47

Introduction

Purpose

The purpose of this Anne Arundel County Greenways Master Plan (the Plan) is to provide an identification, decision making, implementation, and management tool for the County's future greenways network.

Growth in Anne Arundel County and the Role of Greenways

Anne Arundel County enjoys a very attractive location on the Chesapeake Bay close to Washington and Baltimore. This location attracts many people to live and work and enjoy the high quality of life that is available. As a result Anne Arundel County's population and employment base is growing. The County's population in 2000 was 489,600, a 62,000 increase from 1990, and is projected to increase to 541,000 by 2020[1]. The number of jobs in the County is also expected to rise, from 292,000 in 2000 to 337,000 by 2020. The County's rate of growth is faster than that of the State and the Baltimore region. The County's growth management policies have been quite successful; between 1987 and 1997, for example, more than 90 percent of the county's growth occurred in existing and planned sewer service areas[2].

Anne Arundel County's land cover is a mosaic of forest, shrub, agricultural, and developed areas. The northern section of the County tends to be more built up while southern and western areas tend to have more forested areas and agricultural lands. The County has many areas of ecologically valuable land including much unspoiled, high-quality landscape. The scattered pattern of modern development tends to consume large amounts of land and fragments landscapes. Future growth in Anne Arundel County threatens the loss of valuable forested land and other open space both within planned development areas and in rural areas.

Many studies have demonstrated the adverse ecological effects of forest fragmentation in the landscape. As forest areas are divided and isolated by roads and development, interior habitat decreases, human disturbance increases, opportunistic edge animal species replace interior species, and populations of many animals become too small to persist[3]. Fragmentation also has negative effects on the quality of life through the loss of landscape character and scenic beauty, the loss of open spaces for people to enjoy, loss of recreational opportunities, and reduced air and water quality. The most effective way to prevent these negative effects in a developed landscape such as Anne Arundel County is to create an interconnected network of open space or greenways. Anne Arundel County's goal for its greenways network is to:

> **Create an interconnected network of greenways in Anne Arundel County that protects ecologically valuable lands for present and future generations and provides open space, recreational, and transportation benefits and opportunities for people.**

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1 Maryland Department of Planning, September 2001.

2 Anne Arundel General Development Plan, 1997.

3 Maryland's Green Infrastructure- Using Landscape Assessment Tools to Identify a Regional Conservation Strategy. Theodore Weber and John Wolf. Journal of Environmental Monitoring and Assessment 63:2 265-277, 2000. This paper includes a good summary of green infrastructure methodology. See also the Greenprint program at www.dnr.state.md.us/greenways/greenprint/.

The benefits of Anne Arundel County's greenways network will be to:

- Enhance the beauty of the County's landscape by reducing the fragmenting effects of development and preserving valuable open space;
- Provide adequate habitat to support healthy populations of a diversity of naturally occurring plant and animal species;
- Help guide the location of development so that negative effects on ecologically valuable lands are minimized;
- Link communities to a countywide network of open space;
- Provide off-road transportation opportunities;
- Increase recreational opportunities;
- Improve water and air quality;
- Improve the economy by maintaining and increasing property values and by attracting visitors;
- Encourage the ethic of stewardship of the land in the County; and
- Help achieve the recommendations of county, regional and state plans and programs including Anne Arundel County's General Development Plan, Land Preservation and Recreation Plan, and Small Area Plans, the Chesapeake 2000 Agreement[4], and Maryland's Greenprint program.

Definitions

Greenways are, essentially, protected corridors of open space. Communities define greenways in different ways; some communities use an ecological focus while others use a more multi-purpose open space and recreational use focus. Common to nearly all the definitions of greenways, however, is the concept of corridors of open space whose natural assets are protected. The key difference between a greenway and other kinds of open space is the element of "linearity"; greenways often follow rivers or streams and cross landscapes, connecting with other greenways.

Anne Arundel County is taking a primarily ecological approach to defining greenways. In this Plan a greenway is defined as:

> **A hub or a corridor meeting the minimum criteria for providing or connecting to existing or potential habitat areas for wildlife naturally occurring in Anne Arundel County.**
>
> A hub is an ecologically significant natural area of at least 250 acres with a high ratio of interior versus edge habitat. A corridor is at least 200 feet wide. Corridors must connect to hubs; a corridor that dead-ends is not a greenway unless it is sufficiently large to function as a hub itself.

The greenways network in this Plan also includes existing and proposed recreational trails that are of countywide or regional significance even though they do not meet the above definition for ecological greenways.

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[4] Signed by the Chesapeake Executive Council in June 2000, the agreement guides Maryland, Pennsylvania, Virginia, the District of Columbia, the Chesapeake Bay Commission and the U.S. Environmental Protection Agency through the year 2010 in their combined efforts to restore and protect the Chesapeake Bay. The agreement has 93 commitments detailing protection and restoration goals critical to the health of the Bay watershed, including one to permanently preserve from development 20 percent of the land area in the watershed.

Plan Preparation

An Anne Arundel County Technical Advisory Committee including the Department of Recreation and Parks, Office of Planning and Zoning and other resource-related agencies, and assisted by a team of consultants prepared this Plan between Spring 2001 and Spring 2002. Public involvement in the Plan included three informational newsletters sent to community associations and other interested groups, organizations and individuals, public meetings in October 2001 and in Spring 2002, and several meetings with interested groups. The project website included a questionnaire responses to which also provided input for the Technical Advisory Committee.

Above, Baltimore Annapolis Trail Park headquarters south of Pasadena. Left, Severn Run near Dicus Mill Road.

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Chapter 1 Background for the Plan

Around the country in recent years as more and more open space has been lost to or threatened by development, interest in greenways has grown, and many states and communities are planning for and creating greenways. Three key efforts came together and led Anne Arundel County to prepare this Plan:

- The State of Maryland's greenways and green infrastructure initiative;
- Anne Arundel County's General Development Plan and Small Area Planning program; and
- Anne Arundel County's land preservation and recreation planning program.

Each of these efforts includes recommendations for greenways but they do not use a common definition or approach. These three efforts are described in this chapter as background for the Greenways Master Plan, which creates a new framework for greenways in Anne Arundel County on which the recommendations of other planning efforts can be implemented.

Green Infrastructure

Maryland's green infrastructure initiative is a statewide effort by the Maryland Department of Natural Resources (DNR) to identify large, contiguous blocks of ecologically significant natural areas (hubs) and to link them with natural corridors to create an interconnected network of natural resource lands across the state. The major components of Maryland's statewide green infrastructure are shown on Figure 1. Figure 2 shows the green infrastructure for the area in and around Anne Arundel County. The statewide network totals approximately two million acres, equal to approximately one-third of the state's land area. As of 2000, approximately 26 percent of these lands were protected by public or private programs[5]. In 2001 the State created the Greenprint program designed to begin protecting critical unprotected components of the green infrastructure[6].

Green infrastructure was developed at a statewide scale, and made extensive use of computer analysis of databases to identify potential corridors. In releasing the green infrastructure to the public, DNR anticipated adjustments in the configuration of the network as better and higher resolution data became available. This Greenways Master Plan provides this higher resolution analysis for Anne Arundel County[7].

In 2000 the Maryland Greenways Commission published the Maryland Atlas of Greenways, Water Trails and Green Infrastructure. In addition to green infrastructure, the atlas includes existing and proposed recreational greenways. These are summarized on Table 1 and included schematically on Figure 3.

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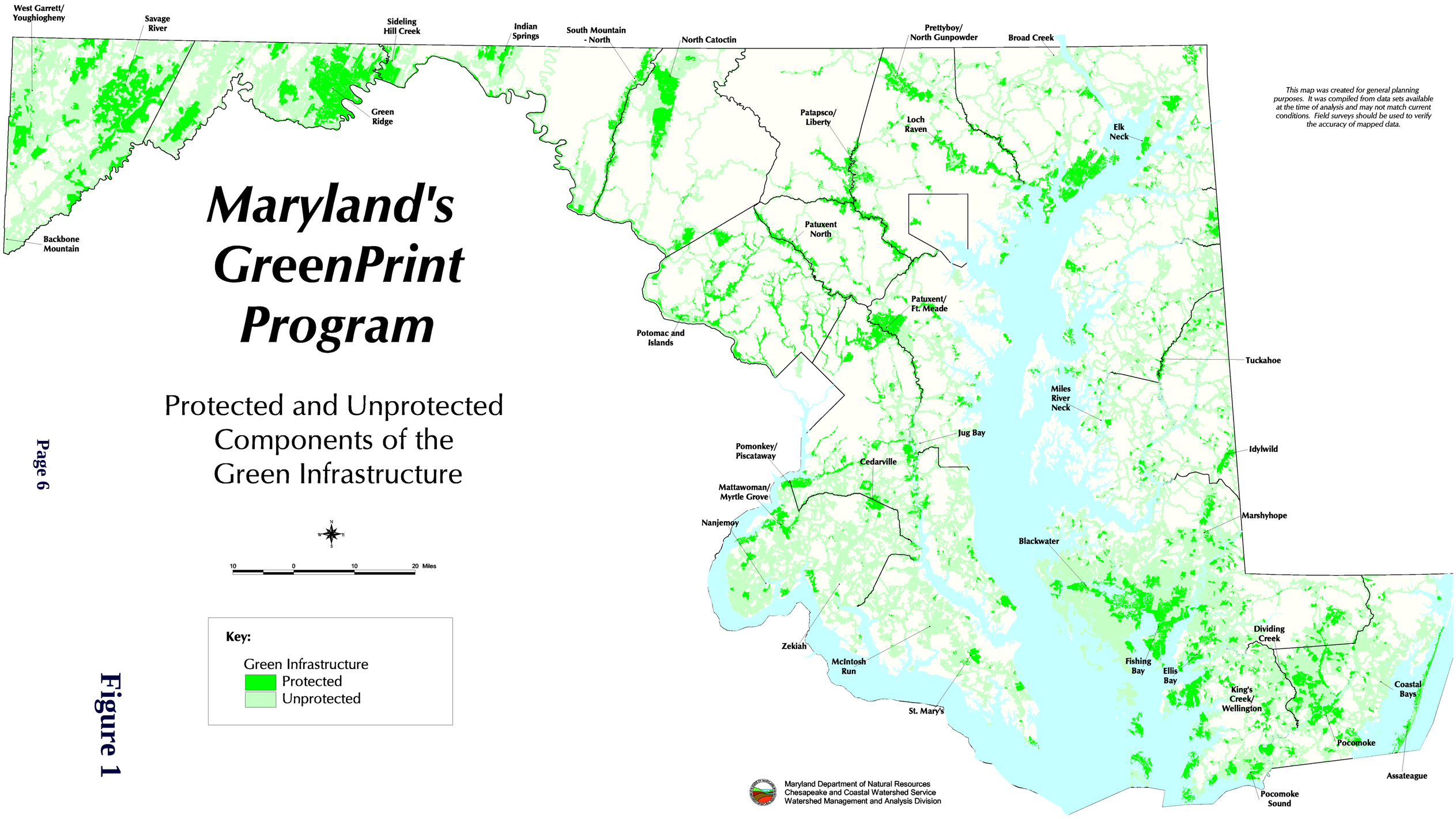
5 Maryland Atlas of Greenways, Water Trails and Green Infrastructure, Maryland Greenways Commission, 2000.

6 Initial funding for Greenprint was set at $35 million.

7 The green infrastructure land analysis used grids with a cell size of 0.34 acres (14,800 square feet). The Greenways Master Plan used aerial photography with a cell size of approximately 265 square feet

Maryland's GreenPrint Program

Protected and Unprotected Components of the Green Infrastructure



This map was created for general planning purposes. It was compiled from data sets available at the time of analysis and may not match current conditions. Field surveys should be used to verify the accuracy of mapped data.

Figure 1

Figure 2 Green Infrastructure in and Near Anne Arundel County

Source: Maryland Department of Natural Resources

Table 1 Summary of Existing and Recommended Greenways from the Small Area Plans, Maryland Atlas of Greenways 2000 edition, and 1998 Anne Arundel County Land Preservation and Recreation Plan (see Figure 3 for locations)

Plan	Recommendation	Figure ID #
Maryland Atlas of Greenways	B&A Trail	3
	BWI Trail	2
	Broadneck Peninsula Trail	20
	Magothy Greenway	19
	South River Greenway	21
	South Shore Trail	16
Annapolis Neck Small Area Plan (SAP)	A major Greenway system for the Neck extending from Waterworks Park to Thomas Point and/or CBF at Bay Ridge. Connect this system to the American Discovery Trail and the East Coast Greenway (Map 15).	14
	Natural areas network as shown on Map 8 and described in Appendix D of the draft Annapolis Neck SAP.	
BWI/ Linthicum SAP	Create a hiker biker trail and greenway between Maritime Institute, Hock Business Park, and Airport Square down to the BWI Trail in order to maximize the buffer between the Linthicum residential community and the commercial development along the east side of West Nursery Road (p 61).	1
	Develop a system of hiker-biker trails, open space, parks, and greenways for the Hanover area incorporating the Stoney Run and Piney Run stream valleys and connecting to the Patapsco Valley State Park (p 32).	5
Broadneck SAP	Pg. 36, Recommendation. "Promote natural greenways, including the reforestation of areas along streams and areas which link existing forested areas and other natural areas of significance."	n/a
Crofton SAP	Create a hiker-biker trail from MD 450 to Waugh Chapel Road along eastern side of Rt 3 separated from the roadway	8
	Develop a major walkway/trail system and linear greenway park along MD 424 from Rt 3 to Bell Branch Athletic Complex, connecting destinations along the route	11
	Create a trail system extending northward along Rt. 3 or through the Little Patuxent Valley to link with the South Shore Trail and to Odenton Town Center and the commuter rail station. Trail along east side of the Little Patuxent River including connections to the commercial areas along MD 3, the MD 424/Conway Road linear park trail, the lake behind the Post Office and the park in the northwest quadrant of MD 3/MD 424. Create a pathway connection to the park property located west of MD 3 and North Conway Rd from the MD 424/Conway Rd and MD 3 trails.	12
Crownsville SAP	Greenways at the following locations: A) Along the North River, B) Along Bacon Ridge Branch, C) Along Rt. 450 from Crownsville Road westward to Staples Corner, D) East of I-97 north from Rt. 450 from Crownsville Rd and crossing General's Highway east of Crownsville to follow Deep Ditch Branch to Maynadier Creek at the Severn River, E) Green Cathedral and Brewer Pond, F) Severn River Run Natural Area, Arlington Echo, Whitney's Landing Farm, Arden Park, and Arden Bog area.	7
Deale-Shady Side SAP	Pp. 30-32. Create a "Greenway" through the Deale/Shady Side Area to preserve riparian buffer, assist in floodwater retention, and provide wildlife corridors (to enhance wildlife movement and cover, and to avoid genetically isolated populations of wildlife).	18
Edgwater/ Mayo	No specific references to greenways.	n/a

Plan	Recommendation	Figure ID #
Jessup/MD City SAP	Designate habitat buffers along the Little Patuxent River, Oxbow Lake, and Dorsey Run.	4
	Open space along the Little Patuxent River north and east of Russett, and from the National Business Park up to MD 175.	6
Odenton	General goal to preserving the area's greenways (p 51). Support for the Patuxent River Greenway (Appendix C). Four major greenway trails (Appendix D): A) Along the Patuxent; B) WB&A trail; C) Severn Run; D) Little Patuxent.	17, 22/23, 7/9, 12
Severn SAP	A corridor from Lake Marion to New Cut Rd using the natural greenbelt along Severn Run as much as possible but detouring into nearby areas when necessary.	9
	A greenway trail from the vicinity of Meade Heights to Provinces Park.	10
Severna Park SAP	No reference to greenways specifically, although there is an open space network that "adds provisions for human needs to the needs for environmental protection……The Open Space Network is intended to serve the objective of providing a portion of the pedestrian and bicycle circulation system, linking public facilities, commercial areas, employment areas, and residential areas. The trail system will provide the linkage needed to the B&A Trail" (Pg. 16).	n/a
South County SAP	Pp. 50-52 and Appendix 6, pg 2. The Patuxent River Greenway…will connect a variety of environmentally sensitive areas including: Patuxent River State Park, Oxbow Nature Area, and Jug Bay Wetlands Sanctuary. The Patuxent River Greenway is bordered by the river on its western boundary, and roughly Patuxent River Road, Queen Anne Bridge Road, Harwood Road, Sands Road, Plummer Lane, Pindell Road, and Mallard Lane on its eastern boundary.	17
Land Preservation and Recreation Plan	East Coast Greenway	22
	American Discovery Trail	20, 22
	Washington, Baltimore & Annapolis (WB&A) Trail	23
	Maryland's Millennium Legacy Trail (comprised of the BWI Trail, Baltimore and Annapolis Trail, and the Colonial Annapolis Maritime Trail)	23A
	Colonial Annapolis Maritime Trail	24
	Chesapeake Beach Rail Trail	25
	East-West Boulevard Trail	26
	Patapsco River Valley Greenway	27
	Spa Creek Trail	28

Notes

1. The information in this table is presented as background for this Greenways Master Plan. The plans referenced in this table do not use the term "greenway" according to a common definition.
2. A number of the plans in this table refer to the same greenway or trail by different names. For simplicity, the table presents each greenway or trail only once; every greenway or trail in each plan may not be shown in the row for that plan, but collectively all the recommendations are reflected in the table.

Anne Arundel County's Comprehensive Plan and Small Area Planning Program

Anne Arundel County's General Development Plan (GDP), adopted in 1997, is the County's official policy document guiding decisions relating to future growth, development, resource management, and provision of services. In Chapter 4 of the GDP, Conserving the Environment, the GDP recommends several open space and greenways actions including:

- Identify environmentally sensitive areas for acquisition by the County;
- Identify and preserve greenways and open space through conservation easements. Establish a funding mechanism, such as a dedicated fund, and incentives as part of development agreements; and
- Develop a countywide greenways master plan and integrate it into regional greenway planning efforts.

The GDP also includes recommendations geared towards improving the planning, development, and management of pedestrian and bicycle facilities in the County. In a parallel effort to this Greenways Master Plan, the County is preparing a Pedestrian and Bicycle Master Transportation Plan.

Small Area Plans

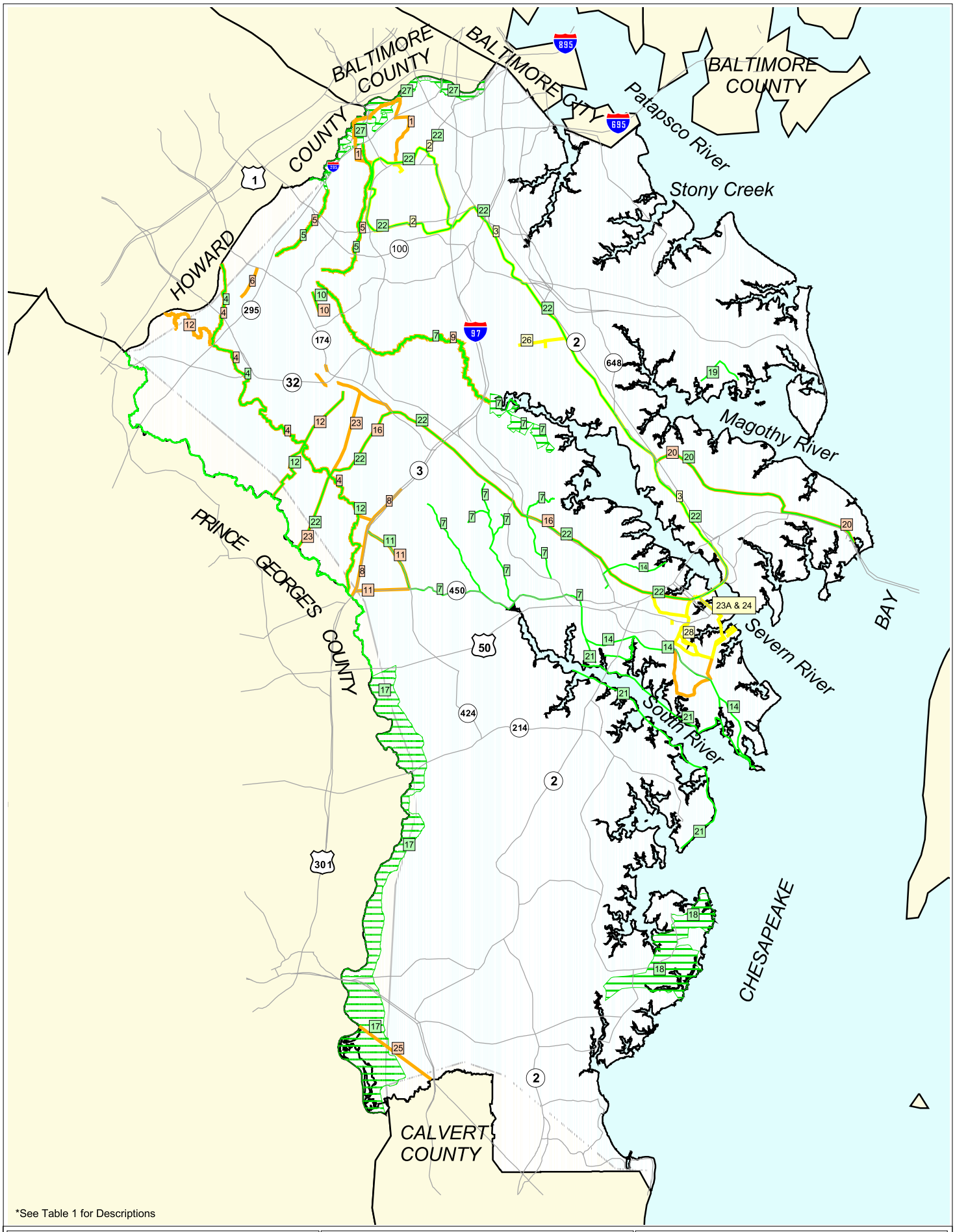
The County is preparing 16 detailed land use and community plans known as Small Area Plans (SAPs) covering the entire county. These plans were a major recommendation of the GDP. As of February 2002, 12 SAPs have been prepared, six of which have been adopted by the County Council.

Since the GDP did not give detailed guidance for how the SAPs should address greenways, the SAPs responded in different ways. Some made greenways an important component of their plans while others made limited references to greenways. Many of the SAPs made recommendations for greenways as recreational trails. Some, such as the Deale/Shadyside and the South County SAPs, identified large areas for protection as open space greenways. Table 1 and Figure 3 summarize the SAP recommendations for greenways.

Anne Arundel County's Land Preservation and Recreation Planning Program

Anne Arundel County has many land preservation and recreation policies, regulations, and programs. These are detailed in the County's current Land Preservation and Recreation Plan (LPRP). Several of the programs are conducted in conjunction with state or federal programs. Land trusts and other non-governmental organizations in the County are playing an increased role in land preservation efforts.

The LPRP includes an acreage protection goal for 2020 of almost 10,000 acres. While a considerable amount of land in the county is protected in some way, the County's land acquisition and protection efforts to date have not followed a coordinated plan and have not resulted in an integrated network of open spaces. The LPRP recommended the County develop a greenways plan in order to preserve and protect the county's natural and cultural resources, provide alternative transportation, enhance wildlife corridors, and serve as a growth management tool. In addition to these purposes this Greenways Master Plan is seen as providing a focus and guidance for future land preservation and protection, helping prioritize land protection efforts to ensure maximum benefit, and helping the County achieve a coherent, integrated network of greenways and open spaces.



*See Table 1 for Descriptions

Legend:

- Existing Trails
- Proposed Trails
- Greenways
- Greenways

N W E S

Scale in Miles

0 2 4

Anne Arundel County Greenways Master Plan

Figure 3

Summary of Existing and Recommended Greenways from Small Area Plans, MD Atlas of Greenways, and Anne Arundel County Land Preservation and Recreation Plan

Participants at one of the October 2001 public meetings to review the initial concept greenways network.

Chapter 2 Approach and Methodology

As described in the introduction to this Plan, communities define greenways in different ways. Following the lead taken by Maryland's green infrastructure initiative, Anne Arundel County's approach to defining greenways is primarily ecological and focuses on hubs and corridors.

Hubs

Hubs are essential features in a greenways network. Hubs are large, ecologically significant natural areas that serve two important purposes:

- They provide habitat for animal and plant species that cannot thrive in small "patches" of open space, that is in highly fragmented landscapes. Without such areas a number of species will not be able to live in Anne Arundel County; and
- They serve as "home ranges" for wildlife, providing sufficient forage, reproductive habitat, and cover to meet all the needs of the species. They are typically large enough to help fulfill many of the requirements of species that forage over large areas and heterogeneous enough to satisfy the unique habitat requirements of species that are specialized to particular environmental niches.

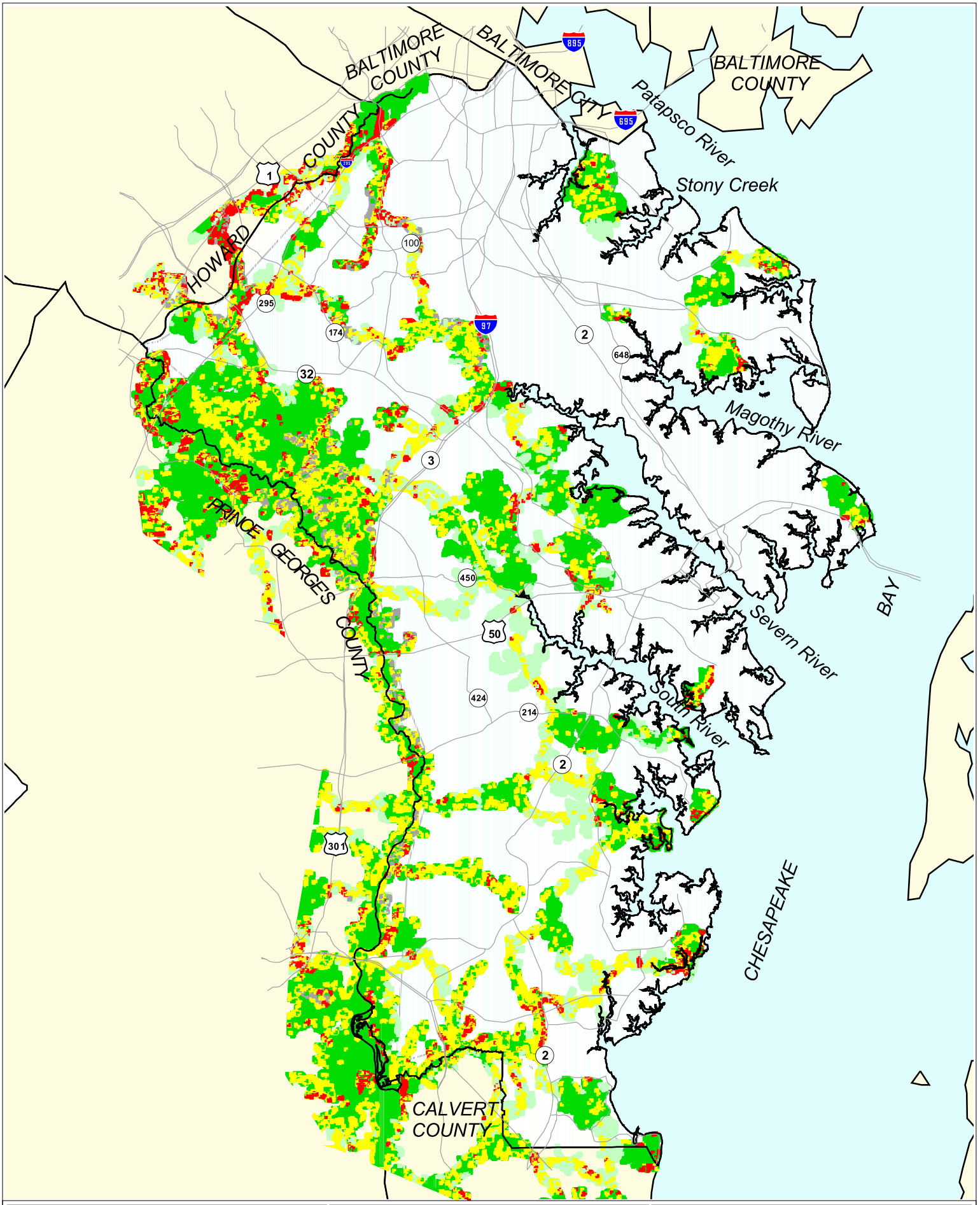
To serve their purposes, hubs should have a high ratio of interior habitat to edge habitat and be structurally diverse, that is containing a variety of microhabitats. They should have the most uniform boundaries possible, since boundaries that are irregular (that is, zigzagging in and out) reduce the ratio of interior to edge habitat. In general the larger and more diverse a hub habitat, the greater its ecological value.

Maryland's green infrastructure identifies hubs and corridors throughout the state (see Figure 1 in Chapter 1). The average size of a hub statewide is around 2,200 acres, although some hubs are as small as 100 acres. Figure 4 shows Maryland's Green Infrastructure in Anne Arundel County. The acreage in hubs totals approximately 88,000 acres, although this includes acreage in hubs that are partially in Anne Arundel County and partially in other counties. The hubs range in size from over 18,000 acres (Patuxent Wildlife Refuge and Jug Bay) to some that are as small as 130 acres. In developing a more detailed local analysis (at a smaller scale) for the Greenways Master Plan than the state used, this Plan reviewed the hubs the state had identified and identifies other potential hubs that have significance at the county level.

Corridors

Corridors are individual units of a greenways network that link hubs together. Corridors serve as "natural highways" providing cover for animals moving from one hub to another. Wildlife corridors have long been considered an effective means of linking isolated "islands" of wildlife habitat that have been fragmented by development, agriculture, or other forms of land use or management that restrict or exclude usage by species that may be sensitive to human encroachment.

Many species of wildlife move between feeding and resting areas daily (top carnivores and large species that require a large amount of food will typically forage over longer distances than smaller species), and the ability to migrate is an important contributing factor to the long-term health of individuals and populations. Individuals may migrate to find a mate, or to move to another home range if their present range becomes unsuitable. Populations generally migrate in response to a change in environmental conditions that precludes their continued use of a particular area. As one area becomes increasingly more developed and unsuitable for use by wildlife, populations may



Legend:

Green Infrastructure
- Corridor Natural Cover
- Gap - Agriculture or Lawn
- Gap - Developed
- Gap - Human-made Barren
- Hub Natural Cover

Major Roads
- Interstate
- State
- US

N W E S

Scale in Miles

0 2 4

Anne Arundel County Greenways Master Plan

Figure 4

Green Infrastructure in Anne Arundel County

migrate to other, more suitable locales. Natural corridors provide pathways between suitable habitats to facilitate these movements.

Corridors are not generally large enough to provide high quality habitat for sensitive species, but do provide mobile species valuable opportunities to travel between feeding, nesting, mating, and nursery habitats on a daily or seasonal cycle depending on the particular needs of each species. Since many species must travel some distance to avoid exhausting food and cover resources available to them, corridors provide an opportunity for species to safely fulfill a basic requirement for survival with a minimum of conflict with humans. Corridors are also of interest to people for recreation and transportation as they often connect areas where people want to go, and can be good candidates for off-road trails

Size of corridors has historically been thought to be the driving factor in corridor usage by wildlife. Small areas tend to lack the microhabitat and structural diversity that larger habitat units provide. Although the importance of maintaining large stands of forest is well documented, recent research has shown that the heterogeneity, or variety, of the habitat contained within a corridor is also an important factor in determining its usage by wildlife. Large, diverse corridors tend to be used more frequently by a wider variety of species than small corridors or large, uniform corridors. Generally, the more diverse a wildlife community becomes, the more diverse a corridor must be in order to effectively serve that community. Effective implementation of wildlife corridors requires that they contain a variety of habitats that fulfill the specific requirements of the species they are meant to serve. If they do not fulfill these requirements, the corridors will only serve generalist species, which typically thrive in fragmented habitats.

Corridors in a greenways network also provide other ecological functions such as reducing erosion and runoff, reducing thermal pollution in streams, and protecting floodplains.

Application to Anne Arundel County - Indicator Species

For the Greenways Master Plan, the County selected locally occurring native bird, mammal, and amphibian species and incorporated their habitat requirements into the selection of criteria for ecological greenways. The specific species were the downy woodpecker, bobcat, and red-spotted newt, and were chosen for the following reasons:

- They occur or are likely to occur within the County;
- They have specific habitat requirements that could be used as design criteria for greenways. The requirements were based on the U.S. Fish and Wildlife Service's Habitat Suitability Index (HSI) model for each of the species;
- They would benefit from the habitat connections that the greenway network is expected to provide; and
- Their habitat requirements are representative of a broad set of animal and plant species, such that if the greenways network could support them it would also support these other species.

Specific findings for birds, mammals and amphibians are described in the next sections and summarized under The Selected Criteria for Greenways later in this Chapter.

Birds

Most of the research on how greenways fulfill habitat needs for wildlife has centered around the requirements of bird species. Neotropical migrant songbirds are some of the most sensitive bird species to habitat degradation and are among the first species to disappear from an area when the

habitat becomes fragmented. It is generally accepted that habitat patches under 300 feet wide are not used by most neotropical migrants, but will be used by urban adapted resident species. Patches 300 to 600 feet wide are used by some migratory species and by most resident species. In patches over 900 feet wide use by neotropical migrant songbirds increases exponentially, and forest stands 2,500 feet wide or wider are used by virtually all forest-dwelling bird species.

Downy Woodpecker

The downy woodpecker is a forest dwelling bird species that requires dead, standing trees in an advanced stage of decomposition in order to reproduce. It can tolerate limited fragmentation of its habitat, but prefers contiguous open forest for breeding and will feed in mature intact forest or recently disturbed forest areas, especially those areas with stressed trees that are infested with insects. The home range of downy woodpeckers can also include open or disturbed areas adjacent to forest. The HSI indicates that a minimum of ten acres of contiguous forest is required in order to maintain a self-supporting breeding population.

Potential use of greenways. Because the downy woodpecker requires standing dead trees within large contiguous forest stands for breeding purposes, only hubs would be expected to fulfill this species' requirements for reproduction. However, wide corridors could provide localized pockets of habitat suitable for breeding. As with most forest-dwelling birds, downy woodpeckers prefer to travel along forested routes, so the forested corridors along streams would be expected to provide this species with a network of travel routes throughout the County. The downy woodpecker would benefit most from the hubs, but could utilize wide corridors as home ranges as well, especially where mature, intact forest adjoins recently disturbed or stressed forest, providing injured or infested trees for feeding.

Mammals

Mammals exploit a variety of habitats throughout Anne Arundel County, from urban areas to mature forests. Because mammals as a group are adapted to such a wide range of habitats, a habitat network that is structurally and vegetatively diverse on a countywide scale can be expected to promote high species diversity in mammals across the county.

In addition to bobcat as representative species for mammals, the needs of some other species were considered in selecting criteria for ecological greenways. These included white-tailed deer, black bear, and red fox.

Bobcat

Bobcats are widely dispersed along the eastern seaboard. They are a secretive species and are rarely seen by humans. Although the bobcat's current status in Anne Arundel County is not known, the County is within its historical range, and they are listed as a species in need of conservation in Maryland. A bobcat's home range can vary widely in size, although under ideal conditions one adult can subsist in an area as small as 400 acres. However, because bobcat populations are subject to dramatic fluctuations, an 8,000-acre (12 to 13 square mile) area is considered the minimum necessary to support a reproducing population. At least a portion of this area should be forested for denning purposes, but bobcats prefer to hunt in grassy or logged areas. Bobcats usually thrive in

areas where agricultural lands mix with intact and disturbed forest, and have been shown to decline in these areas in response to the cessation of agricultural activity.

The HSI model for bobcat relies entirely on the availability of food to determine habitat suitability. Although the model was originally designed to measure the availability of cotton rats (a favored bobcat prey species in the Southeast), it allows for the substitution of metrics (measures) to evaluate availability of other prey species in areas where cotton rats are uncommon. HSI metrics for cottontail rabbits were evaluated in this plan because this species would be a preferred prey species for bobcats in this area, and provide forage for other large predators such as raptors (hawks and owls) and red fox. Thus, evaluating the greenway network's value as cottontail rabbit habitat also incorporates its value as bobcat habitat and potential forage availability for other predator species that could be expected to utilize the network.

Potential use of greenways. The mosaic of agricultural and forest in the southern half of Anne Arundel County is prime bobcat habitat. Bobcats prefer travelling in forested lowlands, so the area along the Patuxent River would be expected to constitute an excellent avenue for north-south travel by bobcat along the western edge of the County. This area is also large enough to support a breeding population. Larger corridors, especially those which follow streams or rivers and connect agricultural fields to the Patuxent should serve as routes from dens to feeding areas.

Other Mammals

White-tailed deer. The largest mammal commonly found within Anne Arundel County and central Maryland is the white-tailed deer. This generalist species does not require large expanses of undisturbed habitat and has adapted well to a patchwork of urban, suburban, and agricultural uses throughout the region. While the white-tailed deer can be expected to benefit from corridor development, the health of the population in this region is not dependent on the establishment of new corridors, and no special provisions for white-tailed deer habitat are needed in the Greenways Master Plan.

Red fox. Red fox is a common mammal in Anne Arundel County. Like the bobcat, the red fox will occupy a home range that varies in size according to the quality of the habitat within that range. In areas with ideal habitat, home ranges can be as small as 3 to 8 square miles, and in less suitable areas ranges can be as large as 30 square miles. Red foxes generally benefit from vegetatively diverse landscapes, and would be expected to benefit significantly from preservation of habitat within the greenway network. An HSI model for red fox has not been developed, however, so the suitability of habitat within the network was not quantitatively assessed.

Black bear. In Maryland, because the human population is growing, bears are coming into contact with humans more frequently, and pushing the bears into increasingly smaller areas of remaining habitat. There are no tracts of forest large enough to serve as a home range within Anne Arundel County.

Amphibians

Amphibians are semi-aquatic and semi-terrestrial during various stages of their life cycle, which means that as a group they require a different set of habitat attributes than species that spend their entire lives on land or in the water. A precipitous and nearly global decline in amphibian biodiversity and an increase in anatomical deformities in some species has caused concern among wildlife biologists during the last two decades. Disease, climate change, and loss of habitat have all been implicated as potential contributing factors in the decline. Because the County's greenway network incorporates forested wetlands and slow moving streams that provide habitat for amphibians, the habitat within the greenway network was examined for its suitability for use by the red-spotted newt, a common amphibian in Anne Arundel County.

Red-spotted newt

The red-spotted newt's life cycle is variable; some populations are completely aquatic throughout their life cycles while others include an eft (terrestrial adult) stage. The eft stage on average occupies a home range of 2,500 square feet, but can establish its home range at least 2,500 feet from its natal pool. No data is available on the size of the aquatic adults' home range, although they are known to occur in small wet depressions and pools adjacent to rivers and streams. The aquatic form benefits from forest cover that provides shade and prevents excessive warming in the summer. Migration typically follows forested streambeds or other moist depressions with forested cover, and cultivated fields or dry forests constitute barriers to these movements. This species requires mixed or deciduous forests where it utilizes moist leaf litter (in the eft stage) for cover and does not typically do well in monotypic coniferous stands.

Potential use of greenways. Because many of the greenways in the Master Plan follow forested stream valleys the red-spotted newt, as well as other amphibian and fish species, would benefit from the cooling effect of the riparian forests at every stage of development. Because of its small size and affinity for water, the red-spotted newt would be able to utilize existing culverts to safely pass under roads where they transect greenways. While the red-spotted newt does not usually utilize uniformly coniferous stands, hubs within the greenway system would provide suitable mixed and deciduous forest habitat for the juvenile stages in addition to the aquatic and eft adult stages**.** The juvenile and aquatic adult stages would be able to utilize all but the narrowest corridors between hubs as home range habitat and also as travel corridors.

Fish and Other Aquatic Wildlife

Although the Master Plan focuses on conservation of terrestrial habitats, the greenways network will benefit aquatic life as well. Uncontrolled runoff harms aquatic ecosystems by eroding stream banks, allowing silt to cloud water, washing pollutants into streams, and warming streams to the point that oxygen levels are reduced, stressing aquatic life. The benefits of riparian forest to aquatic life have long been known, and the greenways network relies heavily on riparian forest to connect hubs. This would benefit fish and other aquatic wildlife by maintaining the integrity of riparian vegetation which, in turn, will reduce runoff and lower the water temperature of streams in the County.

The Selected Criteria for Greenways

Summary of findings

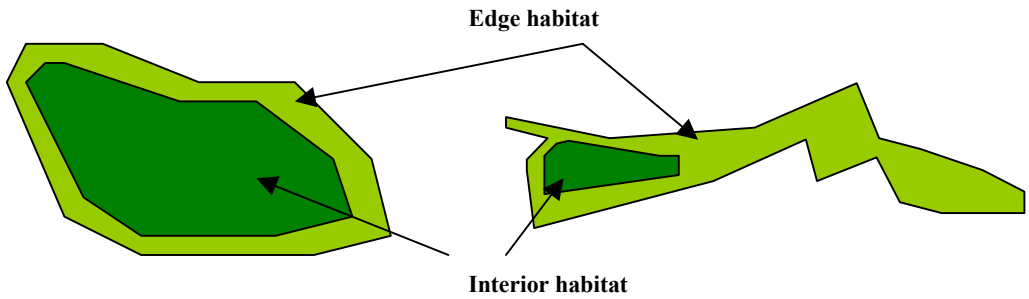
General findings from the research on locally occurring bird , mammal, and amphibian species can be summarized as follows:

- Large contiguous areas (hubs) are needed to provide habitat for animal and plant species that cannot thrive in small "patches" of open space;
- Large, structurally diverse habitat areas (that is containing a variety of habitats such as mixed forest types with an understory together with meadow, uplands and wetlands), are more useful than large or small areas with uniform habitat;
- Movement is necessary to complete the life cycles of many common locally occurring species;
- High quality habitat areas should be connected to provide safe travel and migration routes for wildlife;
- Preserved habitats should have uniform edges to minimize the edge:habitat ratio and preserve interior forest (see diagram on page 20); and
- Habitat requirements for indicator species in bird, mammal, and amphibian/reptile groups provide useful criteria around which greenways can be planned.

Criteria

Based on the findings, the following criteria were selected for use in identifying potential greenways:

1. **Habitat value:**
   - Riparian-forested areas should provide the basic structure of the network.
   - Other lands should be included where they are contiguous to a hub or can form part of a corridor. These include upland forested areas, non-forested riparian areas, agricultural land, and disturbed land (mined, barren).
   - Areas that are structurally diverse (with range of microhabitats) play a key role in the greenways network.
   - Developed areas should be avoided unless they are at critical connections. A "critical" connection is one where there is only one location where two corridors can connect, and if this connection is not made, wildlife movement and the functionality of the greenway will be significantly reduced.
   - Golf courses generally provide little valuable habitat, and should not be included unless contiguous to a hub or corridor.
2. **Size:**
   - Hubs should be a minimum 250-acres in size with high ratio of interior versus edge habitat. This will exceed the home range requirements of virtually all sensitive species (species with specific habitat requirements) known to commonly occur in the County. Some hubs will be larger and provide habitat for the species that require larger ranges.
   - Corridors should be a minimum of 200-feet wide, but wider where possible. This will permit passage for wildlife species between hubs.



Interior and edge habitat. Area on left has higher proportion of interior to edge habitat and supports both edge and interior species. Area on right provides little interior habitat and favors edge species.

The following additional criteria were used in identifying potential greenways:

3. Connectivity:

Hubs and corridors must connect. There should be no "dead end" corridors unless the dead end is large enough to serve as a hub (250 acres)[8].

4. Future potential; that is the potential to create hubs and corridors where they do not currently exist, especially at critical connections.

The Greenways Master Plan is a long-range plan intended to guide land protection in the long term (50-plus year horizon). As a result, areas that currently might have little habitat value, such as mined or barren lands, school sites, or developed parks, were considered as potential greenways because of their long range potential to be part of the greenways network. Road crossings were also considered in this light. Where greenways must cross busy roads, wildlife movement can be impaired or precluded. However, there are ways to design or retrofit roads with greenways in mind, such as incorporating wildlife crossings (commonly referred to as critter crossings) such as oversized culverts. Therefore, in identifying potential greenways, while road crossings were avoided where possible, the presence of a large or busy road was not necessarily considered an unavoidable barrier. This is especially true in the northern part of the County where there are more busy roads and fewer potential greenways than the south.

Roads can be designed or retrofitted to incorporate wildlife crossings (Photo courtesy Jones and Jones)

5. National and Countywide Trails

Two proposed national trails intersect in Anne Arundel County. The East Coast Greenway will run from Florida to Maine and the American Discovery Trail will run from Delaware to California. These trails use all or portions of the following local trails: WB&A, B&A, BWI, South Shore, Broadneck, and Colonial Annapolis Maritime Trails. These trails will be mainly paved or hard surface trails connecting towns and cities and are designed primarily for recreation although locally they are also important alternative modes of transportation.

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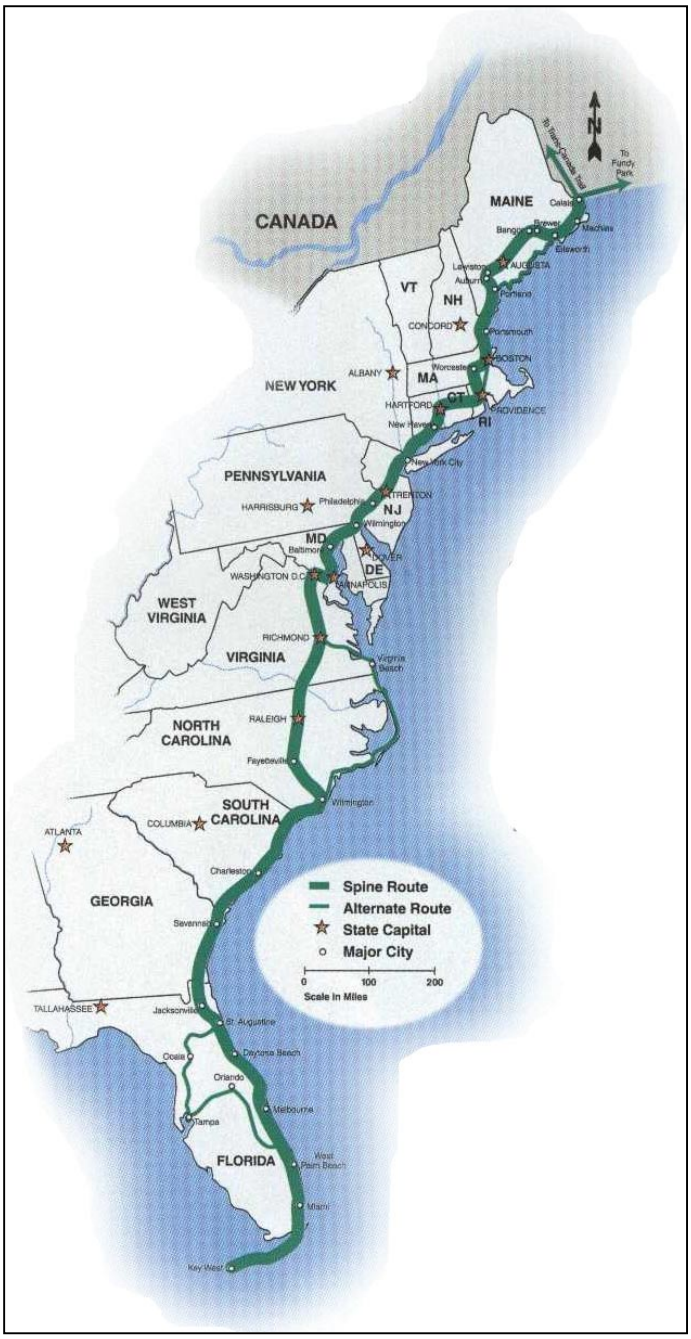
8 For example, a dead end would be a gradually tapering corridor that ends in the middle of a development with no potential to connect to another corridor and a total area of less than 250 acres.

Selection of Greenways

Based on the selected criteria, greenways were identified by analyzing different mapped information, studies, databases, and aerial photographs of the County to identify areas currently meeting the criteria or areas where greenways could, potentially, be created in the future. These information sources are summarized in Chart 1. Adjustments were also made based on input from the public during the Plan process.

Chart 1 Summary of Information Sources for Selection of Greenways

- Maryland's green infrastructure, including Baltimore City, Baltimore, Calvert, Howard, and Prince George's Counties.	- Anne Arundel County Land Preservation and Recreation Plan - Anne Arundel County Small Area Plans
- Maryland Greenways Atlas	- State land
- Federal land	- City of Annapolis-owned land (in the County)
- County land – parks, schools, government sites	- Development activity (subdivisions, site plans)
- County zoning district boundaries, with particular attention to the Open Space Zoning District	- Roads, rail lines
- Streams and floodplains	- Chesapeake Bay Critical Area
- Forest patches over 50 acres in size, with particular attention to patches not included in the state's green infrastructure	- Bogs and proposed bog protection areas
- State sensitive species review areas	- Lands protected by easements, agricultural easements, Maryland Environmental Trust Easements, other easements such as those held by land trusts or conservancies
- Anadromous streams	- Existing and proposed recreational trails
- Privately owned conservation lands	- Annapolis, Londontown, South County Heritage Area boundary
- Rural Legacy program boundary	- Historic sites from the Maryland Historical Trust inventory
- Public water access points	



The East Coast Greenway is a mostly paved trail planned to go from Florida to Maine, passing through Anne Arundel County. Graphic courtesy East Coast Greenway

Chapter 3 Proposed Greenways Network

This Chapter describes the proposed greenways network, its size, number and location of greenway segments, and relation to green infrastructure.

Description of the network

The proposed greenways network is shown on Figure 5. The network covers approximately 71,700 acres, equivalent to approximately 27 percent of Anne Arundel County's total land area. Table 2 shows the total acreage for each of 41 segments (components) of the network, as well as the protected and unprotected acreage of each. Greenways are distributed in all parts of the County. The largest hubs in the network are Bacon Ridge Branch, Bell Branch-Tarnans Branch, Jug Bay, Marley Creek, Patuxent Wildlife Refuge, Severn, Smithsonian, Rock Branch–Tracys Creek, and Trotts-Branch-Herring Bay (see Figure 5).

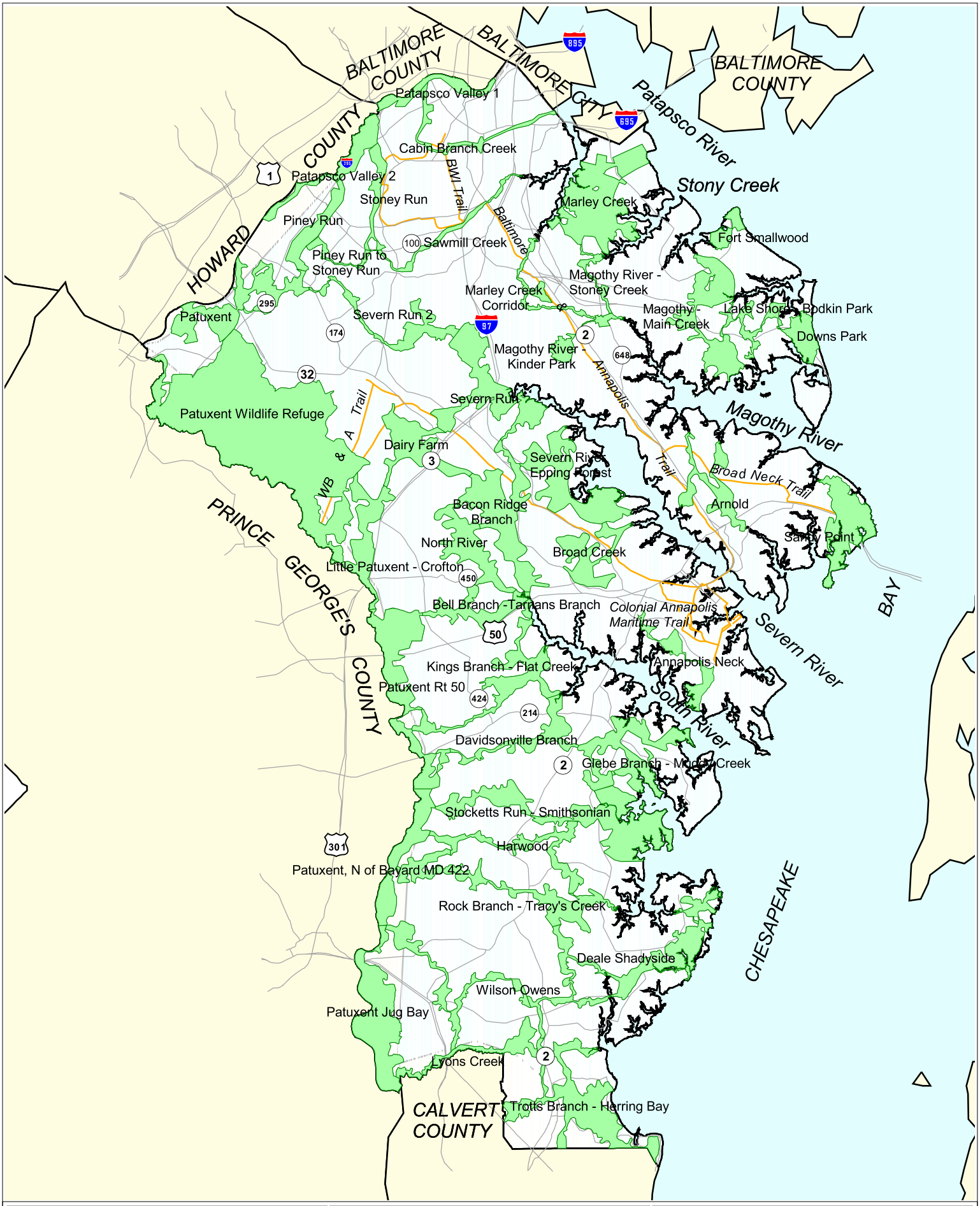
Around 70 to 80 percent of the County's land area is connected by greenways. For example, there is continuous connection between the Patapsco Valley in the extreme north of the County via Piney Run to the Patuxent River and all the greenways in the south part of the county. A second connection from Piney Run follows Severn Run south to Bacon Ridge Branch and thence to all the greenways in the southeast part of the County. Several greenways cross the County from east to west connecting the Patapsco and Patuxent Rivers to the Chesapeake Bay. Much of this network interconnection relies on the protection or creation of what this Plan calls "critical connections"; connections without which a greenway is unable to function as a wildlife corridor. Critical connections are discussed in more detail later in this chapter.

It does not appear possible to make a natural greenway corridor between the greenways east of I-97 north of the Severn River (e.g., Marley Creek, Magothy-Main Creek, Downs Park, and Arnold) and the other greenways in the County, because of development in the Route 2 and I-97 corridors[9]. The major rivers that indent the shoreline in this part of the County (Stony Creek, Magothy River and the Severn River) also make it difficult to connect these greenways, except by water.

Figure 5 also shows national and regional trails which are an important part of the greenways network. These trails are i) the East Coast Greenway (Florida to Maine) using all or parts of the WB&A*, South Shore*, Colonial Annapolis Maritime, B&A, and BWI trails, and ii) the American Discovery Trail (Delaware to California) using all or parts of the Broadneck*, B&A, South Shore*, and WB&A* trails (* = proposed trail).

The greenways network in Anne Arundel County connects to natural greenways in Baltimore City, and Baltimore, Calvert, Howard, and Prince George's Counties (see also Figures 2 and 4 in Chapters 1 and 2).

[9] Interconnection via the B&A and BWI recreational trails, however, does exist.



Legend:

Proposed Greenways with Segment Names

Regional Trails

N W E S

Scale in Miles

0 2 4

Anne Arundel County Greenways Master Plan

Figure 5

Proposed Greenways Network With Segment Names

Table 2 Acreage of Greenway Segments

	Acres			
Segment Name	**Total**	**Protected**	**Unprotected**	**Percent Unprotected**
Annapolis Neck*	736	336	400	55%
Arnold	1,076	282	794	74%
Bacon Ridge Branch	2,683	743	1,941	72%
Bell Branch -Tarnans Branch	1,014	194	820	81%
Broad Creek	1,256	710	545	43%
Cabin Branch Creek	521	326	195	37%
Dairy Farm	1,533	1,041	492	32%
Davidsonville Branch	1,012	142	870	86%
Deale Shadyside	2,593	1,206	1,388	54%
Downs Park	688	279	410	60%
Fort Smallwood	395	329	66	17%
Glebe Branch - Muddy Creek	2,061	780	1,281	62%
Harwood	1,086	403	683	63%
Kings Branch - Flat Creek	1,734	364	1,370	79%
Lake Shore - Bodkin Park	523	151	371	71%
Little Patuxent - Crofton	1,393	1,096	297	21%
Lyons Creek	818	390	428	52%
Magothy - Main Creek	2,146	638	1,508	70%
Magothy River - Kinder Park	456	399	58	13%
Magothy River - Stony Creek	239	52	187	78%
Marley Creek	3,358	469	2,889	86%
Marley Creek Corridor	458	133	325	71%
North River	1,432	405	1,027	72%
Patapsco Valley 1	658	613	44	7%
Patapsco Valley 2	1,004	581	423	42%
Patuxent	2,191	970	1,221	56%
Patuxent Jug Bay	2,647	2,201	446	17%
Patuxent Rt 50	2,670	1,879	791	30%
Patuxent Wildlife Refuge	13,502	10,457	3,045	23%
Patuxent, N of Bayard MD 422	1,357	581	776	57%
Piney Run	817	102	714	87%
Piney Run to Stoney Run	209	51	158	76%
Rock Branch - Tracy's Creek	1,995	921	1,073	54%
Sandy Point	1,796	1,009	788	44%
Sawmill Creek	421	311	110	26%
Severn River Epping Forest	2,414	242	2,171	90%
Severn Run	2,428	1,653	775	32%
Severn Run 2	1,021	711	310	30%
Stocketts Run - Smithsonian	3,603	2,689	914	25%
Stoney Run	500	329	170	34%
Trotts Branch - Herring Bay	2,826	601	2,224	79%
Wilson Owens	1,196	474	722	60%
Total	**72,467**	**37,245**	**35,222**	**49%**
Total Acres in Anne Arundel County	266,078			
Percent County in Proposed Greenways	27%			

* An additional 68 acres in the Annapolis Neck Natural Greenway is protected by a conservation easement or by designation by the City of Annapolis.

Protected and unprotected sections

Figure 6 and Table 2 show the protected and unprotected sections of the proposed greenways network. The sections that are considered protected comprise selected state, federal, county and City of Annapolis owned lands, agricultural and environmental easements, private conservation lands, and land that is in the County's Open Space zoning district[10]. These protected sections total approximately 37,250 acres, or 51 percent of the network. When using the figures and table the following considerations should be borne in mind.

Greenway Names, Segments, and Groups

The network is divided into 42 greenway segments each of which has been given a name, generally based on streams. The names are intended only to be geographically descriptive, and could be amended if desired.

The division into 42 greenway segments was largely for computer mapping efficiency based on the size and shape of the different areas. Some greenways such as the Dairy Farm and Deale Shadyside were mapped as a single greenway segment, but others such as Severn Run and Patapsco, were too large or long to be mapped in a single segment. For purposes of implementation and management, such segments function and should be treated as a single greenway (for example, Severn Run and Severn Run 2). Conversely, some large or long greenway segments could be divided into smaller segments. Table 3 groups the 42 segments into 13 geographic groups.

Map Scale

The network was prepared on a base map at 1:12,000 scale (one inch equals 1,000 feet), and is best viewed at that scale[11]. Figures 5 and 6 show the network at a far larger scale (one inch equals four miles) to fit the entire county on a standard report page. The accuracy of the boundaries will be diminished, however, if the maps are blown up and viewed at a smaller scale than one inch equals 1,000 feet. For example, at 1:2,400 (one inch equals 200 feet) some greenway boundaries may not appear to accurately follow streams or forest patch boundaries, or may run across buildings.

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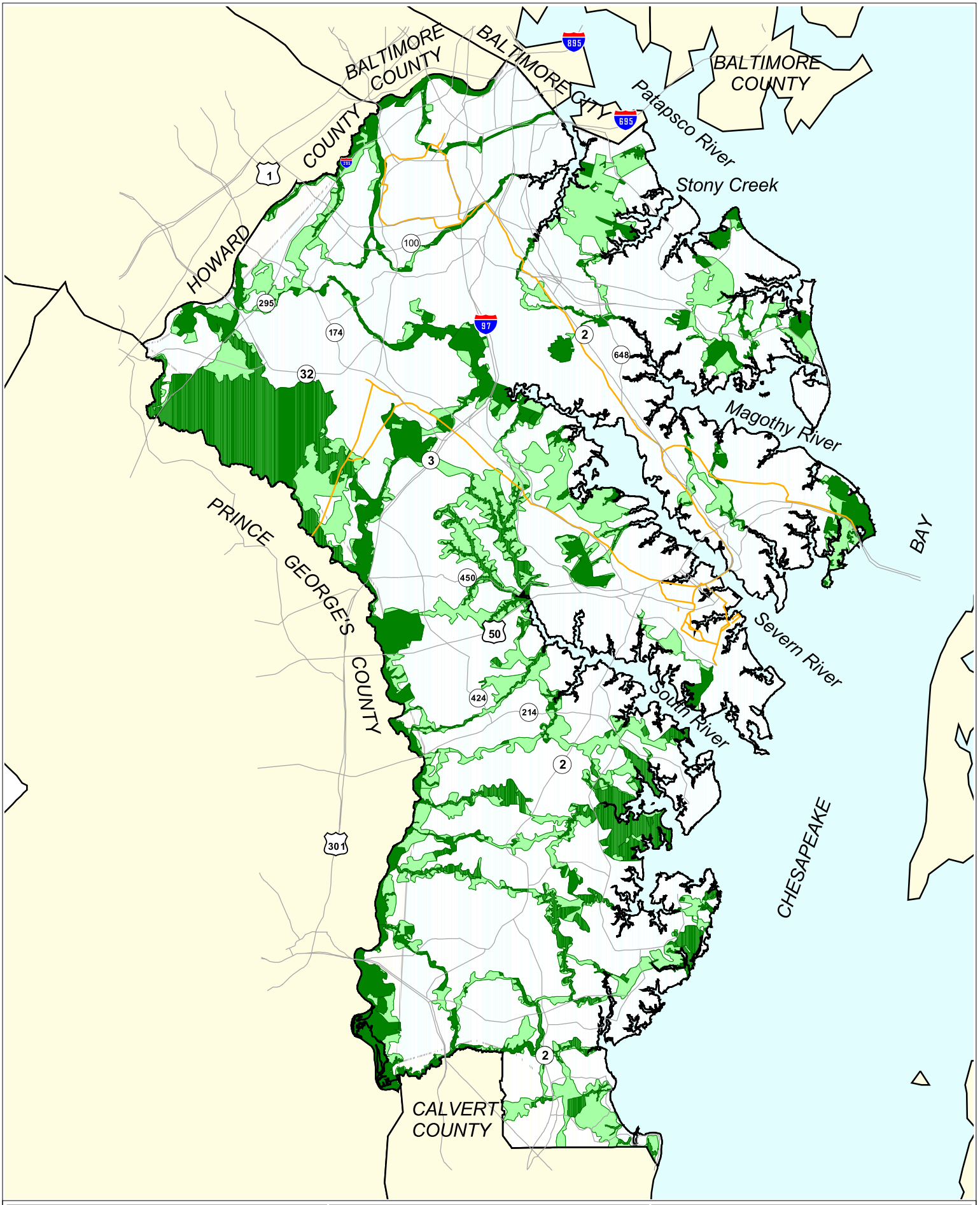
10 This is a mapped zoning district in Anne Arundel County comprising 100-year floodplains, wetlands and other open space. Approximately 32,600 acres are zoned open space, over 11 percent of the County. A limited set of land uses is permitted in the Open Space district, including farming, for example, but excluding new residential development.

11 The maps on the internet (www.aacounty.org) permit viewing at this scale.



Legend:
- Protected Greenways
- Proposed Greenways
- Regional Trails

Major Roads
- Interstate
- State
- US

N W E S

Scale in Miles
0 2 4

Anne Arundel County Greenways Master Plan

Figure 6

Proposed Greenways Network,
Protected and Unprotected Sections
(See Figure 5 for Segment Names)

Table 3 Greenway Segment Groups (Group heading in bold, segment name not bold)

Broadneck	**Marley Creek Stony Creek**	**Patuxent South**
Arnold	Magothy River - Kinder Park	Patuxent Rt 50
Sandy Point	Magothy River - Stony Creek	Patuxent, N of Bayard MD 422
Davidsonville Glebe Muddy	Marley Creek	Patuxent Jug Bay
Davidsonville Branch	Marley Creek Corridor	**Severn River**
Glebe Branch - Muddy Creek	**Patapsco**	Annapolis Neck
Deale Shadyside	Cabin Branch Creek	Broad Creek
Deale Shadyside	Patapsco Valley 1	Severn River Epping Forest
Rock Branch - Tracy's Creek	Patapsco Valley 2	Severn Run
Harwood - Smithsonian	Piney Run	Severn Run 2
Harwood	Piney Run to Stoney Run	**South River**
Stocketts Run - Smithsonian	Sawmill Creek	Bacon Ridge Branch
Herring Bay	Stoney Run	Bell Branch -Tarnans Branch
Trotts Branch - Herring Bay	**Patuxent North**	Kings Branch - Flat Creek
Magothy	Dairy Farm	North River
Downs Park	Little Patuxent - Crofton	**Wilson Owens**
Fort Smallwood	Patuxent	Wilson Owens
Lake Shore - Bodkin Park	Patuxent Wildlife Refuge	Lyons Creek
Magothy - Main Creek		

Greenway Boundaries

The proposed greenway network is conceptual, meaning that the boundaries for each greenway should be reviewed and will likely be refined based on detailed implementation and management plans that are recommended for each greenway. These plans are described in more detail in Chapter 4, and would be prepared at a much finer scale than this county wide Master Plan.

Figures 5 and 6 show the "future potential" greenways network, that is what appear to be the potential outer boundaries of the network that could be created, including some areas that currently might have little habitat value (see discussion in Chapter 2). While it may be desirable to protect the entire area shown on the figures, this may not occur. Developable land, for example, exists within the proposed greenways network. This Plan does not recommend that no development at all occur within the proposed greenways. If because of development the entire area within a greenway could not be protected, this Plan recommends that the County, through proactive planning and protection measures and through the development approval process, seek to protect that portion of the developable land that is needed to preserve the "integrity" i.e., the wholeness and continuity of the greenway. In the case of a corridor, for example, this would mean, typically, protecting at least a 200-foot wide corridor connecting to other greenways.

There are cases where more study is needed to determine the best route for a greenway corridor, including whether a greenway connection is feasible. In such cases the corridor boundaries have been drawn wide on Figures 5 and 6 in order to represent the general area within which, based on the data reviewed in this Plan, a connection appears to be possible. An example is the wide corridor connection shown between the Dairy Farm and Bacon Ridge Branch greenways, especially the area east of Route 3, north of St. Stephens Church Road[12].

[12] This greenway is discussed as a case study, see Appendix.

Sensitive areas outside the greenways network

The proposed greenways network does not include all land in the County that is ecologically sensitive and or otherwise worthy of protection. The criteria that were used to identify greenways (see Chapter 2) meant that some of these lands could not be included. The entire Chesapeake Bay Critical Area, for example, is environmentally sensitive but large portions of the Critical Area do not meet the selected criteria for greenways[13]. Many ecologically important sites are isolated by development and cannot be connected to the greenways network. Examples are the bogs at Cypress Creek and Sullivans Cove near Severna Park. The fact that such lands are not included in the greenways network is not intended to diminish their importance, or to imply that they should not be protected. A variety of laws, plans, and programs exist to protect sensitive areas that lie outside the greenways network.

Critical Connections

The greenways network identifies approximately 100 "critical connections" (see Figure 7). Critical connections are areas where if a connection cannot be made, the segment will be incomplete and be unable to serve its functions of facilitating wildlife movement. Non-existing or poorly functioning connections can be particularly damaging to wildlife movement and result in high incidence of animal mortality in that they can serve as "ecological sinks". Ecological sinks are locations that are hazardous to wildlife or to which wildlife is attracted or lead to, but that do not offer the necessary resources to support healthy populations of species. Ecological sinks may support adult individuals but not meet reproductive requirements so that mates are not available and there is a high rate of mortality among the young of species. This can effectively remove otherwise healthy individuals from a gene pool, thereby acting as a drain or "sink" on an area's biodiveristy. Creating such sinks in an area may be worse than having no greenway at all. Therefore, if a critical connection cannot be made between two corridors, the potential to create a sink should be evaluated, and the corridor considered for removal from the greenways network.

Above left, MD Route 3 near St. Stephens Church Road is a critical connection between the Dairy Farm and Bacon Ridge Branch greenways that will be complex to create. Right, an existing culvert under Dairy Farm Road serves as a wildlife crossing

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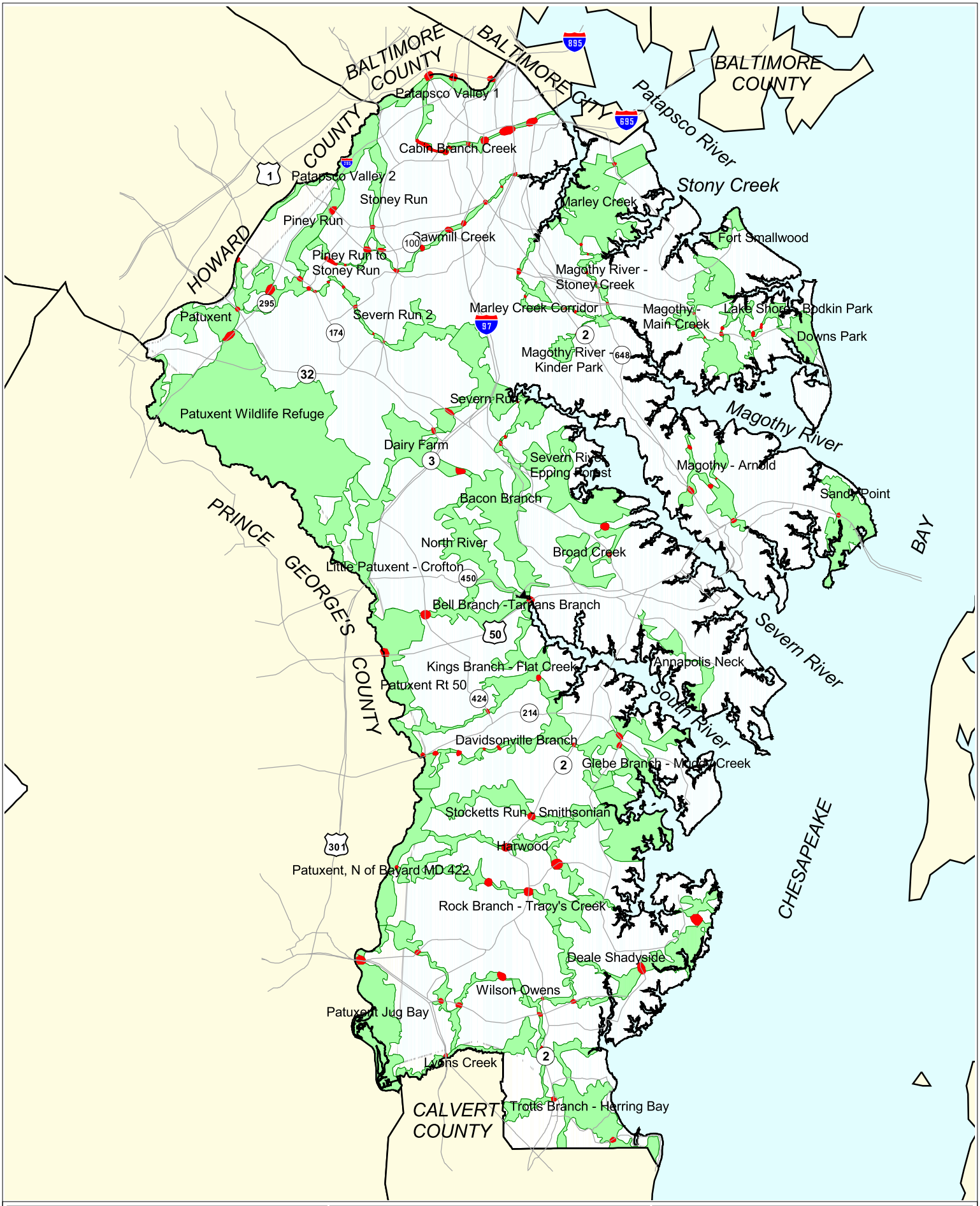
[13] The Critical Area in Anne Arundel County comprises approximately 48,900 acres, 18 percent of the County's land area.



Legend:

Proposed Greenways

Critical Connections

Major Roads

Interstate

State

US

N
W
E
S

Scale in Miles

0 2 4

Anne Arundel County Greenways Master Plan

Figure 7

Critical Connections

The largest category of critical connections is where greenways cross roads. These occur throughout the County, though more are in the north. Other critical connections occur where, for example, a greenway corridor goes through a developed area. In such cases the greenway may run through or adjoin the "back yard" of a residential or business area. How these back yards are used and managed can be critical to the viability of the greenway.

The most critical connections are those where only one location or route exists to create a connection between greenways. An example includes the connection between Severn River-Epping Forest and Severn Run at and north of Generals Highway (see Figures 5 and 7). Without this connection, movement between these hubs will not be possible. Another example is the Dairy Farm to Bacon Ridge Branch connection discussed earlier. Many critical connections lie along Cabin Branch Creek, Sawmill Creek and Severn Run that are all the more critical in that they are along the only greenway connections in the north part of the County between the Patapsco and the Patuxent Rivers and the Chesapeake Bay (i.e., between the east and west sides of the County).

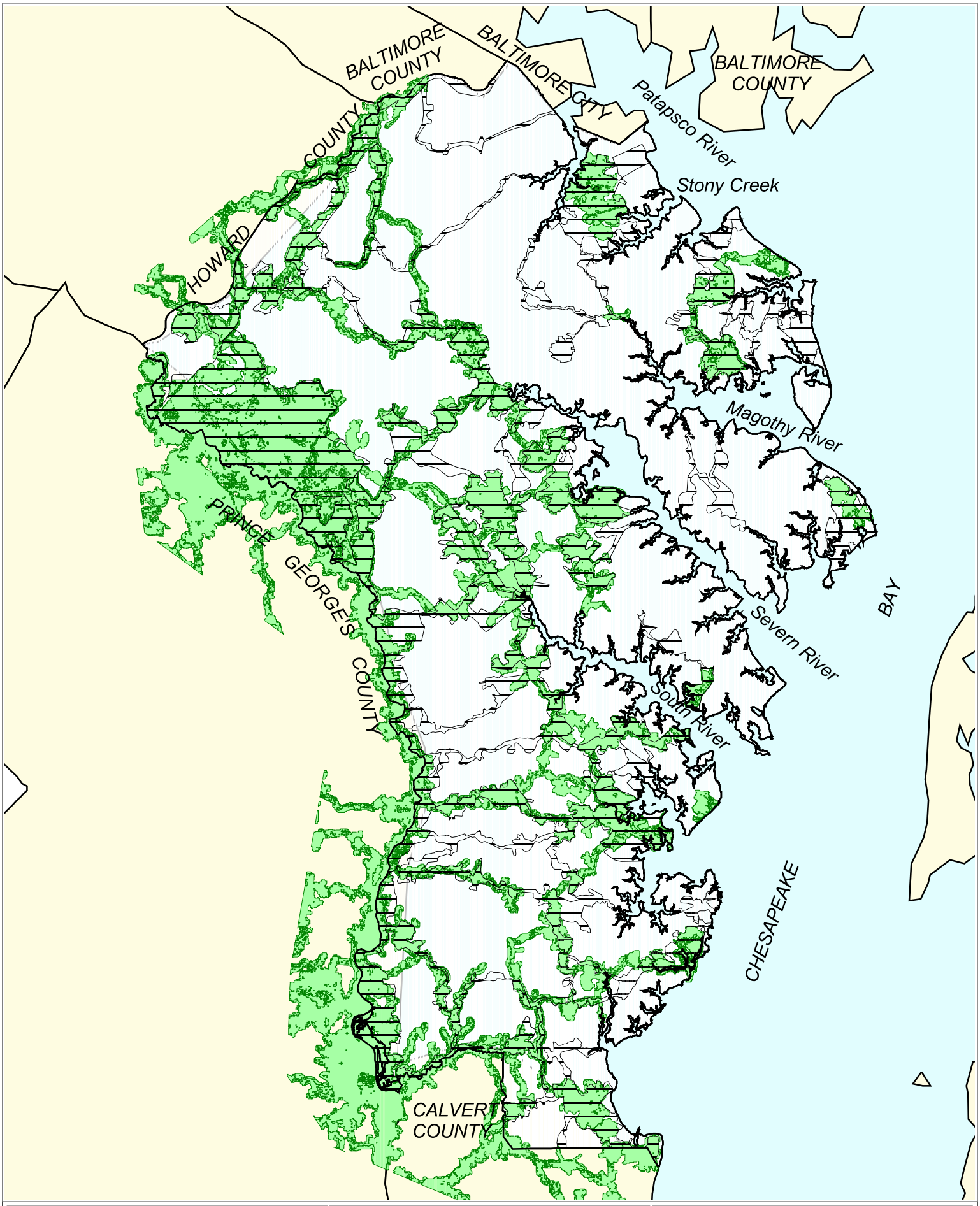
Particular attention must be paid to critical connections in the implementation process. In some critical locations potential alternative corridors have been identified so that if one critical connection proves not to be viable another can be considered. Examples include in Deale-Shadyside east of Route 468 south of Snug Harbor Road, and in the Patuxent north of Route 32. The recommended implementation/management plans may identify other potential connections.

Relation to Green Infrastructure

As discussed in Chapter 2, Green Infrastructure is a statewide effort by the Maryland Department of Natural Resources (DNR) to identify large, contiguous blocks of ecologically significant natural areas (hubs) and to link them with natural corridors. Figure 8 shows, for comparative purposes, the proposed greenways network in this Plan and the state's Green Infrastructure, including connections between greenways in Anne Arundel County and those in surrounding counties. The two networks are generally similar. As discussed in Chapter 3, the County referred closely to the Green Infrastructure maps when preparing the proposed greenways network in this Master Plan, but sought to identify additional greenways that might be significant at the county level, if not at the state level. The Master Plan adds a different, and in some respects more detailed, analysis to the Green Infrastructure, but the Green Infrastructure contains useful data and should be considered carefully when implementation/management plans are prepared[14]. The key differences between the two networks are:

- The Master Plan identifies some potential corridors not identified in the Green Infrastructure, e.g. Magothy River to Stony Creek;
- The Master Plan recommends some corridor routes as more viable than the routes identified in the Green Infrastructure, e.g. the location where the Bell Branch-Tarnans Branch greenway crosses Route 50; and
- The Master Plan does not include some hubs and corridors that are identified in Green Infrastructure. Examples include the Beverley Beach area hub, and the Stoney Run to Severn Run corridor. These did not the meet the Master Plan criteria for greenways.

[14] For example, Green Infrastructure identifies 43 hubs in the County and for each hub can provide data on 14 ecological criteria.



Legend:

Green Infrastructure

Proposed Greenways

N W E S

Scale in Miles

0 2 4

Anne Arundel County Greenways Master Plan

Figure 8

Proposed Greenways and Green Infrastructure

Public use of greenways

Public use of greenways will range from no use to quite heavy use. Public access for different kinds of recreation and transportation is one of the major benefits of greenways for people, and this is one of the benefits in developing a greenways network. This Plan, however, does not identify which greenways should or should not have public use. This question should be determined on a case by case basis in greenway implementation/management plans. As a guide for these plans the following should be considered:

- The public is very interested in access to greenways. Although the Small Area Plans developed to date did not use a common definition for greenways, many of them clearly equated greenways with trails and saw their potential transportation as well as recreational benefits. Public access to greenways has multiple benefits not the least of which is educational; encouraging an ethic of stewardship of the land;

- Portions of some greenways will have active recreational use because developed or undeveloped county parkland and schools are included within greenway boundaries. The Lake Shore-Bodkin Park and Downs Park greenways are one example. They include all or portions of Downs Park, Bodkin Park and Chesapeake Bay Middle and High Schools. Implementation/management plans will need to address the potential incompatibility of recreational use with ecological functions;

- Although approximately half of the greenways network is currently protected, only a portion of this land is publicly owned. The largest single category of protected land in the network is land that is zoned Open Space, but much of this land is privately owned, and zoning is subject to change. Public use requires legal public access, and clearly much of the greenways network will remain privately owned with no public access allowed except by permission of the landowner;

- Public access may offer off-road transportation opportunities. While not every greenway in the network meets a travel demand, some do and, if developed with off-road trails, may complement the on-road transportation network. The Pedestrian and Bicycle Master Transportation Plan network needs to be reviewed when preparing implementation/management plans for opportunities to combine ecological greenways and bicycle pedestrian routes. An example is the Patuxent Greenway in south County where the Pedestrian and Bicycle Master Transportation Plan recommends an improvement corridor along Patuxent River Road. This route might be made in part through the Patuxent Greenway. The Severn Run greenway is another example;

- Because financial resources are limited, increased public access should tier off from existing publicly owned land. Greenways with significant areas that are publicly owned are Broad Creek, Deale Shadyside (portions), Downs Park, Magothy River-Kinder Park, Arnold, the Patapsco River, the Patuxent River (portions), Sandy Point, and Severn Run. Although there is currently little publicly owned land in any of the east-west greenways in south County, public access along all or portions of one of them would be a valuable recreational resource and would support the Annapolis, London Town and South County Heritage Area[15];

[15] See the Annapolis, London Town and South County Heritage Area Management Plan, May 2000.

- There are cases where public access could impact a greenway's ecological functions by, for example, dissuading or interfering with use by wildlife, or by damaging sensitive resources. This should be considered in implementation/management plans[16]. Examples where public use should probably not be encouraged unless protection measures are in place include the bog complexes in the Lake Shore-Bodkin Park greenway, and locations where a greenway corridor is very narrow; and

- Where there is public access the type of recreational accommodations will vary. Some greenways might have trails with the type of surface depending on the level of use. A greenway with light use might have a dirt or mulch trail. Major recreational greenways like the B&A trail will be paved.

Alternative trail types. Left, the B&A Trail is paved. Trail headquarters building on the left of the picture. Right, soft trail in the Severn Run Natural Area.

16 Habitat Suitability Indices can be used to indicate the potential use of areas within a greenway by different wildlife species. See Chapter 2 and the Dairy Farm greenway case study in Appendix.

Recommendations of Small Area Plans

The proposed greenways network incorporates most of the recommendations of the Small Area Plans, Maryland Atlas of Greenways, and Anne Arundel County Land Preservation and Recreation Plan. Table 4 shows the specific recommendations from these plans and how they are addressed in the proposed greenways network.

Table 4 Summary of Master Plan Recommendations Regarding Recommended Greenways from the Maryland Atlas of Greenways 2000 edition, Small Area Plans, and 1998 Anne Arundel County Land Preservation and Recreation Plan

Plan	Recommendation	Master Plan Recommen-dation	Comments
Maryland Atlas of Greenways	Broadneck Peninsula Trail	Included	Proposed recreational greenway trail.
	Magothy Greenway	Included	Hub
	South River Greenway	Not included	Would be mostly on-road: recommend consideration in County transportation plans. Ecological greenways are problematic for entire Annapolis Neck and South River due to development.
	South Shore Trail	Included	Proposed recreational greenway trail.
Annapolis Neck SAP	A major greenway system for the Neck extending from Waterworks Park to Thomas Point, or CBF at Bay Ridge. Connect this system to the American Discovery Trail and the East Coast Greenway (Map 15). The greenway would extend from the headwaters of Church Creek to Quiet Waters Park and include the Masque Farm/Crystal Spring Farm area and the Hunt Meadow Woods open space.	Included	Greenway would preserve a connected system of natural areas and provide for wildlife movement.
BWI/ Linthicum SAP	Create a hiker biker trail and greenway between Maritime Institute, Hock Business Park, and Airport Square down to the BWI Trail in order to maximize the buffer between the Linthicum residential community and the commercial development along the east side of West Nursery Road (p 61).	Included	Area highly constrained by development. Secondary ecological significance due to fragmentation by I-295 (would require an animal crossing, but would link to a hub). Implementation of northern portion not difficult due to floodplain designation, but connectivity an issue in extreme north and south.
	A system of hiker-biker trails, open space, parks, and greenways for the Hanover area incorporating the Stoney Run and Piney Run stream Valleys and connecting to the Patapsco Valley State Park (p 32).	Included	Stoney Run –wide floodplain, ecological corridor Piney Run-narrow floodplain, possible ecological corridor
Crofton SAP	Create a hiker-biker trail from MD 450 to Waugh Chapel Road along eastern side of Rt 3 separated from the roadway	Not Included	On-road: recommend consideration in County transportation plans.
	Major walkway/trail system and linear greenway park along MD 424 from Rt 3 to Bell Branch Athletic Complex, connecting destinations along the route	Not Included	
	Trail system extending northward along Rt. 3 or through the Little Patuxent Valley to link with the South Shore Trail and to Odenton Town Center and the commuter rail station. Trail along east side of the Little Patuxent River including connections to the commercial areas along MD 3, the MD 424/Conway Road linear park trail, the lake behind the Post Office and the park in the northwest quadrant of MD 3/MD 424. Create a pathway connection to the park property located west of MD 3 and North Conway Rd from the MD 424/Conway Rd and MD 3 trails.	Not Included	

Plan	Recommendation	Master Plan Recommen-dation	Comments
Crowns-ville SAP	Greenways at the following locations: A) Along the North River, B) Along Bacon Ridge Branch, C) Along Rt. 450 from Crownsville Road westward to Staple Corner, D) East of I-97 north from Rt. 450 from Crownsville Rd and crossing General's Highway east of Crownsville to follow Deep Ditch Branch to Maynadier Creek at the Severn River, E) Green Cathedral and Brewers Pond, F) Severn River Run Natural Area, Arlington Echo, Whitney's Landing Farm, Arden Ballfields, and Arden Bog area.	All included except C)	B) Corridor connection to Dairy Farm desirable, but may be difficult to create C) On-road: recommend consideration in County transportation plans. D) North end near Maynadier Creek per SAP recommendation; difficulties in creating corridor in Cranberry Woods area; south end of SAP recommendation modified in greenways network.
Deale-Shady Side SAP	Pp. 30-32. Create a "Greenway" through the Deale/Shady Side Area to preserve riparian buffer, assist in floodwater retention, and provide wildlife corridors (to enhance wildlife movement and cover, and to avoid genetically isolated populations of wildlife).	Included	
Jessup/MD City SAP	Designate habitat buffers along the Little Patuxent River, Oxbow Lake, and Dorsey Run.	Included	Will utilize floodplain. Connection to Fort Meade across BW Parkway highly desirable but may be infeasible.
	Open space along the Little Patuxent River north and east of Russett, and from the National Business Park up to MD 175.	Included	
Odenton	Four major greenway trails (Appendix D): A) Along the Patuxent; B) WB&A trail; C) Severn Run; D) Little Patuxent.	Included	A) C) and D) included as ecological greenways with trails possible.
Severn SAP	A corridor from Lake Marion to New Cut Rd using the natural greenbelt along Severn Run as much as possible but detouring into nearby areas when necessary.	Included	
	A greenway trail from the vicinity of Meade Heights to Provinces Park.	Included	
South County SAP	Pp. 50-52 and Appendix 6, pg 2. The Patuxent River Greenway…will connect a variety of environmentally sensitive areas including: Patuxent River State Park, Oxbow Nature Area, and Jug Bay Wetlands Sanctuary. The Patuxent River Greenway is bordered by the river on its western boundary, and roughly Patuxent River Road, Queen Anne Bridge Road, Harwood Road, Sands Road, Plummer Lane, Pindell Road, and Mallard Lane on its eastern boundary.	Included	Some minor recommended boundary adjustments.
Land Preserva-tion and Recreation Plan	East Coast Greenway	Included	BWI and B&A trails are only existing components
	American Discovery Trail	Included	BWI and B&A trails are only existing components
	Colonial Annapolis Maritime Trail	Included	
	WB&A Trail	Included	Proposed, Prince George's County component complete
	Chesapeake Beach Rail Trail	Not Included	Would be mostly on-road: recommend consideration in County transportation plans.
	East-West Boulevard Trail	Not Included	Would be mostly on-road: recommend consideration in County transportation plans.
	Patapsco River Valley Greenway	Included	
	Spa Creek Trail	Included	Part of Colonial Annapolis Maritime Trail

Note:
This table includes only specific recommendations from the various plans and does not include existing trails. See Table 1 and Figure 3 for a list of all these plans' recommendations on greenways.

Other types of greenways

While most of the SAP recommendations on greenways could be accommodated easily within either the proposed greenways network or the County's Pedestrian and Bicycle Master Transportation Plan, there are some "hybrid" recommendations that fall between the two. The best example is the Annapolis Neck SAP that recommends a major greenway system for the Neck extending from Waterworks Park to Thomas Point, and/or the Chesapeake Bay Foundation building at Bay Ridge[17]. A partial model for this greenway would be the B&A trail, that is a facility using, incorporating and connecting to much more open space than a typical on-road trail, a facility that serves both recreation and transportation functions, but a facility that is clearly not primarily an ecological greenway. The Crofton SAP made some similar types of recommendations. A possible term for these facilities in Anne Arundel County is "Urban Greenways".

This Plan supports such facilities and believes they can play a valuable recreation and transportation role in Anne Arundel County. Portions would also have ecological value. They would be especially beneficial where no ecological greenways meeting the criteria in this Plan can be created.

The draft Annapolis Neck Small Area Plan also proposed establishment of a natural areas network to preserve areas of important natural resources and link them in order to create a network that will provide for safe and adequate movement throughout the Annapolis Neck. A major portion of the proposed network forms the basis for the Annapolis Neck Natural Greenway segment.

[17] See Map 15 of the SAP under Transportation and the report in Appendix D.

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Chapter 4 Implementation

To implement the vision for greenways in Anne Arundel County, specific strategies are needed to protect greenway lands, encourage private landowner participation, and to build a variety of partnerships among interested parties. This chapter describes four key strategies for implementing the proposed greenway network:

- Organization and outreach;
- Planning and implementation;
- Land Protection and enhancement, and
- Financing.

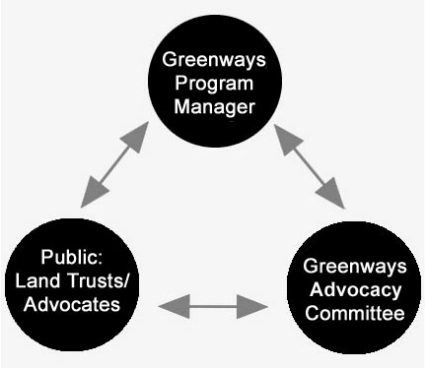
Each strategy serves as an umbrella for a number of activities that should be undertaken in the future. Taken together these strategies identify the core needs, opportunities and issues that the greenways program must address.

This Plan envisions a strong public/private partnership that will take advantage of a wide variety of implementation strategies. Therefore, the actions recommended *are not limited* to activities of the public sector, but include a variety of recommendations for non-profit organizations and advocacy groups.

Strategy 1: Organization and Outreach

Discussion. The proposed greenways network is large in terms of size and scale, and complex in the way it interacts with different program areas such as land planning, recreation, transportation, and the environment. Anne Arundel County currently lacks a central organizational structure focused on implementing the greenways network, therefore new organizational structures or realignments of existing structures will be needed to both create and manage this network. To address this need, this Plan envisions three organizational levels: a County program staffed by a Greenways Program Manager; strong involvement from the public including local land trusts, greenway advocates, conservation and recreation organizations, and an appointed Greenways Advocacy Committee (see Chart 2).

Chart 2 Proposed Organizational Levels



In the early years of implementation the County will need to take a lead role in providing the overall vision for and launching and coordinating the recommendations in this Plan. Over time it is envisioned that the public and the Greenways Advocacy Committee will play an increasingly important role in coordination, implementation and management.

Action 1.1 Establish a Greenways Program within the Department of Recreation and Parks

This Plan recommends that the Department of Recreation and Parks take the lead role in the County for implementing the Master Plan. Although responsibilities for the greenway program could be spread among multiple departments, a single responsible entity would be more effective in ensuring

the overall success of the program. Because of the scale, breadth, and complexity of the program, a greenways program manager will be needed[18]. The program manager's role would be to:

- Serve as a liaison to the County Executive and County Council on greenway issues;
- Support and facilitate implementation and management plans for segments of the greenways network;
- Administer the land protection program including acquisition of land, easements, and development rights;
- Coordinate greenway protection with other county, state, and federal programs including the county's Agricultural and Woodland Preservation Program, and the state's Greenprint Program;
- Participate in the county's subdivision and land development review process identifying opportunities to protect the greenways network;
- Conduct regular public outreach and seek public feedback, via the county's greenways web site, newsletters, media relations, meetings, and workshops;
- Support private efforts to protect greenways, including technical assistance to land trusts, property owners, and local greenway advocates. (see also under Action 1.2, below);
- Coordinate with local communities and business interests;
- Provide staff support to the Greenways Advocacy Committee; and
- Coordinate and facilitate the management aspects of the greenways network including advising private landowners on land management, maintenance of infrastructure such as critter crossings, public access issues, monitoring and restoring habitat, supporting enforcement as appropriate, and coordinating volunteer activities.

Action 1.2 Create a strong public involvement program

The future success of the greenways initiative will rely on the strength of public involvement including local land trusts and conservation and greenway advocacy organizations. Achieving the vision of a county wide network of greenways will require a considerable amount of localized "on the ground" planning and citizen involvement. Local land trusts and greenway advocacy groups will need to support land preservation and restoration at the grassroots level. While these groups will continue to set their own agendas, their ongoing support and involvement in the greenway network will help build a constituency for greenways and be essential to the program's success.

As of March 2002, there were six land trusts in the County: Annapolis Conservancy; Bay Ridge Trust; Magothy River Land Trust; North County Land Trust; Severn River Land Trust; and South County Conservation Trust. These land trusts have begun to meet as a group as the Council of Anne Arundel County Land Trusts. These land trusts and conservancies must strengthen their efforts to work in a unified manner and coordinate with the County and with private landowners on greenway implementation. The County could provide support and assistance to land trusts in the following ways:

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[18] A number other jurisdictions in the U.S. that have implemented successful greenway programs have found it necessary to have a dedicated staff member responsible for the many tasks described in this chapter. One example is the Indianapolis Greenways Program, which includes two staff positions (a Greenways Administrator and a Project Manager) housed in the city's Parks Department. The Program is supported by Indy Greenways (a citizen advocacy group) and the Indianapolis Greenways Development Committee, which is appointed by the mayor and the City/County Council. Similar examples exist in many other communities throughout the U.S., including Roanoke, VA, Cheyenne, WY, Raleigh, NC, and Chattanooga and Nashville, TN.

- The Greenway Program Manager should provide day-to-day technical support that would greatly benefit these all-volunteer organizations. This may range from participating in meetings to helping with mailings and developing brochures. It is to be expected that this would be a temporary arrangement until these land trusts, singly or collectively, achieve their own staffing; and
- The County should support leadership development and strategic planning for these organizations. One result would be to clarify the ways in which these organizations can support greenways. The County should work with local trusts and with the Council of Anne Arundel County Land Trusts, which would also enable all parties to share their experience and provide mutual encouragement.

Over time, land trusts and other groups in Anne Arundel County should be expected to:

- Incorporate appropriate elements of the Greenways Master Plan into their own strategic planning;
- Prepare or participate in implementation/management plans dealing with specific greenways and the individual properties affected (see Action 2.1 and Chart 3);
- Work with willing donors and sellers to protect land;
- Educate property owners, developers, and their advisors about greenways, land protection techniques, and appropriate land management (such as restoration for habitat enhancement);
- Provide technical assistance to property owners, including outreach to new owners of already-protected lands. This should include looking at opportunities to manage property or design new development to support greenways;
- Conduct public outreach and education, including celebrations and events;

Action 1.3 Establish a Greenways Advocacy Committee to work with County on greenway issues

The County should establish a regular public forum for greenway issues in the form of a Greenways Advocacy Committee. As envisioned, this advocacy group would be appointed by the County Executive with members whose interests and expertise would assist in different aspects of greenway implementation. The Committee could be modeled after Maryland Greenways Commission, a highly effective group with staff provided by an established agency (the DNR). Membership could include individuals drawn from supporters of current greenways projects and land trusts, property owners affected by the proposed greenways network, business leaders, attorneys and others who can help implement the Plan. The specific roles of the Greenways Advocacy Committee would be to:

- Advise the County Executive on greenway issues, especially in the broader context of open space and parkland;
- Help build broad public constituency and support for greenways, including providing a vehicle for public outreach;
- Provide visibility and a public forum for greenways in Anne Arundel County. As envisioned the Committee would meet quarterly. One of its meetings might be a conference bringing together different sectors of the public in Anne Arundel County with an interest in greenways. An annual Greenways Report could be presented at the conference and be an effective way of summarizing activities and progress on greenways implementation;

- Promote and support implementation/management plans. Possibly make recommendations on these plans if they are to have some form of official status, such as incorporation into this Master Plan; and
- Review and discuss priorities for land protection and management policies.

Strategy 2: Detailed Planning

Discussion: This Plan envisions a greenway network extending throughout Anne Arundel County that will one day encompass up to 72,500 acres of protected land, in private and public ownership. A little over half of the network is already under some form of protection, either through open space zoning, easements, or public ownership (see Figure 6 and Table 2). However, approximately 35,000 acres of the proposed network are not protected. It will require careful planning and a significant level of effort to protect these lands.

This Plan provides an overall guide for the development of the County's greenways network, but does not provide detailed recommendations for individual greenway segments, or determine what kinds of uses (from trail use to ecological reserve) are appropriate for each segment. The most effective way to address these issues is to develop detailed implementation/management plans for individual greenways.

As a natural progression of the County's small area planning process, citizen-based community groups and local land trusts are placed to take the lead with County support on many local greenway projects. The Patuxent River Greenway (initiated and supported by the South County Exchange) is one example of a successful local initiative (see case study in Appendix).

Action 2.1: Develop greenway implementation/management plans throughout the County

Chart 3 on the following page describes the general planning process for implementation/management plans. No two greenways are alike, however, and different approaches may be appropriate in different situations. The Appendix to this Plan contains two case studies illustrating different approaches towards preparing implementation/management plans. While the case studies are not "full scale" implementation plans, they provide practical guidance and technical information on how to conduct resource assessments and begin organization for implementation. Chart 4 lists additional sources of information on implementing greenways.

The County recognizes that some greenways will need high levels of county support for planning and implementation. Examples include a greenway that does not extend through an established community, or a proposed greenway that extends through an area of the county that is proposed for development, but where there is no local citizen group to champion the greenway. The County should take the lead on greenway implementation/management plans in these areas. In other areas citizens are expected to continue to advocate for and in many cases play a major role in moving greenway projects forward to implementation.

Chart 3: Implementing Greenway Projects – Taking the Next Steps

No two greenways are alike, so the process of making a greenway "happen" will be unique to each project. Still, there is a general process that most public/private greenway initiatives can follow as described here. The steps below, however, only scratch the surface of what is involved in implementing a greenway. The references in Chart 4 are highly recommended for more detailed assistance and advice.

Step 1. Identify the project, establish goals:

A. Identify and map the area to be encompassed by the proposed greenway. The proposed Greenways Network in this plan is a starting point, but the mapping effort for an individual greenway segment will require a higher level of detail. It may also be desirable to identify "conceptual management areas"; distinct areas of the greenway that may require different management/land preservation strategies.

B. Establish goals/objectives for your project. Some initial considerations (these may change based on Steps 2 and 3) are:

- What is the desired future condition for the greenway? Will this be primarily an ecological greenway? Would the greenway serve a transportation function? Is public access a goal? What level of public access is desired (none, hiking trails, or paved multi-use trails)?
- What kinds of management will be needed for this greenway? This means assessing habitat quality, restoration activities, tackling invasive species, and monitoring and management over time of various issues (including human intrusions).
- What partnerships should be fostered among local organizations and individuals, including the County? Would partnerships with other organizations/agencies outside the local area be beneficial?

Step 2. Conduct mapping, inventory and assessment:

Within each conceptual management area, conduct assessments on a parcel-by-parcel basis; store map and text information in a common Geographic Information System (GIS) database format, if possible:

A. Identify existing land uses, including existing protected lands.

B. Determine what is planned for the area in the GDP and in Small Area Plans, and how the land is zoned i.e. what types of uses are permitted in different parts of the greenway.

C. Conduct resource assessments and record the findings: identify structures; land cover; natural/cultural resources (streams, wetlands, forested areas, critical area, historic and archeological sites etc.); condition of the land (e.g., riverbank/riparian zone, extent of invasive species, condition of forest cover, habitat potential, etc.).

D. Identify developable lands, and identify parcels that are at risk of development.

E. Verify landowner(s) of record.

Step 3. Synthesize information and set priorities

A. Develop prescriptions for each management area, identifying a strategy or series of steps to be taken for protection and management. It may be necessary to identify a short term and long term strategy for some areas.

B. Prioritize lands for future restoration and/or protection activities.

C. Set and map priorities and management actions.

D. Identify lands qualifying for federal, state and local protection/restoration programs, funding, etc.

E. Identify potential funding sources.

Step 4. Initiate implementation activities

A. Develop short and long-range implementation schedule.

B. Determine best means of public outreach.

C. Initiate actions on high priority parcels.

D. Identify means of ongoing management of specific management areas.

Chart 4: References for Additional Information and Assistance

Publications with additional information on implementing greenways:

Greenways – A Guide to Planning, Design and Development, Flink and Searns, 1993.

Ecology of Greenways: Design and Function of Linear Conservation Areas, University of Minnesota Press, 1993.

Greenways for America, Little, 1990.

Trails for the 21st Century, Rails-to-Trails Conservancy, 2000.

Saving America's Countryside, Stokes, Watson, Keller and Mastran, 1997.

Economic Impacts of Protecting Rivers, Trails and Greenway Corridors: A Resource Book, National Park Service, 1993.

Community Trails Handbook, Brandywine Conservancy, 1997.

Greenway Implementation in Metropolitan Regions: A Comparative Case Study of North American Examples, Rails-to-Trails Conservancy, 1997.

Keeping our Commitment: Preserving Land in the Chesapeake Bay Watershed, Trust for Public Land, 2001.

National Website Clearinghouses:

Green Infrastructure Working Group: www.greeninfrastructure.net

Trails and Greenways Clearinghouse: www.trailsandgreenways.org

National Park Service Rivers, Trails and Conservation Assistance Program: www.nps.gov/rtca

Trust for Public Land: www.tpl.org

Also see the Anne Arundel County Greenways web site www.aacounty.org for other helpful information and links.

Organizations that can provide technical assistance:

Anne Arundel County Department of Recreation and Parks www.aacounty.org

Anne Arundel County Office of Planning and Zoning www.aacounty.org

Anne Arundel County Land Trusts. The Severn River Land Trust website is at www.srlt.org

Maryland Department of Natural Resources: www.dnr.state.md.us

Maryland Enviromental Trust: www.dnr.state.md.us/met/

National Park Service Rivers, Trails and Conservation Assistance Program

Rails-to-Trails Conservancy

Trust for Public Land

Action 2.2 Initiate immediate action on high priority greenways

In order to set priorities for future implementation activities, the following table identifies six greenway segments (in alphabetical order) that are recommended for immediate preparation of implementation/management plans (see Table 5).

Table 5: Priority Greenways

Segment	Comments
Deale Shadyside, Wilson Owens	Small Area Plan (Deale Shadyside) made extensive recommendations. Part of Annapolis Londontown and South County Heritage Area. Potential link (ecological and recreational) to Patuxent Greenway.
Lake Shore- Bodkin Park, Downs Park	Large population in vicinity. Large number of ecologically sensitive bogs. Several critical connections. Good model for other segments.
Marley Creek	Largest hub in northeast part of the County. Major development has been proposed.
Bacon Ridge Branch	Part of highly valued South River watershed. Large population in vicinity. Small Area Plan (Crownsville) made extensive recommendations for public access. Good model for other segments.
Sawmill Creek	Urban area. Potential useful model for other segments. Large population in vicinity. Important connection between east and west sides of the County. Several critical connections.
Severn Run 2	Part of highly valued Severn River watershed. Important connection between east and west sides of the County. Large population in vicinity. Several critical connections.

Action 2.3 Amend the Greenways Master Plan based on new planning and research

This Plan is a tool for the identification, implementation and management of the County's greenways network. Given its long range (50 year) time frame and its purpose as a tool, change is inevitable and the Plan should be amended as necessary as new plans are completed including the four remaining Small Area Plans and the greenway implementation/management plans.

Strategy 3: Land Protection and Enhancement

Discussion: As discussed in Chapter 3, a large portion of the greenways network will remain *privately* owned and managed. Large portions of the protected lands in the County are in fact privately owned, though zoned Open Space. Protection and enhancement measures will be needed within all the hubs in the County to ensure they maintain and enhance their hub functions

A complementary program of public and private land preservation will be needed. Private sector participation in the greenways program will be primarily through voluntary measures and incentives, rather than through explicit regulatory means, (other than those regulations that already apply to land development).

Action 3.1 Prioritize greenway "target areas" for protection

In cases where voluntary preservation measures may not succeed, the County should be prepared to protect by acquisition or other means high priority land parcels. These would be parcels identified through implementation/management plans, parcels that are under imminent threat of development, or that form critical connections in the greenway network (see Figure 6 in Chapter 3).

This prioritized list should be regularly updated to reflect changing development patterns and new opportunities.

Action 3.2 Fully integrate the greenways network into county land and transportation planning, capital improvements programming, and development review procedures

The Greenways Master Plan should be fully integrated into the County's development review process. As discussed under Action 1.1, a greenways program manager who would participate in the plan review process would be the most effective way to accomplish this integration, including giving guidance to other plan reviewers on how to address projects that are in proposed greenways. In addition the County should:

- Inform developers, designers, and engineers about the Greenways Master Plan and their responsibilities under the Plan.
- Add a greenways layer to County View and MapOptix (part of the County's internal database system), so that all departments will be able to quickly identify projects that may impact the greenway network.
- Adopt standards for road construction in greenways, so that new roads are built and existing roads reconstructed with greater sensitivity to wildlife movement. Chart 5 provides guidance for designing wildlife crossings.

Action 3.3 Amend County codes and manuals to reflect emphasis on protecting greenways

Anne Arundel County codes and manuals should be reviewed in light of this Plan. At a minimum, the Greenways Master Plan should be referenced in the Codes so that the greenways network is considered when land is developed or county plans, programs, or actions are initiated. A partial list of regulatory considerations includes:

- Add the Greenways Master Plan to the list of guidance plans in the Code documents used in the future development of land and the location of public facilities and services (Art. 24, §1-102).
- Consider changes to the Open Space zoning district (Code Art. 28 §6-205). This district is critical to the success of the greenways network. While the district is quite protective, some uses (such as telecommunication facilities) are permitted that could negatively impact greenways. The district could be strengthened by adding setback requirements for uses within greenways (§6-207), and by adding a condition for uses permitted by special exception that they make a positive contribution to greenways where appropriate and mitigate any adverse impacts.
- Revise open space requirements to reference greenways and increase the county's authority and ability to work with developers to protect greenways. Examples include:
    - In the Subdivision Regulations (Code Art. 26), revise the list of features in the section on Preservation of Existing Features (§3-109) to include greenways. Add references to greenways in the section on Community Facilities (§3-104). Increase the dollar value of the fee-in-lieu of providing recreation land (§3-104(f)) and add greenways as a priority to the list of uses for these funds.

Chart 5 Designing Wildlife Crossings

The following guidelines for the effective implementation of critter crossings are adapted from the Federal Highway Administration (http://www.fhwa.dot.gov/environment/wildlifecrossings/)

- **Design crossings to accomodate specific site conditions.** In order to be effective, critter crossings should be designed to fit the specific ecology, topography, etc. at a given site. For example, a crossing meant for terrestrial wildlife would be better placed on a ridge with natural vegetative cover than on a streambank that is frequently inundated by floods. Predator-prey interactions, where they have been studied, should also factor in the design of critter crossings: in Banff, Alberta wildlife biologists have noted that prey species travel high ridges where they can spot approaching predators while predators utilize valleys and riparian areas because the comparatively dense vegetation in these areas supplies them with ample cover during hunting forays.

- **Avoid single species designs.** Healthy ecosystems support a diverse community of wildlife utilizing the same resources in a given area. Likewise, many species will utilize the same crossing as long as the design of the crossing does not preclude such use. The most obvious feature of a critter crossing that influences the species that use it is the size of the crossing, especially if the crossing is contained within a culvert. Other features that could influence the number of species utilizing a crossing include but are not limited to the substrate in the crossing, exposure of the crossing route, and light levels in the crossing.

- **Know the biology of the target species.** While crossings should be designed to maximize the amount of species that could potentially use them, some crossings will be designed to benefit particular species especially where threatened or endangered species are concerned. The habits, requirements, and preferences of the target species should always be considered when species-specific crossings are designed. For example, burrowing species such as groundhogs may utilize tunnel-like crossings, however species like deer require well-lit crossings with exits that are clearly visible from the entrances.

- **Encourage use of crossings through wise placement and "funneling" features.** Crossings should be located so that wildlife will be drawn to them as the paths of least resistance around an obstacle (such as a road). This means that crossings should be located so that wildlife does not have to negotiate hazards or cross habitat gaps to reach them. With respect to the Anne Arundel County Greenway Master Plan, this means locating critter crossings within the greenway corridors. It also means that animals should be directed to the crossings through natural or man-made landscape features, such as canyon walls or fences. In Florida, the DOT constructed a 3.5 ft high concrete wall that excluded small mammals and reptiles from U.S. 441 and redirected them to four crossings placed under the road surface. Large mammals can likewise be excluded from roadways and re-directed with fences.

- **Monitor the project and make appropriate adjustments.** As with other elements of urban infrastructure, maintenance of critter crossings is necessary, especially where vegetative cover is a significantly attractive feature of the crossing to wildlife (a critter crossing near Banff, Alberta has been planted with native vegetation to enhance its attractiveness to large mammals which might otherwise avoid the crossing). In Florida, eradication of dandelions (a favorite black bear food) in medians has been considered as a way of making medians less attractive and consequently making dedicated critter crossings more attractive to this species.

- **Utilize existing technology**-As discussed in the fourth bullet above, the success of critter crossings is largely dependent on 1) the ability to funnel wildlife to the crossings and 2) promoting use of the crossings by making them attractive to wildlife and discouraging use of other potential routes. While natural landscape features can sometimes be used to accomplish this, wildlife must often be excluded from roadways using man-made structures, such as fences, walls, and berms. Zoos and wildlife parks have developed this technology, and planners and engineers can benefit from their experiences in designing species-specific wildlife containment structures.

- Within the Critical Area the expansion of the 100-foot buffer requirement from tidal waters streams and wetlands to include contiguous sensitive areas might be expanded to include greenways (Code Art. 28 §1A-104).
- Consider offsets to developers who work with the County to protect greenway lands (e.g., allowing trades or transfer of open space outside a greenway for more acreage within a greenway).

- Add a new section in the County's Landscape Manual on conservation subdivision design, in order to give practical guidance on preserving a portion of a development property for greenway purposes.
- If the term "greenway" is used in the Code, a definition should be added using the definition in the introduction to this Plan.

Action 3.4 Strengthen and coordinate existing state and local programs to promote land preservation in greenway corridors

Anne Arundel County administers a number of land preservation programs and strategies, such as the Agricultural Land and Woodland District Programs (including Rural Legacy), the Chesapeake Bay Critical Area Program, the Forest Conservation Program, the bog program and the Heritage Area Program. With the adoption of this Greenway Plan, these programs should be coordinated to encourage land preservation and land management within greenways. For example, properties that lie within the boundaries of a proposed greenway could receive extra "points" in the evaluation process for the County's agricultural land preservation program, or could be granted exceptions from the existing eligibility requirements (e.g., a smaller acreage size to qualify for a program).

Greenway lands that lie within the Chesapeake Bay Critical Area already receive considerable protection measures, including specific limits on development density and forest loss. The key in applying these regulations to benefit the greenways network will be to ensure that, where development is permitted, that forested land is preserved (or created) in areas that correspond to the proposed greenway network.

For lands that lie outside the Critical Area, the County's Forest Conservation program applies. This program can help protect large contiguous forested areas, even on sites that are being developed. This will require careful site planning on the part of county planners and developers to ensure that the function and intent of the proposed greenways network is preserved.

Action 3.5 Encourage small landowners to participate in the greenway program through new tax incentives.

Rising development pressures on small landowners present a serious threat to preserving greenway lands in the County, because small landowners are not eligible for some existing preservation programs[19]. In areas of the County that are experiencing rapid growth, these small landowners may

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[19] For example, the Maryland Environmental Trust has a 25-acre minimum acreage requirement for accepting easements unless land is contiguous to other sensitive land. A landowner may enlist in the County's easement purchase program by forming an agricultural district, and then can sell the development rights to this land to the County (or the State). However, in order for the land to be eligible for inclusion as a County Agricultural District, it must contain at least 50 contiguous acres of agricultural land. In order to be eligible for a County Woodland District, the area to be included must contain at least 10 contiguous acres of woodlands per landowner, with a minimum of 25 acres required for consideration of an easement offering. One exception is the State Forest Conservation Agreement Program (administered by the Maryland Forest Service). Through this program, owners of five or more acres of forestland are eligible for reduced and/or frozen property tax if they enter into an agreement to follow a forest management plan for 15 years. House sites, cropland and non-forest open space are not eligible for this program.

face higher tax assessments and no longer be able to pay property taxes and be forced to sell for development. The County should investigate ways to encourage small landowners to participate in the greenways network by reviewing eligibility requirements in different programs and making land preservation a feasible and attractive option.

The County's adoption of this Plan is intended to provide the policy assurance that easements accepted by local land trusts in support of this Plan, no matter how small, are expected to qualify under Internal Revenue Service rules governing charitable contribution deductions for conservation easements, which require that they be pursuant to official planning[20]. In Anne Arundel County, easements held by a local land trust results in elimination of County property tax as long as the easement remains in effect. Elimination of property tax applies only to unimproved land subject to easement, not to improvements. This treatment of easement land is among the most generous among Maryland counties.

Action 3.6 Provide user-friendly information for citizens and developers, publicize incentives

Some landowners fail to participate in land preservation programs because they are not aware of the programs or benefits, including tax benefits. It can be difficult to navigate through the myriad of programs and requirements to determine which is the best option for a landowner's given situation. To gain increased awareness among local citizens, the County should create a brochure entitled: *Guide to Private Landowner Participation in Anne Arundel County's Greenway Network*. This brochure should be specific to the programs available for Anne Arundel County landowners, including both land conservation programs and land management assistance and should explain eligibility requirements for each program in a clear and easy-to-read format.

This brochure should be made available to land trusts, greenway advocates, and other citizens groups working on greenway projects, as well as through traditional sources within the County, including the County's greenways website[21].

The county should also provide periodic updates to the development community regarding the greenway network. Developers and their engineering consultants should be made aware of changes in the County's review process with regards to protecting greenway lands, as well as the incentives that are available to them.

Strategy 4: Financing the Greenway Network

Discussion: By adopting this Plan, the elected officials and citizens of Anne Arundel County envision a network of greenways that will ensure a better environment and a high quality of life in the decades to come. While this Plan envisions significant private involvement in the Greenway Program, the network will not be successful without public financial investment. Anne Arundel County is an extremely attractive place to live and do business. Development pressures continue and the success of the greenways network will rely in part on protecting key segments. The County needs to be in a position to act on opportunities and challenges to protect key parts of the greenways network.

While there will be financial costs in developing the network, the financial benefits of the network and the costs of not developing the network also need to be recognized. Financial benefits will

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[20] Easements accepted by a local government *a priori* meet the test of public benefit that this statement addresses on behalf of land trusts.

[21] Descriptions for many of these programs already exist; this would consolidate them in one brochure for ease of access

come from improved property values and from increased visitation to the County. The costs of not developing the network will come in the form of increased costs for public services to serve development in greenways, and the costs of restoring degraded streams and riparian areas for flood control, water quality, and habitat.

Action 4.1: Create an Anne Arundel County Greenways Fund

The present-day resources of the County will not be sufficient for all the portions of the greenways network that need protection. This plan strongly recommends that the County pursue funding opportunities for greenways that will not deplete other programs. It is therefore recommended that the County establish the *Anne Arundel County Greenways Fund*. The Fund would be used for the following purposes:

- Acquire properties and easements;
- Match monies from other sources including federal and state programs, land trusts and conservancies;
- Build infrastructure including trails and wildlife crossings; and
- Fund habitat enhancement and restoration activities.

The fund could be created from a number of sources:

State of Maryland:

- Program Open Space

Anne Arundel County:

- General fund
- Capital improvements program
- Bond issue
- Funds from the "fee-in-lieu" provision for recreation land in subdivisions (see Action 3.3)
- Use of a portion of the County's share of the real property transfer tax.

Federal:

- Land and Water Conservation Fund (National Park Service).

It is common for economic development agencies to create a "shell" or "package" name for their programs. A single fund might combine different monies that have different purposes, with the purpose of focusing public attention and support on the agency's systematic efforts to meet a given goal. This approach would work well for the County in the goal to preserve greenways. For example, a County acquisition using Program Open Space funds would be characterized also as being an acquisition under the Greenways Fund.

Action 4.2: Create an Advanced Land Protection Revolving Fund

The County's ability to protect critical properties will require not only a consistent source of funding, but also the ability to act quickly when unforeseen opportunities arise. For this reason the County should establish an Advanced Land Protection Revolving Fund. This fund would be used only for land purchases or protection measures that are unexpected, especially in cases where critical segments or connections are threatened. The fund should contain between $1.0 and $3.0

million. The County's greenways program manager would determine when these funds were needed based on pre-approved guidelines, and the County's Right-of-Way office would conduct negotiations with the landowner. Following the completed transaction, the manager would prepare a report and request reimbursements from the appropriate funding source so as to refinance the fund[22].

Action 4.3 Make maximum use of related federal, state, and local programs to increase funding for greenways

In today's environment protecting and funding land protection and other greenways programs requires creativity and pooling of resources. The strengthening and coordination of existing state and local programs discussed under Action 3.4 needs to extend to funding and financing. Related programs and potential funding sources include:

State of Maryland:

- Greenprint
- Rural Legacy
- Maryland Agricultural Land Preservation Foundation
- Heritage Areas Program

Anne Arundel County:

- Forest Conservation

Federal:

- Land and Water Conservation Fund (National Park Service).
- Transportation Enhancements (US Department of Transportation). Under the Transportation Equity Act for the 21st Century (TEA-21) FHWA funding support is available for wildlife crossings on both new and existing roads. Through an expanded Transportation Enhancements category states and communities can get help for both crossing structures and for habitat connectivity measures. (See Chart 5 on Designing Wildlife Crossings)
- Wetlands Reserve Program (US Department of Agriculture)
- North American Wetland Conservation Act (US Fish and Wildlife Service)
- Migratory Bird Conservation Fund (US Fish and Wildlife Service)

Non-Profit:

- The Conservation Fund
- The Nature Conservancy
- Trust for Public Land

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22 Revolving funds are quite common in Maryland. Calvert County maintains a $1.0 million revolving fund available interest-free for county-based land trusts. The Maryland Environmental Trust has a $1.5 million fund of which $1.25 million is currently (March 2002) on loan. The Eastern Shore Land Conservancy has a Land Rescue Revolving Fund for use in acquisitions where time is not available to raise enough funds to make a transaction work in "conventional" ways. The Harford Land Trust has access to zero percent financing from Baltimore's Abell Foundation, and has used this money for pre-acquisitions.

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Appendix

Case Studies

Case Studies

This chapter contains two case studies of greenways in Anne Arundel County that illustrate how some of the general implementation approaches, methodologies, and strategies can be applied to actual greenways in the County. The first study describes the planning and organizational approach, now already in its fourth year, taken by the Greenway Committee of the South County Exchange for the Patuxent River Greenway in Southern Anne Arundel County. The second study looks at the area around the Dairy Farm in Gambrills, an important hub in central north county with three corridors connecting to other hubs.

Patuxent River Greenway[1]

Overview

In 1998, a group of concerned citizens formed a small non-profit organization to participate in a Countryside Stewardship Exchange. Of the many recommendations generated by the Exchange, the single, unifying need was to protect the area's rural lifestyle and landscapes from the sprawl of Washington, D.C. just 25 miles to the west. After months of organizational development and goal setting, citizens who had participated in the Countryside Exchange formed the non-profit South County Exchange and targeted their initial effort on developing a greenway along the 25-mile segment of the Patuxent River within the southern portion of Anne Arundel County. With a tangible goal established, the Exchange conducted community meetings, contacted property owners along the Patuxent River and developed a concept plan for an "ecological" greenway, intended to be largely undeveloped natural lands. As the Exchange built local support, many County officials became involved supporting the need for a countywide greenways network. The County's greenway initiative has been substantially bolstered by efforts along the Patuxent as a locally-driven example of citizen action and by Maryland Governor Glendening who recently approved the purchase of 615 acres of land within the greenway as the first land acquisition funded by the Maryland GreenPrint Program.

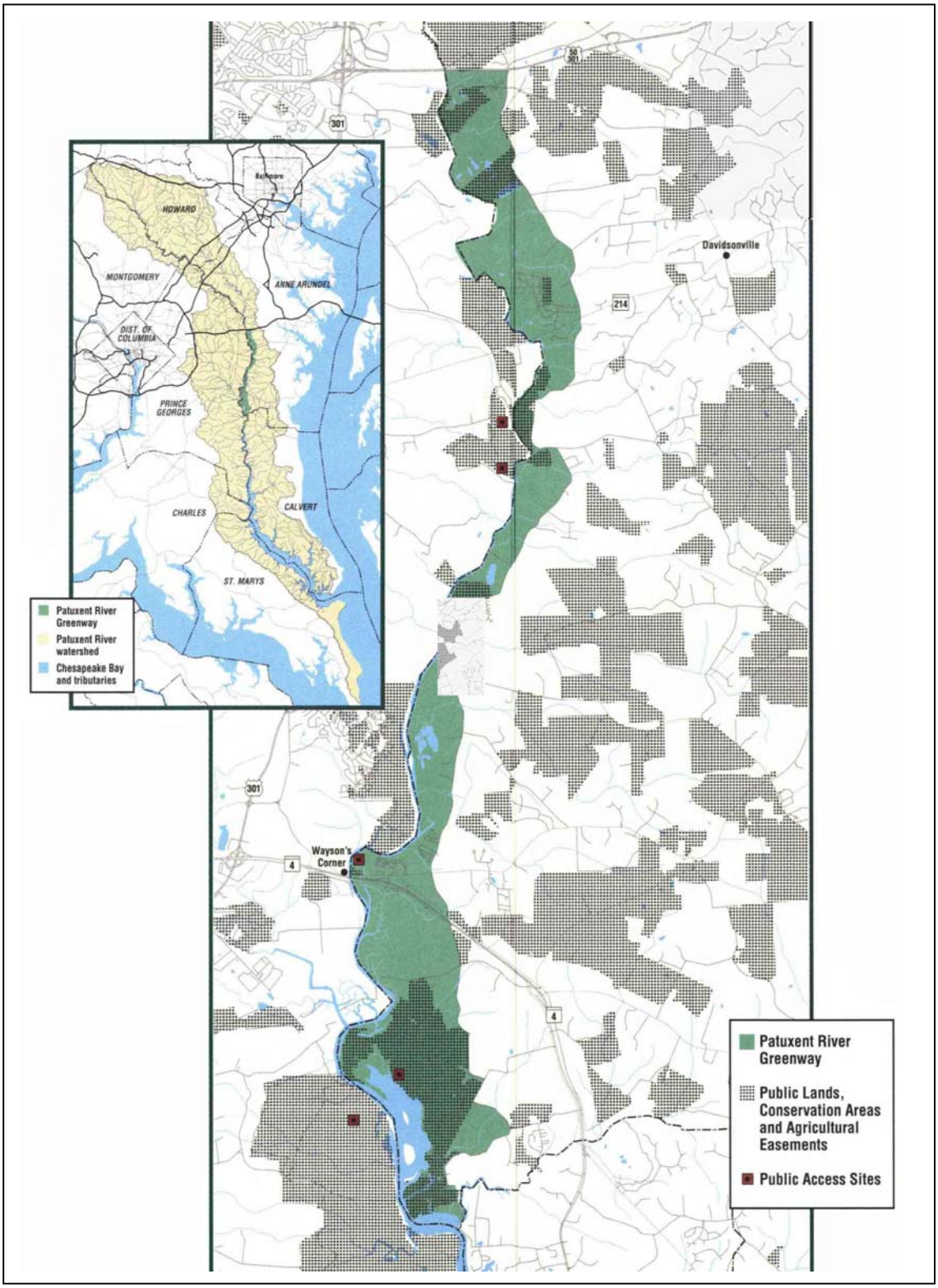
Patuxent River Greenway Process Summary

Goals and Objectives: *"keep South County rural," identify open space opportunities throughout South County, establish a greenway along the Patuxent River.*

Approach: *manage the Patuxent River Greenway as an ecological corridor through voluntary public/private partnerships.*

Methods: *natural resource and land use evaluation, prioritized restoration and protection strategy, resource management plan, voluntary landowner management activities.*

[1] Special thanks to the South County Exchange Greenway Committee for preparing this case study.



Local Action begins with Countryside Stewardship Exchange

A Countryside Exchange brings together international teams of volunteer professionals to work with communities on their most pressing conservation and development issues. It serves as a catalyst; using a visit by objective "outsiders" to motivate the creation of new coalitions, spur the emergence of new leaders, identify shared concerns and inspire collaborative action. The Chesapeake Bay Program and the National Park Service provided funding to the Alliance for the Chesapeake Bay and the Glynwood Center (a non-profit organization that organizes and facilitates exchanges across the

United States and Canada) to conduct countryside exchanges within the Chesapeake Bay watershed. Such Chesapeake Bay Exchanges encourage communities to identify themselves in the context of their watershed. Activities on the land may be artificially divided by political boundaries, but their effects can and do accumulate within the local watershed. The impact of poor land management in the hundreds of small watersheds that feed the Bay can be devastating to the ecosystem the Bay supports. At the end of an intensive, weeklong exchange, participants formulate suggestions and recommendations to assist the community in responding to conservation, land use and quality of life needs.

A group of concerned citizens in the southern portion of Anne Arundel County formed a Local Organizing Committee (LOC) and were selected for a Chesapeake Bay Exchange, which was conducted in October 1998. In organizing for the Exchange, participants hoped to incorporate recommendations resulting from the Exchange into the development of the South County Small Area Plan that was required by the County's new General Development Plan which also recommended development of a countywide greenway plan (Anne Arundel County Office of Planning and Zoning provided financial and technical support to the LOC). The primary goal of the Exchange was to establish a balanced approach for development, natural resource protection and the preservation of South County's rural character. Among the numerous recommendations developed by the Exchange team, several formed the basis for subsequent efforts associated with the Patuxent Greenway--identify opportunities for open space in partnership with private landowners, determine community support for a greenway program along the Patuxent River, and support the County's goal of preserving agricultural and rural areas. Following the Countryside Stewardship Exchange, the local Organizing Committee formally organized the South County Exchange, a non-profit organization, to implement key recommendations resulting from the Countryside Stewardship Exchange.

Wootons Landing Wetlands Park off Sands Road near Bayard

A Vision for South County

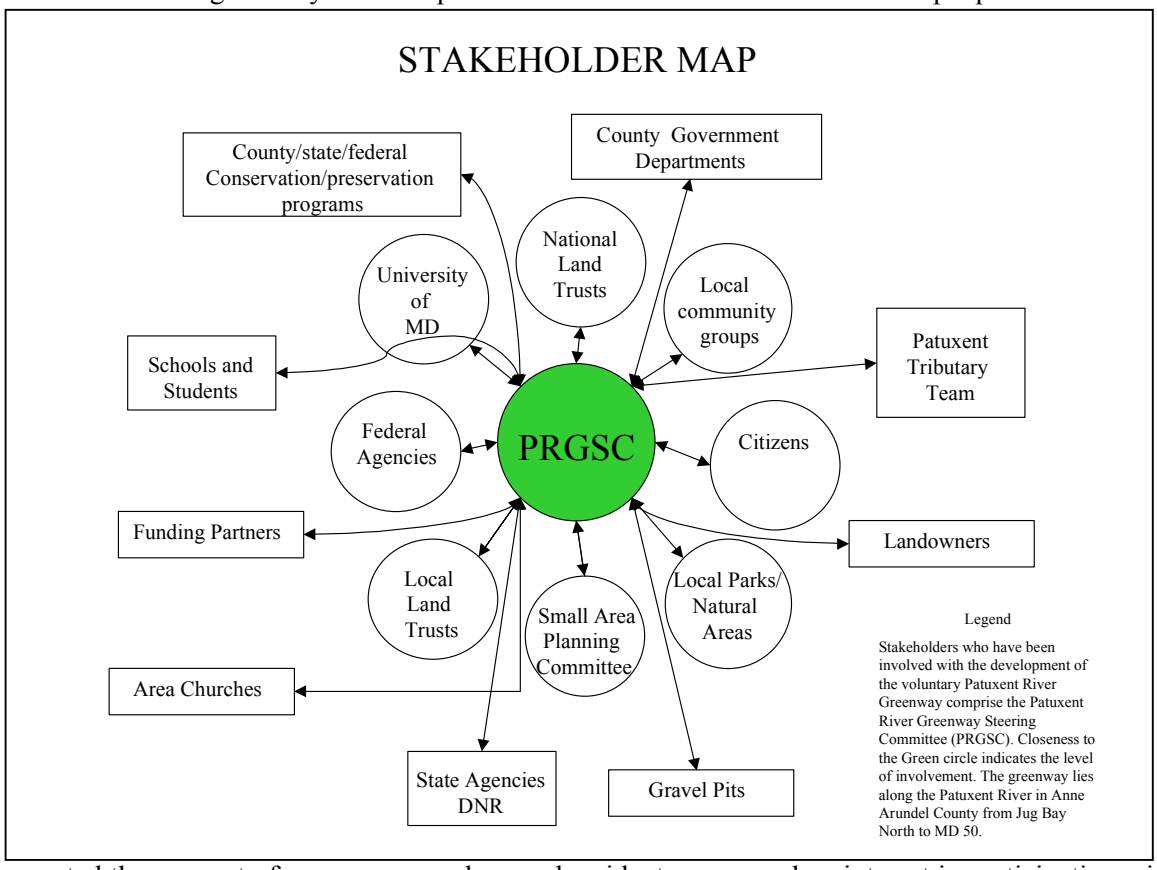
A number of local citizens who had participated in the Countryside Exchange were appointed by the County Executive to be members of the committee responsible for the preparation of the South County Small Area Plan. In developing this plan, participants articulated a vision for South County which established the important goals of preserving the area's agricultural, rural and historical qualities and emphasized that the quality of life in South County would be enhanced through the preservation, protection and restoration of its existing natural resources. This vision closely parallels many of the specific recommendations of the Countryside Stewardship Exchange. One of the key recommendations developed through the small area planning process was the creation of a greenway along the Patuxent River from Route 50 south to the Calvert County boundary. The South County Small Area Planning Committee

conduct several public forums to determine resident desires and needs within the planning area. The single most mentioned request was to *"keep South County rural."*

Planning the Patuxent River Greenway

Among the specifics regarding this request was the desire to create a greenway along the Patuxent River. The residents of South County wanted the greenway to provide an environmentally friendly buffer along the Patuxent River to mitigate the impacts from land uses including agriculture, residential development and mineral extraction activities. They also expressed a strong desire to have public access to areas along the Patuxent River for a variety of recreational purposes. In response to the strong public support, the plan recommended the establishment of a Greenway Overlay area to protect the Patuxent River and its natural resources, including fish and wildlife, forested areas, wildlife habitat, wetlands and water quality. Although certain areas of the Patuxent River are open to the public, the majority of the area is under the stewardship of private landowners. In recognition of landowner interests, the Greenway will serve the purpose of recreation and education in public areas and assistance to landowners in privately owned areas. As envisioned by the planning committee, the Greenway will protect the Patuxent River by recognizing landowner stewardship, providing resource management information and services to landowners, build community and landowner support for continued resource protection, such as protecting and improving wildlife habitat, educating the community about the importance of wetlands and forested areas, and on what they can do to minimize the impact of land use activities on the water quality of the Patuxent River and its tributaries.

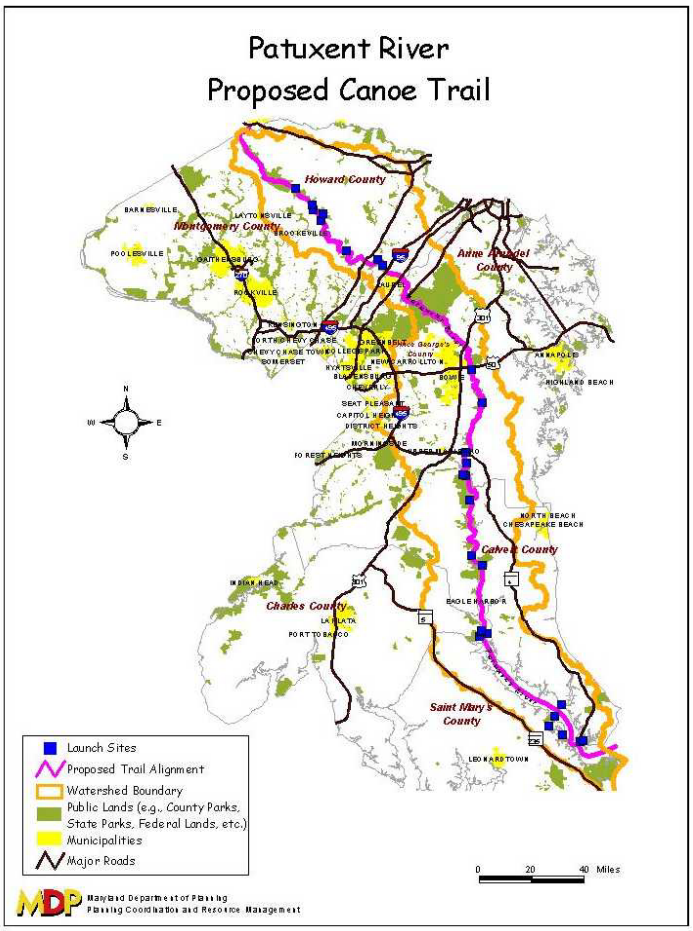
At the completion of the draft South County Small Area Plan, members of the planning committee and the newly organized South County Exchange sponsored a community meeting to discuss ongoing sand and gravel mining operations along the Patuxent River and explain how the establishment of a greenway could improve the area in the future. The 60 or so people in attendance



supported the concept of a greenway and several residents expressed an interest in participating with

the South County Exchange in its efforts to implement such a greenway. Additional public forums and workshops promoted the greenway concept. As community support for the greenway increased, the South County Exchange formed the Patuxent Greenway Committee to lead planning and implementation activities. This committee, broadly representative of surrounding communities, includes civic and conservation organizations, citizens and elected officials as well as staff of Federal, State of Maryland and local governmental agencies. With assistance from the National Park Service, the Exchange developed a brochure to describe the goals, objectives and conceptual plan of the greenway. In preparation for a large community workshop at Jug Bay Wetlands Sanctuary, the Trust for Public Land and Chesapeake Bay Program researched land records and prepared a letter to each property owner within the greenway explaining the greenway initiative. Anne Arundel County's Forestry Board and Office of Planning and Zoning assisted in the preparation of educational handouts explaining various conservation tools available to protect lands as well as a Federal, State and local programs and funding sources available to assist in establishing the Greenway. The University of Maryland Environmental Finance Center, in response to local landowner concerns, analyzed the potential economic implications that the greenway might have on property values and taxes.

Canoeing on the Patuxent River in Anne Arundel County's Patuxent River Greenway



A proposed canoe trail would run from Solomons in Calvert County, through Anne Arundel County north to Howard County (http://www.mdp.state.md.us/info/patux.htm)

Implementing the Greenway

Following the development of a conceptual plan and broad public acceptance of the greenway, the Exchange's greenway committee focused on implementation. The development of the Patuxent River Greenway implementation strategy, funded in part by a U. S. Environmental Protection Agency/National Fish and Wildlife Foundation Chesapeake Bay Small Watershed Grant, includes completion of a detailed evaluation of existing natural resources, development of a conservation strategy and preparation of a management plan for the Greenway. The resource evaluation, to be completed through a geographic information system (GIS) analysis of larger land parcels (10 acres and more), will include location, ownership and existing land uses; Chesapeake Bay Critical Area land use designations; and the presence of wetlands, forested areas and riparian buffers (stream-side vegetation). This will provide an accurate and detailed record of the existing condition of the Greenway and, with additional information characterizing potential future development, serve as a basis to prioritize areas for future restoration and protection efforts. With the aid of a conservation matrix developed by The Trust for Public Land, Environmental Finance Center and Anne Arundel County, resource managers will have the necessary information to identify the most appropriate conservation programs and tax incentives based on specific parcel attributes. The management plan will consist of a map depicting the "desired future condition" of the Greenway (how the area should look in 20 to 25 years) and a series of management prescriptions (actions) designed to achieve the future condition through a variety of activities. The completed plan will describe a range of management activities that, if implemented for each type of land use-rural agricultural, rural forested, residential or sand and gravel mining operation would protect and enhance the natural condition of the greenway. These management efforts will be implemented through voluntary landowner actions and participation in a variety of conservation easement programs in coordination with various watershed management efforts such as the Patuxent River Policy Plan and Patuxent River Tributary Strategy.

Beyond South County

The approach used for the greenway in South County is also appropriate for other portions of the Patuxent River including northern areas of Anne Arundel County as well as other jurisdictions throughout the extent of the Patuxent River. The management process developed by the Exchange is available as a model for future greenway efforts along the Patuxent River. The efforts of the South County Exchange also serve as a useful guide for future greenway activities throughout Anne Arundel County, effectively facilitating the implementation of the countywide greenway plan. The efforts of the Exchange also increase the capabilities of area citizens to actively participate in environmental stewardship protecting the character of the region so important to residents, while substantially contributing to the improvement of the Chesapeake Bay.

Patuxent River Greenway Partners

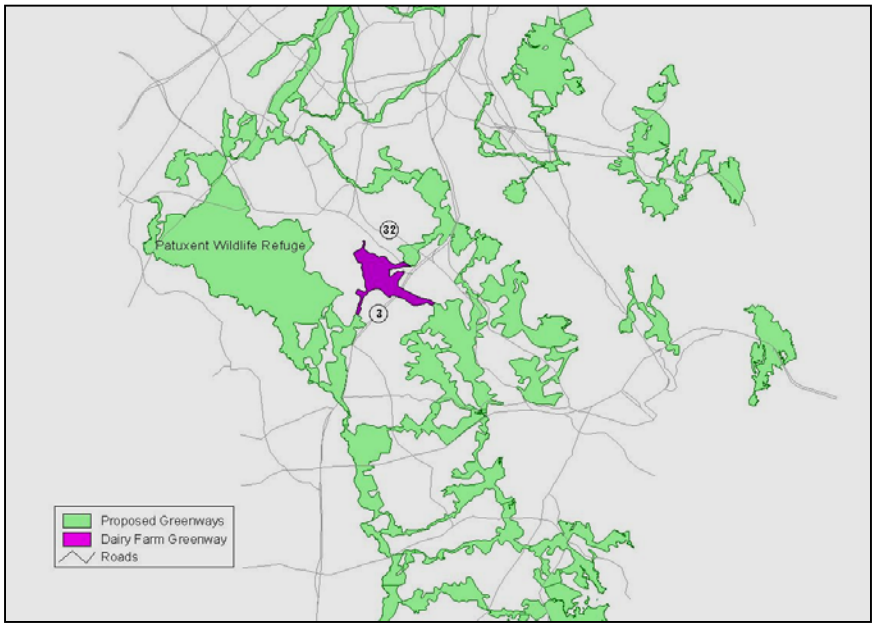
Anne Arundel County Forest Conservancy District Board, Anne Arundel County Department of Recreation and Parks, Anne Arundel County Office of Planning and Zoning, Bristol Civic Association, Chesapeake Bay Program, Environmental Finance Center University of Maryland, Davidsonville Area Civic Association, Harwood Civic Association, Jug Bay Wetlands Sanctuary and Friends of Jug Bay, Glynwood Center, National Fish and Wildlife Foundation, National Park Service, Patuxent River Commission, Severn River Association, Sierra Club, Sollers United Methodist Church, Adams United Methodist Church, South County Coalition, South County Exchange, South County Heritage, South County Land Trust, Trust for Public Land and U. S. Fish and Wildlife Service Chesapeake Bay Field Office.

Dairy Farm Greenway

Introduction

The proposed Dairy Farm greenway is an approximately 1,500 acre tract south of the intersection of Route 3and Route 32 in northern Anne Arundel County (see Figure A-1). The corridor is bisected east of the Dairy Farm by U.S. Rt. 3, and continues in an easterly direction between the neighborhoods of Hamondell Heights and Brandy Farms. Almost 60 percent of the 1,533 acres within the greenway comprise the U.S. Naval Academy Dairy Farm (832 acres) and the Odenton Nature Area (78 acres).

Figure A-1 Dairy Farm Greenway Location



Planning in the Dairy Farm Greenway

Anne Arundel County's 1997 General Development Plan (GDP) Land Use Plan Map designates land use within the Dairy Farm Greenway as mostly agricultural. The Dairy Farm itself is designated as Governmental/Institutional. Smaller sections of land are designated as Natural Features and Low Density Residential. While the Dairy Farm is designated as a government installation, it is operated as a working farm, so the amount of land used for agricultural purposes within the Dairy Farm Greenway is not reflected on the Land Use Plan Map. Because so much of the surrounding land is rural and/or natural and is expected to remain that way, much of the land on which the Dairy Farm now operates would probably be protected from intense development if the Farm were closed or sold. Thus, the GDP encourages the preservation of open space within the Dairy Farm Greenway.

The Dairy Farm Greenway is in the extreme upper portion of the Bacon Ridge Branch watershed, a tributary to the South River. In response to growing concerns relating to habitat degradation and declining water quality in the South River, the County developed the South River Watershed Master Plan in 1997. This plan makes specific reference to greenways in Chapter 6, noting that public access greenways within the South River watershed could provide an alternative to vehicular travel, thereby reducing water pollution associated with motor vehicles. In addition, the plan includes three

other recommendations that could incorporate greenways. In the executive summary the plan advocates sensitive planning measures (which would include greenways) to alleviate pollution. In chapter 3, the plan cites habitat degradation in general as a problem in the watershed, especially in riparian areas. Many of the greenway corridors in the Greenways Master Plan follow stream valleys in the South River watershed and would address this concern directly by improving riparian habitat. In chapter 4, the South River watershed plan recommends improvement of road crossings to alleviate flooding problems. While this does not relate directly to the Greenways Master Plan, retrofitting of bridges and culverts to alleviate flooding problems and to improve habitat connectivity could be performed concurrently.

With respect to the county's small area planning program, most of the Dairy Farm Greenway is in the Odenton Area, but the segment of the greenway east of Rt. 3 is in the Crownsville Area. Both plans recommend that their land use plans recognize existing commercial uses along Rt. 3. The draft Odenton Small Area Plan sets 12 goals for improvements relating to the management of environmental and natural resources including preservation of environmentally sensitive areas, forested areas, agricultural areas, open space, and greenways[2]. Of these goals, three relate to the Dairy Farm Greenway generally and one mentions the Odenton Natural Area (which is within the Dairy Farm Greenway) specifically. Goal 1 encourages the protection of rivers, streams, and watersheds in the Odenton Small Area. The Dairy Farm Corridor encompasses parts of the Bacon Ridge Branch and Towsers Branch watersheds. Goal 7 promotes the protection of environmentally sensitive areas. Designation of the Dairy Farm Greenway as protected land would protect these portions of the Bacon Ridge Branch and Towsers Branch watersheds, in addition to providing additional protection to the Odenton Natural Area (which is specifically recommended in Goal 9). Goal 8 supports preservation of forested and agricultural land, which comprises most of the Dairy Farm Greenway.

The State Highway Administration is planning a major study of the 8.9 mile corridor along Rt. 3 between US Rt. 50 to MD Rt. 32 beginning in 2002. The major goals of the study are to improve safety and relieve congestion. The study provides an opportunity to consider the proposed greenway including the critical connection across Rt. 3 (see below).

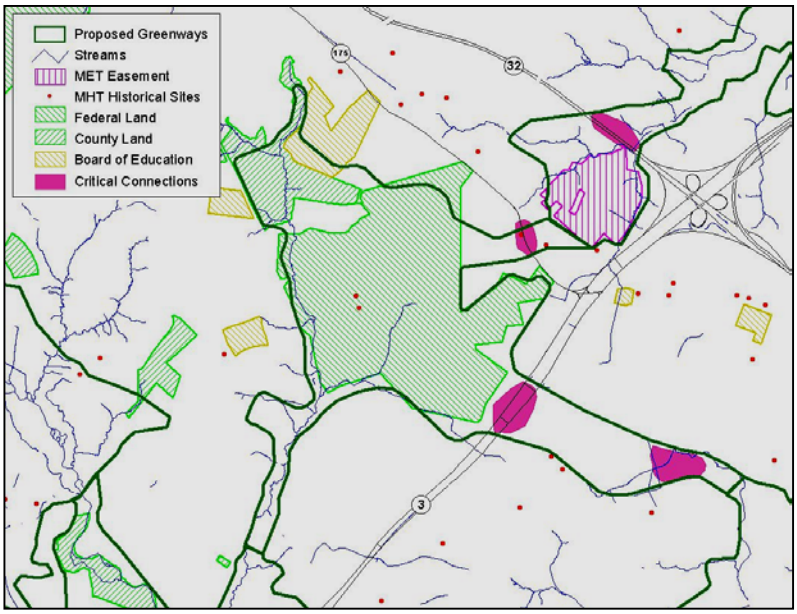
Connectivity and Assets

The Dairy Farm Greenway links to the rest of the proposed greenway network in three places: to the Severn Run Corridor in the north; the Bacon Ridge Branch Hub in the southeast, and the Little Patuxent-Crofton corridor in the southwest (see Figure 5, in Chapter 4 and Figure A-1). While the Dairy Farm Corridor provides a valuable connection between these other elements of the greenway network, it does not provide the only connection. The Severn Run Corridor provides an east-west link across Rt. 3 north of the Dairy Farm, and the network crosses Rt. 3 again south of the Dairy Farm Greenway immediately south of the intersection of Rt. 3 and Rt. 450 near Crofton. The Dairy Farm Greenway does provide a north-south connection through the Severn Run and Little Patuxent-Crofton Corridors, but this connection is also made by the Patuxent Research Refuge Hub, the largest hub in the greenways network. From a land planning perspective, the Dairy Farm Greenway is probably most notable because it contains one of the largest remaining contiguous tracts of agricultural land in the north-central portion of the county and roughly 60 percent of its land is already protected from development. Its significance as a large undeveloped tract is likely to increase as this portion of the county develops. From an ecological perspective, the corridor is significant because it provides a link between the Patuxent Research Refuge and the Bacon Ridge Branch Hub, two very large, regionally significant habitat areas and it encompasses parts of the headwaters of the Bacon Ridge Branch watershed and the Towsers Branch watershed, two regionally significant watersheds. The greenway also has two historic sites and is close to several others. Two

[2] Draft Odenton Small Area Plan, November 20, 2000

schools are partially within the greenway (Arundel Senior High School and Arundel Middle School. The Maryland Environmental Trust holds an easement in the corridor connecting the Dairy Farm and Severn Run greenways (see Figure A-2).

Figure A-2 Dairy Farm Greenway Features



Public access

Other than the Odenton Natural Area, there is currently no public access within the greenway. Although the Dairy Farm is not privately owned, it is officially a government installation and not generally open to the public. The rest of the corridor is owned privately, except for a very small open space parcel that is owned by the County in the southern portion of the corridor. This parcel is entirely surrounded by privately held land, however, and does not support transportation or recreational uses by the general public. The Dairy Farm's close proximity to existing and planned residential communities suggests that if more public access to land within the corridor were available, it would probably be utilized by the public for a variety of passive and active recreational activities. Most of the residences in the immediate vicinity of the greenway are along its western and northern boundaries. The Odenton Natural Area fills a need for public access to open space along the northern boundary and additional public access could build on this existing area.

The County's draft Bicycle and Pedestrian Master Transportation Plan identifies Route 3, including the section that runs through the Dairy Farm Greenway, as part of the proposed countywide main bicycle and pedestrian transportation network. The Plan recommends as a potential improvement a pathway along the east side of MD 3 to provide a pedestrian route from Crofton to the Village of Waugh Chapel, just South of the Dairy Farm Greenway. Improvements such as these would increase public access to the Dairy Farm Greenway.

Critical connections

Critical connections are areas or location where if a connection cannot be made between greenways the network will be discontinuous and be unable to serve its functions of facilitating wildlife movement (see Chapter 3). Two critical connections are associated with the Dairy Farm Greenway and both are located where roads intersect the greenway network (see Figure A-2). The first is where the intersection with the Greenway crosses Rt. 175 near Gambrills, and the second is where the Greenway crosses Rt. 3. The Rt. 3 crossing is the more problematic of the two connections: Rt. 3 is a divided highway, making the potential crossing relatively long, and the crossing would have to be at grade within a commercial area.

Northbound Rt. 3 in the vicinity of its intersection with the Dairy Farm Greenway. Left, commercial section, right, area just north of the commercial section.

A site investigation of the Rt. 3 crossing revealed that there are no stream culverts or other structural components of the roadway that could be easily utilized by wildlife as a crossing. Further, because the road is mostly at grade through this area, retrofitting the roadway to add a crossing could involve a major construction effort affecting a significant portion of the roadway. Alterations to highways that are as large and highly used as Rt. 3 can be expensive. Generally culverts are the most cost effective means of providing for wildlife passage over roadways. Because Rt. 3 is divided in this location and there is some natural vegetation in the median, a possible design solution would be to install separate culverts under the north and south bound lanes leaving the median in its current state. This would minimize the amount of construction required and the cost associated with the crossing, and allowing retention of natural vegetation through the central portion of the crossing. The greenway connection across Rt. 3 should be investigated as part of the SHA's proposed Rt. 3 study.

Although not identified as critical connections in this Plan, the intersection of Waugh Chapel Road and the southwest portion of the Dairy Farm Greenway and the intersection of Dairy Farm Road with an unnamed tributary to Towser's Branch were both examined as examples of critter crossings in this area. This analysis was completed in order to characterize the types of crossings within the corridor and to identify measures that could be taken to reduce road-kill and reduce accidents related to animal-traffic conflicts in areas that are used frequently by wildlife. The Waugh Chapel Road crossing consists of three culverts one of which accommodates the stream and two that are mostly dry but which probably accommodate larger flows during high water events.

One of the dry culverts contains a small wall that is placed in the center of the culvert for its entire length. While the wall does not completely preclude passage by wildlife, it is probably an impediment to use of the culvert, especially by large mammals. The culvert contains virtually no natural substrate. The exit of the culvert is visible from the entrance, and the riparian area is vegetated to the culvert's edge on both sides of the crossing. The travel lanes are elevated above the forested riparian area, although dense shrubs and vines on the embankment could provide cover for

wildlife up to the edge of the road surface, and could potentially lure wildlife into traffic. To prevent wildlife from entering the roadway, exclusion devices (i.e., fences or walls) should be added. While the visible entrances and exits, natural vegetation in the corridor, and elevation of the roadway are features that are beneficial to wildlife, the Waugh Chapel crossing could be improved by mowing vegetation that could attract wildlife out of the corridor and onto the roadway, fencing wildlife out of the roadway, and placing a natural substrate in the bottom of the dry culvert. It is possible that these culverts could serve as pedestrian crossings at some point in the future, however improvements would have to be made in order to make them more attractive to people and human use could curtail their use by wildlife.

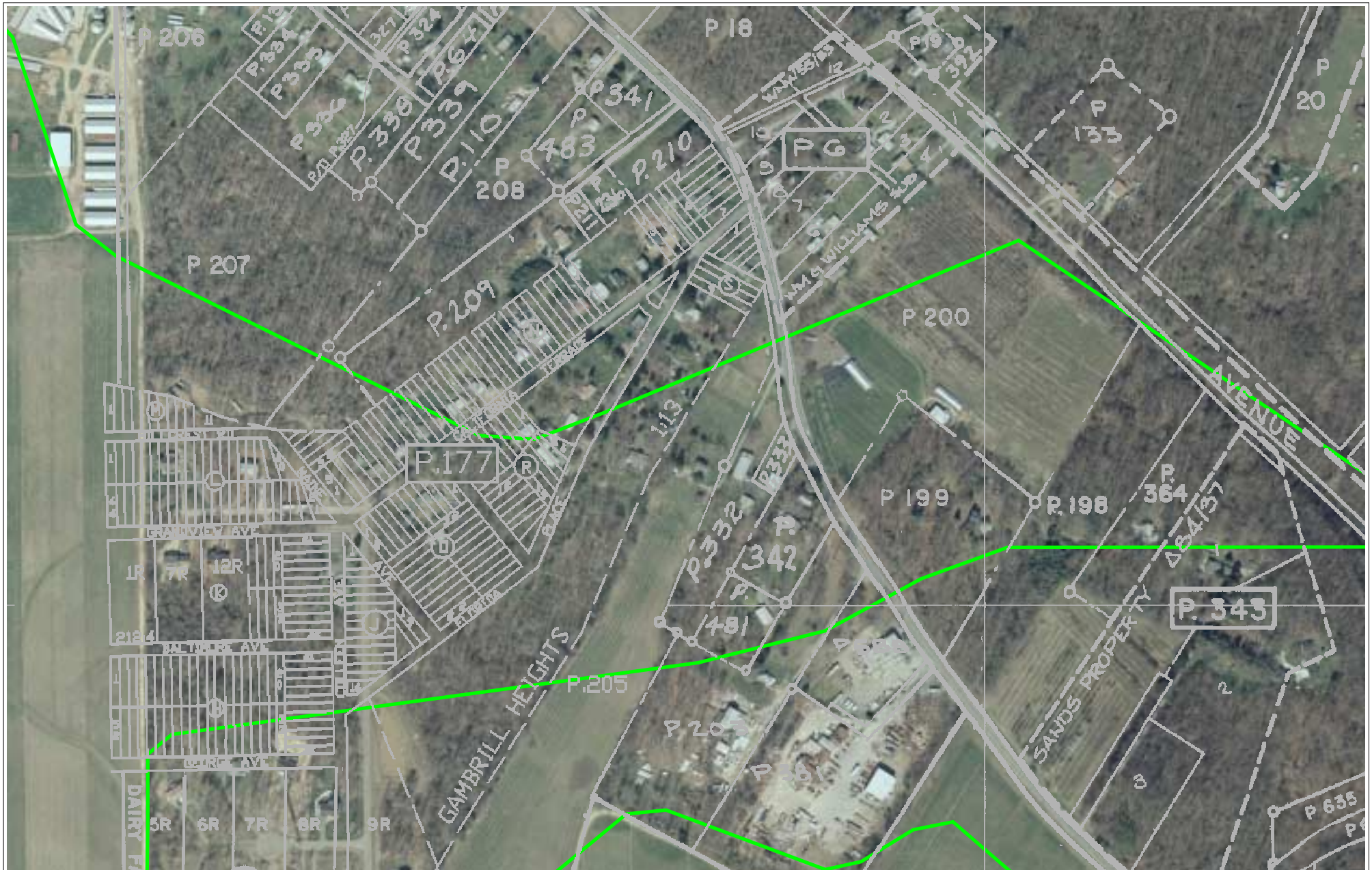
Mostly dry culvert with a "wall" at the Waugh Chapel Road Crossing. Note the lack of natural substrate in the culvert.

Dry culvert under Dairy Farm Road. Note the visible exit and natural substrate in the culvert.

The Dairy Farm Road crossing consists of two culverts, one which accommodates the stream and one that is dry. The dry culvert does not contain walls or other obstructions to passage. The interior floor of the dry culvert is covered with a small amount of natural sediment, and the exit of the culvert is visible from the entrance. The riparian zone is vegetated to the entrance of the culverts on both sides, providing cover for wildlife approaching and leaving the culvert, and the road surface is on an elevated, mowed berm. These factors, and the fact that the vegetated corridor is separated from the mowed right-of-way by a barbed-wire fence, probably makes the dry culvert an attractive passage alternative for wildlife during normal stream flows. Small mammal tracks entering the culvert were noted during the field visit. The culvert was large enough to accommodate all species common to this area.

Subdivision activity

In contrast to many areas in the north central portion of Anne Arundel County, subdivision activity within the proposed Dairy Farm Greenway is light with only two subdivisions currently planned. Gambrill Heights, is a 46 acre recorded subdivision in the area bounded by Rt. 175 and the Dairy Farm would completely span the connection with the Severn Run Corridor (see Figure A-3, area to the left of the figure in the vicinity of parcel 177). Gambrill Heights is in the final stage of planning and is in an area that is zoned RA (Residential Agricultural). The subdivision plat originally contained 56 lots but few have been built on and the proposed subdivision would create more buildable lots.



Legend:

- Proposed Greenways
- Property Lines (MD Property View 2000)
- Aerial Photograph 2000

N W E S

Scale in Feet

0 200 400

Anne Arundel County Greenways Master Plan

Figure A-3

Gambrill Heights and Route 175 Area of Dairy Farm Greenway

Because of the low housing density required by zoning ordinances in this area, it appears to be possible to design the subdivision to incorporate a minimum 200 foot natural corridor through the subdivision and maintain the integrity of the greenway connection is. However, this will require very careful planning.

Church View Estates is the other proposed subdivision planned within the Greenway. It contains approximately 250 acres and under the current plat it would contain eleven single family lots and a forest retention area extending roughly eastward from the vicinity of the intersection of McKnew Road and Rt. 3 to the intersection of Baldwin Drive and Cecil Avenue. This subdivision is also zoned RA. The priority retention area could provide a link between the Dairy Farm Greenway and the Bacon Ridge Branch Hub. The priority retention area lies very close to the section of Rt. 3 identified during the field assessment as the most practical candidate for a critter crossing and could be incorporated into the greenway. Church View Estates is also in the final stage of subdivision.

Application of Habitat Suitability Indices

As part of this case study there was interest in determining the approximate value of a greenway for a range of wildlife species and comparing this value to other greenways. Habitat Suitability Indices (HSIs) are models published by the U.S. Fish and Wildlife Service that are used to evaluate the suitability of habitat areas for selected species. These models quantify the relative fitness of habitat areas based on metrics developed for each species from the available information regarding each species' food, range, and reproductive requirements. HSI models were utilized in this case study because they are designed to be quick and easy to apply, versatile enough to be applicable in a wide range of potentially useful habitats, and do not require specially trained personnel to apply. By analyzing the value of habitat within the Dairy Farm Greenway for several "indicator" species it was possible able to estimate its approximate value for a wide range of wildlife species, and assign numerical values to the habitat to facilitate comparison between the Dairy Farm Greenway and other segments of the greenway network.

Habitat areas within the Dairy Farm Greenway were evaluated using HSI models for three species that are common locally and are likely to utilize habitats within the Greenway: downy woodpecker, eastern cottontail rabbit, and red spotted newt. These species were selected as "indicator" species, representatives of larger groups of species that have similar but not identical habitat requirements.

Downy woodpecker

The HSI for downy woodpecker is based on estimates of the amount of foraging and reproductive habitats available to individuals within a forest stand. The model uses the basal area of a forest stand (area covered by standing trees), and the number of standing dead trees (snags) within the stand to measure these variables. Because downy woodpeckers feed on insects on standing trees, the basal area of a forest stand provides an estimate of the amount of foraging habitat available to this species. Downy woodpeckers nest in cavities excavated in snags, so the number of snags provides an estimate of reproductive habitat available within a forest stand. Between 44 ft^2 and 87 ft^2 of basal area per acre is considered optimal foraging habitat and five or more snags per acre are considered to provide optimal reproductive habitat[3]

Methods

Two test plots were located in intermediate deciduous forest within the Odenton Natural Area near the terminus of Indian Summer Court. The standing timber was divided into five size classes and the number of trees in each size class within each test plot was visually estimated. Basal area of the test plot was then calculated as the mean of each size class multiplied by the number of trees counted in

[3] USFWS, 1983. Habitat Suitability Index Models: Downy Woodpecker.

each size class. This value was then converted into basal area per acre. The number of snags was then counted within each test plot. This protocol was followed at both test plots. The suitability of the foraging and reproductive habitats was expressed through variables (V_1 and V_2, respectively). The values of V_1 and V_2 were determined for each test plot using the suitability graphs provided in the USFWS model text (USFWS, 1983) and the overall HSI values for each plot were calculated as the product of the suitablility of the foraging habitat (V_1) multiplied by the suitability of the reproductive habitat (V_2), or:

$$V_1 \times V_2 = HSI$$

Results and Discussion

The test plots both received HSI scores of 0.5 on a scale of 0 to 1, where 0 indicates no suitable habitat and 1 indicates maximum habitat suitability, so the habitat for downy woodpeckers within this forest patch is average. V_2 essentially measures the number of snags within a stand, and both test plots received very high scores for V_2 (1 and 0.95). The V_1 scores for both test plots were substantially lower, at 0.5 each. This means that while both test plots had optimal reproductive habitat in the form of snags, the forest was too dense to provide optimal foraging habitat. In both test plots the most abundant size classes of standing timber was 10-20 inches in diameter. Downy woodpeckers would likely benefit from management of the stand to remove some of these smaller trees. Removal of smaller trees would be preferable to removal of large trees because mature trees would support more insects for woodpeckers to eat and would likely be a better source of quality snags in the near future than immature trees. It should be noted that woodpeckers currently utilize this stand, as evidenced by a snag with excavated cavities located during the field investigation (see figure at right), however it was not determined whether downy woodpeckers had made the cavities.

Snag with holes excavated by woodpeckers in the Odenton Nature Area

Eastern Cottontail Rabbit

The HSI for rabbits is based on estimates of winter cover and winter food provided by vegetation within a given area. In this model the percentage of shrub crown closure, percentage of tree canopy closure, and percentage of persistent herbaceous canopy closure are measured to evaluate the amount of cover and food available within a habitat area. Because rabbits utilize woody vegetation (shrubs and trees) as cover and food throughout the winter, and may utilize herbaceous vegetation for cover and food if the cover is dense or the winter weather is not severe, these variables together yield an estimate of suitable cover and food for rabbits. Crown cover is considered optimal at 20 percent to 50 percent for shrubs, 25 percent to 50 percent, for trees, and 100 percent for herbs[4].

Eastern Cottontail Rabbit habitat test plot along the western boundary of the Odenton Nature Area

Methods

Two test plots were located on the border between a power line right-of-way (ROW) and an intermediate mixed forest immediately at the end of Indian Summer Court (see figure at right). Linear woodland features and herbaceous areas adjacent to them are utilized year-round by Eastern cottontails. The test plots were located so that the shrub community on the edge of the forest and the herbaceous vegetation in the ROW were included. No true forest was included in the test plot. Percent crown cover was visually estimated for trees, shrubs, and herbs. This protocol was followed at both test plots. Variables contributing to the suitability of the habitat (SIV_1, SIV_2, and SIV_3) based on percent crown cover of shrubs, trees, and persistent herbaceous vegetation, respectively, were determined using suitability graphs provided in the description of the HSI model. A winter cover/food index (WCFI) was calculated using the following equation per the model guidelines:

$$WCFI = \frac{(4(SIV_1) + SIV_2) + SIV_3}{5}$$

The WCFI was calculated for each of the two habitat types (forest and herbaceous field) in each test plot and the final HSI score for each test plot was expressed as an average of both WCFI values for each plot, weighted by the percent coverage of each vegetation typed within each plot .

Results and Discussion

The analysis described above resulted in a WCFI score for herbaceous vegetation and a WCFI score for woody vegetation for each plot. The values of SIV_1, SIV_2, SIV_3, WCFI, are given in Table A-1, in addition to the final HSI score for each plot. Since each test plot was placed so that woody vegetation and herbaceous vegetation dominated approximately half the plot, each WCFI score was weighted equally in the final HSI calculation. In both plots the woody vegetation WCFI was very high (0.95 and 1), indicating nearly optimal and optimal coverage of woody vegetation, respectively. Both plots received scores of 0.6 for the herbaceous vegetation WCFI, indicating that rabbits in this area would benefit from a more complete herbaceous canopy. If the herbaceous canopy within the ROW was allowed to develop further by mowing less frequently and/or supplemental plantings of native herbs, use of this area by rabbits would be expected to increase.

[4] USFWS, 1984. Habitat Suitability Index Models: Eastern Cottontail Rabbit.

Table A-1 `Suitability Index Values, Winter Cover/Food Indices and HSI scores for Eastern Cottontail Rabbits

Test plot 1			Test plot 2		
Cover type	**Woody**	**Herbaceous**	**Cover type**	**Woody**	**Herbaceous**
SIV_1	0.95	0	SIV_1	1	0
SIV_2	0	0	SIV_2	1	0
SIV_3	0.19	0.6	SIV_3	0.25	0.6
WCFI	0.95	0.6	WCFI	1	0.6
Final HSI	0.78		Final HSI	0.8	

Bobcat

A special discussion of bobcat is warranted here because the corridor is within the bobcat's historical range, the species has special concern status in Maryland, and the HSI for bobcat relies solely on the availability of food to determine value for the species[5]. The cottontail rabbit would likely be major prey species for bobcat in this area, and the HSI score for bobcat is equal to the HSI score for rabbit in this area. Although the current presence of bobcats in the corridor is unconfirmed, if they do occur here management of the habitat to benefit rabbits will likewise benefit bobcats (and other predators). If they do not currently occupy habitat in this portion of the greenway network, they could spread here through natural migration or be reintroduced and the habitat could support them.

Red Spotted Newt

Newts most often utilize wetland or aquatic habitats with slow moving or stagnant, permanent water less than 6 feet deep. To be considered optimal for newts, a wetland must also be 75 percent-100 percent covered by aquatic vegetation. A wetland with no aquatic vegetation will not support red-spotted newts. Distance to forest is important only for populations exhibiting a terrestrial life stage, but was included in this application of the model because no data on the life cycle of the local newt population was available. The HSI for red spotted newt therefore uses three habitat parameters as indicators of habitat suitability: percent of wetted area < 6.6 ft deep (P_1), percent coverage of aquatic vegetation (P_2), and distance to forested habitat (P_3).

Investigating red-spotted newt habitat near the intersection of the greenway and Waugh Chapel Road

Methods

Two small wetlands were surveyed for suitable habitat according to the guidelines published by the USFWS[6]. The HSI for red-spotted newts was designed to measure habitat parameters during summer, but project scheduling issues made it necessary to perform field work in mid December. Depth of water in both ponds during typical summers was estimated using surrounding topography and

[5] USFWS, 1987. Habitat Suitability Index Models: Bobcat.

[6] USFWS, 1985. Habitat Suitability Index Models: Red-Spotted Newt.

water stained leaves on the shorelines of both ponds. Due to a particularly mild autumn in 2001, remnants of emergent aquatic vegetation were present at the time the field work was completed, making it possible to estimate coverage of aquatic vegetation during summer conditions. Distance to the nearest forest patch was measured as the shortest distance from suitable shoreline habitat across land to the nearest forest margin. The HSI was calculated as the product of the suitability indices for each of the three habitat parameters above, or:

$$HSI=P_1 \times P_2 \times P_3$$

Results and Discussion

The HSI score calculated for wetland 1 was 0.36 and the score for wetland 2 was 0.4 on a scale from 0 to 1 where 0 indicates no suitability and 1 indicates maximum suitability. Both wetlands had forest habitat available at an optimum distance, therefore distance to forest did not influence the scores. Both wetlands were associated with small ponds, parts of which are probably deeper than 6.6 ft during the summer, although pond 2 was shallower than pond 1 and received a higher score for that parameter. Wetland 1 had more aquatic vegetation than wetland 2 and received a higher score on that parameter, however wetland 2 scored higher on the overall HSI than wetland 1 because the difference in area covered by water less than 2m deep in both wetlands was greater than the difference in area covered by aquatic vegetation in both wetlands. Overall, wetlands that have a large percentage of shallow, vegetated, permanently wetted area in summer will be utilized by red-spotted newts more frequently than those that are deep, ephemeral, or denuded.

Significance and Desired Future

The Naval Academy Dairy Farm Greenway is a microcosm of the entire County with respect to greenways because it contains a patchwork of land including agricultural, natural, and developed areas. Regionally, this segment of the Countywide network is significant because it spans the headwaters of two watersheds, contains a large contiguous patch of agricultural land in a developing area, and provides north-south and east west habitat linkages within the larger greenway network. While these connections are not unique, they are valuable. If other connections in this part of the County were lost through subdivision, road construction, or other changes to the landscape, the Dairy Farm Corridor could easily become the only north-south or east-west connection between high quality wildlife habitats in this region of the County. The Dairy Farm Greenway's most difficult connection to the rest of the network is the Rt. 3 crossing. While this connection is potentially expensive, however, it would not be impossible to make. Finally, the corridor is large enough that with careful attention to layout and design, some development could still occur in the Greenway without completely jeopardizing its ecological values.

Although the Dairy Farm Greenway is not among the largest hubs in the County, it meets the minimum acreage requirements for a hub and contains a high percentage of protected land that is unlikely to be developed in the near future. It is also centrally located with respect to other hubs, such as the Patuxent Research Center and the Bacon Ridge Branch Hub. The habitat value of the forest, shrubland, and wetlands within the Greenway as measured by the HSI models is fair, and could be improved in the future by careful management of natural resources within and surrounding the greenway. Currently the corridor probably has more ecological value than recreational value, although the Odenton Natural Area serves both needs. Expansion of public access both within the Natural Area and in the southwestern portion of the Greenway would increase its value for recreation. However, because the Dairy Farm Greenway would not connect major population areas, management strategies for the Dairy Farm Greenway should concentrate on increasing habitat value and improving ecological connectivity rather than on trails through the entire greenway.

Recommended Next Steps for the Dairy Farm Greenway

1. Develop a plan to maintain a greenway corridor through or in the vicinity of the Gambrill Heights subdivision. This is a critical connection currently going through subdivision.
2. Ensure that the State Highway Administration considers the Greenways Master Plan in its forthcoming planning study of Route 3. Focus special attention on the critical connections across the highway.
3. Develop a strategic plan in cooperation with property owners, residents and businesses to protect land in the greenway and adjoining greenway corridors.
4. Manage habitat areas to increase habitat suitability scores. Specifically, management efforts should focus on preservation of mature forest, shrubland and wetlands, especially wetland areas that support emergent aquatic vegetation.
5. Discuss opportunities with staff of the Naval Academy Dairy Farm to tailor management and operations at the Dairy Farm to increase the value of the habitat on the farm for wildlife.
6. Explore ways of improving access via trails at the Odenton Natural Area.
7. Support bicycle and pedestrian improvements along Route 3 as a means of increasing public access to and visibility for the Greenway.