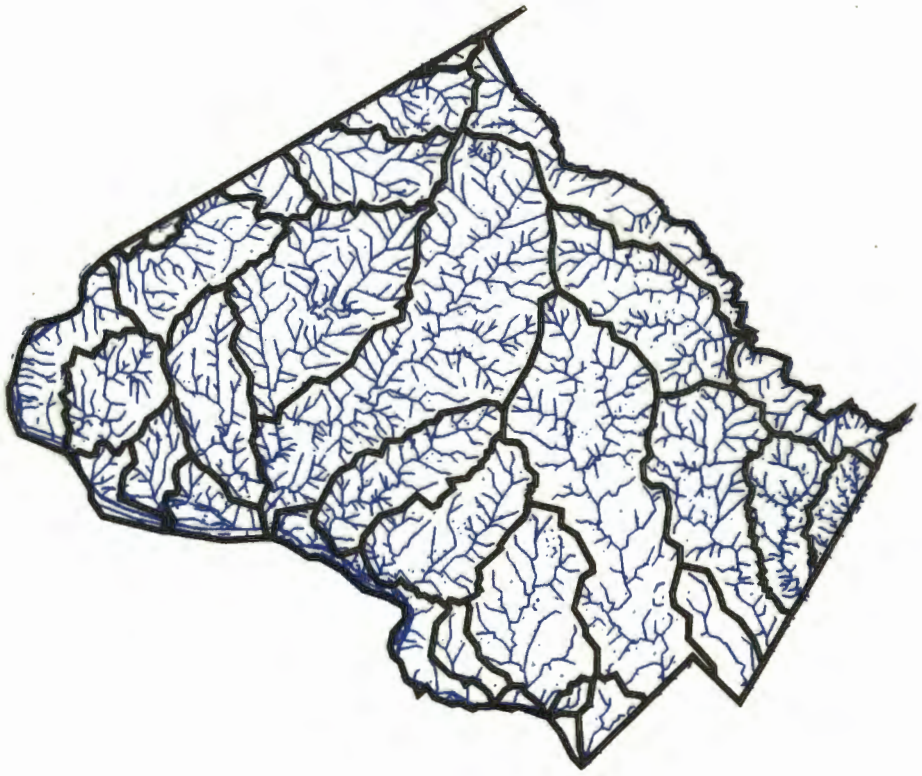
MONTGOMERY COUNTY

Countywide Stream Protection Strategy

FEBRUARY 1998



Prepared by

Montgomery County Department of Environmental Protection

In cooperation with

Maryland-National Capital Park and Planning Commission

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ACKNOWLEDGMENTS

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Executive Summary

- **Background:** Montgomery County has conducted a countywide assessment of conditions in its 1,500 miles of streams for the first time since 1980. This was an intensive and cooperative multi-agency and volunteer effort which evaluated data from over 200 monitoring stations.

- **Methods:** The resulting Countywide Stream Protection Strategy (CSPS) is the first countywide assessment of stream resource conditions based upon assessment of aquatic life and stream channel habitat indicators in addition to typically applied stream chemistry measurements.

- **Compliance with water quality standards:** Nearly all Montgomery County streams meet Maryland water quality standards and criteria (for dissolved oxygen, temperature, and pH), as they have historically. However, the extent and diversity of biological life and stream habitat conditions vary significantly.

- **Biological life in County streams:** Across the County, 48 species of fish and about 140 different types of aquatic insects (benthic macroinvertebrates) were found. While many streams supported diverse and vibrant aquatic communities, many others were in an impaired condition, with few species and reduced populations. In a few cases, streams were nearly devoid of aquatic life.

- **Ranking of stream conditions:** Based upon biological assessments covering most of Montgomery County's subwatersheds, 8% of County stream miles were rated as being in excellent condition, 46% in good condition, 26% in fair condition, and 9% in poor condition. There was insufficient data available to rank the remaining 11% of County streams.

- **Cause of impacts:** Stream erosion and sedimentation were the dominant impacts to habitat conditions and aquatic life found in Montgomery County's streams. These impacts originate primarily from uncontrolled or inadequately controlled stormwater from developed areas which significantly altered natural stream flows. Inadequate sediment control from construction sites has also caused problem "hot spots". There were also isolated instances where other pollutants were a primary cause of biological impairment.

- **Nature of impaired subwatersheds:** The most severely impaired streams were generally located in the older down-county areas which developed to urban and suburban densities before stormwater controls were required to manage increased runoff. Outmoded land development practices in these areas had also piped headwater streams and springs and filled in wetlands rather than preserving them. Biological impairment was also found in some predominately agricultural subwatersheds, suggesting a need for voluntary implementation of additional best management practices.

- **Relationships of impacts to impervious areas:** The severity of stream habitat loss and biological community impairment in a subwatershed appears generally related to the extent that developed land has replaced natural land cover with impervious areas (e.g., roads, parking lots, driveways, buildings). This increases stormwater flows and reduces groundwater infiltration to the detriment of natural stream hydrology.

- **Effectiveness of stormwater controls:** In general, modern on-site stormwater controls appear to be having positive effects in mitigating, although not eliminating, the impacts of increased stormwater runoff. More data is being collected on specific stormwater controls in smaller subwatersheds to refine the County's knowledge beyond these very preliminary observations.

- **Watershed management category designations:** Each subwatershed was assigned to a management category based upon review of stream conditions, existing watershed development, and projected land use changes. The management categories are: *Watershed Preservation Area, Watershed Protection Area, Watershed Restoration Area, Urban Watershed Management Area,* and *Agricultural Watershed Management Area.*

- **Use of management categories:** For each watershed management category, a set of management tools is identified to address the stream conditions and levels of development anticipated. The management categories and tools provide a basis for targeting interagency resources to address stream quality problems, using a focused, watershed-based approach.

- **Mitigating new development impacts:** For newly developing watersheds, the CSPS provides an improved level of information on stream conditions which regulatory agencies and permit applicants should carefully consider as land use master plans are updated and site design, stormwater management, and sediment control decisions are made under the development review process. The inspection, enforcement, and maintenance of construction site sediment controls must be improved. Regulatory agencies must also find ways to reduce impervious areas resulting from currently required land development standards (e.g., for roads, sidewalks, parking lots, building restriction lines).

- **Costs of stream restoration:** In already developed watersheds, the extent of degraded stream habitat in need of restoration far exceeds County resources presently available for stream restoration projects. Stream rankings, watershed management categories, and related management tools identified in the draft CSPS will help target available resources for stream restoration to their best use.

- **Next steps:** County agencies are now targeting resources to implement watershed management programs in the designated priority subwatersheds as specified in Table 3.1. Other follow-up activities being pursued between now and the next update in 2000 include the following:

    - Set more specific resource-based stream protection goals for priority subwatersheds.
    - Evaluate the effectiveness of modern stormwater controls in mitigating development impacts on streams.
    - Refine relationships between imperviousness, land use, stream quality, and levels of stormwater control, and apply to further identify stream protection needs.
    - Develop a targeted education program for the County's highest quality subwatersheds.
    - Develop consensus resource-based criteria for possible consideration in the designation of future Special Protection Areas for stream resource protection as provided under Montgomery County Code (Chapter 19, Article V).

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Glossary of Terms	
baseline monitoring	monitoring designed to identify existing ("baseline") conditions
benthic	associated with stream bottoms
biological assessment	evaluation of the type and number of organisms (the community) living in a stream to determine the quality of that stream
biological indicators	a characteristic set of aquatic organisms used to identify the overall conditions of the streams that they are found in
cumulative impact	the sum of effects from all factors that influence the condition of a stream and its aquatic community that together have a greater impact than if each acts alone
embeddedness	the extent to silt, sand, or mud covers larger rock substrate on stream bottoms and which thus limits habitat for benthic organisms or smothers them
entrenchment	degree to which a stream is vertically confined within its channel with restricted access to an adjacent active floodplain during frequent storms; in urban streams, entrenchment may become severe due to channel downcutting associated with increased storm flow velocities
habitat	where an organism lives or could live under specified environmental conditions
IBI	***Index of Biological Integrity***, a group of measurements that respond in a measurable and predictable way to cumulative impacts; the IBI is based on measurements taken from reference streams
imperviousness	the amount of hard, paved ("impervious") surfaces like rooftops, parking lots, and roads, present in the land draining to a stream
incised channel	condition in which the stream displays a deeply downcut bed, from high flows confined to the channel during storm events
macroinvertebrate	aquatic organism without a backbone (***invertebrate***) that can be seen with the naked eye (**macro**); usually refers to aquatic insect larvae or nymphs
NPDES	***National Pollutant Discharge Elimination*** System, program originating from the 1972 Federal Clean Water Act to control pollution to the Nation's waters
reference conditions	characteristics typically associated with those County streams which show the least cumulative impacts on habitat and the aquatic community
reference streams	streams which show the least impaired habitat and other characteristics used to develop reference conditions
refugia	stream areas that can provide shelter from predators or during adverse environmental conditions, e.g., pools that maintain cooler waters during warmer months of the year

Glossary of Terms	
runoff	water that flows across land or paved areas to enter man-made or natural channels
storm drain	structure designed to carry runoff in a controlled fashion to management facilities or directly to streams
stormwater	runoff generated as a result of precipitation (rain or snow)
substrate	materials such as rocks or logs found in streams that can provide habitat for aquatic organisms
strategic plan	a comprehensive set of programs and policies to achieve a define set of goals
subwatershed	refers to smaller drainage areas within the watersheds of the County's major streams (e.g., Hawlings River within the Patuxent River watershed)
watershed	refers to all of the land area draining to one of the County's major streams (e.g., Patuxent River)

PART I. BACKGROUND AND METHODS

Chapter 1. Overview and Findings

BACKGROUND: MONTGOMERY COUNTY'S WATER QUALITY GOALS

Montgomery County's adopted water quality goals are to:

- *Protect, maintain, and restore high quality chemical, physical, and biological conditions in the waters of the state in the County;*
- *Reverse the past trends of stream deterioration through improved water management practices;*
- *Maintain physical, chemical, biological, and stream habitat conditions in County streams that support aquatic life along with appropriate recreational, water supply, and other water uses;*
- *Restore county streams damaged by inadequate water management practices of the past, by reestablishing the flow regime, chemistry, physical conditions, and biological diversity of natural stream systems as closely as possible.*
- *Help fulfill interjurisdictional commitments to restore and maintain the integrity of the Anacostia River, the Potomac River, the Patuxent River and the Chesapeake Bay.*
- *Promote and support educational and volunteer initiatives that enhance public awareness and increase direct participation in stream stewardship and the reduction of water pollution.*

Source: Montgomery County Code, Chapter 19, Article IV.

Addressing these goals requires resource-based actions that are specific to the unique conditions of each stream. In addition, agency policies and program initiatives must be coordinated as part of a comprehensive watershed-based approach.

INTRODUCTION

Montgomery County has a rich and diverse natural heritage which includes over 1,500 miles of open streams that provide habitat vital to aquatic life and water dependent wildlife, including mink, river otters, and

many other familiar species. Forty-eight species of fish and about 140 different types of aquatic insects have been found in our streams. Our streams and watersheds help replenish water sources which ultimately provide us with drinking water. They are also places of natural beauty which provide recreational and aesthetic opportunities that contribute to the quality of life in Montgomery County as a place to live and work. The County's stream resources are a legacy to preserve and protect for today's citizens and our future generations. This can be accomplished through scientific examination of existing stream resource conditions and a well-planned effort to prioritize, protect, restore, and monitor changes to these resources using watershed and subwatershed-based strategies.

Over the last several centuries, Montgomery County's landscape has been through several cycles of change starting with extensive land clearing, followed by farming, abandonment, and natural reforestation. Following the turn of the century, rapid and accelerating growth transformed the County to its present status as a home to more than 810,000 residents. The County's diverse landscape still supports a significant agricultural industry in its rural areas that contributes to its economic health, open space, and overall beauty. The impacts of deforestation and sedimentation associated with earlier agrarian practices often had devastating effects on County streams. However, time and nature's resiliency enabled many of these streams to heal and recover to a relatively undisturbed state. The acquisition of over 27,000 acres of stream valley as parkland since 1927 has also helped mitigate impacts on many stream floodplains and adjacent natural areas. Stream resources have more recently been impacted, in varying degrees, by watershed conversions to urban and suburban land uses which cause more permanent landscape changes that can have lasting effects on stream hydrology and resident aquatic life.

The effects of these changes to stream hydrology can be partially controlled or mitigated in developing watersheds by requiring stormwater runoff control measures which attempt to mimic the natural delivery of runoff to streams and reduce effects of intensified land use on natural stream flow characteristics and resource conditions. Some impacts (e.g., increased stream temperature, reduced groundwater infiltration) are more difficult to manage and are somewhat inevitable consequences of the County's changed landscape as it continues evolving to accommodate a growing population.

Purpose of the Countywide Stream Protection Strategy

This Countywide Stream Protection Strategy (CSPS) was developed to provide an overall assessment of County stream conditions in order to identify and prioritize those subwatershed areas most in need of attention. The strategy identifies broad management goals for the preservation, protection, and restoration of streams countywide, and identifies specific subwatersheds to be addressed in the near term. It describes management tools that can be applied to efficiently target future public and private resources to protect those streams most in need and to restore aquatic habitat and the biological community to those that have been damaged, to the extent this is feasible. The CSPS provides information and findings that agencies, businesses, and the general public can use to develop and focus public/private partnerships to address stream resource problems on smaller, workable subwatershed levels. The document should also be useful to agencies in the identification, targeting, and budgeting of specific,

watershed-based resource protection initiatives.

Content and organization of this document

The CSPS is organized into two major parts with a supporting technical appendix. Part I consists of four chapters. Chapter 1 includes the overview and findings of Countywide stream resource conditions and highlights the basic factors which influence these conditions. It summarizes the extent of observed stream protection and stream restoration needs and outlines how this document will be used to address those needs. Finally, it highlights ongoing interagency activities which contribute to Countywide and watershed-specific stream resource protection.

Chapter 2 explains the scientific methods applied to monitor and evaluate stream resource conditions. It also describes how watershed management categories were developed and assigned to the County's 270 subwatersheds based upon evaluation of the stream resource condition and the extent of existing and projected subwatershed development. Chapter 3 identifies subwatershed priorities for stream protection, and the approach used to identify priorities. Table 3.1 identifies the nature and timing of programmed or planned agency initiatives for the priority subwatersheds. Chapter 4 discusses County goals and opportunities for citizen involvement in stream stewardship, including an invitation to help assign names to presently unnamed County streams. This will help to provide many of the County's unnamed stream tributaries with a clear identity and hopefully stimulate citizen stewardship activities to assist in their protection.

Part II of the CSPS includes sets of maps and tables describing watershed conditions, and biological resource and stream habitat conditions for each of Montgomery County's 22 major watershed groupings and their contributing subwatersheds. Stream resources in the County's subwatersheds are rated as being either in "excellent", "good", "fair", or "poor" condition based on *biological indicators*. The maps indicate the extent of existing and planned development in each watershed and related changes to subwatershed impervious areas (e.g., roads, parking lots, and buildings) that affect stream hydrology and aquatic habitat. Subwatersheds are then assigned to management categories based upon observed stream conditions and projected land uses or zoning that may impact these conditions. Management tools are described that apply to each assigned management category to address the observed subwatershed conditions.

A supporting technical appendix contains more detailed information on fish and aquatic insect species found in Montgomery County's streams. Appendix A provides example data sheets outlining the types of monitoring information which is available for each of some 200 monitoring stations . The folded map accompanying this report provides a composite Countywide summary of observed stream conditions and the assigned watershed management categories.

Use of the Countywide Stream Protection Strategy

The CSPS is intended to be used as both a program guidance and a public education tool for improving stream resource protection. The information on countywide stream conditions will be used to focus agency programs on addressing the most critical stream protection needs in the County's subwatersheds. The priority subwatersheds identified in Chapter 3 and the accompanying Table 3.1 provide a basis for more effectively targeting programs and agency budgets to achieve the County's adopted stream protection goals outlined at the beginning of this chapter. The outcome of this approach will be the targeting of capital expenditures, such as funding for stream restoration and land acquisition, as well as planning activities, to address the identified priorities. In support of public education and information needs, this document also contains general information on the character of the County's watersheds and some of the unique natural heritage found in our streams, as well as current problems that are observed. An effort has been made to make the technical information about our stream resources accessible and usable by all interested parties.

The CSPS will be updated in 2000 and approximately every five years thereafter to incorporate new biological monitoring data, identify trends in stream conditions, and refine watershed management categories to reflect the latest available information on existing and projected watershed conditions. Addenda on stream conditions for specific watersheds will be available as analyses for these watersheds are completed on a regular rotating watershed monitoring cycle.

Relationship to County's Strategic Plan for Water Quality Protection

Although drafted to be read as a self-standing document, the CSPS is also intended to serve as Volume III of the County's umbrella ***Strategic Plan for Water Quality Protection*** (November 26, 1996). Volume I of the *Strategic Plan* identifies the County's overall water quality goals and objectives and indicates current agency roles, responsibilities, and implementation tasks that are being pursued to address these goals. Volume II of the *Strategic Plan* summarizes agency progress in addressing their respective implementation tasks. In December 1996, the County Executive transmitted the *Strategic Plan* to the County Council and recommended its endorsement as a statement of goals and program direction for protecting the County's water resources. The CSPS, as Volume III, provides the information that will enable pursuit of a targeted watershed protection approach for many of the program initiatives identified in Volume II of the *Strategic Plan.*

Volume II of the County's *Strategic Plan* lists many proactive interagency activities now underway which contribute to Countywide and watershed-specific stream resource protection. In summary, these include: stream and best management practices (BMP) monitoring, illicit discharge monitoring, natural resource inventories for master plans, stream valley protection through acquisition, dedication, or conservation easements; watershed project inventories and feasibility planning studies; design and implementation of stream restoration projects; inspection and enforcement activities to regulate illicit discharges and maintain stormwater management facilities; industrial pollution prevention activities; improved regulations and environmental guidelines that provide for enhanced site planning and stormwater controls through development

review permitting; and expanded public education and involvement opportunities.

Montgomery County agencies are using the information in the CSPS to formulate and target programs and budget proposals to enhance the protection of Montgomery County's stream resources and address stream protection needs in priority subwatersheds.

Relationship to Independent Municipalities within Montgomery County

Three municipalities within Montgomery County, the City of Gaithersburg, City of Rockville, and City of Takoma Park operate their own programs for stream protection and stormwater management. Priorities for stream protection and watershed management in these jurisdictions are identified and pursued through their existing programs.

City of Rockville

The City of Rockville is split between three watersheds: Watts branch, Cabin John Creek and Rock Creek. Since the City is situated at the headwaters of both Watts Branch and Cabin John Creek, the task of providing proper stormwater management is crucial to the stream quality for both the City and the downstream portions of the County. The City directs its own stormwater management and sediment control programs, and also administers its own watershed studies and subsequent capital improvements. This allows the City to consider timing and project priority for watershed protection independently of the County, although the two jurisdictions cooperate on projects near the City-County border. The City has completed a watershed management study for Cabin John Creek and has a study underway for Rock Creek in a joint effort between the City and Montgomery County. A watershed study covering Watts Branch will begin as the Rock Creek study is finalized. The City is drafting its first set of environmental management guidelines to direct development away from environmentally sensitive resources. Given the built-out condition of the City, it is anticipated that public education and outreach will become a significant part of the watershed protection program.

City of Gaithersburg

The City of Gaithersburg is located in the Great Seneca Creek and Muddy Branch watersheds. It maintains its own stormwater management and sediment control programs and administers its own budget and capital improvements. The City adopted Environmental Standards in 1995 to preserve and protect natural resources during the development process. In addition to protecting the City's natural resources by alleviating the impacts of future developments, the City has investigated the current conditions of the City's streams in order to develop goals for protecting and improving them. Based on a study evaluating 24.5 miles of perennial streams, and recommendations from the City's Environmental Affairs Commission, the Mayor and Council have developed a strategic direction to implement recommendations from ongoing evaluations of natural resources and encourage protection of the environment (streams, parks, stormwater management, and other CIP projects). The City of Gaithersburg will work closely with Montgomery County to attain their common goals for improving water quality in streams, while continuing to identify and pursue priorities for achieving their environmental and water quality goals within the City's corporate boundary.

City of Takoma Park

The Montgomery County portion of the City of Takoma Park is located in the Sligo Creek watershed. In 1990 the City became responsible for stormwater management and since then has instituted a program for maintaining the City's stormwater system to address flooding problems, reduce nonpoint source pollution, monitor water quality, and prevent stream bank erosion. Their annual maintenance program includes cleaning storm drains and a capital improvements program to address drainage problems. The City has an innovative funding mechanism for funding stormwater management activities, the stormwater utility, which was adopted in February of 1997. The City identifies priorities for their programs with the overall goal of helping to address water quality in Long Branch and Sligo Creek.

Subwatersheds Not Currently Identified as Priorities

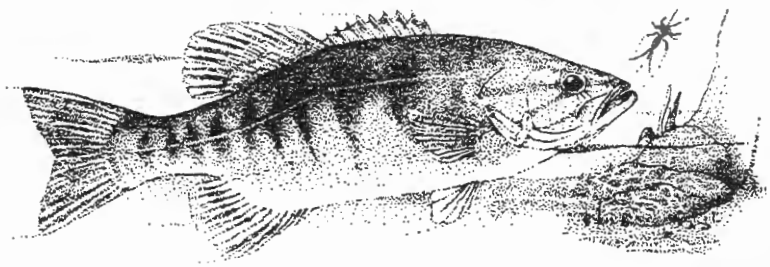
Agencies will continue their ongoing countywide programs to provide watershed management and stream protection functions within their respective areas of responsibility, as discussed in detail in the *Strategic Plan*. These include ongoing activities such as stream monitoring, plan review and permitting functions, land use planning, stormwater control and facility maintenance, sediment control, and public education. Additionally, a new initiative to develop a public education program targeted toward our highest quality subwatersheds will be undertaken prior to the planned year 2000 CSPS update.

The County's commitment to protecting, maintaining and restoring (to the extent possible) stream conditions in all of our watersheds is unchanged. The primary change in watershed protection activities that will occur as a result of identifying priority subwatersheds is the targeting of planning and implementation activities involving capital expenditures, for which there is a far greater need than can be funded at any given time within the limited resources available.

The land use planning process, although it will address priority subwatersheds within the context of area-wide planning efforts, will include study of non-priority subwatershed areas as well as priority areas, in order to examine alternatives that balance land use, the need to address conditions in priority subwatersheds, and the continued protection of non-priority subwatershed areas. Through the land use planning process, potential impacts of any proposed land use changes are determined for relevant subwatersheds. The Montgomery County Planning Board and M-NCPPC staff consider the information developed in the CSPS as one of many factors in their formulation of recommended land uses in master plans and in the development review process.

Stream resource monitoring approach

This is the first countywide assessment of conditions in Montgomery County streams conducted since 1980. It is also the first assessment which monitored and evaluated the actual presence or absence of biological life (fish and aquatic insects) and stream channel habitat conditions (condition of stream riffles and pools, extent of channel erosion, sedimentation, riparian tree cover) as primary indicators of stream health. The assessment also employed stream chemistry parameters (dissolved oxygen, temperature, pH) that are used as criteria to assess compliance with the water use classifications adopted in Maryland water quality regulations.



Stream chemistry measurements by themselves generally do not identify the major factors impacting resource conditions in County streams. On the other hand, biological and habitat measures can be used to identify and track the cumulative impacts of altered stream hydrology, channel erosion, and sedimentation that are often observed when a watershed undergoes extensive change. Individual factors acting together, or cumulatively, will have a greater impact to stream systems than if their effects are completely separate from each other. Using biological and stream habitat indicators has significantly improved our understanding of countywide stream conditions and the underlying causes of impairment to biological resources and stream habitat. They have also provided valuable insights regarding management techniques most appropriate and likely to be successful in achieving long-term protection or restoration of specific subwatersheds.

Using biological and stream habitat data can also have public education advantages. Results from the CSPS can be presented in terms familiar to the general public to increase their understanding of conditions in County streams and interest in stream ecology. Staff has found that citizens better understand and respond to indicators about stream health when presented in terms related to the presence or absence of sensitive fish or aquatic insects. The vagaries of stream habitat conditions become clearer when pictures of an undisturbed stream are compared to those from a stream impacted by a combination of severely altered hydrology, excessive sedimentation and erosion, and neglect.

PRINCIPAL FINDINGS

Countywide stream conditions

As has been the case historically, it was found that nearly all County streams complied with State criteria for dissolved oxygen, stream temperature, and pH. However, the extent and diversity of biological life and habitat conditions found in County streams varied significantly. While many streams support diverse and vibrant aquatic communities, others showed signs of significant impairment. In a few cases, monitored streams have very little aquatic life.

Stream resource conditions were rated by comparing baseline data in most County streams with "reference" conditions found in the County's highest quality, least-impaired streams. Indices of biological integrity for fish and benthic macroinvertebrates were used to develop reference conditions and rate each stream resource as being in "excellent", "good", "fair", or "poor" health in comparison to these conditions. Table 1.1 summarizes results of these comparisons. Where County baseline data was not available, biological and habitat data from other local and state agencies, from the private sector, and from volunteer monitoring organizations were used to develop a preliminary assessment of stream resource conditions.

As derived from the data in Table 1.1, about 54% of streams monitored were rated as being in "excellent" or "good" condition at this time while 35 % were degraded and rated as being in a "fair" or "poor" status. As useful as these comparisons are in understanding countywide stream resource conditions, they do not begin to describe the diverse biological community in our streams or convey the wonder and sense of excitement people have when they first learn about the life found in the streams of their own neighborhoods.

Table 1.1 Summary of preliminary findings on County stream resource conditions

Stream Resource Conditions	Stream Miles	Percent Stream Miles	Watershed (acres)	Percent County Acreage
Excellent	129	8	25,497	8
Good	680	46	138,086	43
Fair	391	26	84,848	26
Poor	143	9	43,908	13
No data	171	11	31,444	10
TOTAL	1,514	100	323,783	100

Countywide, many of our streams teem with life and still support a remarkable diversity of fish and aquatic insects that reflect stream resource conditions. We, as stewards, will pass on this component of our natural heritage to future generations. Forty-eight species of fish and about 140 different aquatic insects were found in this countywide assessment. New fish and aquatic insects continue to be found each year as the County conducts baseline monitoring in different watersheds.

Some of our stream fish are extremely colorful, such as the mature greenside darters which have an emerald green color during spawning season. Rosyside dace, as the name implies, have a bright, almost ruby, rosy flank that is visible from shore as these small "trout like" minnows dart and leap in pools and runs. Even the usually plain white suckers develop orange-red fins during spawning season. Sensitive fish species intolerant to pollution such as northern hogsucker, Potomac sculpin, and mottled sculpin and hardier, pollutant tolerant species such as blacknose dace, creek chub, and bluntnose minnow are also found in County streams. Smallmouth bass, sunfish, and brown trout remain popular among those who fish in County streams. Some uncommon fish found in several small areas of the County were the roseyface shiner, comely shiner, and eastern mudminnow.

Aquatic insects found in County streams are extremely well adapted to living underwater in immature nymph and larval stages. Thousands of black fly larvae can be found on a single rock in

the fastest flowing water, holding on to a silken safety net with a circlet of claws. In some streams, brushlegged mayflys actively swim through the water catching prey within their leg hairs. Net-spinning caddisflys weave a net to catch any food particles drifting by in the water, periodically emerging from their nearby tunnels to check on their catch. Other caddisflys use a wide variety of materials, including small pieces of wood, leaves, small sand grains, or rocks to construct cases to live in. Some species of mayflys and caddisflys live several years as aquatic nymphs and larvae in County streams. In the spring, mayflys and stoneflys hatch into adults by the millions. Adults live for several days, reproduce, and then die after their eggs have been deposited into the streams so that another generation can begin.

The first sounds of spring along County streams occur during some of the first warm days in late February or early March when choruses of spring peepers and wood frogs herald winter's demise. Sadly, several of our more urban watersheds have had this spring chorus silenced and only through County restoration efforts has the chorus recently been heard again in places such as Sligo Creek. Other amphibians seen in County watersheds include the spotted salamander, grey tree frog, and the two-lined salamander. Reptiles include spotted turtles and northern water snakes.

Findings on stream resource conditions in individual watersheds are presented in Part II, and include a list of the fish species found in each major watershed.

Factors impacting Montgomery County stream resource conditions

The dominant factor impacting County stream habitat conditions and aquatic life support was stream erosion and sedimentation, stemming primarily from uncontrolled or inadequately controlled stormwater runoff and insufficient or bypassed natural stream buffers. Some isolated instances of stream impairment caused by severe water pollution were also identified through this countywide monitoring effort. Watershed development and associated increases in impervious areas have some inevitable effects on natural stream systems which can be only partially mitigated by current stormwater runoff control technologies. Sediment generation and delivery to streams as a result of inadequately controlled runoff from construction sites has also caused problem "hot spots" that adversely impact stream channel habitat and aquatic life in some local streams and, ultimately, the Chesapeake Bay. Once sediment enters a stream channel, the only way it can be removed is through a "flushing" storm that deposits it onto the floodplain or carries it downstream to deposit in larger, slower moving receiving waters. Such flushing storms usually occur infrequently and it may take several years for an impacted stream segment to recover from a single major sediment pollution event.

Inadequately controlled runoff has caused many imbalances in stream hydrology resulting in habitat degradation. Observed examples of this degradation include stream channel erosion, channel widening and down-cutting, bottom sedimentation, and the loss of riparian tree cover at rates significantly accelerated from those found in streams in a natural balance with their watershed. These accelerated channel erosion processes can act to severely degrade or eliminate

the natural riffle and pool structure vital to aquatic life and can severely impair a stream's ability to sustain diverse biological communities. Depending upon the size of the affected stream and its location in the watershed, these consequences may be long-term as a stream seeks to find a new equilibrium in a radically altered hydrologic regime. Localized flooding of roads and other structures also often occurs. These problems were found in many streams draining the County's established and highly urbanized areas and in some rural/agricultural subwatersheds.

The most biologically impaired subwatersheds were generally located in the older down-county areas. Watershed development in these areas was generally not accompanied by stormwater controls to handle the additional runoff generated from the increase of impervious areas and the reduction in forested and other natural areas. The extent of "fair" or "poor" resource conditions found in the down-county reflects the use of outmoded land development practices which piped headwater tributaries, seeps, and springs and filled wetland and floodplain areas, rather than preserving them.

The piping of natural stream systems which occurred in these older down-county areas accelerated the delivery of increased runoff flows to the remaining natural stream system. This, in turn, overwhelmed natural stream channel capacities to convey flows causing increased frequency of flooding, channel erosion, and habitat loss in downstream areas. Accelerated rates of channel erosion and down-cutting, in turn, reduced stream access to adjacent floodplains that could help dissipate the energy and absorb out-of-bank storm flows. The piping of headwater streams and natural springs coupled with increased impervious areas from upland development reduced critical groundwater infiltration and stream base flows needed to maintain stable, diverse, and healthy biological communities during dry weather periods. Severely degraded stream channel habitat and poor biological resource conditions found in many portions of Lower Rock Creek, Cabin John Creek, and Little Falls are prime examples of the devastating and lasting effects inadequately controlled runoff can have in highly developed watersheds.

Wetland Resources

Wetlands, including seeps and springs, play a crucial role in overall watershed protection. They provide many ecological functions, including filtering of pollutants in surface runoff, maintenance of stream baseflow, slowing of flood waters, and provide both aquatic and terrestrial wildlife habitat and food-chain support. A study is currently underway to update map inventories of the County's existing wetlands. This information will be included in subsequent updates of the CSPS. Assessments of wetland function and protection needs in developing areas are being conducted as part of land use master planning studies.

In developed areas receiving large amounts of uncontrolled runoff, a consequence of channel down-cutting is that wetland areas adjacent to streams are essentially cut off hydrologically, as stream base flow levels change elevation in the deepened channel. Under these conditions, wetlands do not function effectively in maintaining watershed hydrology or filtering runoff, because streams do not flood into the floodplain as frequently once channels are down-cut. in many cases they may lose wetland characteristics altogether. Restoring wetland functions is one important goal of stream restoration efforts. This can be accomplished to some extent by adding

constructed wetland areas where possible, and diverting stormflows back onto the floodplains where flows can access previously functional wetland areas.

Nutrient loadings and nutrient management

Historically, significant problems of nutrient over-enrichment have not been regularly observed in most Montgomery County streams. In large part, this reflects the gradient and free flowing nature of most streams and the relatively short travel times before stream base flows and storm flows reach the Potomac and Patuxent river systems. Recent concern about possible nutrient over-enrichment in the quiescent waters of the impounded Patuxent water supply reservoir system led to execution of an interjurisdictional Patuxent Reservoirs Agreement in October 1996. Montgomery County is also an active participant on the mid-Potomac and Patuxent Tributary Teams. These teams are developing strategies to address the impacts of nitrogen and phosphorus loadings generated from these watersheds and ultimately delivered to the Chesapeake Bay.

Until recently, the primary focus on managing these regional and primarily downstream impacts has been to reduce nutrient concentrations discharged from wastewater treatment plants (WWTPS). Upgrades to require nutrient removal are now included in the NPDES discharge permits regulating all WWTPs in Montgomery County. Urban and agricultural runoff controls also provide nutrient reduction benefits. However, for most structural urban stormwater quantity controls and many agricultural practices, these benefits are often incidental to their main purpose of reducing sediment loadings and stream erosion caused by inadequately controlled runoff.

With significant advances in the technology to reduce nutrient loadings in wastewater treatment plant discharges, the Chesapeake Bay Tributary Strategies Teams have begun focusing on ways to reduce nutrient loadings from urban and agricultural runoff in order to achieve Bay nitrogen and phosphorus reduction goals. Runoff quality and quantity controls now required in conjunction with new development projects in Montgomery County help reduce nutrients in runoff and therefore ***reduce increases*** in total nutrient loadings delivered to County streams. However, achievement of any significant ***reductions*** in existing nutrient loadings must rely primarily on expanded public outreach and education to reduce unnecessary and excessive applications of lawn and garden fertilizers and to properly dispose of pet wastes, as well as increased implementation of agricultural BMPs.

The County is expanding its outreach efforts through targeted subwatershed approaches that address uncontrolled urban runoff impacts on streams and stream restoration needs. These targeted efforts will help make the public more aware of their role as stewards in helping to resolve regional nutrient management issues. In agricultural watersheds, continued and expanded efforts will be needed to promote voluntary implementation of nutrient source controls.

Effectiveness of stormwater best management practices

Based upon preliminary analysis of limited data, modern on-site stormwater controls, known as urban best management practices (or BMPs), appear to be having positive effects in mitigating, although not eliminating, impacts of increased runoff as watersheds develop. In general, streams

draining developed areas lacking stormwater controls appear more impaired than streams protected with stormwater controls of modern design. This general conclusion is most apparent in subwatersheds having high degrees of development and corresponding levels of watershed imperviousness. However, significantly more monitoring and analysis of data from small developed watersheds is needed to confirm these initial observations with confidence.

The County's stormwater facilities database is being improved in accuracy and linked directly to geographic information system (GIS) files to determine the percent of developed drainage areas actually controlled by BMPs. More monitoring is being conducted to compare conditions in small subwatersheds where impervious areas are totally controlled to those in small subwatersheds which have no controls. This data will help determine BMP effectiveness in mitigating hydrologic changes and removing pollutants to streams.

Scientific assessment of impervious area impacts is further complicated by variability in the age of development projects with and without BMPs. Communities established in the County without BMPs are generally much older than those protected by effective BMPs, and streams have been influenced by changed hydrology for a longer time period. For example, most development in the down-County area (e.g. in Sligo Creek, Lower Rock Creek, Little Falls, and Cabin John watersheds) occurred decades before the State began requiring stormwater controls in 1984. Preliminary assessment of monitoring data suggests that developed subwatersheds protected by BMPs are in better condition than those which are unprotected. With additional data and further analysis, the County will be better able to determine the degree to which these differences reflect actual BMP effectiveness versus the length of time streams have been exposed to increased storm flows in general.

Stream protection and restoration needs

In developing watersheds, it is important to understand natural stream and watershed resource conditions when evaluating the environmental consequences of land use master plan alternatives and balancing these consequences against equally compelling County needs for transportation, housing, and economic development. Permit applicants and agencies involved in the development review process must become more aware of stream resource conditions and consider this information as site plans are reviewed and stormwater and sediment control plans are developed and implemented. This is the most cost-effective way of protecting streams in the County's planned development areas.

In already developed watersheds, the need for stream repair and restoration, based on the degradation observed, far exceeds the County's resources. The costs of implementing remedial stream restoration measures can be extremely high. For example, actual costs of County projects to stabilize severely eroded stream channels and create riffles and pools in several down-county streams ranged from $200,000 per stream mile for "soft" (bioengineered, natural stabilization) restoration to $1,000,000/stream mile for "hard" (extensive stone rip-rap) projects. Applying these figures, the costs of a stream restoration program to even partially address the needs for restoration projects identified in the County's good, fair, or poor streams would far exceed currently budgeted funding levels for capital improvement projects.

Recognizing the many other needs competing for resources, any increase in funding available for stream restoration work will realistically need to be modest and phased-in gradually over a long-term period. **Stream rankings, watershed management categorizations, and related management tools identified in the CSPS will be helpful in targeting resources available for stream protection to their best use.**

NEXT STEPS

An intensive monitoring and analytical effort was required to develop the comprehensive information on Montgomery County's stream and subwatershed conditions found in this document. We are now in a position to conduct detailed analysis on the relationships between observed stream conditions, watershed development, and the effectiveness of stormwater management controls. The following activities will be pursued between now and the year 2000 update to explore these relationships and improve stream and watershed management programs:

- Set more specific resource-based stream protection goals for priority subwatersheds.
- Refine relationships between imperviousness, stream quality, and levels of stormwater control, and apply to further identify stream protection needs and improve watershed management efforts.
- Develop a targeted education program for highest quality subwatersheds.
- Develop concensus resource-based criteria for possible consideration in future designations of Special Protection Areas for stream resource protection as provided under Montgomery County Code (Chapter 19, Article V).

CONCLUSION

It is hoped that this CSPS and related efforts to increase public understanding of Montgomery County's watersheds and stream resources will help stimulate more active citizen and business involvement in stream stewardship. The formation of active and sustained public agency/private partnerships continues to be absolutely vital if efforts to protect and restore streams and to achieve Montgomery County's adopted water quality goals (Montgomery County Code, Chapter 19, Article IV) are to be successful.

Chapter 2. METHODOLOGY

Overview

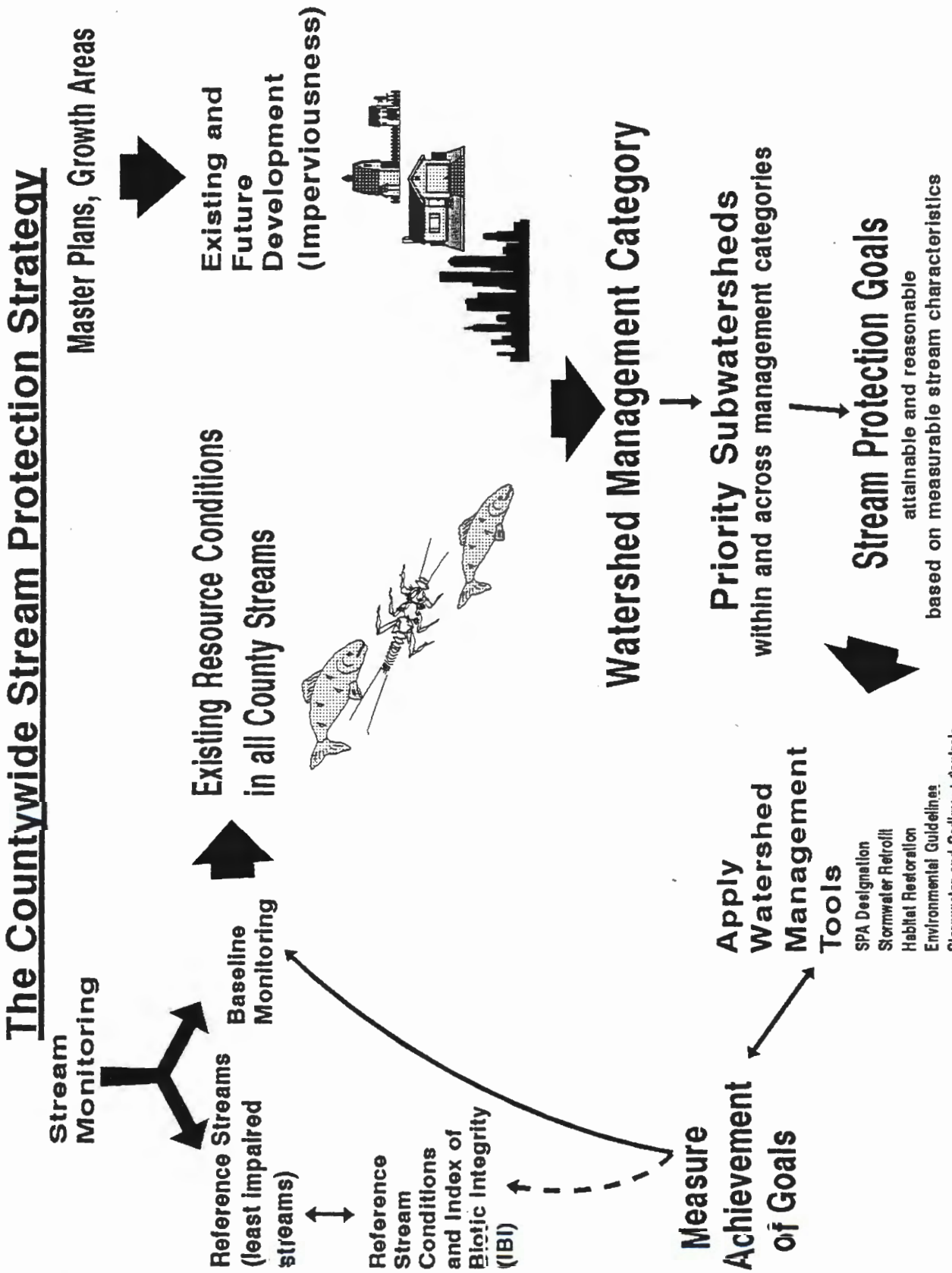
The CSPS is a dynamic tool used to measure the condition of Montgomery County's stream resources and to target programs to respond to existing problems and changing conditions in the County's stream systems. Figure 2.1 shows the cyclical process and linkages between the various data sources used to develop and apply this tool. The overall process for developing the CSPS begins with the compilation of data on existing stream conditions, existing development, and projected development. Existing stream conditions are described in terms of the biological resources each stream can support as measured through monitoring of resident fish and aquatic insect communities. Existing development and projected development levels are described in terms of the percentage of impervious areas within subwatersheds (e.g., roads, parking, building footprints). Comparison of stream biological condition and watershed imperviousness provides two quantifiable measures for assessing relationships between land use and stream quality. Another quantifiable measure to be considered, as data permits, is the extent to which stormwater controls are effective in mitigating the impacts of new watershed development. Examining the potential change between existing and projected land use allows us to identify those areas where the most or the least additional stress to streams may occur.

The Stream Protection Strategy uses *watersheds* and *subwatersheds* to define the geographic area for managing stream resources. Subwatersheds have been delineated such that the contributing land uses are more or less homogenous and the geographic area is spatially manageable for targeting activities and involving local residents in stewardship of their neighborhood streams. Conditions observed in a stream are a reflection of the cumulative effects of runoff and pollution generated by land uses and human activity in the contributing drainage within the subwatershed.

Within subwatershed areas, the level of imperviousness is determined and, where data is available, compared to potential increases in impervious areas which could occur based on full implementation of zoning. This provides a means for estimating the extent and type of land use change and potential impacts to stream systems. The relationship between existing stream conditions and the potential for change in subwatershed land use is then used to identify an appropriate management category which embodies an overall goal of preserving, protecting, or restoring watersheds, or for managing specific conditions within subwatersheds. The cycle repeats as management tools are applied and stream monitoring efforts re-evaluate stream conditions on a five-year cycle (Fig.2.1). Changes in subwatershed conditions and overall progress are assessed, and management goals and categories re-examined on this 5-year cycle.

The following sections provide more detail on the methodologies used to measure the biological condition of the streams, quantify existing imperviousness, estimate projected imperviousness, and assign management categories. Part II of this document contains detailed Watershed Assessments which provide specific information on each watershed, showing the land use conditions, biological conditions, and habitat conditions within each contributing subwatershed and the management category recommended for each subwatershed area.

Figure 2.1. The Countywide Stream Protection Strategy Process



BIOLOGICAL MONITORING

Evaluating Stream Conditions

Potential stressors to biological life in streams (e.g., excessive runoff flows, stream channel erosion, bottom sedimentation, pollution) usually manifest their impacts cumulatively rather than independently. Generally, these cumulative impacts have more far reaching and debilitating effects on biological life than the isolated impacts of a single stressor, unless it is an acutely toxic one. ***Cumulative impacts*** are difficult to measure. Assessing these impacts requires indicators of stream resource conditions which can accurately reflect the combined effects of exposure to all stressors encountered. Representatives of biological communities living in our streams can serve as such indicators. Measurement of the quality of a stream's habitat (e.g. riffles, pool, stream bank stability, riparian tree cover, lack of excessive bottom sedimentation) also provide important information on a stream's ability or inability to support diverse aquatic communities. Fish and aquatic insects have to adapt to the cumulative stressors and changing stream conditions occurring around them or they die. They do not simply move away. Other possible stream water quality indicators (e.g., chemical parameters such as pH, conductivity, dissolved oxygen, nutrients, and water temperature) cannot by themselves, adequately describe the full range of cumulative impacts occurring in County streams.

Fish and aquatic insects respond to stressors in ways that can be very similar and also in ways that can be quite different. Data on the condition of both of these biological communities is needed to accurately assess overall stream resource conditions. For example, the impacts of Winter/Spring flooding can be assessed by monitoring changes in the Spring aquatic insect community. These seasonal impacts can be separated from other kinds of chemical or habitat impacts. For example, we can determine whether an impaired biological community of fish and/or aquatic insects observed in the Spring has been naturally restored to a more healthy condition by the Summer/Fall, or if these communities remain impaired, suggesting something other than a seasonal impact. In another example, a stream's habitat condition within a particular stream reach may be excellent, yet fish and insects may be missing entirely. This would suggest that a toxic chemical spill may have occurred. If no other toxic incidents occur, and there are no blockages to normal fish passage, stream fish may quickly reoccupy the impaired area from upstream or downstream. Aquatic insects may also quickly repopulate the area by drifting into the stream reach from upstream, although populations would probably not completely recover until the following Spring when adult insects return and deposit their eggs. On the other hand, if toxic discharges were frequent and regular events, biological impairment would be permanent, until the offending pollution discharge source was found and eliminated.

Monitoring Partnerships and Data Sharing

There are many different groups monitoring streams in Montgomery County. DEP established the ***Montgomery County Biological Monitoring Work Group*** (BMW Group) to coordinate the activities of the different stream monitoring programs and to develop comparable methods for monitoring, data analysis, and reporting of stream resource information. By using comparable methods to assess the structure and function of fish and aquatic insect communities, and using a

comparable "yardstick" of community attributes collected from the highest quality streams remaining in the County, the collected data can be combined to form a detailed assessment of County stream resource conditions. Members of the BMW Group can also form cooperative monitoring partnerships to avoid duplication of effort and to monitor streams more efficiently. Some of the member groups of the BMW Group and their remarkable assistance in the development of the CSPS deserve mention here.

The Maryland Department of Natural Resources ***(MdDNR) Maryland Biological Stream Survey (MBSS)*** first conducted stream monitoring at several locations within Montgomery County in 1994 using monitoring protocols comparable to those used on the County. MBSS data was used to develop the resource condition for the Little Falls watershed. Data from the 1994 MBSS monitoring was instrumental in the development of resource conditions for the Great Seneca Creek watershed. However, because of the large size of this watershed relative to the number of monitored stations, many subwatershed resource conditions were assigned a ***preliminary stream resource condition***. The County again cooperated with the MBSS when the State monitored several watersheds in Montgomery County during 1997. The MBSS data has, and will be, an essential part of the CSPS effort.

The ***MdDNR Freshwater Fisheries Division Region 3*** staff have always provided support and guidance to County biologists. We have coordinated all stream monitoring within the Paint Branch with Region 3 staff to ensure that the sensitive trout resource in this watershed is protected. Staff regularly coordinate monitoring programs and cooperatively monitor stream reaches whenever possible.

From the initial inception of the BMW Group, stream ecologists from the ***Natural Resources Management Group*** (NRMG) of the Montgomery County M-NCPPC have worked cooperatively with DEP staff to monitor County baseline and reference streams. Staff from the ***Natural Resources Conservation Service*** have supported the reference stream monitoring program and assisted in the monitoring of rural streams. Staff ecologists from the ***Environmental Planning Division*** of M-NCPPC have assisted in the location of reference stream reaches, peer reviewed the monitoring protocols, and developed comparable monitoring protocols for development related stream monitoring.

Monitoring data was willingly provided for this effort by the ***Metropolitan Washington Council of Governments*** and the ***Interstate Commission on the Potomac River Basin***.

The ***Audubon Naturalist Society's (ANS) Volunteer Stream Monitoring Program***, made their multi-year data set available to the County for the CSPS. Their data confirmed many of the subwatershed resource condition evaluations and provided insights into how stream resource conditions changed seasonally and over time.

Several environmental consulting firms have supported this cooperative monitoring effort. ***Environmental Quality Resources, Inc.*** has provided several monitoring reports that were used to either confirm resource condition assessments or to develop assessments. ***Rogers and Associates*** stream monitoring staff have assisted DEP staff at stream reaches of interest to both

the County and their clients. ***Loiederman and Associates, Inc.*** ecologists have provided monitoring reports that materially assisted the County in developing resource conditions in several watersheds. ***TetraTech, Inc.*** ecologists have assisted our efforts to develop reference conditions by providing much appreciated advice and review. ***Versar, Inc.*** ecologists and biostatisticians have also provided much appreciated professional guidance and review as the County developed its program.

Baseline Stream Monitoring Program

Using biological and habitat sampling methods peer reviewed through the County's BMW Group, aquatic insects are monitored during the Spring when the immature insect stages are almost ready to hatch into adults. They are easier to identify at this life stage. Fish are monitored during the Summer through Fall. A stream ***habitat assessment*** is also conducted whenever biological monitoring takes place. The stream ***pH, conductivity, dissolved oxygen concentration,*** and ***percent saturation***, and ***stream temperature*** are also recorded at time of monitoring. More detailed ***stream channel and flow measurements*** are taken in late summer.

County monitoring crews have been working to complete baseline monitoring of all County watersheds on a five year schedule. A number of watersheds are sampled intensively each year to achieve this schedule. The first complete rotation across all County watersheds is not scheduled to be completed until 2001. In order to develop an interim water quality assessment for this first CSPS report, supplemental data was collected in 1996 and 1997 to provide some monitoring coverage for each of the County's 22 major watershed groupings, and many of the component 200 subwatersheds. The data from over 200 monitoring stations were analyzed for this first CSPS. For this interim assessment, the density of sampling stations within some of the major watershed groups was less than the number ultimately anticipated following completion of a full five-year Countywide monitoring period. Baseline stream monitoring typically requires collection and analysis of ten to twenty monitoring stations to thoroughly cover each major watershed.

A ***summary data sheet*** is developed for each County monitoring station. The summary sheet contains information on the kinds and numbers of fish or aquatic insects found at a station, measurements of fish and aquatic insect community structure and function, the habitat assessment rating for the station, observed physicochemical parameters, and a description of the station. Appendix A provides an example of this data assemblage for a typical baseline monitoring station. Collectively, this biological, habitat, and physical/chemical data, combined with stream channel morphology measurements and flow information, provides a comprehensive set of tools to assess stream resource conditions, trends, and the possible causes of any observed impairment.

Reference Stream Monitoring

Concurrent with the baseline stream monitoring program, County staff have been working to develop a common "yardstick" to describe and compare resource conditions found in all County streams. This "yardstick" is called an ***Index of Biological Integrity*** **(IBI)** and is composed of measurements, or ***metrics***, of the fish and aquatic insect community found in the County's highest quality, least impaired streams. Metrics are measured attributes of the biological community

found in these high quality (***reference***) streams. These metrics respond to cumulative impacts in a predictable and consistent manner. For example, the number of taxa in a community will increase as resource conditions improve, and decrease as resource conditions decline.

The ***IBI*** actually has two parts:

- ***Scoring Criteria Tables*** organize measurements of the fish and aquatic insect community (metrics) into a scoring criteria table. The table is used to transform calculated biological community metric ***values*** into comparative ***scores*** that can then be summed. Examples of the scoring tables developed by the County for assessing the fish community and aquatic insect community are presented in Tables 2.1 and 2.2.

- ***Biological Integrity Classes*** compare the summed scores of data from a baseline stream monitoring station to the full range of summed scores found among the reference streams. Scores are placed into four narrative Biological Integrity classes and each class signifies a further departure from the highest quality ***reference condition*** found among the reference streams. The four narrative Biological Integrity Classes are ***excellent. good, fair***, or ***poor***. An example of a narrative biological integrity class table is given in Table 2.3.

The IBI is used in the CSPS to develop the overall resource condition of all County watersheds. As depicted in the previous tables, the higher the total scores, as determined from the biological metric values, the higher the quality of the stream resource condition will be as compared to County reference conditions.

Table 2.1 Description of Metrics and Scoring Criteria for Fish Community from Channery Silt Loam Region, 1st and 2nd Order Streams

METRIC[b]	SCORING CRITERIA[a]		
	5	3	1
1. Total number of fish species.	Comparable to the biological community found in the reference streams. Balanced feeding group structure. Optimum community composition for stream size and habitat quality.	Community composition less than that found in the reference streams due to loss of some sensitive and intolerant taxa. Percent contribution of tolerant forms increases. Specialized feeding group taxa decrease.	Few species present. If high numbers of organisms, then they are dominated by one or two taxa. Only tolerant and general feeding group organisms present.
2. Number of fish that live on the bottom of streams in riffles and only eat insects.			
3. Number of minnow species.			
4. Number of species that are intolerant to pollution or other stressors.			
5. Proportion of individuals that can tolerate pollution and other stressors.			
6. Proportion of individuals that are not specialized feeders (i.e will eat almost anything).			
7. Proportion of individuals that only eat insects.			
8. Proportion of individuals that can live in unstable habitats (i.e. streams that dry up or are actively changing).			
9. Total number of individuals (excluding tolerant sp.).			
10. Proportion with disease/anomalies.			
(a) Scoring criteria are based on the **1995** and **1996** reference streams.	Max Score = 50	Max Score = 30	Max Score = 10

(b) Metrics are based on Karr et al. (1986) original scoring criteria, and modifications from Plafkin et al. (1989) and Hall et al. (1993).

Table 2.2. Description of Metrics and Scoring Criteria for Macroinvertebrate Community for Channery Silt Loam Region, 1st and 2nd Order Streams

METRIC	SCORING CRITERIA[a]		
	5	3	1
1. Number of different taxa.	Comparable to the biological community found in the reference streams. Balanced feeding group structure. Optimum community composition for stream size and habitat quality.	Community composition less than that found in the reference streams due to loss of some sensitive and intolerant taxa. Percent contribution of tolerant forms increases. Specialized feeding group taxa decrease.	Few species present. If high numbers of organisms, then they are dominated by one or two taxa. Only tolerant and general feeding group organisms present.
2. Community pollution tolerance Index.			
3. Ratio of Scrapers to (Scrapers+Filtering Collectors). (different specialized insect feeding groups)			
4. Proportion of Hydropsyche and Cheumatopsyche (tolerant caddisfly genera) to the Total Number of Mayfly, Stonefly, Caddisfly Individuals.			
5. Proportion of Most Abundant Taxa			
6. Total number of Mayfly, Stonefly, and Caddisfly Taxa			
7. Proportion of Number of Mayfly, Stonefly, Caddisfly Individuals to Total .			
8. Proportion of Shredders (Specialized insect feeding group).			
(a) Scoring criteria are based on the **1995** and **1996** reference streams.	Max. Score = 40	Max. Score = 24	Max. Score = 8

Table 2.3. Example of a Biological Integrity Classification Method Using Total Index of Biological Integrity (IBI) Scores, Narrative Biological Integrity Class Descriptions, and Characteristics of Each Class.

IBI SCORE	NARRATIVE INTEGRITY CLASS	CHARACTERISTICS
46 to 50	Excellent	Comparable to the biological community found in reference streams. Exceptional assemblage of species with a balanced community composition.
34 to 45	Good	Decreased number of sensitive species, decreased number of specialized feeding groups some intolerant species present.
22 to 33	Fair	Intolerant and sensitive species are largely absent; unbalanced feeding group structure.
10 to 21	Poor	Top carnivores and many expected species absent or rare; general feeders and tolerant species dominant.

(a) From Plafkin et al. 1989, and Karr et al. 1986, Ohio EPA 1987.

Developing the *Index of Biological Integrity*

Biological integrity is defined as "***the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the best natural habitats within a region***" (Karr and Dudley 1981; Ohio EPA 1987; Gibson et al. 1996). The streams with the best natural habitats remaining are those with "least impaired" habitats. Due to human impacts, there simply are no more "pristine" streams left in the County. ***Reference streams*** were identified throughout the County using an accepted set of criteria and characteristics that streams would have to meet in order to be considered a "least impaired" stream. The fish community and aquatic insect community were monitored in these "least impaired" streams and the results used to develop County reference conditions for assessing the integrity of other more impaired County streams.

Since one reference stream would not be truly representative of all County streams in developing reference conditions because of the natural variability found throughout the County, reference

conditions were based on multiple monitoring sites. ***Other factors*** that would naturally influence the stream community include ***stream size*** (either drainage area or stream order) and the ***underlying soils and geology*** of the watershed. Montgomery County has three major soil areas within its boundaries: silt loam, channery silt loam, and triassic loam. These three areas, originally defined by soils groupings, have been found to correspond to ***three major sub-ecoregions*** of Maryland. In order to account for the natural variability expected from geology and stream size, separate IBIs are developed for two stream sizes for both fish and aquatic insects, for the three major soil areas. One set of IBIs represents 1st and 2nd order streams and the other represents 3rd and 4th order streams. These IBIs have been developed for two soil types - the silt loam and channery silt loam. However, insufficient data were collected in 1996 to enable developing separate IBIs that also covered triassic loam soils for the two stream sizes. Fortunately, this soil type is located only in the County's rural western area and, as such, did not substantially alter the results of the analysis in the rest of the more urbanized portions of the County.

Developing Stream Resource Conditions

Countywide baseline stream monitoring data was compared and evaluated against the appropriate IBIs to assess current stream resource conditions. Where available, the analysis of baseline watershed monitoring stations included composition of both the Spring aquatic insect community and the Summer fish community. This analysis was used to calculate the metrics of community structure and function that were needed to assess cumulative impacts and overall watershed health. A narrative description of "excellent", "good", "fair", or "poor" was applied in a consistent and objective manner to the appropriate numeric Index scores shown in Table 2.4. ***Narrative biological integrity class descriptions*** were applied to the results of each monitoring stations' aquatic insect and fish data. ***Year long or multi-year trends*** were then examined in order to determine ***overall resource conditions*** on a ***subwatershed scale***.

Developing Preliminary Stream Resource Conditions

When sufficient data was not available from the County's baseline monitoring program to assess resource condition trends on a specific subwatershed basis, other directly comparable stream monitoring data were utilized.

The ***Environmental Planning Division*** of M-NCPPC monitored aquatic insects and habitat in several lower Patuxent River tributaries. This data was used to establish preliminary resource conditions for these tributaries. Division staff also submitted several development monitoring studies, some of which were useful in developing preliminary resource condition assessments.

Other data sources were used to develop preliminary resource conditions or to confirm resource condition evaluations. ***Rapid Stream Assessment (RSAT)*** data was used in Rock Creek and Cabin John watersheds as either conformational data or to develop preliminary resource conditions. ***Modified RSAT*** methods were examined in the Muddy Branch watershed to assist in the development of preliminary resource conditions for portions of that watershed. The ***ANS***

Volunteer Stream Monitoring Program data confirmed many of the subwatershed resource condition evaluations.

Use of Resource Condition Information in Determining Causes of Impairment

Habitat trends and physical/chemical monitoring results were examined to help confirm resource condition trends for individual subwatersheds. Possible habitat/IBI relationships are depicted in Table 2.4.

Table 2.4. Generalized Relationships: Index of Biological Integrity (IBI) and Habitat Assessment Scores and Possible Causes of Stream Impairment.

IBI SCORE	*HABITAT ASSESSMENT SCORE*	*POSSIBLE CAUSE OF IMPAIRMENT*
HIGH	HIGH	NO IMPAIRMENT
LOW	HIGH	CHEMICAL/ALTERED FLOW
LOW	LOW	HABITAT
HIGH	LOW	NUTRIENT ENRICHMENT

If habitat condition is the primary determinant of the biological resource condition, then high habitat scores should predict high IBI scores, and lower habitat scores should predict lower IBI scores. If stressors other than habitat are primary determinants of the biological resource condition, then relationships such as outlined in Table 2.4 may occur. For example, if the stressors influencing the biological resource condition are factors associated with altered flow patterns (e.g., lower base flow, higher storm flows, increased sediment loads, and increased stream temperatures) or with water chemistry changes (e.g., illicit discharges, pesticides, metals) then the IBI scores might be lower than expected for the higher corresponding habitat values.. Low habitat assessment scores can have higher then expected IBI scores where nutrient enrichment supports a more abundant community than the habitat by itself would normally support.

IMPERVIOUSNESS ANALYSIS

Existing imperviousness for most of the County is measured from actual paved land surfaces based on aerial photographs which are digitally compiled and used to develop the County's Geographic Information System layers. Paved surfaces include buildings (based on roof-outline), roads, parking lots and sidewalks. Existing impervious analysis has been conducted for all of the County subwatersheds. In Part II., Watershed Assessment Map 1 for each of the 22 major watersheds shows the existing impervious land cover features. Map 2 shows the existing

and projected percentage of paved area to overall subwatershed area (imperviousness percentage) for each subwatershed. Analysis of impervious surfaces for subwatersheds in the western area of the County will be added as the supporting GIS information becomes available.

Estimates of potential increases in imperviousness for each subwatershed are based upon generalized zoning information. The estimates were derived using factors for the percentage of impervious area typically found in each zone. It should be noted that the projected increases in imperviousness assume full implementation of zoning. This is generally a maximum value which can be used as a gauge, but not as an absolute value. The estimates do not take into account factors such as market demand or caps on development due to road capacity, school capacity, etc. Complete build-out of an area to its total zoned capacity is fairly unusual.

The relationship between existing and projected subwatershed imperviousness is useful for gauging the potential magnitude of change between existing and future conditions. It allows us to compare subwatersheds and identify streams that may be more heavily impacted than others. This is useful for targeting watershed management tools and in discussions with the public and among agencies on setting priorities. Map 4 in each of the Watershed Assessments sections shows projected imperviousness level by zone in order to identify where the highest future levels of impervious area are concentrated within subwatersheds. This is useful for identifying specific areas for targeting efforts, and the extent to which potential impacts are either widespread or limited in area. Map 4 also shows the management categories for each subwatershed.

The level of imperviousness in our landscape is used as a gauge of potential impact because it is strongly correlated with stream quality. This correlation is stronger and much better understood for areas that have developed without stormwater management controls. A number of studies have drawn direct relationships between increases in imperviousness to impairment of biological life in streams, and taken together, generally conclude that stream degradation occurs at levels of imperviousness between 10-20% (Schueler, 1995). These studies, however, were conducted primarily in urban or urbanizing streams that did not have widespread stormwater management. The use of stormwater management controls can lessen the adverse effects of stormwater runoff on receiving streams. The extent to which these effects are lessened, however, has not been rigorously examined, and cannot be determined from the previous studies which have been conducted. One of these studies conducted in Maryland Piedmont headwater streams found that macroinvertebrate diversity dropped greatly when watershed imperviousness exceeded 10 to 15% (Klein, 1979). This general threshold is still commonly used, particularly when discussing stream resources which are particularly sensitive to impacts, such as changes in temperature, which are not easily controlled by stormwater BMPs. The County has a controlled study currently underway comparing 1st and 2nd order streams with and without BMPs to examine the effects of stormwater controls on biological conditions.

The effects stemming from changes in imperviousness are not limited to just the increase in surface runoff. The increase in stormwater runoff volume and peak flows caused by an increase in imperviousness can be mitigated to some extent by stormwater management controls. Other

changes in subwatershed conditions occur with increased imperviousness which are more difficult to mitigate. These changes include reduced groundwater recharge which may reduce baseflow levels necessary for aquatic life, and an increase in stream temperatures as the input of cool baseflow is reduced relative to the amount of surface runoff entering the streams. Surface runoff is also frequently warmed significantly as it flows over hot paved surfaces or through stormwater ponds, particularly in the summer. Increases in imperviousness also provide a general indicator of other watershed changes related to overall human activity which affects streams. This includes such things as additional road crossings and increased pollutants from road and parking lot runoff, new or expanded sewer lines, increased levels of litter and illegal dumping in streams, such as improper disposal of used motor oil, household chemicals, etc.

MANAGEMENT CATEGORIES AND SETTING GOALS

The stream protection strategy employs five different management categories to preserve, protect or restore stream resources. Selection of an appropriate category is based on both existing stream conditions and projected impacts from estimated changes in subwatershed imperviousness. Each management category identifies a general goal and set of tools that are expected to provide the most success for managing man-made changes to the landscape and stream conditions. These five management categories are ***Watershed Preservation Area, Watershed Protection Area, Watershed Restoration Area, Urban Stream Management Area, and Agricultural Watershed Management Area.***

Watershed Preservation Areas

In some of our watersheds and subwatersheds, changes to the natural landscape have been minimal or have had time to heal, and Watershed Preservation tools will maintain the excellent stream condition in these areas. These areas have generally been protected because their drainage area is within the County's stream valley park system or State parkland, or has very low densities through agricultural preservation programs and other conservation efforts, and will continue to be preserved.

Watershed Protection Areas

Large areas of the County have developed since requirements for stream valley protection and stormwater management went into effect, or are now being newly development with these protections. Good or excellent stream conditions are found throughout these areas and Watershed Protection tools have been used and will continue to be used to lessen the negative impacts of development on stream conditions. These areas greatly benefit from the County's stream valley park system which has preserved the main stream valley and many of the smaller tributaries, and stream buffers within residential developments further protect the tributaries and wetlands integral to the health of the watersheds. Based on the sensitivity of the streams, the intensity of new development proposed, and the extent of previous impacts, either regular levels, special levels, or remedial levels of protection may be required to ensure that streams are protected.

Watershed Restoration Areas

In older developed areas of the County, our impacts on the landscape have been long established and occurred prior to the establishment of comprehensive environmental regulations. In these subwatersheds, streams have been degraded to varying degrees, primarily from the effects of uncontrolled runoff, and Watershed Restoration tools are necessary to stop further degradation and improve fair or poor stream conditions. Stream valley parks along the main stems of these streams often provide the only buffer and harbor most of the remaining natural stream channels in these systems.

Urban Watershed Management Areas

Within the most urbanized areas of our County, there are stream systems which have been extensively piped and channelized, and may exist almost entirely underground as storm drains. In these areas, restoration of natural streams will be difficult to impossible, and in any case, costly. Urban Watershed Management tools are needed here to ensure that runoff entering the storm drains is as clean as possible so that impacts downstream are minimized.

Agricultural Watershed Management Areas

In the northern and western areas of the County, agriculture is the primary land use and development densities are very low. With the use of appropriate agricultural best management practices, stream and watershed conditions would flourish. Agricultural areas that support excellent stream conditions are designated as Watershed Preservation Areas. Where agricultural land uses have, over time, had an adverse effect on the streams due to outmoded or inadequate management practices, Agricultural Watershed Management tools will be most useful in improving stream conditions.

Criteria used in Assigning CSPS Watershed Management Categories and Examples of Management Tools

The five general management approaches to stream protection are tailored to address the specific problems found in the County's streams. The following information describes how the management categories are assigned to different subwatersheds and the types of management tools that can be applied to protect stream conditions.

Watershed Preservation Areas

- Stream condition is EXCELLENT.
- Projected land use is not expected to put significant stress on resource and projected imperviousness is generally less than 10% of the subwatershed area.
- Areas are generally protected by very low density zoning or parkland.

Examples of management tools that would apply to these areas include:

- Stream valley park acquisition or dedication.
- Conservation and agricultural preservation easements.
- Expanded stream buffers and restrictions on types of land use in stream buffers (e.g. Patuxent Primary Management Area).
- Public education and outreach to promote stream stewardship.
- Agricultural BMPs for active farm, pasture and horse operations.
- Application of existing environmental guidelines for the limited areas of development that may occur.

Watershed Protection Areas

- Stream condition is EXCELLENT or GOOD.
- Existing and/or planned land uses result in development patterns with imperviousness above 10% and protection of the resource from development impacts is necessary.
- Different management levels are applied based on the level and type of protection deemed necessary to protect the resource:
  Special level - Due to the sensitivity of the resource and the magnitude of change between existing and planned development, some level of enhanced watershed management is necessary beyond typical environmental guidelines and sediment control and stormwater permitting requirements.

  Examples of management tools that would provide a special level of protection:

  - Regulatory Special Protection Area designation as provided under the Water Quality Review Law (Montgomery County Code, Chapter 19, Article V).
  - Expanded stream valley park acquisition or dedication.
  - Increased forested buffer requirements.
  - Expanded protection for wetland recharge and hydrology.
  - Zoning overlay for subwatershed protection.
  - Impervious surface reduction strategies.
  - Targeting of public education efforts and water pollution discharge enforcement programs.

  Regular level - Standard existing protection measures are expected to adequately protect the resource from existing or projected land use. Development activity is not expected to significantly increase impervious area over what already exists and accompanying development review requirements and stormwater controls would provide adequate mitigation.

  Examples of management tools that would provide a regular level of protection:

- Application of existing stormwater, sediment control, wetlands, and forest conservation regulations and Environmental Guidelines for Development.
- Public education and outreach to promote stream stewardship.

Remedial level - Stream condition is good or excellent but problems are observed, usually in the habitat condition, that are attributable to previous land use impacts. Habitat conditions may be on the verge of or in the process of deteriorating, but stream biological integrity has not yet deteriorated to fair or poor conditions requiring more comprehensive restoration efforts. The remedial level may be used in conjunction with a special level of protection, where existing habitat problems exist AND projected land uses are expected to increase imperviousness significantly. In these areas it is particularly important to address existing channel instability so that stream reaches will be able to withstand small incremental impacts associated with changes in land use. The remedial level under Watershed Protection Areas differs from Watershed Restoration by being applied as limited spot improvements to areas with good or excellent stream condition. Watershed Restoration Areas have fair or poor stream condition and require more comprehensive restoration efforts.

Examples of tools for providing remedial levels of protection:

- Stream channel and habitat restoration and improvement.
- Riparian buffer improvements.
- Improvements to stormwater flows in areas that are developed, particularly on-site solutions and small-scale retrofits.

Watershed Restoration Areas

- Stream condition FAIR or POOR.
- Contributing drainage generally has less than 55% ultimate impervious area.
- Significant areas of natural stream channel still exist.
- Most land abutting the stream is in conservation easements or public ownership.

Examples of management tools that would apply to restoration areas include:

- CIP projects to retrofit or add new stormwater controls and restore stream habitat (both in-stream and riparian).
- Targeted public education and water pollution discharge enforcement programs.
- Measures to increase forested buffers and wetland habitat and function.
- Application of existing stormwater, sediment control, wetlands, and forest conservation regulations.

Urban Watershed Management Areas

- Would be designated based on a recognition that certain existing and planned land uses have a detrimental and unavoidable effect on subwatershed hydrology, stream habitat, water quality, and aquatic life that limits the potential for restoration.
- Stream condition is POOR.
- Land use generally consists of intense development (e.g. Central Business Districts, major commercial areas).
- Contributing drainage generally has 55% or greater ultimate impervious area and system presently does not support viable biological community.
- Significant portion of the drainage area is piped or channelized and habitat restoration is generally infeasible.

Examples of urban watershed management tools:

- Targeted public education and enforcement programs and pollution prevention programs.
- CIP projects where stabilization of degraded or degrading stream habitat conditions is necessary and where limited stormwater retrofit projects are feasible.
- Opportunities to retrofit stormwater controls as areas undergo redevelopment would receive major emphasis.

Agricultural Watershed Management Areas

- Stream condition is GOOD, FAIR or POOR.
- Agriculture is the predominant land use.
- Some level of impairment is reflected in the monitoring data, as indicated by a resource condition of good, fair, or poor. (Excellent agricultural subwatersheds would fall into the Watershed Preservation Area management category.)
- The Montgomery Soil Conservation District would be the lead agency for developing management approaches and tools for Agricultural Watershed Management Areas.

Examples of management tools (Note: tools would vary by stream condition):

- Agricultural subwatersheds with "good" stream conditions would be targeted for expanded educational programs and opportunities to improve buffer function.
- Agricultural subwatersheds with "fair" stream conditions would be targeted for implementation of additional BMPs, targeting of buffer enhancement activities such as off-site forest conservation, and increased educational programs.
- Agricultural subwatersheds with "poor" stream conditions would be targeted as high priorities to receive BMP cost-sharing, forested buffer establishment, and targeted educational programs.

ASSESSING PROGRESS

Biological data provides us with a consistent, real life picture of the health of our stream systems. The state of the biological community reflects the cumulative impacts on our streams, and is particularly useful for tracking long-term trends in stream conditions. Used in conjunction with stream habitat, physical/chemical, and stream morphological data collected during the same monitoring year, areas of stream impairment can be located and possible stressors identified and prioritized for follow-up investigations. Short-term one-time impacts to a stream may impact the local community temporarily. However, in most cases, a healthy biological community will be able to recover from this sort of impact. Catastrophic, short-term impacts that can radically alter a community are generally discovered and mitigated as a priority.

The County's stream monitoring program is designed to assess baseline conditions throughout the County compared to least-impaired conditions in a set of reference streams, monitor conditions over time, and identify areas of impairment. As the monitoring progresses, our assessment of stream conditions will provide more information on trends. At this time, we have only a snapshot of the conditions in our streams, since our data presently covers just one or two monitoring seasons. However, the data on aquatic life in our streams which we have collected so far has already given us a more reliable indication of conditions in our streams than previously available. A chemical sample can only tell you about that day and time when the sample was collected; data on the biological community reflects the cumulative impacts of stressors which have shaped it over time. The County is currently in the middle of the first 5-year rotating monitoring cycle, therefore, this first iteration of the CSPS will be updated at the end of the 5-year period to incorporate new data. As the County continues its monitoring in successive cycles, the CSPS will be fully updated every five years to reevaluate stream conditions and reassess and develop current priorities. More frequent updates of individual watershed conditions may be provided as data is available.

As the County completes the full five-year cycle of stream conditions and begins to develop a complete picture of stream conditions based on baseline monitoring, the establishment of measurable quantitative goals for streams will become possible. One goal could consist of achieving stream conditions that can support a targeted number of fish species, or a certain level of macroinvertebrate diversity, based on a percentage of the reference condition.

Until we have developed a full quantitative assessment of all streams, narrative goals for each subwatershed will be used, based on the overall management goal. The process of setting these goals will begin first in the priority subwatersheds. Goal setting for specific subwatersheds will occur through dialogue with the citizens and further coordination with affected agencies as activities proceed to address priority areas. These goals will be established, for instance, as watershed restoration action plans are developed by DEP, or in area master plans.

Chapter 3 - Watershed Management Priorities

IDENTIFICATION OF COUNTYWIDE STREAM PROTECTION PRIORITIES

The Countywide Stream Protection Strategy is Montgomery County's first effort to comprehensively assess biological resources and stream habitat conditions and apply the results to identify subwatershed priorities for stream protection. Prioritization of the County's stream protection needs through a targeted subwatershed approach will enable achievement of the County's water quality goals in a manner that uses available resources efficiently and avoids the need for more costly remedial efforts in the future. The management priorities presented in this chapter are based on our current understanding of the most serious problems in each subwatershed and overarching needs to protect the highest quality streams.

The extent of streams in need of additional protection or restoration exceeds the resources available to address these problems. A phased implementation approach must be pursued if the County is to address the most critical stream restoration, protection, and preservation needs.

The CSPS will be updated in the year 2000 and approximately every five years thereafter. Each update will reassess the subwatershed protection priorities based on the progress made in addressing identified problems and new data on stream conditions. Just as our streams are dynamic systems, the CSPS is intended to serve as a dynamic tool which responds effectively to changing stream protection needs and trends. The overall feasibility, complexity, and degree of resources likely to be required to address these priorities requires comprehensive study which will occur through cooperative agency programs and new initiatives which are identified on Table 3.1.

The local agencies responsible for various aspects of stream and water quality protection (as identified in Vol. I of Montgomery County's Strategic Plan for Water Quality Protection), are using this document to help set planning and budgeting priorities in their respective work programs. As work progresses to address the County's water quality goals, use of this priority framework will help maximize interagency coordination and the most efficient use of resources, and avoid costly and unnecessary duplications of effort. Volunteers and businesses will also find these priorities useful in assessing where and how they might best work in partnership with each other and the responsible agencies to address the specific stream protection needs in individually targeted priority subwatersheds.

Need for a Comprehensive, Watershed-based Approach to Stream Protection

Resolution of many of the serious stream degradation problems and protection needs documented in the CSPS will require a comprehensive and well-coordinated effort among many partners from both the public and private sectors. Solutions are likely to be costly and take a long time before the positive benefits of implemented stream restoration and other remedial measures become clear. Most of the observed stream and resource problems identified in the CSPS took many years to degrade to current levels.

Even with a focus limited to the identified priority subwatersheds, the needed program commitments and investments will be long-term and substantial in nature. Adherence to a

watershed and subwatershed-based approach is therefore critical to efficiently marshall the combination of policy choices, project investments, enforcement, educational, and personal stewardship commitments necessary for success. Inevitable temptations to pursue more expedient "band-aid" approaches to address scattered and isolated problems on specific stream segments must be avoided if the County's aquatic resources are to be most efficiently and effectively protected.

Primary Focus of the Priority Setting Process

The stream protection priorities presented in this CSPS directly address the County's adopted water quality goals by focusing on:

o Protecting the highest quality streams;
o Maintaining existing conditions and reversing past trends of stream deterioration; and
o Restoring degraded streams, where feasible and cost-effective.

Watershed management categories (from Chapter 2) assigned to each subwatershed and used to target management approaches fall within this resource-based approach as follows:

Protecting the Highest Quality Streams...
- o Watershed Preservation Areas
- o Watershed Protection Areas - special level

Maintaining Existing Conditions and Reversing Past Trends of Stream Deterioration...
- o Watershed Protection Area - regular level
- o Watershed Protection Area - remedial level
- o Agricultural Watershed Protection Area (streams w/good or fair resource condition)

Restoring Degraded Streams...
- o Watershed Restoration Area
- o Urban Stream Management Area
- o Agricultural Watershed Protection Area (streams w/poor resource condition)

Subwatersheds identified as priorities are grouped by watershed and according to which of these three management approaches is most appropriate. (See Table 3.1.)

Protecting the Highest Quality Streams
Subwatersheds identified as priorities for protecting the highest quality streams offer perhaps the greatest challenge because they require a level of commitment extending beyond capital investments. This commitment includes tailoring land use policy and aggressive education programs targeted at providing a special level of protection to maintain the high quality of these streams. Most of the subwatersheds in this group have been the focus of past or current land use planing efforts that have included watershed protection initiatives. Despite this, many are now

exhibiting signs of *stream channel instability* and must be investigated to determine if current levels of protection are adequate. Table 3.1 provides examples of new initiatives for these subwatersheds where a special level of protection is deemed necessary. Limited capital investments to reserve strategically located stream valley parkland may be warranted in some of these subwatersheds.

Maintaining Existing Conditions and Reversing Past Trends of Stream Deterioration
Subwatersheds identified as priorities for maintaining existing conditions and reversing past trends of stream deterioration are those where stream resources are in generally good condition (or fair condition with good habitat), but where field indicators show evidence of accelerated erosional processes. These accelerated erosional processes are a sign of *instability* in stream habitat that could impair the quality of the resource in the immediate future if left unaddressed. Remedial or spot intervention can avoid the need for more expensive full-scale restoration in the future.

These subwatersheds include some of the County's developed urban and suburban areas and agricultural areas where best management practices to control runoff and sediment are either lacking or outdated. The priority subwatersheds identified in this group offer the highest potential for realizing success with cost-effective efforts to protect stream quality, including local partnerships, volunteer projects, and targeted education programs, possibly in conjunction with limited capital investments. Through efforts in these subwatersheds, the County can avoid future needs for major and costly in-stream erosion control and habitat restoration measures which are now necessary in streams draining many of the County's older developed areas. More detailed analysis of the problem areas in these subwatersheds may be needed, a task that could be done through cooperative agency/volunteer efforts.

Restoring Degraded Streams
These priority subwatersheds contain degraded streams in fair or poor condition that will need extensive, full-scale restoration efforts undertaken within a watershed context in order to achieve lasting results. Also included among these priorities are subwatersheds in the Urban Watershed Management category that, although not easily "restorable", play an important role in the restoration of adjacent downstream areas and include some limited habitat area in a condition of instability. In general, the most capital intensive and costly watershed protection efforts would occur in subwatersheds where *Restoring Degraded Streams* must be the primary focus.

Restoring degraded stream systems, though frequently a very lengthy and costly process, serves both a local and regional function. Locally, our most degraded streams are frequently found in our most populous areas and most heavily used sections of the County stream valley park system. Stream restoration work can enhance active and passive outdoor recreational experience and contributes to the overall quality of life for Montgomery County's citizens. Other local benefits include enhanced wildlife habitat (particularly aquatic and riparian dependent species), reduced impacts to infrastructure such as paths, sewer lies,sewer lines, roads, and bridges;and bridges, and reduced property damage, both public and private, from severe erosion.

From a regional perspective, large sections of seriously degraded streams essentially cut off higher quality upstream areas from providing a living link to downstream ecosystems. Montgomery County's regional commitments involve stewardship of our own stream resources

within the context of larger watersheds including the Potomac, Patuxent, and Chesapeake Bay. It is within the context of regional efforts to restore and protect the Anacostia and Potomac Rivers, the Patuxent reservoirs, and ultimately the Bay, that many of our local stewardship and restoration efforts provide one of their greatest benefits.

Restoring stream systems on a watershed scale is difficult, but not impossible, to do. A sustained, cooperative interagency effort has had some success in restoring an extremely degraded stream system in Sligo Creek. Although aspects of the watershed restoration effort are still underway, areas where restoration work has been completed now support a dramatically improved biological community. Amphibians and a fish community supporting 11 native fish species have been reestablished in the Wheaton Branch tributary and parts of the Sligo Creek mainstream.

HOW SUBWATERSHED PROTECTION PRIORITIES WERE IDENTIFIED

The first step in determining priorities was to evaluate stream resource and habitat conditions for each subwatershed as described in Chapter 2. Next, the existing stream condition was compared to the anticipated level of development, as measured by the projected increase in impervious area in each subwatershed. Changes in population density and the timing of these changes were examined to determine which subwatersheds were likely to experience the most immediate and significant impacts. (See Part II for more information on the existing and planned development levels of each subwatershed.) Each watershed was then placed in the appropriate watershed management category and management tools were identified that could best protect the stream resources assigned to that category. (See Chapter 2 for more information on these management categories and the criteria used to place subwatersheds.)

Evaluation of Stream Channel Instability: ***Streams exhibiting high levels of channel instability were selected as priority subwatersheds because, if not addressed promptly, the instability can cause further degradation to stream habitat and supportable biological resources.*** **Immediate action is deemed necessary, either to further assess or directly address the problem or to determine whether possible remedial project alternatives exist which are likely to be effective. Active channel *instability* that resulted in subwatersheds being identified as priorities was found in streams across all resource conditions, from excellent to poor.**

For the purposes of this analysis, *instability* is defined as observed and documented evidence of active and accelerated rates of alteration in natural stream channel conditions. Evidence includes exposed root hairs from woody vegetation, undercut stream banks, slumping banks with frequent fallen trees, large and unstable sediment deposits, and embedded stream channels. The severity of these conditions was measured and used to determine the level of instability. For example, bank stability was measured to assess the degree that active or accelerated bank erosion was occurring. Active bank erosion adds many tons of sediment to a stream channel, causing cumulative *instability* problems downstream. Stream embeddedness was another measure used to assess the degree to which sediment covered natural rock bottom substrate areas which serve as critical habitat for the survival of aquatic insects, which, in turn, are an important food source for many resident fish. Other measures of *instability* included the level and quality of streambank

vegetation, and the extent of eroded streambank areas unprotected by vegetation.

In most cases, the observed instability has been a direct result of the physical impacts of increased storm runoff flows that could not be handled by the existing natural stream channel. In a few cases, the streams have been subjected to high flows for so long, that active instability is no longer apparent in the physical condition of the channel (e.g., the stream has cut down and "scoured" to a stable bedrock substrate), but high flow events continue to impair the stream's ability to support a stable biological community. Within large watershed systems in need of restoration, the best solution to problems in priority subwatersheds on the main stream channel, where many of these "scoured" conditions exist, may actually involve addressing flow problems in some other upstream area which is contributing the drainage. In other cases, instability has been caused by widespread removal of streamside vegetation and forest cover, thus weakening the streambank and removing the natural system that filters sediment-laden runoff.

Identifying Priorities within the Watershed Restoration Area Management Category: Priorities among subwatersheds categorized as watershed restoration areas were placed on those stream reaches where: a) there is disparity between the condition of the biological community and stream habitat, **AND** b) channel instability is identified to be a primary cause. These subwatersheds are targeted among all of the many unstable stream reaches found in *Watershed Restoration Areas* because they contain streams where habitat conditions can potentially support a better biological community than is now present, or the biological community is more diverse than what would be expected given the habitat condition and targeted habitat improvements can ensure that the biological resources continue to be supported and even improve.

Other Impacts Considered in Selecting Priorities: Some subwatersheds have been identified as priorities based on existing problems related to some other primary factor, some not easily correctable. These factors include chronic pollution problems, major barriers to fish migration, wide-scale riparian buffer and temperature impacts.

Data Considerations: In many cases, the assessment of resource condition was based on preliminary data that did not reflect the full range of data analyzed for most streams. (Appendix A identifies the sources of data available and analyzed for each subwatershed.) Subwatersheds identified as priorities based on preliminary data will need to be further monitored before the scheduled year 2000 update to refine the resource condition assessment and confirm the priority level.

MONTGOMERY COUNTY'S PRIORITY SUBWATERSHED AREAS

Ninety-nine (99) of Montgomery County's 270 subwatersheds, are identified as priority subwatersheds. Collectively, these cover about 30% of the County's land area. Approximately 50% of these subwatersheds presently have watershed project inventories and/or project design work presently underway or programmed within the next five years to implement stream restoration measures.

Table 3.1 identifies County agency watershed protection initiatives that are underway, programmed, or planned and funded through the County's amended Fiscal Year 1998-2002

Capital Improvements Program (CIP) to address stream protection needs within the priority subwatersheds. These initiatives include remedial project inventories, feasibility planning studies, stream restoration projects, stream valley park management plans and other implementation measures. Further details on recommended management tools that would generally apply to priority subwatersheds can be found in the individual watershed assessment sections found in Part II of this report. Table 3.1 also shows those priority subwatersheds where, because of limited resources, significant remedial activities are not anticipated for scheduling or funding before FY 2004.

Table 3.1. Countywide Stream Protection Strategy - Priority Subwatersheds

Key to Watershed Management Categories
PRES - Watershed Preservation Area
PROT - Watershed Protection Area
SPA - Existing Regulatory Special Protection Area
REST - Watershed Restoration Area
AGR - Agricultural Watershed Management Area
URB - Urban Watershed Management Area

Key to Current Programmatic Activities
C- Completed Study
U- Underway
E - Existing Funded Program FY98-02
P- Proposed Funding FY99
PF- Proposed Future Funding FY99-04
PI - Proposed Funding Increase FY99-04
B - Funding Beyond FY04

Key to Comments
RSPA - Recommend Consideration for Special Protection Area Designation (Ch.19, Art.V)
EP - Study for Expanded Park Acquisition/Dedication
PEN - Target Public Education and/or Enforcement Programs
SO - Study other special protection tools (e.g. expanded forest buffers and wetland protection, zoning overlay, impervious surface reduction, etc.)

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Cabin John Creek												
Maint. Exist. Cond/Reverse Past Trends of Stream Degradation	PROT remedial	Buck Branch - upper & lower	2003	C	E	B	U					PEN
		Congressional Trib.	2003	C	E	B	U					
		Ken Branch - upper & lower	2003	C	E	B	U					
Restore Degraded Streams	URB	Beltway Branch	2003	C	E	B						PEN

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Restore Degraded Streams cont'd.	REST	Lower Booze Creek	2003	C	E	B						
		Snakeden Branch	2003	C	E	B	U					PEN
		Upper Old Farm[3]	2003	C	E	B						
Great Seneca Creek												
Protect Highest Quality	PRES/ SPA(part)	Wildcat Branch	2004								E(part)	SO/PEN
Maintain Ex. Cond/Reverse Past Trends	PROT remedial	Goshen Branch	2004									
	REST	Magruder Branch	2004									
Hawlings River			*efforts underway through interagency Patuxent Reservoirs Protection Agreement									
Maint. Exist. Cond/ Reverse Past Trends	AGR	Middle Mt. Zion	2004		U*							
		Reddy Branch - upper & lower	2004		U*							
	REST	Lower Hawlings	2004		U*		U partial					part within Sandy Spring/Ashton
Little Bennett Creek							*Trout Management Plan					
Protecting Highest Quality Resources	PRES	Ballfield Trib.	1999					C1997*	✔			

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Protect Highest Quality Resources cont'd	PRES	Dark Branch	1999					C1997*				
		Kingsley Trib .	1999					C1997*				
		Little Bennett headwaters	1999					C1997*	✔			
		Lower Mainstem - Ballfield	1999					C1997*				
		Lower Mainstem - Dark Branch	1999					C1997*				
		Soper's Branch	1999				C 1994	C1997*				Area in Clarksburg
		Unnamed Trib.	1999					C1997*				
Little Falls Watershed												
Restore Degraded Streams	REST	Little Falls Mall Trib.	2001	C	E	PI		C 1997				
		Middle Mainstem	2001	C	E	PI		C 1997				
		Upper Mainstem	2001	C			C 1998	C 1997				PEN
Little Paint Branch												
Maint. Exist. Cond/Reverse Past Trends of Stream Degradation	PROT remedial	Greencastle Trib.	2003				C 1997					PEN
		McKnew Park Trib.	2003				C 1997					

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Restore Degraded Streams	REST	Tanglewood Trib.	2003				C 1997					PEN
Little Seneca Creek												
Protect Highest Quality Resources	PROT special	Milestone Trib.	1998				C 1989					SO
		Upper Little Seneca (nonSPA)	1998				C 1994					PEN
		Upper Tenmile Creek (nonSPA)	1998				C 1994					PEN
Maint.Exist. Cond/Reverse Past Trends	AGR	Boyds Trib.	1998				P (FY00)		✔			
Restore Degraded Streams	REST	Unnamed Trib.	1998						✔			
		West Lake Direct	1998				C 1994					
Muddy Branch												
Maint. Exist. Cond/Reverse Past Trends	PROT remedial	Mainstem Above Turkeyfoot	2004				U					
		PotomacGrove Tribs	2004				U					
		Quince Orchrd Knlls	2004				U					

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Northwest Branch												
Protect Highest Quality Resources	PROT special & remedial	Bryants Nursery Trb	2002	C	E	PI, B	C 1997					
		Old Orchard Trib.	2002	C	E	PI, B	C 1997					
	PROT special	Upper Mainstem	2002	C	E	B	C 1997					SO, PEN
Maintain Ex. Cond/Reverse Past Trends	PROT remedial	Batchellors Forest	2002	C	E	PI, B						
		Rolling Stone Trib.	2002	C	E	PI, B	C 1997					
		Sandy Spring Trib.	2002	C	E	PI, B	U					
	REST	Lower Mainstem	2002	C	E	B	C 1997					
		Middle Mainstem	2002	C	E	PI, B	C 1997					
Restore Degraded Streams		Batchlors Forest East	2002	C	E		U					
		Bel Pre Creek	2002	C	E	PI, B	C 1997					
		Lamberton Dr. Trib.	2002	C	E	B						
		Lockridge Dr.	2002	C	E	E	C 1997					
		Longmeade	2002	C	E		C 1994					
Paint Branch												
Protect Highest Quality Resources	SPA	Fairland Farms	2001	C	B	PI	C 1997				E	PEN

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Protect Highest Quality Resources cont'd.	SPA	Good Hope - upper & lower	2001	C	E	E, PI	C 1997		E-FY98-02		E	PEN
		Columbia Park Trib.	2001	C	B	PI	C 1997		E-FY98-02		E	PEN
		Right Fork	2001	C	B	PI	C 1997		E-FY98-02		E	PEN
		Upper Gum Springs	2001	C	E	PI	C 1997		E-FY98-02		E	PEN
		Upper Left Fork	2001	C	B	PI, B	C 1997		E-FY98-02		E	PEN
		Upper Mainstem	2001	C	B	PI, B	C 1997					
Maint. Exist. Cond/Reverse Past Trends	PROT remedial	Middle Mainstem	2001				C 1997					
Restore Degraded Streams	REST	Snowdens Mill	2001			E	C 1997					
Patuxent River			***interagency study with DEP in supporting role**									
Protect Highest Quality	PROT special	Greenstone Trib.	1999	E *								EP/PEN/SO

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Maintain Ex.Cond./ Reverse Past Trends	PROT remedial	Foxes Branch	1999	E			C 1997					
	AGR	Damascus Trib.	1998	E								
		Haights Branch	1998	E								
		Upper Scotts Branch	1998	E								
	REST	Ednor Trib.	1999	E			C 1997					
Rock Creek												
Protect Highest Quality Resources	PROT special	Cherrywood Trib.	2002	E	E	E, B	P (FY00)					SO
		Lower North Branch C (south)	2002	E	E	E	P (FY00)					SO
		Mainstm - Farm Prk A & B	2002	E	E		P (FY00)					SO
		Mainstm Fraley Frm	2002	E	E		P (FY00)					SO
		North Fraley Farm	2002	E	E		P (FY00)					SO
		Nrth Lke Needwood	2002	E	E	E	P (FY00)					SO
		Pope Farm Branch	2002	E	E		P (FY00)					SO
		Upper North Branch A&B	2002	E	E	PI,B	P (FY00)					SO
		Upper Rock Creek A&B	2002	E	E	PI	P (FY00)					SO

Watershed	Mgmt. Category	Subwatershed	Current Program Activities									Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)	
Maint. Exist. Cond/Reverse Past Trends	PROT remedial	Middle North Branch A&B	2002	E	E	PI	P (FY00)					
Restore Degraded Streams	REST	Josephs Branch	2003	E	E	E, PI						
		Low.Main Bethesda	2003	E	E	B						
		Low. Main Veirs Mill	2003	E	E	PI	C 1994					Part in Aspen Hill Master Plan
		Lower Mainstem	2003	E	E	PI		C 1997				
		Luxmanor Branch	2003	E	E	E, PI						
		Mill Creek - upper & lower	2002	E	E	E, PI, B						
		Sycamore Creek	2003	E	E	PI	C 1994					
		Turkey Branch - upper & lower	2003	E	E	E, B	C 1994					
	URB	Southlawn Branch[3]	2002	E	E	PI, B			✔			
Sligo Creek												
Restore Degraded Streams	REST	Long Branch[4]	2000				U					PEN

Watershed	Mgmt. Category	Subwatershed	Current Program Activities										Comments
			Next Monitor Year[1]	DEP Wtrshd Invent.	DEP Feasib./ Planng Study	DEP/Parks Retrofit/ Stream Restore. Projects	M-NCPPC County Land Use Studies	M-NCPPC Park Mgmt. Plans	Planned Park Acq./ Dedic.	Soil & Water Conser. Plans[2]	Reg. SPA (Ch.19 Art.V)		
Watts Branch													
Protect Highest Quality	SPA	Middle Piney Branch	1998	E	B	B	U				E		
Maint. Exist. Cond/Reverse Past Trends	PROT remedial	Greenbriar Branch	2003	E	B	B	U		✔				
		Upper Sandy Branch	2003	E	B	B	U		✔				
	REST	Kilgour Branch	2003	E	B	B	U						
		Mddle Watts Branch	2003	E	B	B	U	C 1997					

1 Based on current level of funding.
2 Information on coverage of soil and water conservation plans is currently being developed.
3 Applies only to the areas outside of the City of Rockville. The City of Rockville is pursuing stream restoration and protection initiatives within their jurisdiction.
4 Applies only to the areas outside of the City of Takoma Park. The City of Takoma Park is pursuing stream restoration and protection initiatives within their jurisdiction.

CONCLUSIONS

Using objective and repeatable analysis from the County's monitoring program, this first Countywide Stream Protection Strategy has identified many priority subwatersheds where immediate actions are needed to protect, enhance or restore the quality of our streams and rivers. Recognizing that specific management approaches and tools will be needed to address the myriad problems cumulatively impacting our streams, the priority subwatersheds have been organized into specific groups. Each group has commonalities in the identified problems and/or resource conditions. These common traits allow for the identification of specific management tools or approaches that can begin to address the problems in an integrated and cooperative partnership approach.

Results from more detailed stream habitat assessments and technical work on the feasibility and cost-effectiveness of potential stormwater retrofit and stream restoration projects presently ongoing may ultimately yield new information on stream resource conditions and the feasibility of remedial projects. This new information, in addition to information from the County's ongoing stream monitoring program, could cause some reevaluation of the present subwatershed priorities. As this information becomes available, subwatershed priority changes will be considered as part of the year 2000 and subsequent CSPS updates.

Priorities for Meeting Other Broader Countywide Stream Resource Protection Initiatives

This is the first time that Countywide stream resources have been assessed and priorities for stream restoration and management developed using a comprehensive watershed-based approach. As a result of this assessment, several broader Countywide initiatives to be implemented during this next CSPS planning cycle have been identified:

- Refine and finalize the interim reference conditions used to evaluate and rank stream resource conditions through the County's Biological Monitoring Work Group.
- Evaluate the effectiveness of modern stormwater controls in mitigating development impacts on streams.
- Refine and implement the monitoring methods used to determine stream stability.
- Develop public education and agency/volunteer monitoring partnerships targeted those watersheds with the highest remaining stream resource conditions.
- Continue database development efforts necessary to begin to relate land use (imperviousness and population projections) and the effectiveness of stormwater best management practices to stream quality.
- Develop consensus resource-based criteria for use in identifying additional subwatersheds for possible Special Protection Area designation as provided under Article 19, Chapter V.

Chapter 4. PUBLIC STEWARDSHIP OF STREAMS

COUNTY WATER QUALITY PROGRAMS

As stated in the **Strategic Plan**, the overall goal of the Montgomery County's outreach programs for water resources is to encourage, involve and educate volunteers to help monitor and restore County streams and associated natural resources. County resource agencies provide exhibits and information at many community functions throughout the year, including the Montgomery County Fair, the Ethnic Heritage Festival, Celebrate Earth, Watershed Awareness Day, and the National Institutes of Health Pollution Prevention Conference. Staff have active dialogues with residents to make them aware of County environmental issues and programs, their linkages, and agency-sponsored stewardship opportunities such as those listed below.

- **Clean Water Partners.** DEP initiated a volunteer program in the spring of 1995 targeted at commercial and industrial facilities in the County. Owners or managers are asked to take a "Clean Water Protection Pledge" to help prevent water pollution from their work-place and to undertake a "watershed awareness activity" to involve members and patrons of their workplace with their local environment and to provide water quality information to the public. DEP provides technical assistance and promotes participating businesses through press releases and news articles.

- **Pipe Detectives.** During 1996, DEP initiated a volunteer program to assist in the illicit connection detection and enforcement program. Through routine field visits, the "pipe detectives" assist DEP staff in finding and, to some extent, identifying illicit discharges at outfalls in targeted watersheds. Volunteers have been recruited and trained for the Little Falls and Paint Branch watersheds in the first year and the Rock Creek, Cabin John, Northwest Branch, and Sligo Creek watersheds in this second year. Volunteers will be recruited for the Watts Branch, Rock Run, Muddy Branch and Great Seneca watersheds in 1998.

- **Watershed Advisory Groups.** Montgomery County staff also meet routinely with community groups such as the Little Falls Advisory Group, composed of concerned citizens from the Little Falls Watershed and representatives from Montgomery County agencies involved with issues that affect Little Falls. Agency staff submit reports and give presentations to the Advisory Group to inform them of progress on improving water quality, including the elimination of illicit discharges, the results of the Clean Water Partners Program, and ongoing watershed restoration efforts. DEP intends to develop similar citizen groups in other county watersheds as watershed restoration action plans are developed.

OTHER STEWARDSHIP OPPORTUNITIES

There are many non-profit environmental groups in the County who routinely sponsor training sessions and workshops on monitoring and other stewardship opportunities. Table 4.1 lists some of these organizations and the types of activities sponsored.

Table 4.1 Stewardship Opportunities

Organization	Telephone	Activities Sponsored	County Areas
Audubon Naturalist Society	301-652-9188	Environmental advocacy, classes, field trips, biological monitoring	Countywide
Eyes of Paint Branch	301-989-0331	Environmental advocacy, stream clean-ups	Paint Branch watershed
Izaak Walton League-Maryland Division	301-253-5009	Adopt-A-Stream and Adopt-A-Road	Upper Patuxent
Izaak Walton League of America	301-548-0150	Classes, biological monitoring	Countywide
Maryland Save Our Streams	1-800-448-5826	Be A Part of Something Big	Patuxent
Sierra Club	301-294-0466	Environmental advocacy, stream clean-ups, field trips	Countywide, emphasizing the City of Rockville
Trout Unlimited Potomac/Patuxent Chapter	301-989-0331	Environmental advocacy, many hands-on projects including fish stocking, stream clean-ups, and tree plantings	Countywide

NAMING OUR STREAMS

Stimulating and maintaining higher levels of public stewardship is essential to the ultimate success of Montgomery County's stream protection efforts. A major step in this effort is creating greater citizen awareness and a sense of connection with their local streams. Many neighborhood streams are unnamed tributaries and rivulets that may be invisible to the residents in the watershed. Over the course of the next year, DEP will be accepting and compiling suggestions for names for these unnamed tributaries. For those unnamed streams appearing on United States Geologic Survey (USGS) maps, DEP will follow the process for official naming of streams through the USGS, including public notice. For streams not appearing on the USGS maps, which include many of our smaller tributaries, the suggested names will be incorporated into the County's official stream database maintained by DEP. Future iterations of the Countywide Stream Protection Strategy, as well as watershed maps, will reflect the new names.

For further information and to determine if a stream is officially named, please contact Pamela Rowe with the DEP Watershed Management Division at 301-217-6394.

LITERATURE CITED

Davis, W.S., and T.P. Simon. 1995. Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers/CRC Press, Boca Raton, FL.

Dietermann, A. J. 1975. A Provisional Inventory of the Fishes of Rock Creek, Little Falls Branch, Cabin John Creek, and Rock Run Montgomery County, Maryland. Maryland National Capital Park and Planning Commission.

Dietermann, A. J. 1975. A Provisional Inventory of the Fishes of Watts Branch, Muddy Branch, and Seneca Creek Montgomery County, Maryland. Maryland National Capital Park and Planning Commission.

Hall, L.W., Jr., S.A. Fischer, W.D. Killen, Jr., M.C. Scott, M.C. Ziegenfuss, and R.D. Anderson,1993. A Pilot Study to Evaluate Biological, Physical, Chemical, and Land-use Characteristics in Maryland Coastal Plain Streams. Maryland Department of Natural Resources, Annapolis, MD.

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing Biological Integrity in Running Waters, A Method and Its Rational. Illinois Natural History Survey, Special Publication 5.

Klein, R. 1979. Urbanization and stream quality impairment. American Water Resources Association. *Water Resources Bulletin. 15(4).*

Ohio Environmental Protection Agency. 1987. Biological Criteria for the Protection of Aquatic Life: Volume II: Users Manual for Biological field Assessment of Ohio Surface Waters. Division of Water Quality Monitoring and Assessment. Columbus, Ohio.

Ohio Environmental Protection Agency. 1989. Biological Criteria for the Protection of Aquatic Life: Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities. Division of Water Quality Monitoring and Assessment. Columbus, Ohio.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. RapidBioassessment Protocols for use in Streams and Rivers: Benthic Macroinvertebrates and Fish. U.S. EPA, Off. of Water. EPA/444(440)/4-39-001, Wash. D.C.

Schueler, T. 1995. The Importance of Imperviousness. Chapter 2 in: Site Planning for Urban Stream Protection. Center for Watershed Protection.

PART II. WATERSHED ASSESSMENTS

The detailed Watershed Assessments in this part provide specific maps and descriptions on all the subwatersheds within each of the 22 watershed groupings.

Table II.1 Major Groupings for Watershed Assessments

1	Bennett and Little Bennett Creeks	12	Little Seneca Creek
2	Broad Run	13	Muddy Branch
3	Cabin John Creek and Minnehaha Branch	14	Northwest Branch
4	Dry Seneca Creek	15	Paint Branch
	Great Seneca Creek		
5	Upper		Patuxent River
6	Middle	16	Upper
7	Lower	17	Lower
7 8	Hawlings River		Rock Creek
		18	Upper
		19	Lower
9	Little Falls	20	Rock Run
		21	Sligo Creek
10	Little Monocacy	22	Watts Branch
11	Little Paint Branch		

Each of the 22 assessments follows the same eight page format. Map 1 shows watershed land use, streams and subwatersheds. Map 2 is actually two maps which compare the average existing and projected imperviousness percentages (the percentage of paved area to overall subwatershed area) for each subwatershed. Map 3 shows rankings of existing stream resource conditions based on biological indicators with a companion table showing details on biological integrity, habitat conditions, and management categories assigned to each subwatershed. Map 4 shows the watershed management categories for each subwatershed and the ranges of projected imperviousness for the watershed based on the actual location by zone. A companion map shows the management categories assigned by subwatershed with a written explanation of the assigned watershed management categories.

The Bennett Creek and Little Bennett Creek Watersheds

Located in western Montgomery County, Bennett Creek and Little Bennett Creek flow southwesterly into Frederick County where they converge and flow into the Monocacy River. These watersheds contain predominately agricultural land uses with large areas remaining in forest cover. Most of the Little Bennett Creek watershed is protected by parkland, and above Route 355, it supports cold-water wild trout streams. Bennett Creek, with less forest cover and a larger actively farmed area, supports a cool-water fish community that includes Potomac sculpin, central stoneroller, and common shiners. Rock bass are found in many of the pools in these streams.

Stream conditions in both Bennett Creek and Little Bennett Creek have been impacted by past agricultural land uses and these impacts are still evidenced by areas of bank instability and some sedimentation. Generally, conditions are better where good forested stream buffers were left in place. Stream conditions are improving where the land has been farmed with modern best management practices, or left idle with forest cover coming back over time.

Stream conditions in Little Bennett vary considerably throughout the watershed. Some of the factors influencing specific areas in the Little Bennett watershed include the channelization of much of the lower tributary within the I-270 median, and the road crossings on Soper's Branch and Dark Branch. These crossings, which have created fish barriers, are being corrected through better designed stream crossings.

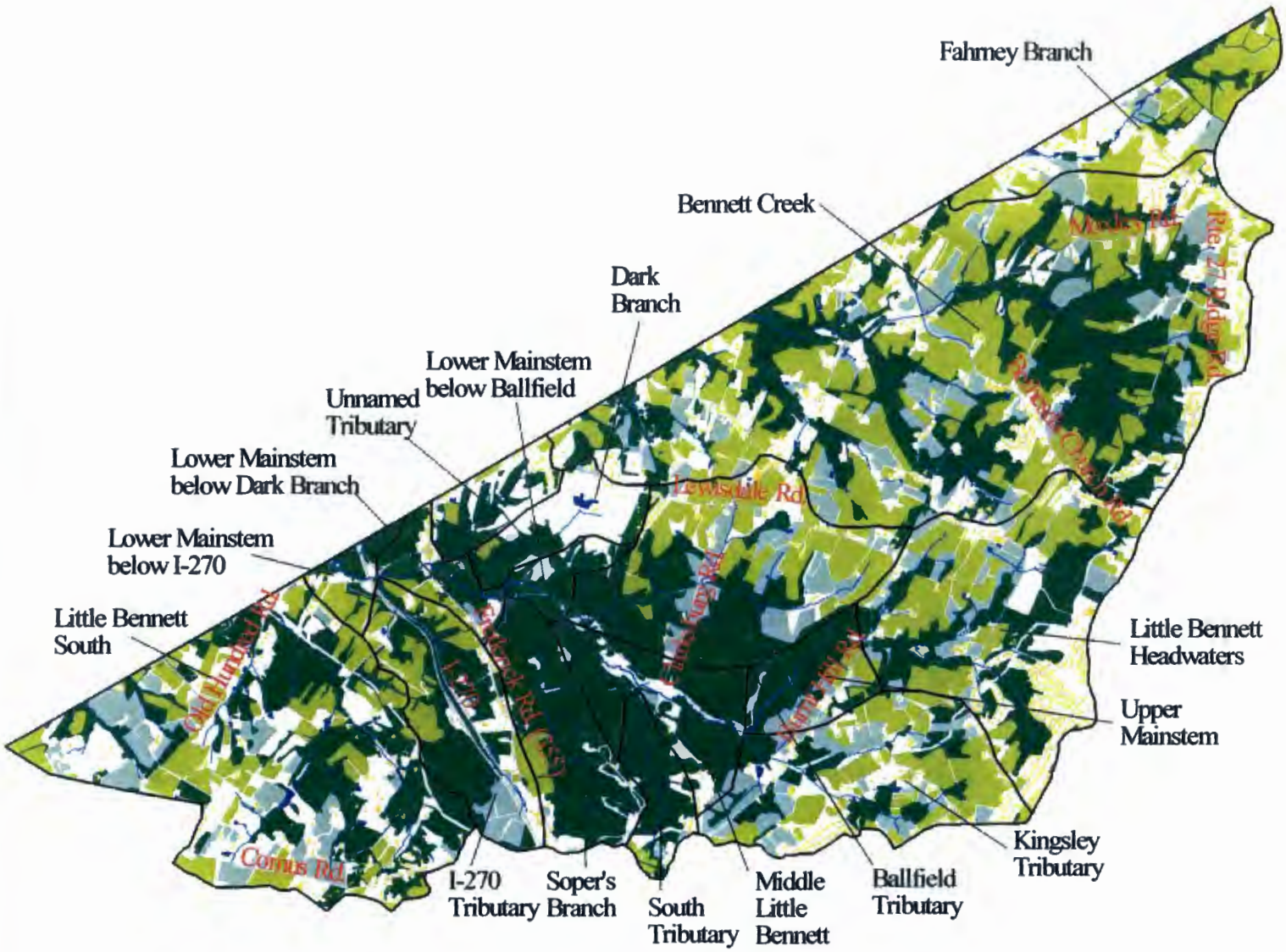
The hydrology of Little Bennett Creek is influenced by the fracture formation in the watershed's underlying geology. Rock outcroppings are common along the hillsides of the park, and the underlying fault pattern makes the streams naturally "flashy", with the streams having naturally low baseflow at times, which rises and peaks rapidly following a runoff producing rain.

Little Bennett is a high quality cold-water stream. However, habitat and flow problems currently are limiting the ability of Little Bennett to improve as a coldwater fishery. Restoration to improve the temperature regime of the Ballfield Tributary would measurably improve the quality of this resource.

Bennett Creek is predominately zoned as an agricultural preserve, with agriculture the preferred land use, and some residential development occurring on large lots (generally over 25 acres). This watershed has somewhat less overall forest cover than Little Bennett, although most of the streams have some level of forested buffer protection. The headwater areas of Bennett Creek are influenced by imperviousness and related runoff impacts from the town center of Damascus located in the top of the drainage. More large lot residential development is expected in Bennett and Little Bennett Creeks as Clarksburg and surrounding areas develop.

Bennett Creek, Little Bennett Creek, and Fahrney Branch Watersheds

Map 1
Land Cover



Land Cover

- Lawns/Open Land
- Woodlands
- Pasture
- Cropland
- Buildings
- Parking Lots
- Roads

Bennett Creek and Little Bennett Creek Impervious Area Analysis

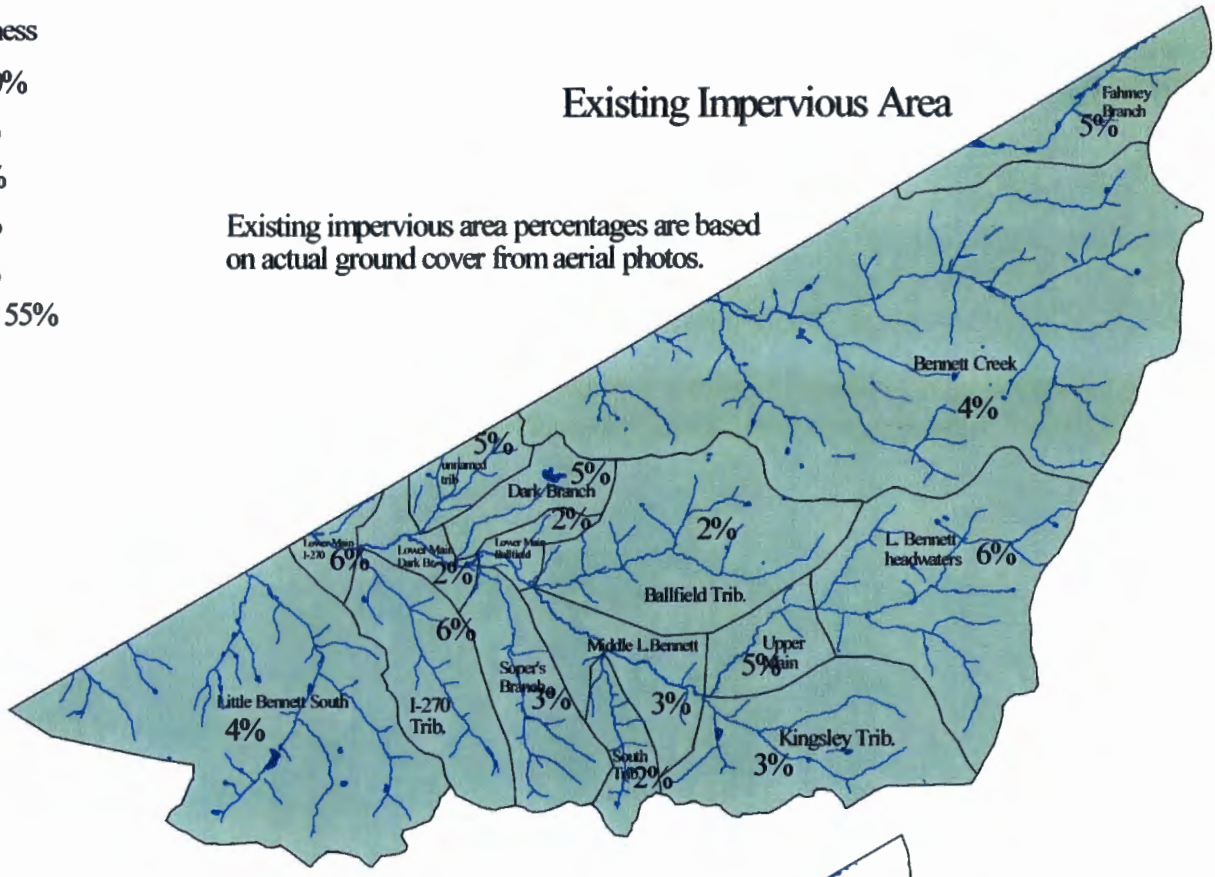
Map 2

Percent Imperviousness

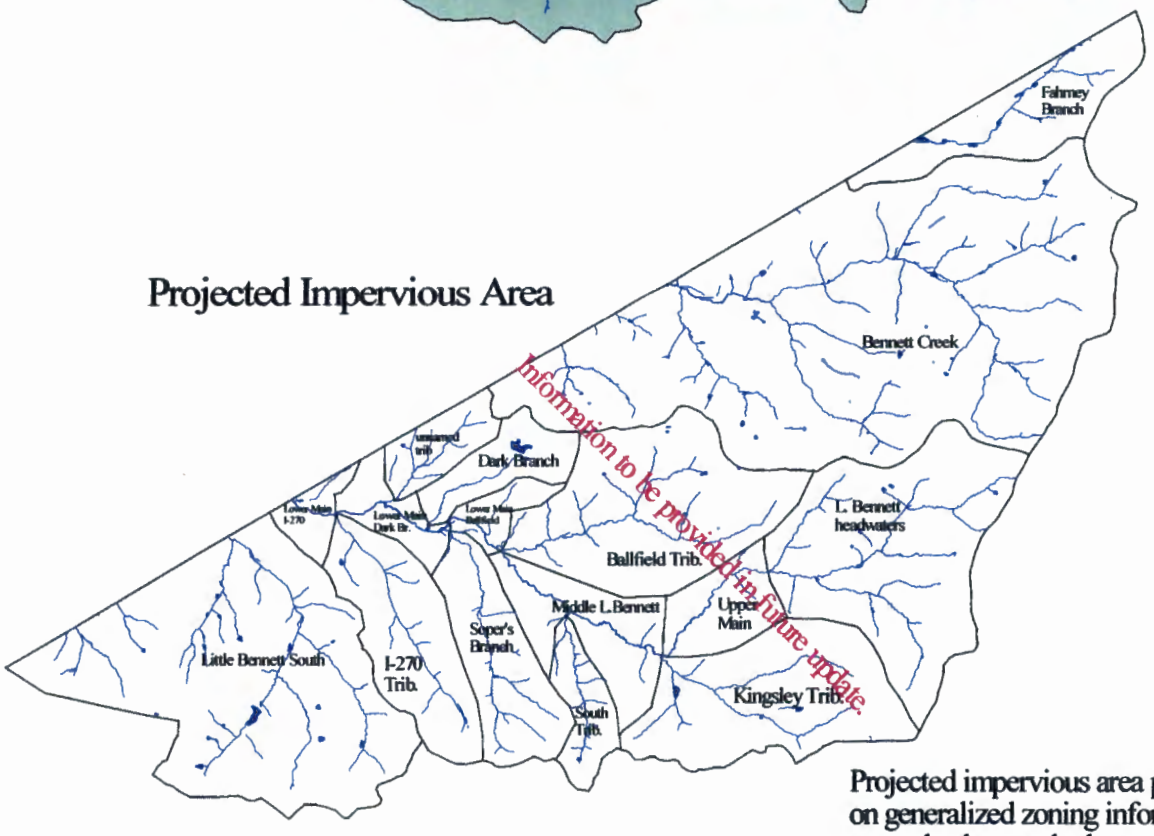
- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



Projected Impervious Area



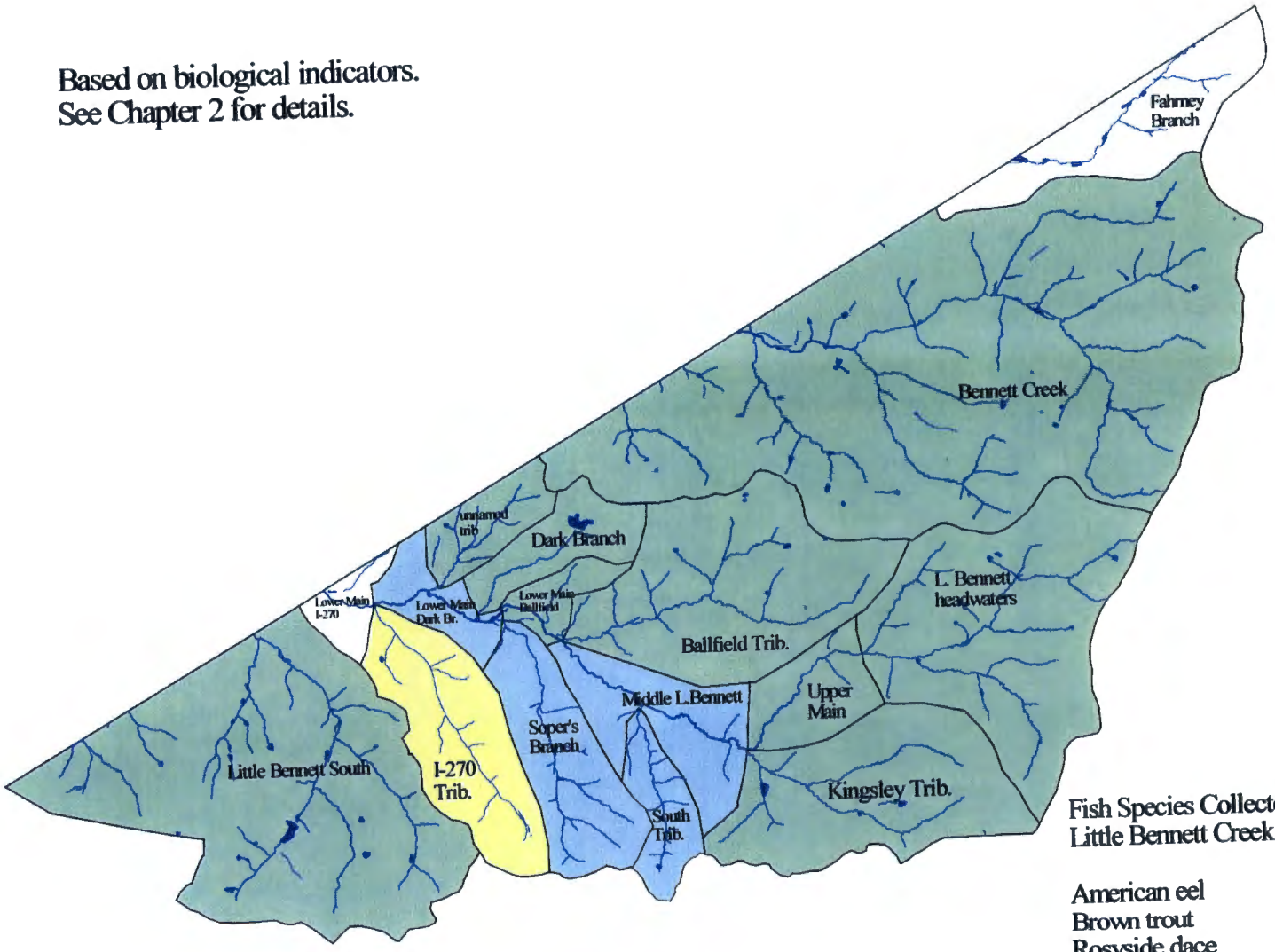
Information to be provided in future update.

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Bennett Creek and Little Bennett Creek Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected
Bennett Creek

American eel
Rosyside dace
Fallfish
Central stoneroller
Blacknose dace
Longnose dace
Common shiner
White sucker
Northern hogsucker
Mottled sculpin
Potomac sculpin
Rock bass
Green sunfish
Bluegill
Pumpkinseed
Tessellated darter
Fantail darter

Fish Species Collected
Little Bennett Creek

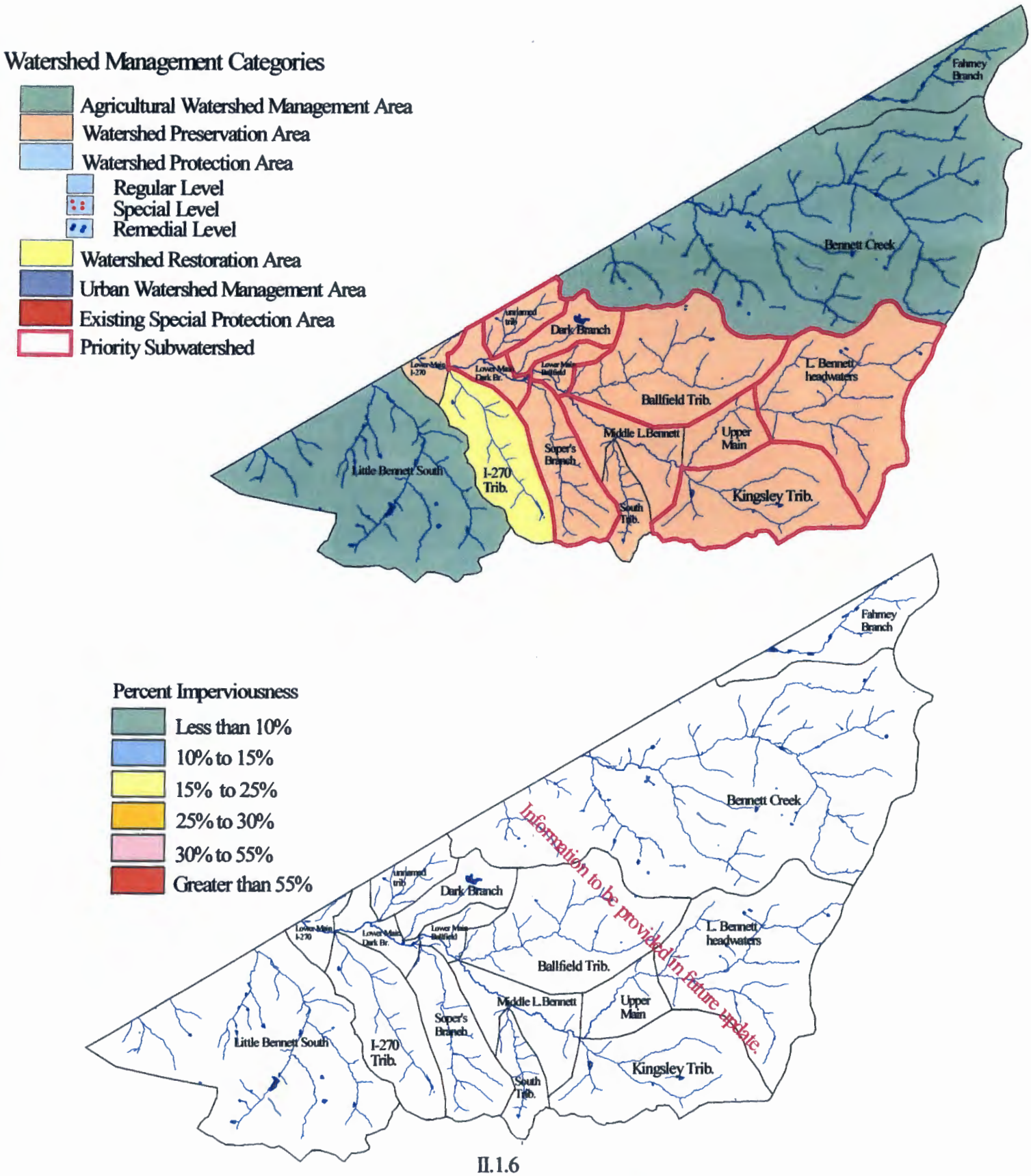
American eel
Brown trout
Rosyside dace
Creek chub
Fallfish
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Silverjaw minnow
White sucker
Northern hogsucker
Mottled sculpin
Potomac sculpin
Rock bass
Smallmouth bass
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Tessellated darter
Greenside darter
Fantail darter

Bennett and Little Bennett Creek Stream Condition, Habitat Condition, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
DEP baseline watershed monitoring to occur in 1999.			
Little Bennett Headwaters- GOOD (preliminary)	GOOD - (preliminary)	Areas of channel widening and sedimentation due to impacts of past land use practices were observed.	Channel is in a fracture/fault valley. Watershed Preservation Area
Upper Little Bennett - GOOD	EXCELLENT Overall	Excellent riparian buffer and fish habitat. Some active bank erosion and sediment deposition observed. Evidence of "flashy" storm flows.	Site of first successful stream restoration effort in the County, dating from the 1970's. Watershed Preservation Area
Kingsley Trib. GOOD (preliminary)	GOOD - (preliminary)	Reconnaissance revealed channel widening and bank erosion in some areas.	Watershed Preservation Area
Middle Little Bennett - EXCELLENT	EXCELLENT	This is a stable high quality channel section.	Beaver have created large beaver wetland downstream of Clarksburg Rd. Watershed Preservation Area
Ballfield Trib. - GOOD (preliminary)	GOOD - (preliminary)	This drainage contains large forested areas and high quality seeps and springs throughout. Headwater areas shown signs of impact from past land uses but appear to be recovering through reforestation efforts.	Actions to improve the temperature regime in this tributary would measurably improve the overall cold-water fishery. Watershed Preservation Area
Soper's Branch - EXCELLENT	EXCELLENT	This tributary contains excellent in-stream habitat conditions and is a largely forested watershed. Road culvert has created a fish barrier.	Watershed Preservation Area
Lower Mainstem between Route 355 and Dark Branch - EXCELLENT	EXCELLENT	Forested stream buffer provides stream cover. Southern valley wall is steep and also provides shade. Possible water quality problems.	Wetlands of "special state concern". Watershed Preservation Area
Lower Mainstem between Dark Branch and Ballfield Trib. - GOOD	GOOD	Above Dark Branch, the mainstem condition declines somewhat, potentially due to flow alteration from road crossings. Large mid-channel sediment bars and severe bank erosion are present.	This is the first area in the watershed where young of year from a naturally reproducing brown trout population were found in the 1970's. Watershed Preservation Area
Dark Branch - GOOD	GOOD to FAIR	An incised channel and unstable substrate influence this tributary. A perched culvert in the lower section blocks fish passage from the mainstem.	This was formerly the main spawning/nursery tributary for Little Bennett. Watershed Preservation Area
Unnamed Trib. - GOOD	GOOD	Channel is incised with fair bank stability and sedimentation.	Watershed Preservation Area
I-270 Trib. (preliminary) -FAIR	FAIR (preliminary)	Much of this tributary has been channelized and flows in the median of I-270. Possible water quality problems.	Watershed Restoration Area
Bennett Creek (preliminary) - GOOD	GOOD (preliminary)	Reconnaissance of the upper watershed revealed areas of deeply entrenched channels in the headwaters.	Agricultural Watershed Management Area

Bennett and Little Bennett Watershed Management Categories and Projected Development

Map 4



Bennett and Little Bennett Creek Watershed Management Categories

Management of the resources in these watersheds occurs primarily through voluntary actions among agricultural and large lot land owners, particularly in Bennett Creek, and through management of the Little Bennett Regional Park by the M-NCPPC. A new State Highway Administration initiative will occur during the winter of 1998 to test the use of new more environmentally sensitive and effective road salts along the portion of I-270 adjacent to Frederick County.

Watershed Preservation Areas

This category covers all of the subwatersheds in Little Bennett Creek with the exception of the I-270 tributary and Little Bennett South. Subwatersheds are placed in this category due to the high stream quality in this area, and the existence of extensive parkland which functions to preserve watershed conditions. In addition to the large area already preserved in parkland, efforts are underway and planned to improve the preservation of these resources.

Watershed Management Strategy

- Protect key stream reaches through parkland dedication and acquisition.
- Implement M-NCPPC Trout Management Plan
- Target in-stream and riparian habitat improvement projects to address existing problem areas in the Ballfield tributary, Sopers Branch and Dark Branch.
- Provide educational efforts to improve best management practices and stewardship among private landowners.

Agricultural Watershed Management Areas

This management category includes all of Bennett Creek within Montgomery County and the Little Bennett South subwatershed. The primary land uses in this area are agriculture and fallow land with occasional large lot residential uses. Imperviousness is not anticipated to increase significantly, and with the use of appropriate best management practices on actively farmed areas, streams should remain in good condition. Standard environmental guidelines and regulations are expected to adequately protect stream resources from limited areas of residential development.

Watershed Management Strategy

- Continue current practices.
- Increase forested buffer area through educational initiatives and voluntary implementation.

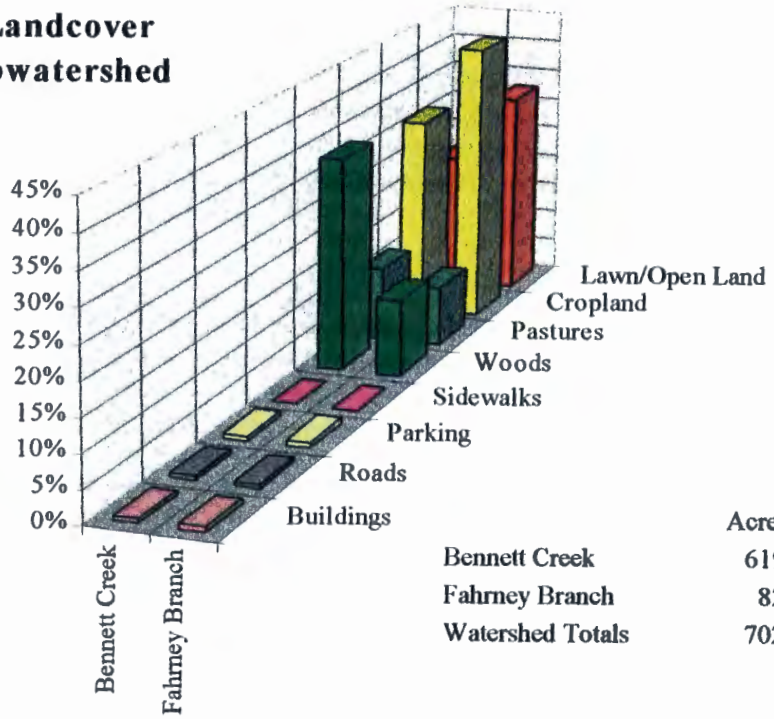
Watershed Restoration Areas

The I-270 tributary is placed within this category due to the fair resource condition and impacts to the natural channel condition.

Watershed Management Strategy

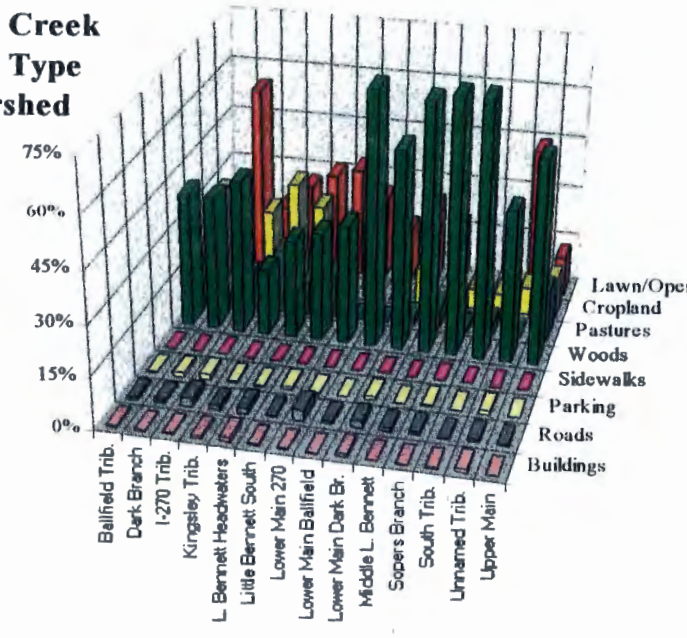
- Cooperate with SHA to monitor effectiveness of alternative de-icing agent.

Bennett Creek Landcover by Type and Subwatershed



	Acres	Stream miles
Bennett Creek	6197.1	29.5
Fahrney Branch	828.6	3.7
Watershed Totals	7025.6	33.2

Little Bennett Creek Landcover by Type and Subwatershed



	Acres	Stream miles
Ballfield Trib.	1670.6	7.2
Dark Branch	499.0	1.7
I-270 Trib.	999.1	4.8
Kingsley Trib.	1346.0	5.0
L. Bennett Headwaters	2027.4	10.2
Little Bennett South	3144.3	14.4
Lower Main 270	161.6	0.7
Lower Main Ballfield	97.0	1.4
Lower Main Dark Br.	305.6	1.9
Middle L. Bennett	722.0	3.2
Sopers Branch	782.3	5.7
South Trib.	326.4	3.2
Unnamed Trib.	321.8	3.0
Upper Main	428.3	1.9
Watershed Totals	12831.3	64.1

The Broad Run, Horsepen Branch and Western County Potomac Drainages

Broad Run Watershed

The Broad Run originates west of Poolesville near Wasche Road and West Hunter Road. Flowing south toward the Potomac River, it passes through a part of Montgomery County that has changed little in over one-hundred years. This region, a part of the County's agricultural preserve, is characterized by rolling hills and many forested stream buffer areas. The watershed has red Triassic sandstone, with soils that tend to be droughty; consequently, the Broad Run can have low base flows during the summer months.

County biologists monitored the Broad Run during the summer of 1996, above River Road. This part of the stream is in a wide forested stream valley, just downstream of the NIH Animal Center. Stream habitat was in good condition with stable overhanging banks providing excellent fish cover, frequent riffles, and stream base flow reaching both lower banks with little channel substrate exposed. Seventeen species of fish were found in the lower Broad Run including largemouth bass and five species of sunfish. A caddisfly (Ochrotrichia sp.) was found in this watershed that had not been identified elsewhere in the County through the County's stream monitoring program. If the identification is verified, it would add a new taxon to the County's list of benthic macroinvertebrates. Grab samples for water chemistry for pH, dissolved oxygen, conductivity, and water temperature were all within state standards.

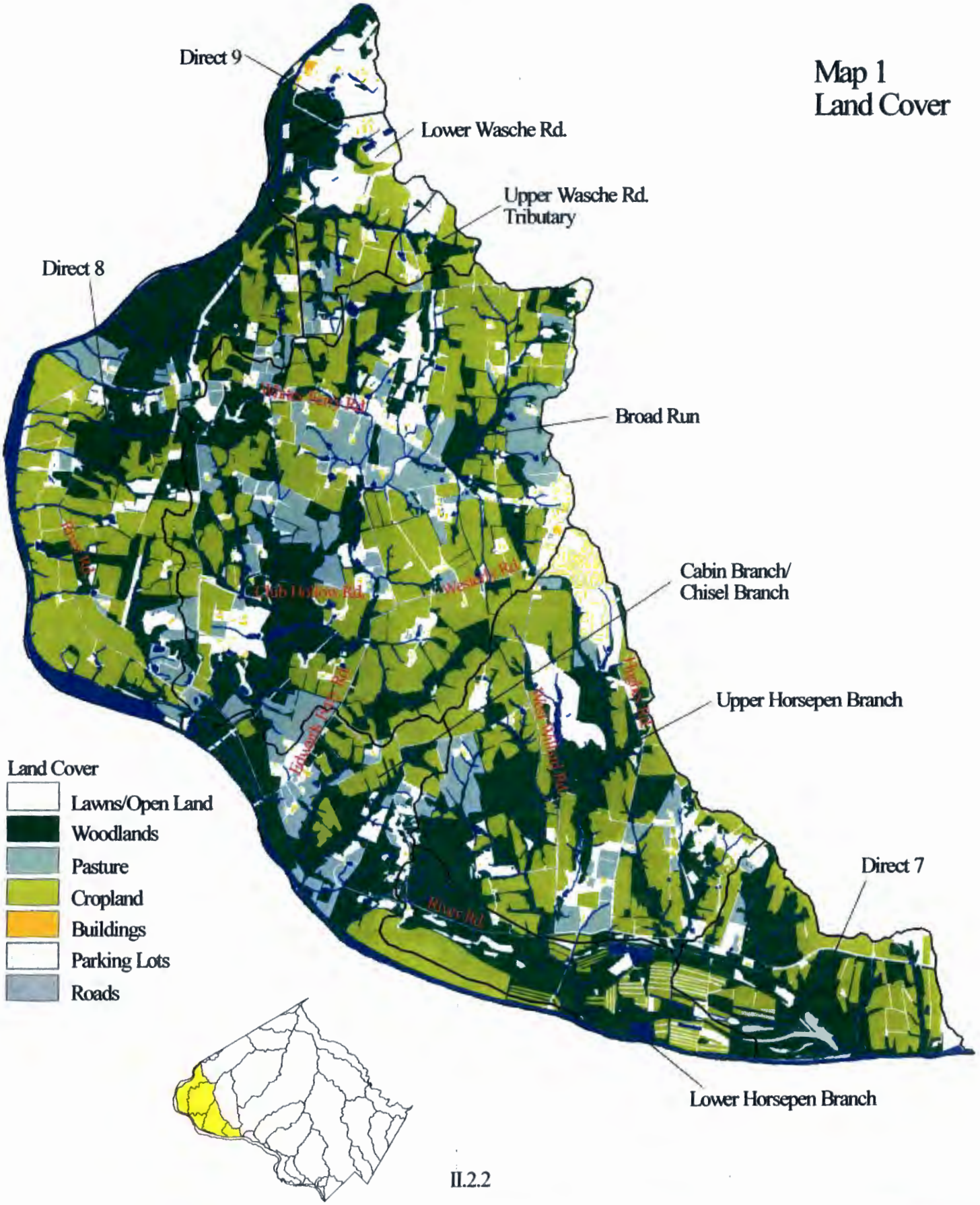
Horsepen Branch

Horsepen Branch originates south of Poolesville near the intersection of Westerly Road and West Willard Road. Like Broad Run, Horsepen Branch is within the red Triassic sandstone geologic area rather unique to this part of the County. Horsepen Branch flows through the Poolesville Public Golf Course and onto the Izaak Walton League property where two tributaries join with the main stem. At River Road, the Horsepen Branch abruptly leaves the upland areas around Poolesville and enters the Potomac River floodplain. Above River Road, Horsepen Branch is a typical piedmont headwater stream with a series of pools and riffles along its length.

Below River Road, Horsepen Branch loses its stream gradient as it enters the Potomac River floodplain in the McKee-Besher Wildlife Management Area. Many areas of the stream within the WMA have been impounded to provide different types of wetland habitat for many kinds of wildlife. These wetland areas have been designated as wetlands of state concern because of their botanical diversity and value to wildlife.

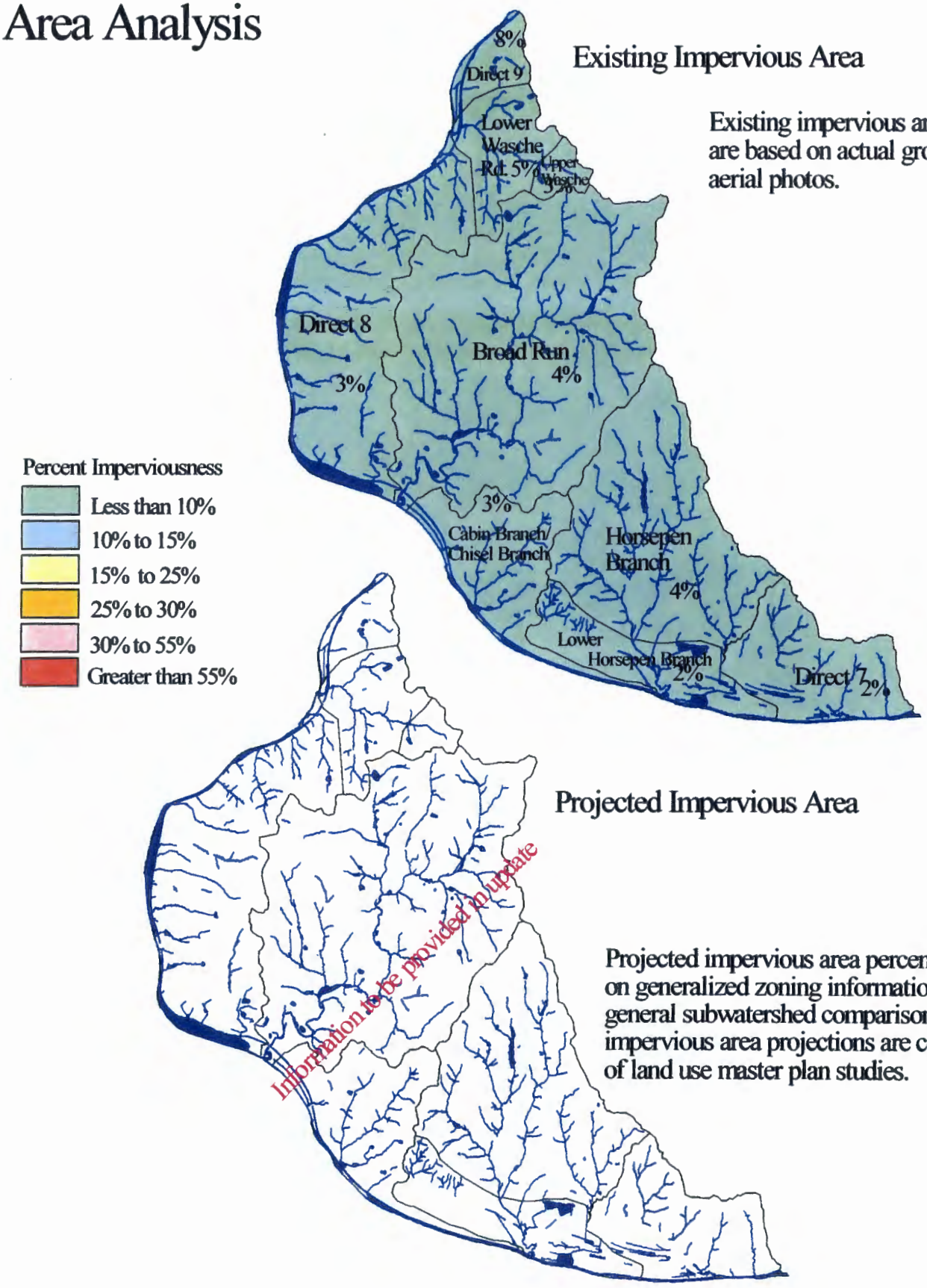
The lower reaches are subject to Potomac River floodwaters that back water up the Horsepen Branch and cause bank erosion and sediment deposition into the stream. The temperature regime of the streams in the lower reaches of the Horsepen Branch may also be affected by the Potomac River. Another possible cause, or contributing factor to conditions in the lower reaches are the two large impoundments in the watershed.

Broad Run, Horsepen Branch, Cabin Branch, Chisel Branch and Surrounding Potomac Drainage



Broad Run, Horsepen Branch, Cabin Branch, Chisel Branch and Surrounding Potomac Drainage Impervious Area Analysis

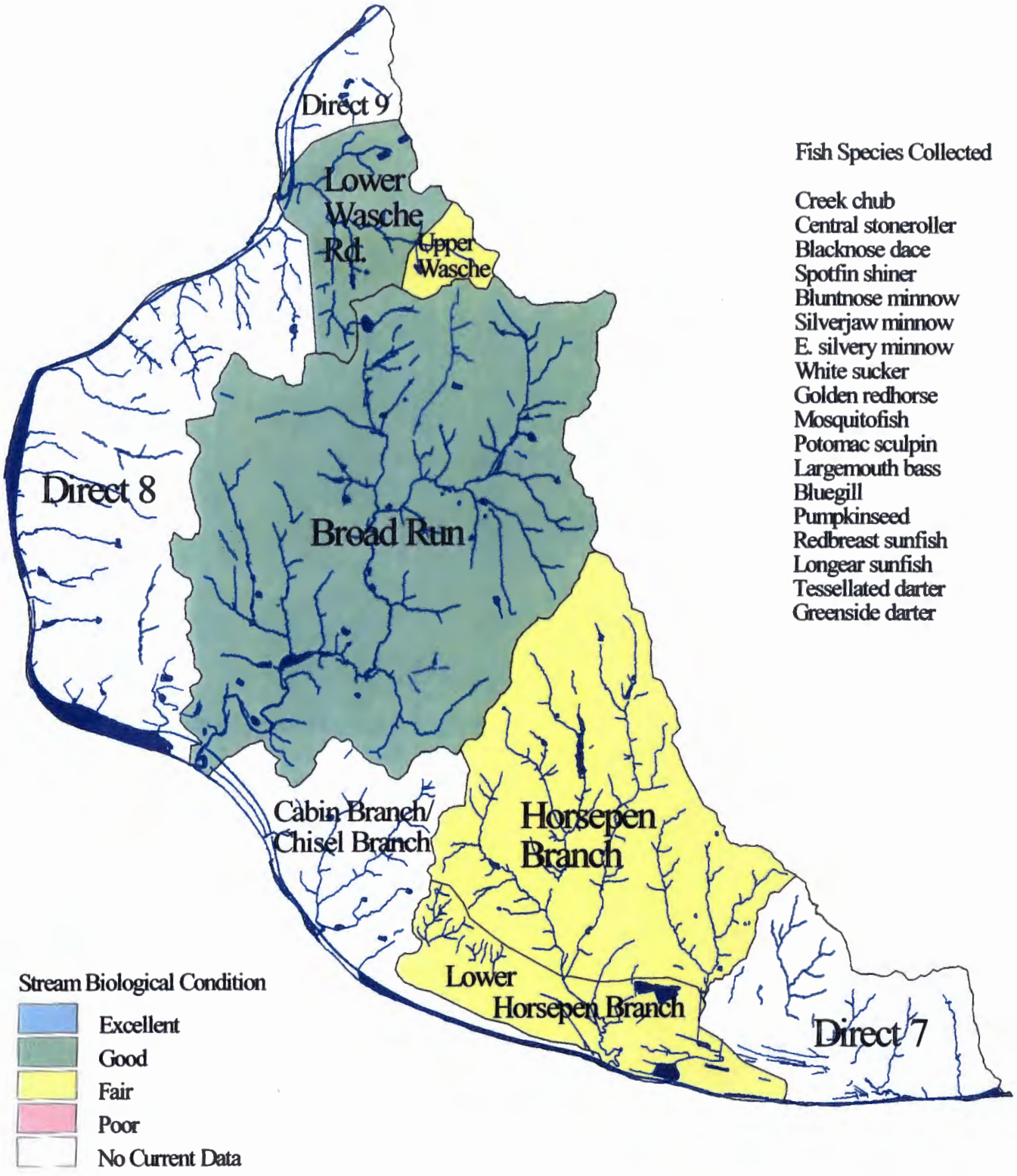
Map 2



Broad Run, Horsepen Branch and Surrounding Area Stream Condition

Map 3

Based on biological indicators.
See Appendix 1 for details.



Fish Species Collected

Creek chub
Central stoneroller
Blacknose dace
Spotfin shiner
Bluntnose minnow
Silverjaw minnow
E. silvery minnow
White sucker
Golden redhorse
Mosquitofish
Potomac sculpin
Largemouth bass
Bluegill
Pumpkinseed
Redbreast sunfish
Longear sunfish
Tessellated darter
Greenside darter

Broad Run, Horsepen Branch and Cabin Branch/Chisel Branch, and Western County Potomac Tributaries Stream Condition and Habitat Conditions with Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics/Management Category Designation
DEP Baseline monitoring is scheduled to occur in 2000.			
Broad Run - GOOD (preliminary)	GOOD - (preliminary for upper reaches)	Agricultural land uses are widespread throughout the watershed, with buffers and forest cover increasing in downstream areas. The many farm ponds throughout the watershed and unforested riparian areas at the NIH facility may be affecting stream temperatures.	Broad Run has remained in essentially the same land use - open, rolling farmland - for over 100 years. Agricultural Watershed Management Area
Horsepen Branch - FAIR (preliminary)	FAIR - (preliminary)	The lower reaches of this drainage are influenced by the Potomac River floodplain and are subject to backwater flooding. Instream fish and benthic habitat is scarce. Large impoundments are found in both the upper and lower areas of the watershed. The upper ponds provide irrigation water. The lower ponds were created to provide seasonal open water wetland areas.	The lower reaches of Horsepen Branch and adjoining drainages have an unusual delta-like drainage pattern formed by floodplain migration on the Potomac River. Wetlands of special state concern are found in the lower and are regionally renowned for their habitat value. Agricultural Watershed Management Area
Cabin Branch/Chisel Branch and Potomac River Direct drainages below Horsepen Branch	No current data	Large lot residential areas interspersed among agricultural uses make up the predominant land use. The seasonally wet conditions on the floodplain support diverse wetland communities.	The McKee Besher Wildlife Management Area contains designated wetlands of special state concern for their unique natural heritage. Agricultural Watershed Management Area
Wasche Rd. Trib. - lower - GOOD	GOOD	Agricultural land uses are widespread throughout watershed. Dickerson Conservation Park protects large forested area.	Agricultural Watershed Management Area
Wasche Rd. Trib. - upper - FAIR	GOOD	Riparian buffer area sparse.	Agricultural Watershed Management Area
Potomac River Direct drainages, between Little Monocacy and Broad Run	No current data	These numerous streams consist of small drainage areas which are heavily influenced by seasonal water table fluctuations due to their location on the Potomac floodplain. The small drainage areas associated with these tributaries makes them very sensitive to localized land use conditions	Agricultural Watershed Management Area

Broad Run, Horsepen Branch and Surrounding Area
Watershed Management Categories and Projected Development

Map 4

Watershed Management Categories

- Agricultural Watershed Management Area
- Watershed Preservation Area
- Watershed Protection Area
  - Regular Level
  - Special Level
  - Remedial Level
- Watershed Restoration Area
- Urban Watershed Management Area
- Existing Special Protection Area
- Priority Subwatershed

Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Broad Run, Horsepen Branch, Cabin Branch/Chisel Branch and Western County Potomac River Tributaries' Watershed Management Categories

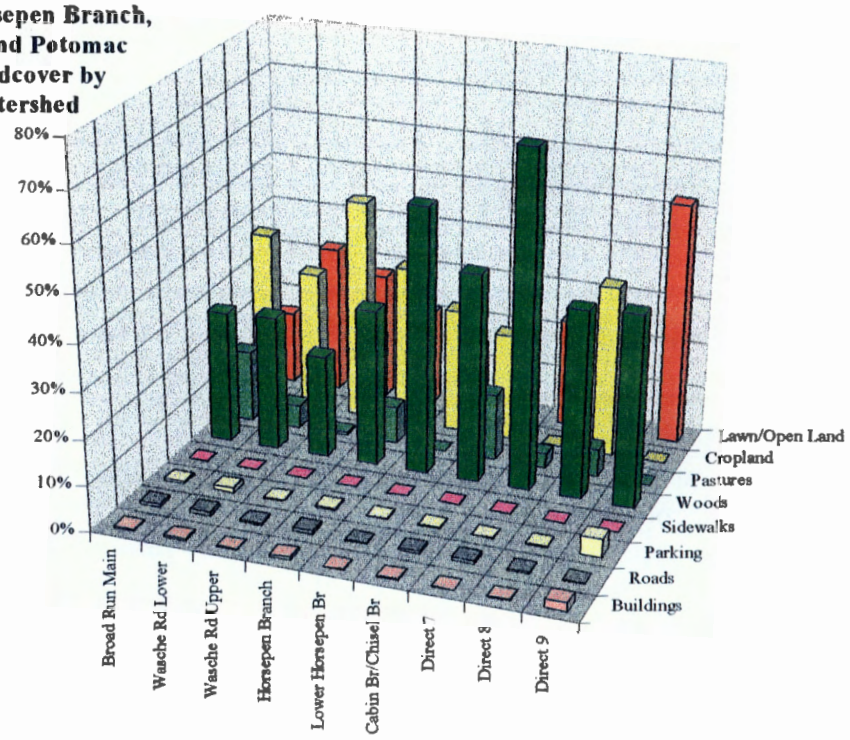
Agricultural Watershed Management Area

All of these western County drainages are located in the Agricultural Reserve wedge, and agriculture remains the predominant land use. Several large institutional and recreational land uses are located in these watersheds, including the NIH Animal Research Center in Broad Run and the Poolesville Golf Course and Izaac Walton League in Horsepen Branch. In addition to the use of best management practices on the agricultural areas, good stewardship and stream valley conservation measures are highly recommended for these areas and for the large lot residential areas. The C&O Canal National Historic Park extends along the Potomac River.

Watershed Management Strategy

- Complete monitoring of these watersheds in 2000 to allow more detailed targeting of specific problem areas.
- The use of appropriate agricultural BMPs is highly recommended as well as efforts to improve riparian buffers throughout these drainage areas.

Broad Run, Horsepen Branch, Cabin Branch, and Potomac River Direct Landcover by Type and Subwatershed



	Acres	Stream miles
Broad Run Main	9227.3	51.4
Wasche Rd Lower	1285.7	8.4
Wasche Rd Upper	306.8	1.0
Horsepen Branch	5035.8	29.7
Lower Horsepen Br	1696.7	16.2
Cabin Br/Chisel Br	2219.0	19.5
Direct 7	1486.1	11.9
Direct 8	4919.4	39.6
Direct 9	621.0	5.5
Watershed Totals	26797.8	183.3

The Cabin John Creek Watershed

The Cabin John watershed drains to the Potomac River where it discharges downstream of the Beltway above Lock 7 of the C&O Canal. The watershed has been significantly impacted by suburban development patterns centered around the County's main transportation corridors. The Interstate 495/270 corridor passes through the central part of the watershed, and commercial and high density residential development are common along this corridor, particularly affecting the eastern tributaries. Rockville Pike and the City of Rockville occupy the headwaters of Cabin John. In contrast, the western tributaries transition to lower density residential communities with far less commercial development. Like many downcounty watersheds, this area developed before environmental regulations for stream buffers and stormwater management went into effect, so on-site stormwater runoff controls are uncommon in Cabin John. The mainstem of Cabin John Creek is protected within the County's stream valley park system and, to some extent, the western tributaries also benefit from parkland buffers, particularly Buck Branch. Drainage from the highly impervious areas in these tributaries, however, has had a detrimental effect on habitat quality and stream conditions within the park.

Several regional stormwater control facilities are located in the watershed, including ponds controlling drainage from Montgomery Mall, the office parks at Democracy and I-270, and several headwater areas in the upper watershed. These ponds treat runoff from only a small part of the highly developed areas of the watershed.

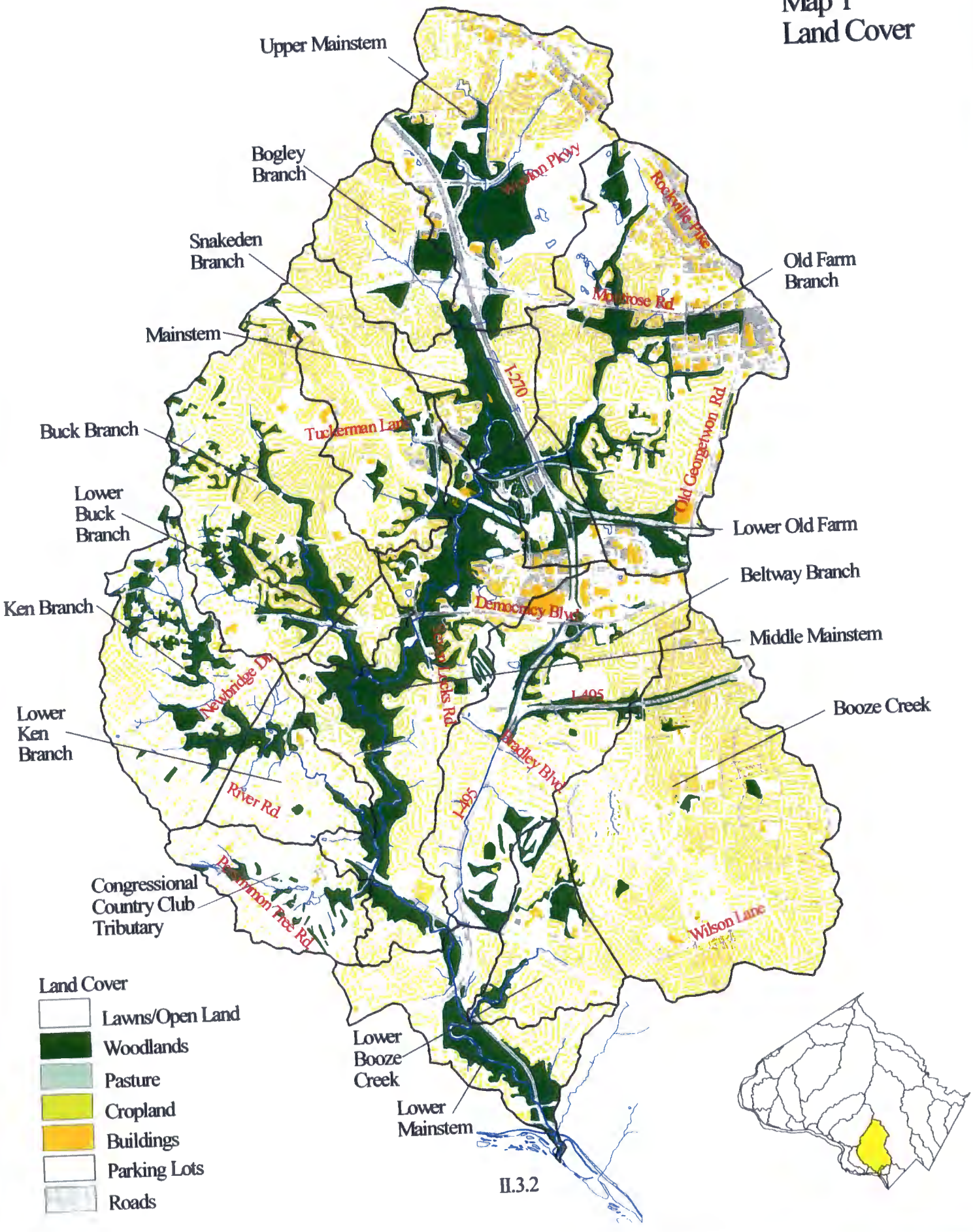
Uncontrolled runoff in Cabin John has resulted in seriously impaired habitat throughout the watershed. Impacts have included accelerated stream channel downcutting and widening of channels which has undermined and toppled trees. Exposed sanitary sewer lines, in many cases originally buried 10 -20 feet below the bottom of stream channels, are a common occurrence in Cabin John, as in some other urban County watersheds. Booze Creek in particular has been adversely affected by stormflow impacts to the sewer system. Many problems can develop when sanitary sewer systems are exposed, including leakage of raw sewage into the streams. Repair of these systems is costly and requires temporary construction impacts to the stream system.

Despite the overall fair/poor quality of the stream conditions in Cabin John, there are still three remaining tributaries that maintain a good resource condition. These tributaries, Buck Branch, Ken Branch and the Congressional tributary, support a diverse community of insectivorous fish species. The presence of this fish community is reassurring evidence that polluted runoff has not become a chronic problem and that habitat still provides in-stream cover adequate to support the fish and benthic macroinvertebrate community.

Observant visitors to the lower Cabin John mainstem, where the fish community is influenced by proximity to the Potomac mainstem, may eventually be rewarded with sightings of large golden redhorse (a sucker species) resting quietly on the bottom of deep pools or swimming quickly through shallow areas. This species was identified in monitoring efforts during the summer of 1996 and added a new species to the overall County fish list.

To help address the chronic problems associated with urban stream degradation in Cabin John, development of a watershed restoration action plan is scheduled to begin in 1999 to identify goals and target capital improvement projects and stream restoration needs.

Cabin John Creek Watershed

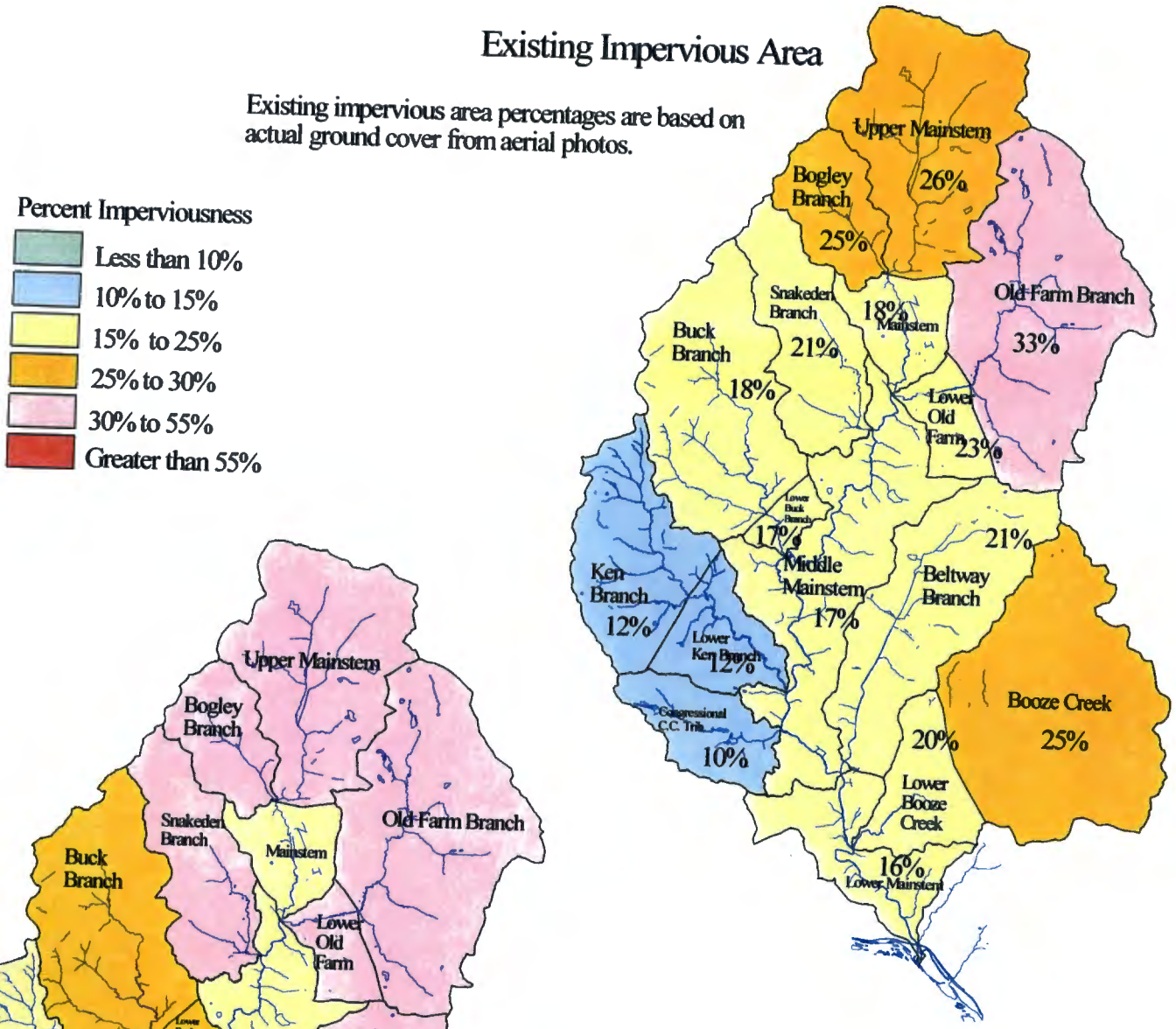


Cabin John Creek Impervious Area Analysis

Map 2

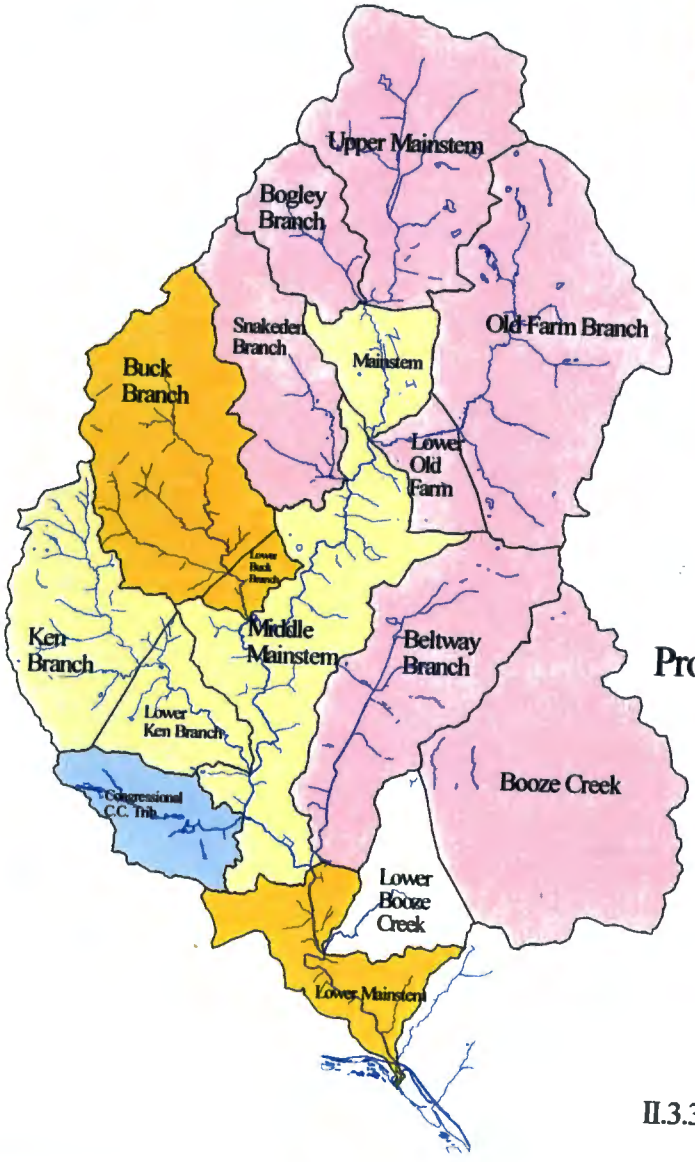
Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



Projected Impervious Area

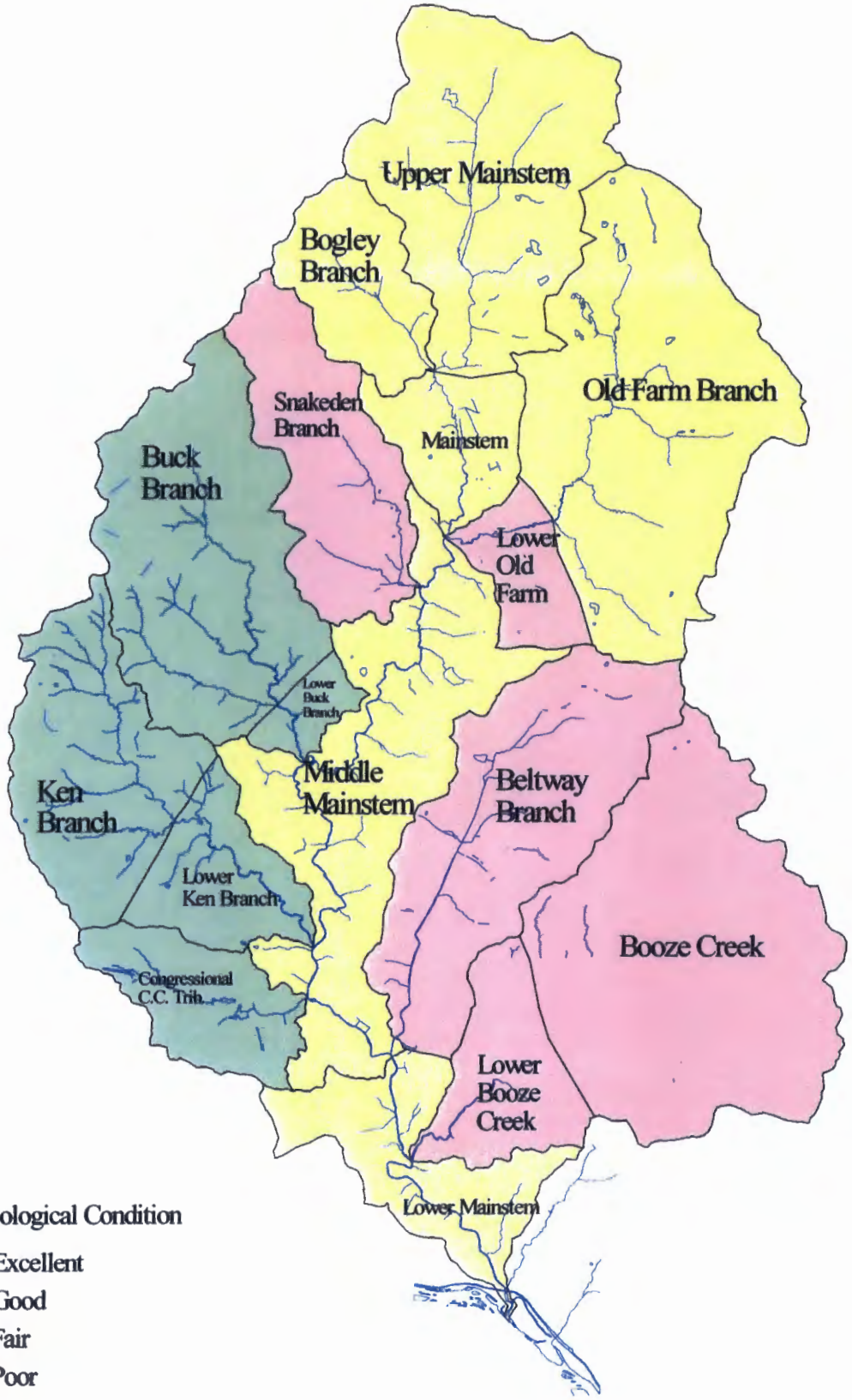
Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.



Cabin John Creek Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

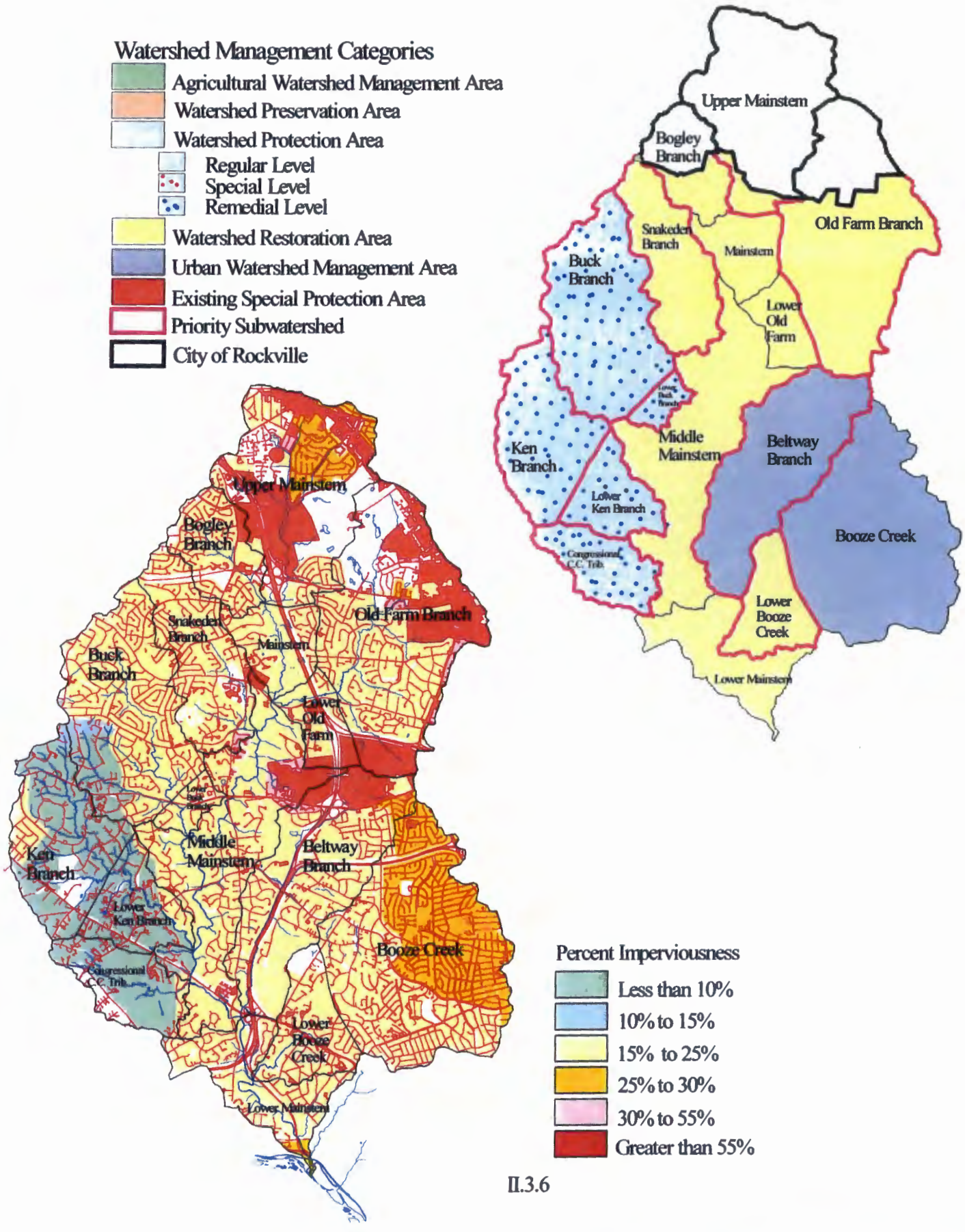
American Eel
Goldfish
Common carp
Golden shiner
Rosyside dace
Creek chub
Fallfish
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Commonshiner
Satinfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
Silverjaw minnow
White sucker
Northern hogsucker
Golden redhorse
Potomac sculpin
Smallmouth bass
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter
Greenside darter
Fantail darter

Cabin John Creek Biological Integrity, Habitat Conditions, and Management Category

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics/Management Category Designation
DEP baseline monitoring of Cabin John was conducted in 1996			
Upper Mainstem - FAIR (preliminary)	GOOD - (preliminary)	Uncontrolled stormwater runoff is affecting channel stability. In-stream habitat problems are limiting biological community.	City of Rockville
Bogley Branch - FAIR (preliminary)	FAIR - (preliminary)	High imperviousness and uncontrolled runoff are affecting channel stability, in-stream habitat. Riparian buffer provides inadequate protection.	Watershed Restoration Area (outside City of Rockville)
Upper Old Farm Branch - FAIR (preliminary)	GOOD - (preliminary)	Problems are similar to those in Upper Mainstem and Bogley Branch. All of these headwater areas are impacted by impervious conditions, inadequate buffers, and in-stream habitat problems.	Watershed Restoration Area (outside City of Rockville)
Lower Old Farm Branch - POOR	POOR	This section has been impacted by imperviousness form the I-270/I-495 spur	Watershed Restoration Area
Snakeden Branch (Deborah Dr. Branch) - POOR	FAIR	Poor bank stability, embeddedness and sediment deposition are resulting from uncontrolled stormwater flows. Concrete swales in this watershed create flashy hydrology.	Watershed Restoration Area
Middle Mainstem - FAIR	FAIR Overall	Channel alteration from road crossings and erosion control measures is common in this section. Embeddedness, and problems with bank stability and sediment deposition indicate impacts from stormwater flows.	Watershed Restoration Area
Buck Branch - GOOD (preliminary)	GOOD - (preliminary)	This tributary is on the margin between good and fair. Flow-related bank stability and sediment deposition problems are affecting in-stream habitat, particularly benthic habitat.	This stream currently supports the most diverse fish community of all the tributaries. Watershed Protection Area - remedial
Beltway Branch - POOR	FAIR	This stream runs alongside I-495 and I-270 and has been altered by these roads. Channel stability and embeddedness impact substrate.	Urban Watershed Management Area
Ken Branch - GOOD (preliminary in upper area)	FAIR (preliminary in upper area)	Sediment deposition, embeddedness and bank stability problems are impacting the benthic community. Fish community is less impaired than elsewhere in Cabin John. Close observation of trend is important.	Frequent flooding problems occurring at Bradley Blvd. Watershed Protection Area - remedial
Congressional Trib. - GOOD (preliminary)	FAIR (preliminary)	Good biological conditions were observed during a COG inventory, however, that assessment is based primarily on intolerant species collected above the golf course. COG rated bank stability as fair.	Watershed Protection Area - remedial
Upper Booze Creek - POOR (preliminary)	POOR to FAIR (preliminary)	Significant areas of the headwaters have been channelized or piped. Non-point source pollutants and chronic problems with leaking sewer lines are also sources of impairment to biological community.	Urban Watershed Management Area
Lower Booze Creek - POOR	FAIR to GOOD	Habitat is on the margin between fair and good, with impacts occurring from scouring, sediment deposition and channel widening. Biological conditions, despite availability of habitat, are impaired by very flashy hydrology.	Watershed Restoration Area
Lower Mainstem - FAIR	GOOD Overall	Benthic community is impaired by impacts to substrate from scouring and embeddedness. Fish community remains good due to better fish habitat and access to the Potomac River.	Passes through Potomac River valley wall in steeply descending section of the Creek. Watershed Restoration Area

Cabin John Creek Watershed Management Categories and Projected Development Levels

Map 4



Cabin John Creek Watershed Management Categories

Management of the stream resources in this watershed includes activities by the City of Rockville in the upper part of the watershed, and upcoming efforts to develop a watershed restoration action plan by Montgomery County DEP.

In addition, the Potomac Subregion Master Plan Study is currently underway, covering the Cabin John watershed west of the mainstem, which will include an examination of land use and stream condition relationships. Watershed management appproaches will be updated in the CSPS as necessary to respond to land use recommendations.

Watershed Protection Areas

Remedial level of protection

The three tributaries in this management category, *Buck Branch*, *Ken Branch*, and *Congressional Tributary*, include the stream reaches that have good stream conditions although problems in the habitat condition are being observed in all three of these drainages as a result of uncontrolled stormflows and sediment deposition. Remedial actions, which include addressing accelerated streambank erosion and preservation of refugia, are recommended as part of comprehensive efforts to restore the watershed, in order to avoid deterioration in overall conditions and maintain and improve biological function.

Watershed Management Strategy

- Conduct additional biological monitoring to update preliminary assessments.
- Study and implement remedial protection measures as part of a comprehensive watershed restoration action plan, to begin in FY99.
- Further evaluate relationships between land use and stream conditions through the Potomac Subregion Master Plan Study.

Watershed Restoration Areas

The majority of the tributaries in the watershed fall into this category, including *Upper Mainstem, Bogley Branch, Old Farm Branch, Snakeden Branch, Middle Mainstem, Lower Booze Creek*, and the *Lower Mainstem.*

Watershed Management Strategy

- Study and implement stormwater retrofit and stream restoration measures as part of a comprehensive watershed restoration action plan, to begin in FY99.
- Ongoing application and enforcement of existing environmental regulations and guidelines.

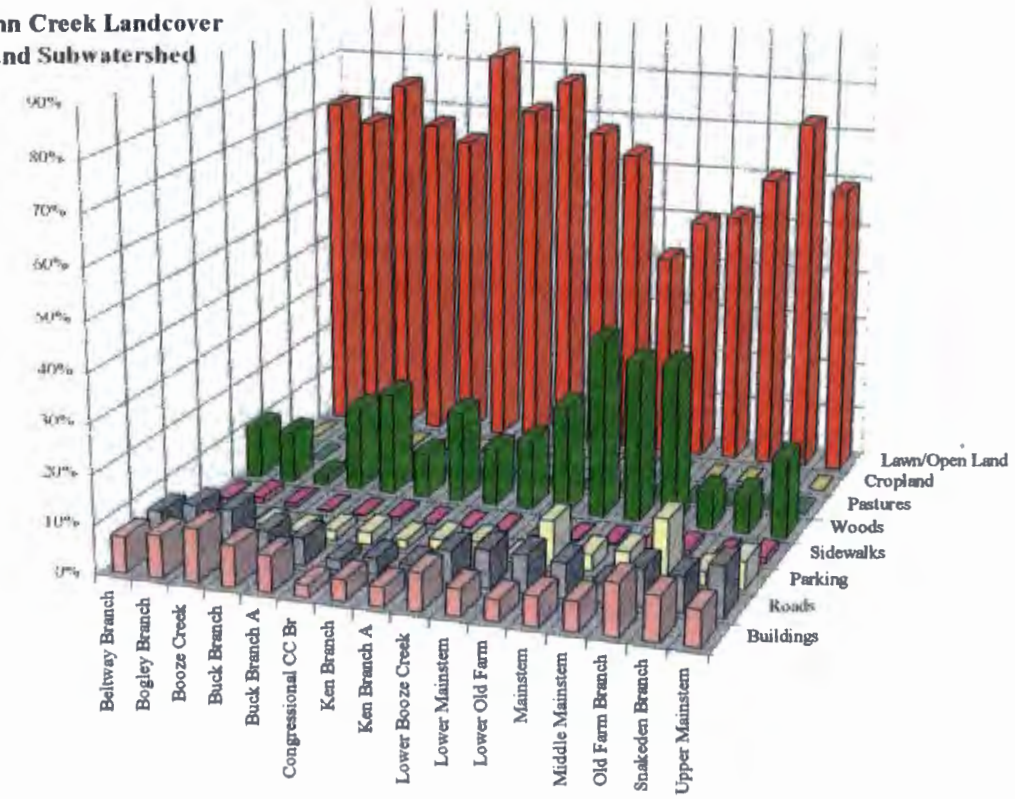
Urban Stream Management Areas

Two tributaries in Cabin John are recommended for this management category - *Beltway Branch* and *Upper Booze Creek*. Streams in these areas have been highly altered by land use, and implementing water quality improvements and pollution prevention efforts will be the most effective management tools to ensure that impacts to downsrtream reaches are minimized. Limited areas of stream channel stabilization may be warranted to address specific erosion problems, but the likelihood of restoring highly functioning biological communities in these areas is unlikely.

Watershed Management Strategy

- Identification and implementation of pollution prevention efforts and erosion control measures as part of the Cabin John Watershed Restoration Action Plan to begin in FY99.

Cabin John Creek Landcover by Type and Subwatershed



	Acres	Stream miles
Beltway Branch	1483.2	6.0
Bogley Branch	523.9	1.4
Booze Creek	2199.0	0.9
Buck Branch	1501.5	7.5
Buck Branch A	148.0	0.6
Congressional CC Br	520.2	2.3
Ken Branch	996.4	7.8
Ken Branch A	484.7	2.3
Lower Booze Creek	532.7	1.2
Lower Mainstem	690.5	4.8
Lower Old Farm	313.0	1.3
Mainstem	421.3	2.3
Middle Mainstem	1675.5	11.4
Old Farm Branch	1902.5	7.0
Snakeden Branch	872.6	2.5
Upper Mainstem	1570.7	6.4
Watershed totals	15835.6	65.9

The Dry Seneca Creek Watershed

Dry Seneca Creek, originating south of Barnesville, is a large tributary to Great Seneca Creek. The towns of Beallsville and Poolesville are located on the western edge of the drainage and influence conditions in Upper Dry Seneca and Russell Branch. Stream conditions in Dry Seneca are generally good, although, habitat conditions tend to be influenced by excessive levels of sediment deposition. Change has come to the upper reaches as the town of Poolesville has grown. A newly designed wastewater treatment plant (WWTP), brought on-line in 1988, has overflowed several times into Dry Seneca, however, this is not expected to be a recurring problem.

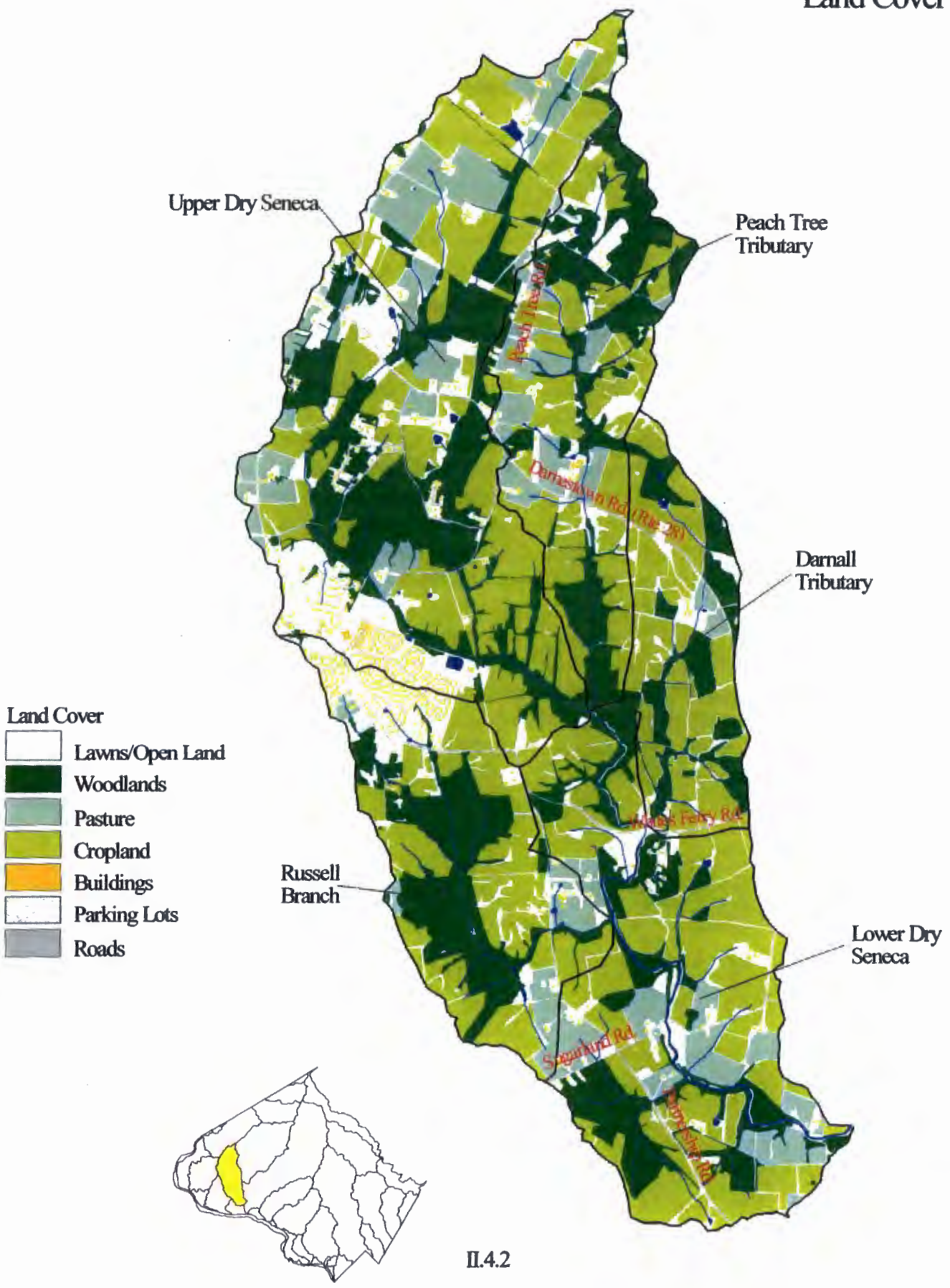
The watershed remains in primarily agricultural land uses, with the exception of developed areas within the town of Poolesville. Large lot residential uses within the agricultural preserve are beginning to appear across the area. No significant changes in land use are anticipated. A drive along Montevideo Road above Poole's Store crosses an old metal span bridge over a County stream that flows much as it has for the last hundred years; this is the Dry Seneca Creek.

The upper reaches of Dry Seneca contain forested tributaries that have been investigated in 1997 for potential inclusion into the County's reference stream database. Detailed monitoring will be conducted during 1998 as part of the County's baseline monitoring program. This watershed includes a north to south transition in geologic character. In the southern part of the watershed, the streambed has cut down to reveal blocks of red sandstone bedrock. The fish community includes large populations of central stonerollers which feed on the algae coating these sandstone blocks. This is also one of the very few County watersheds where the eastern silvery minnow is found.

The Maryland Biological Stream Survey also monitored several areas of Dry Seneca. The County will incorporate all comparable stream data to evaluate existing conditions in the Dry Seneca stream system. The County's monitoring during 1997 and 1998 will provide data for a more comprehensive understanding of the status and possible existing impacts to the biological community of Dry Seneca Creek.

Dry Seneca Watershed

Map 1
Land Cover

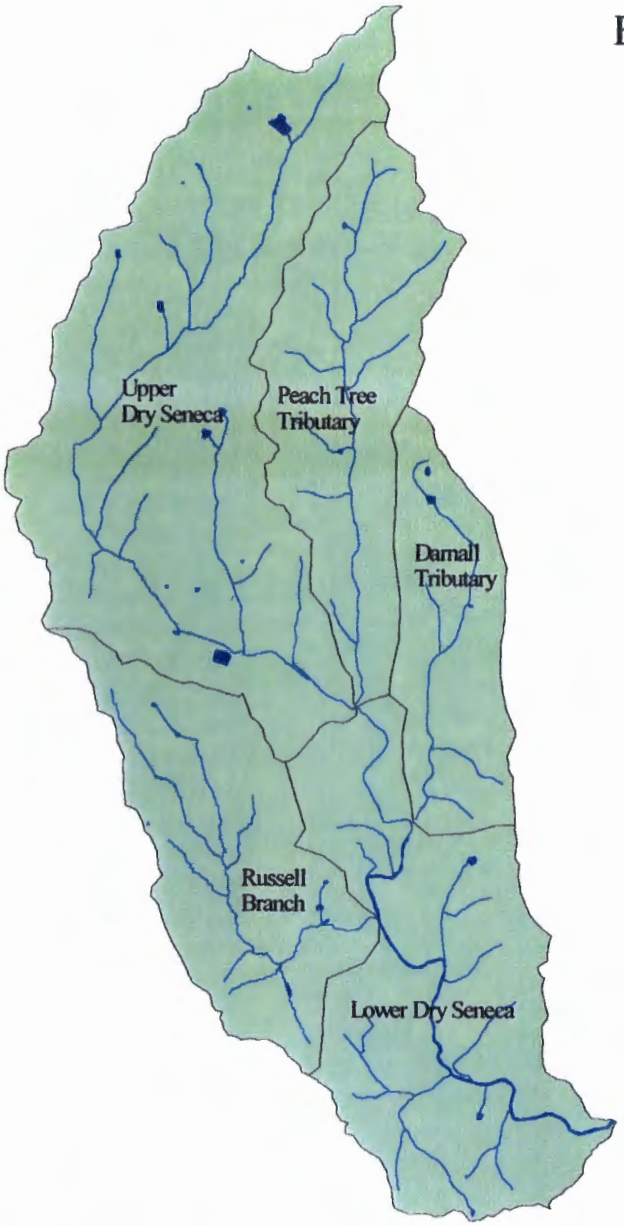


Dry Seneca Impervious Area Analysis

Map 2

Existing Impervious Area

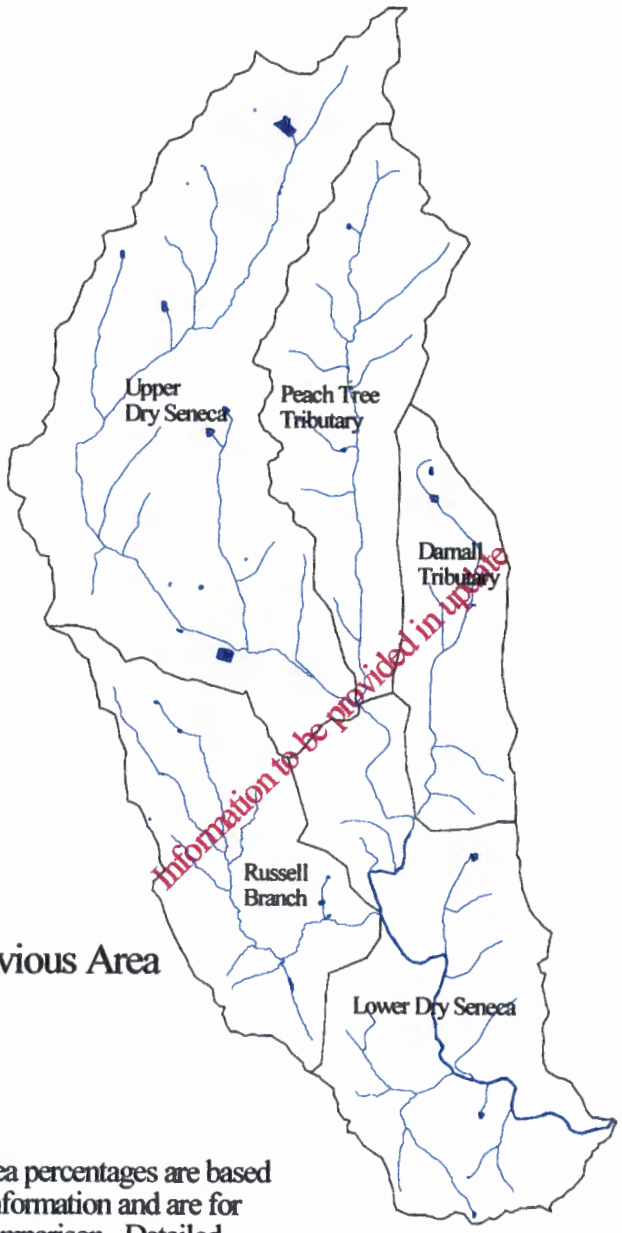
Existing impervious area percentages are based on actual ground cover from aerial photos.



Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Projected Impervious Area

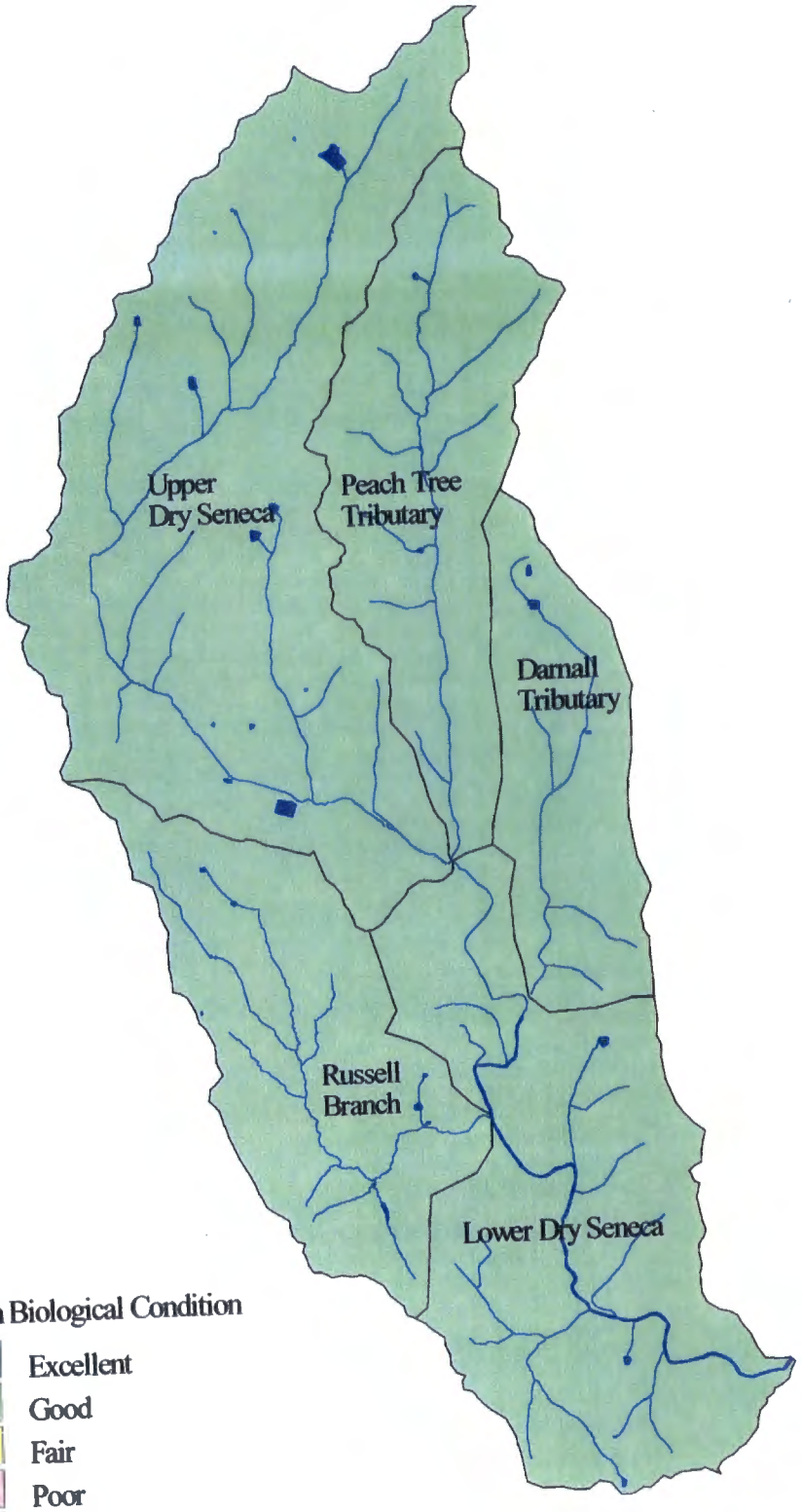


Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparison. Detailed impervious area projections are conducted as part of land use master plan studies.

Dry Seneca Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

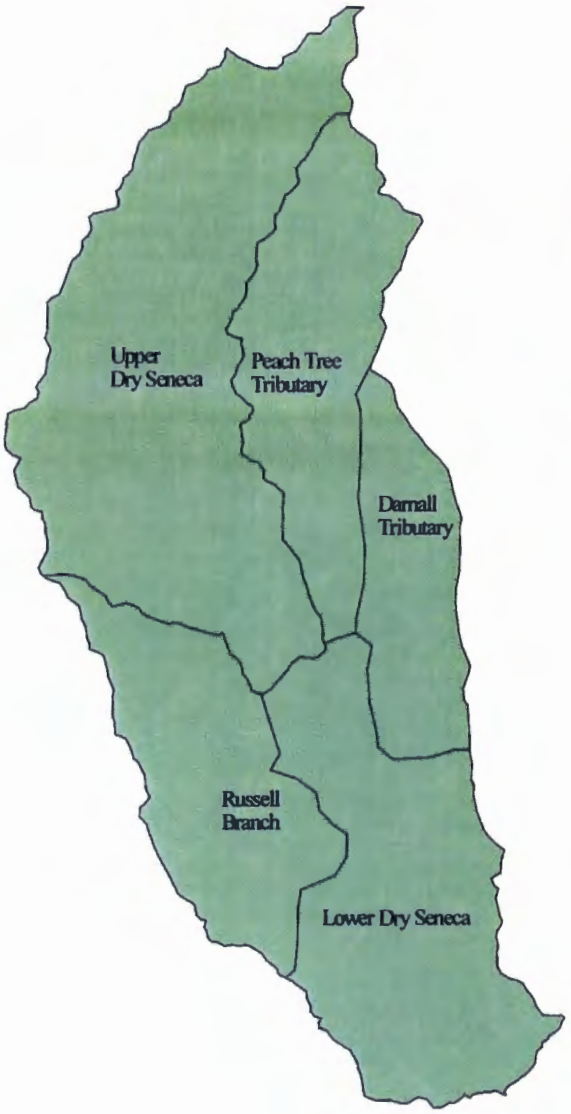
American eel
Rosyside dace
Creek chub
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
Silverjaw minnow
E. silvery minnow
White sucker
Northern hogsucker
Creek chubsucker
Yellow bullhead
Mottled sculpin
Potomac sculpin
Rock bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter
Greenside darter
Fantail darter

Dry Seneca Creek Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
DEP will be conducting baseline watershed monitoring in 1998. This current assessment is based on two monitoring stations and land use characteristics.			
Upper Dry Seneca - GOOD (preliminary)	GOOD to EXCELLENT (preliminary)	Some Sediment deposition and embeddedness noted.	Agricultural Watershed Management Area
Peach Tree Trib. GOOD (preliminary)	no current data		Agricultural Watershed Management Area
Darnall Trib. - GOOD (preliminary)	no current data		Agricultural Watershed Management Area
Russell branch - GOOD (preliminary)	no current data		Agricultural Watershed Management Area
Lower Dry Seneca - GOOD (preliminary)	EXCELLENT (preliminary)	Low abundance in macroinvertebrate community, likely the result of upstream WWTP. Sediment deposition noted.	Agricultural Watershed Management Area

Dry Seneca Watershed Management Categories and Projected Development

Map 4



Watershed Management Categories

- Agricultural Watershed Management Area
- Watershed Preservation Area
- Watershed Protection Area
  - Regular Level
  - Special Level
  - Remedial Level
- Watershed Restoration Area
- Urban Watershed Management Area
- Existing Special Protection Area
- Priority Subwatershed

Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Dry Seneca Creek Watershed Management Category

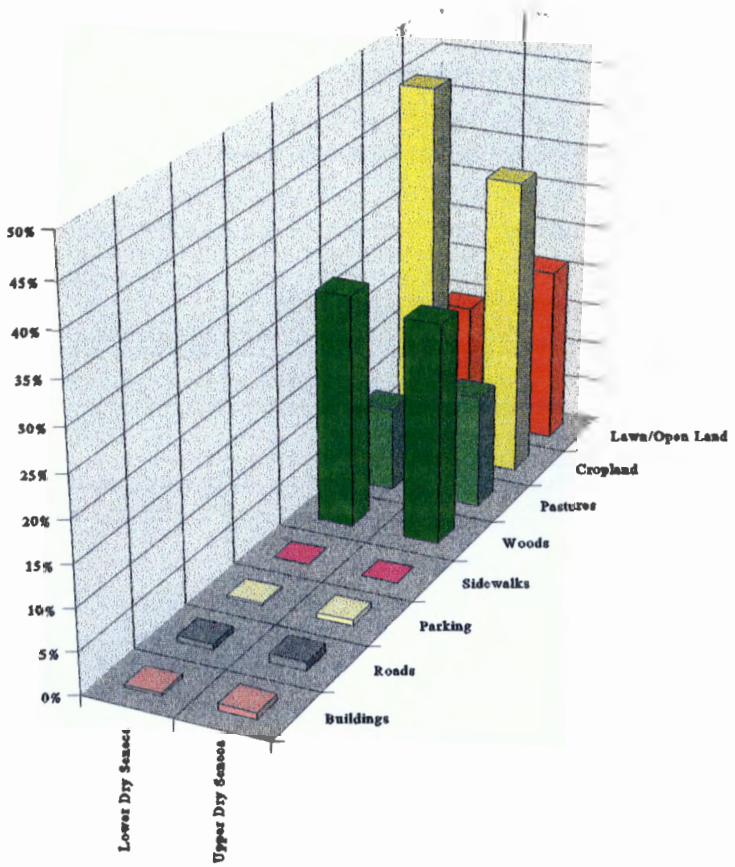
Land uses remain primarily agricultural throughout most of Dry Seneca. Areas of residential development occur in the towns of Poolesville and Beallsville, and throughout the watershed on large lot residential parcels within the agricultural reserve. BMPs on agricultural lands and standard environmental guidelines and regulations elsewhere are expected to continue to protect stream conditions. Further investigation of stream conditions will occur in 1998 and will allow more detailed evaluation of stream conditions and appropriate management strategies.

Agricultural Watershed Management Area
All of the subwatersheds in Dry Seneca are within this management category.

Watershed Management Strategy

- Conduct baseline monitoring in 1998 to more thoroughly evaluate conditions
- Continued application of applicable environmental regulations and guidelines for new development.
- Voluntary implementation of best management practices.

Dry Seneca Landcover
by Type and Subwatershed



	Acres	Stream miles
Lower Dry Seneca	7887.6	41.7
Upper Dry Seneca	4447.4	23.7
Watershed Totals	12334.9	65.4

The Great Seneca Creek Watershed

Great Seneca Creek is the largest watershed located entirely within Montgomery County. In addition, two large tributary systems flow into Great Seneca. These are Little Seneca Creek, and Dry Seneca. Almost every species of fish found in Montgomery County can be found in this watershed. Smallmouth bass have been found in the lower sections. Redbreast sunfish and central stonerollers are found throughout the middle section, and portions of the upper reaches support a coldwater fish community. The Great Seneca headwaters begin near Hawkins Creamery Road southeast of Damascus and flow through low density residential and agriculture areas. Magruder Branch, a large tributary which begins in south Damascus, flows through county parkland and joins Great Seneca downriver of Woodfield Rd. It then passes through commercial areas in Damascus and continues through low to medium density residential areas. Magruder Branch contains a system of vernal pools, built as mitigation for an adjoining hiker-biker trail system, that supports a diverse amphibian community. The Damascus Wastewater Treatment Plant (WWTP) is located in the Magruder Branch subwatershed.

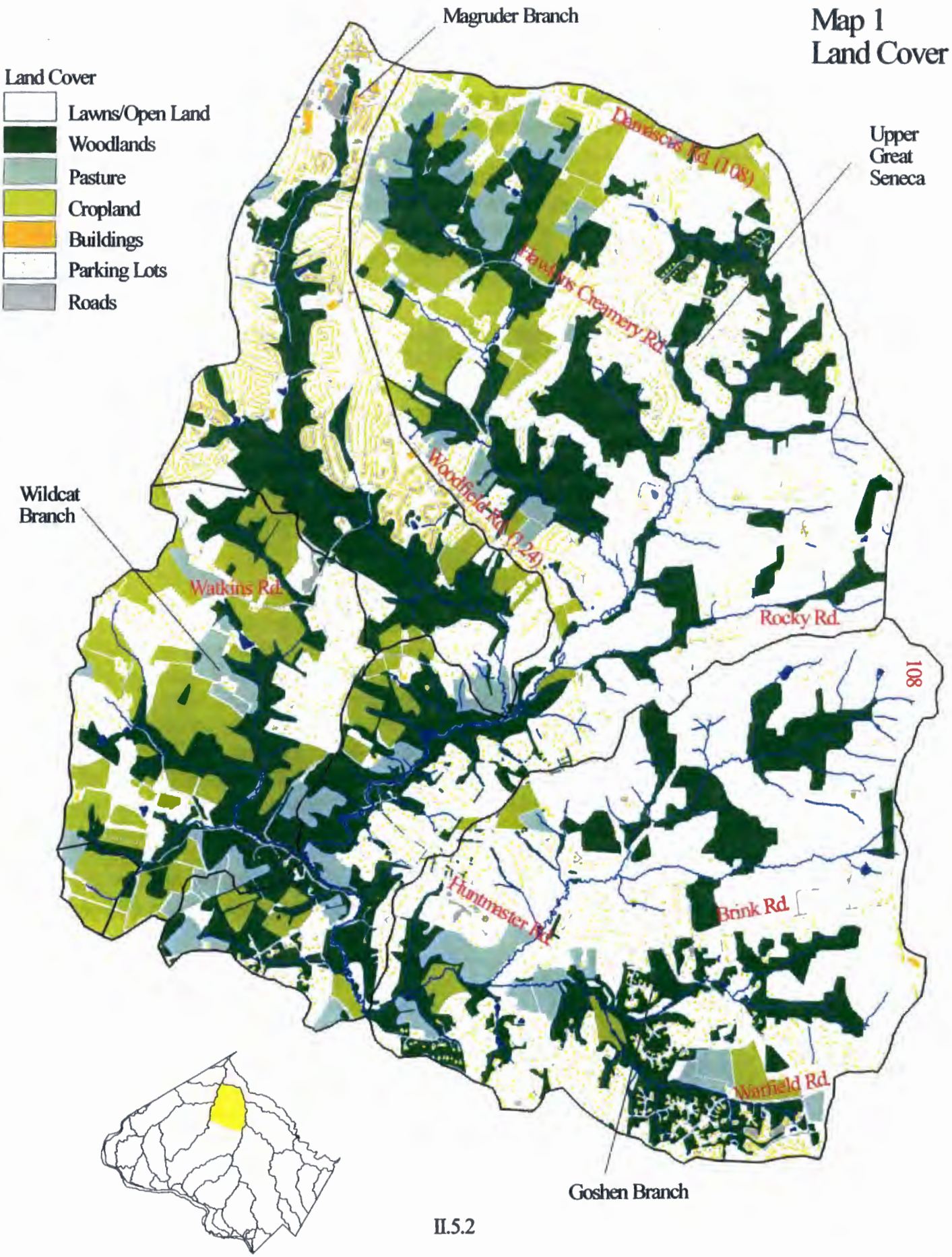
Great Seneca Creek continues southwest of Laytonsville, rapidly increasing in size as other tributaries join it. Wildcat Branch, a naturally reproducing brown trout stream, and Goshen Branch join Great Seneca above Brink Road. Great Seneca Creek then flows through the Montgomery Village area, where land use densities increase considerably. Many of these areas were built before modern stormwater runoff controls were required by the State and, consequently, the quality of the stream channel has declined.

Below Route 355, Great Seneca picks up additional drainage from high density areas in Gaithersburg and Germantown. It then transitions back to low density residential with areas of agricultural land uses from approximately Riffle Ford Road in south Germantown down to the Potomac River. Along Clopper Mill Road one can see the ruins of a mill, and old photographs at the Seneca Creek State Park record a visual history of Great Seneca in this vicinity. The quality of the stream channel has significantly degraded, with areas of active stream bank erosion and long reaches of deep runs with fewer riffle areas than observed 20 years ago. Above Riffle Ford Road is the Seneca WWTP. Ongoing studies will provide a baseline record of stream conditions before plant expansion is scheduled to come online. Some concerns have been raised about the increased nutrient load into Great Seneca resulting from this and the Magruder WWTP.

Major tributaries in this portion of Great Seneca include Whetstone Run, Gunners Branch, and Long Draught Branch. These three tributaries all originate in high density residential areas and each have instream impoundments: Lake Whetstone, Gunners Lake, and Clopper Lake. Whetstone Run is occasionally blue-tinted from light-filtering dyes intended to reduce algae and aquatic plant growth in the lake.

Below Riffle Ford Road, some tributary areas of Great Seneca are changing from agriculture to low and medium density residential. Great Seneca flows westward towards Dawsonville. It is joined by Little Seneca Creek, becoming Seneca Creek below the confluence. Flowing south towards the Potomac River, Seneca Creek is joined by Dry Seneca Creek before flowing into the Potomac River above the Seneca Breaks. Many people enjoy fishing, sailing, and paddling within the mouth of the creek, and out on the Potomac River.

Upper Great Seneca Watershed

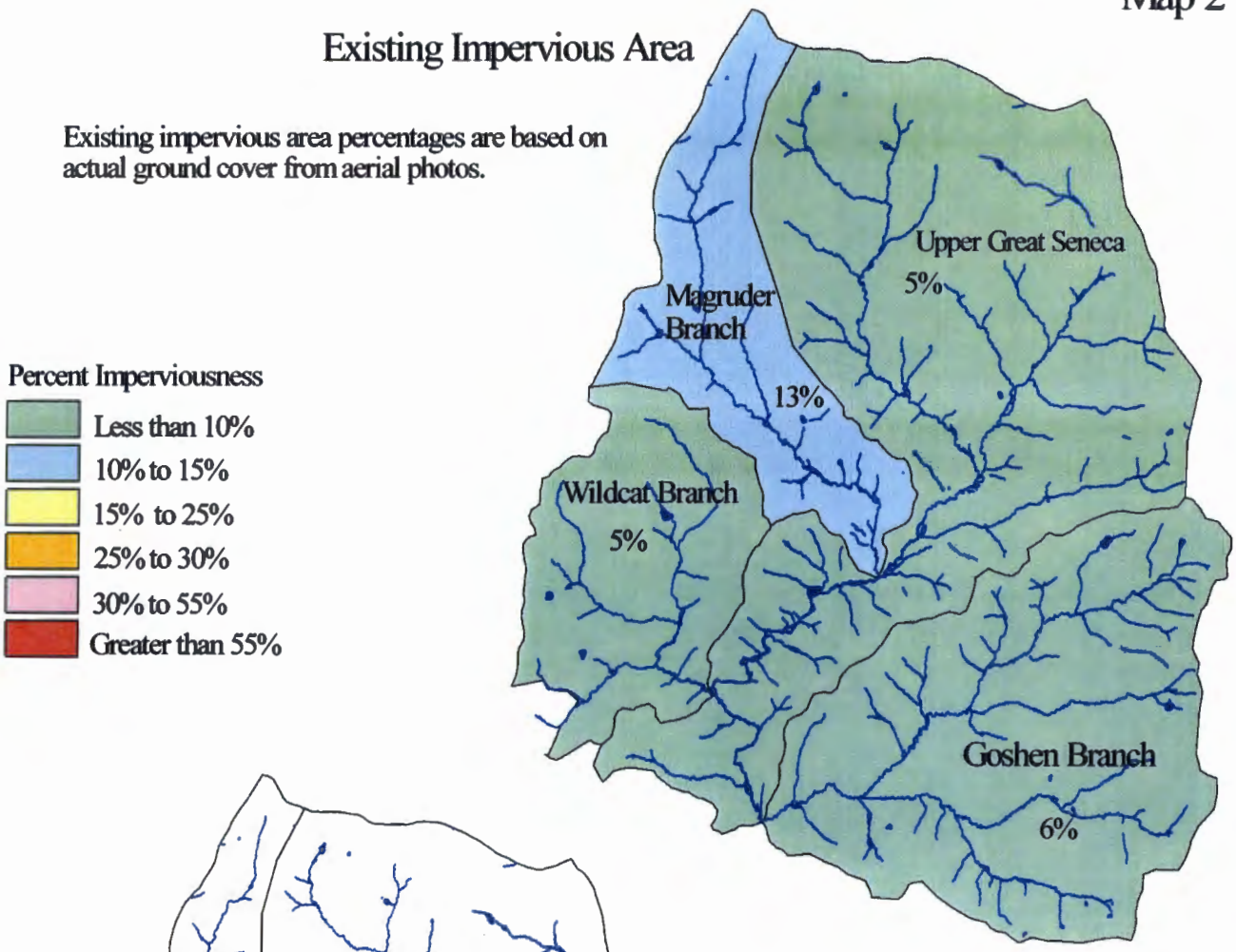


Upper Great Seneca Impervious Area Analysis

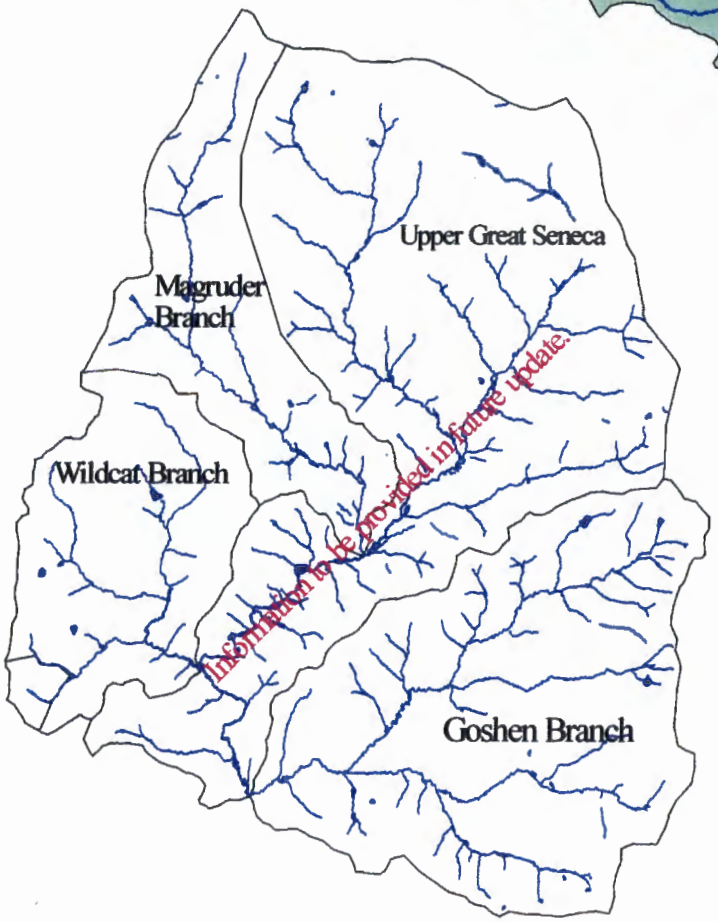
Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



Projected Impervious Area

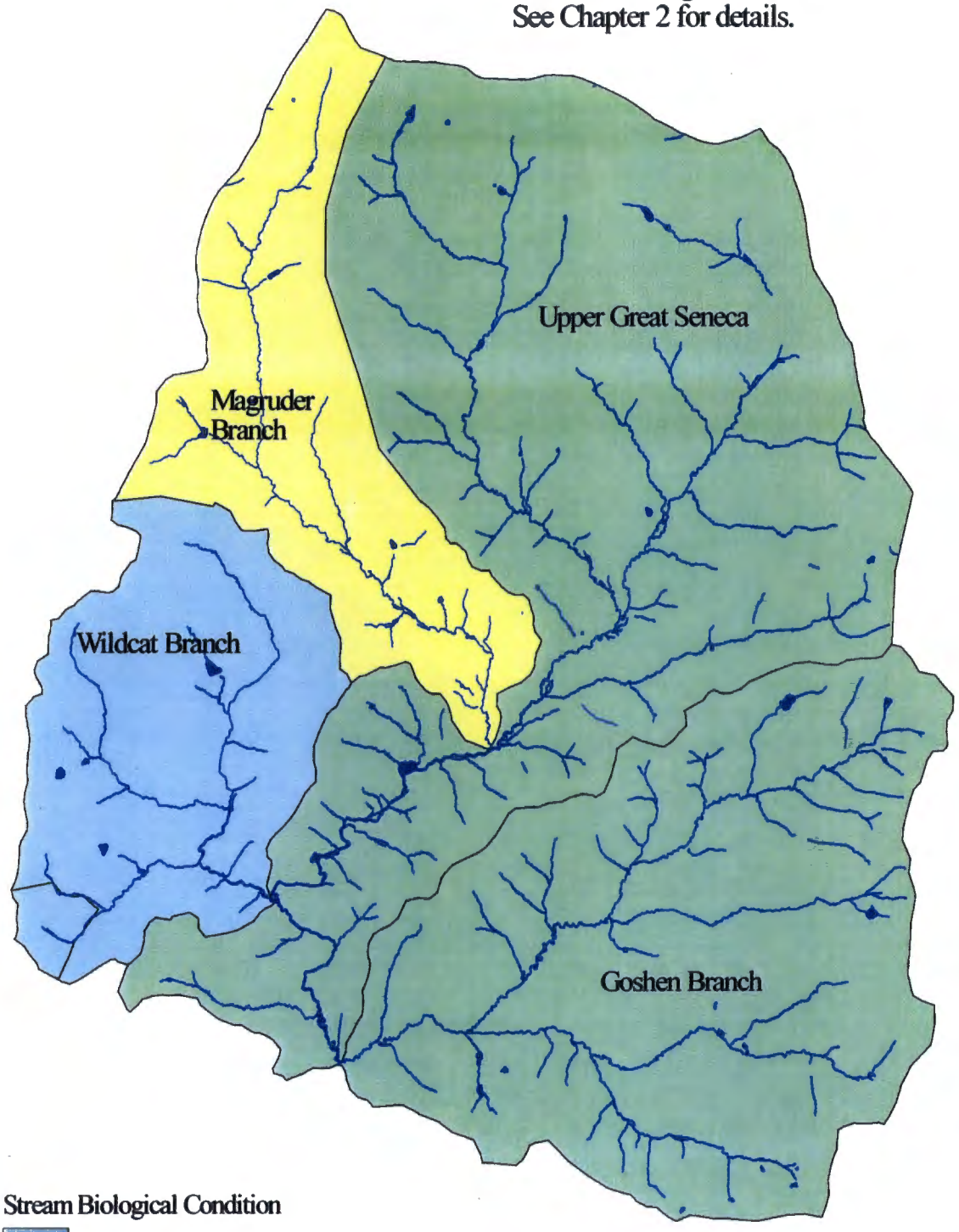


Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plans.

Upper Great Seneca Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

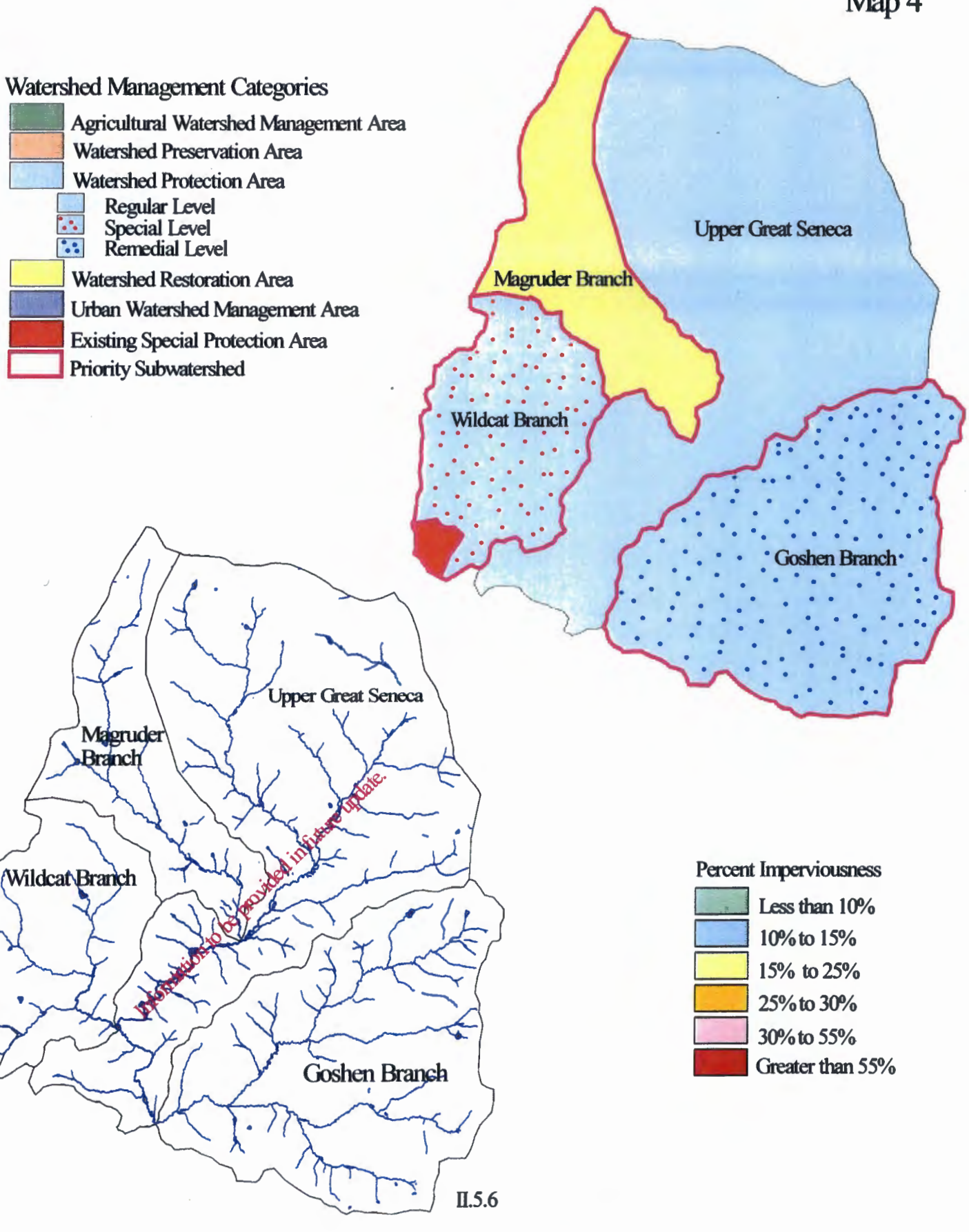
American eel
Brown trout
Rainbow trout (stocked)
Golden shiner
Rosyside dace
Creek chub
Fallfish
River chub
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Bluntnose minnow
Swallowtail shiner
Silverjaw minnow
White sucker
Northern hogsucker
Creek chubsucker
Yellow bullhead
Mottled sculpin
Potomac sculpin
Smallmouth bass
Largemouth bass
Rock bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter
Greenside darter
Fantail darter

Upper Great Seneca Creek Stream Condition, Habitat Condition, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
DEP conducted baseline monitoring in Upper Great Seneca in 1997.			
Upper Great Seneca - GOOD (preliminary)	GOOD - (preliminary)	Upper reaches continue to support good resource condition; however, below Hawkins Creamery Rd., sparse riparian buffer and sediment deposition in pools and riffles affect stream condition.	Watershed Protection Area - regular
Magruder Branch - FAIR - (preliminary)	GOOD - (preliminary)	Higher density land uses in and around Damascus are drained by this tributary. Sediment deposition noted.	Vernal pools provide good habitat for amphibians. Watershed Restoration Area
Wildcat Branch - EXCELLENT	GOOD	Some tributaries are experiencing significant levels of bank erosion and sediment deposition. Low density land uses are predominant, however, several areas adjacent to rte 27 are beginning to redevelop with higher densities.	This subwatershed supports the only cold-water fish community currently found in Great Seneca Watershed Protection Area - special
Goshen Branch - GOOD (preliminary)	FAIR - (preliminary)	Extreme downcutting of the channel has occurred along with major areas of sediment deposition in the pools and runs.	Watershed Protection Area - remedial

Upper Great Seneca Watershed Management Categories and Projected Development Levels

Map 4



Upper Great Seneca Watershed Management Categories

Watershed Protection Areas

Three of the four tributaries to upper Great Seneca Creek are in good or excellent condition and are designated Watershed Protection Areas. Each of the tributaries, however, has a different protection level associated with it, based on specific conditions found.

Special Level of Protection

Wildcat Branch, the only tributary in Great Seneca found to support excellent biological conditions, is recommended for a special level of protection to ensure that the high quality conditions in this stream are protected as predominately rural, agricultural lands develop. As development pressures increase in the areas surrounding Clarksburg, redevelopment along the Route 27 corridor and special exception uses within the agricultural reserve have the potential to impact this stream system.

Watershed Management Strategy

- Encourage the continued voluntary implementation of best management practices on agricultural lands.
- Implement education program targeted to high quality streams.
- Identify and pursue opportunities to provide a special level of stream protection through voluntary establishment of forested buffers, wetland protection, imperviousness reduction strategies, etc.

Remedial Level of Protection

Goshen Branch, which has undergone a great deal of development activity as part of the growth of Montgomery Village, still supports good biological conditions, but is in need of remedial habitat improvements to address areas of instability and past degradation. This subwatershed, particularly its upper reaches, is in transition from largely agricultural areas to residential uses. Large agricultural tracts still exist east of Route 124, where many small tributaries flow through fields, without the benefit of forested buffers. This subwatershed also contains areas of RE-2 zoning which are generally exempt from stormwater runoff controls due to the lot size, however runoff related impacts are being seen in many streams with this land use density.

Watershed Management Strategy

- Public education and outreach to landowners to increase awareness of the importance of stream valley buffers, which are a key feature of environmental protection in these areas developing with larger lot sizes.
- Increase forested buffer area through educational initiatives and voluntary implementation.

Regular Level of Protection

Upper Great Seneca is designated to receive a regular level of protection, through the application of existing environmental guidelines and regulations. Above Magruder Branch, the Upper Great Seneca subwatershed is hilly, with fewer actively farmed areas than are found in Goshen Branch. Although this area is developing fairly rapidly with generally 2 acre and greater lot sizes, the current environmental guidelines and regulations are expected to provide good stream protection. In addition, many areas are protected by forested stream valley parks.

Upper Great Seneca Watershed Management Categories (cont'd)

Watershed Management Strategy

- Promote increase in forested buffer area through educational initiatives and voluntary implementation.

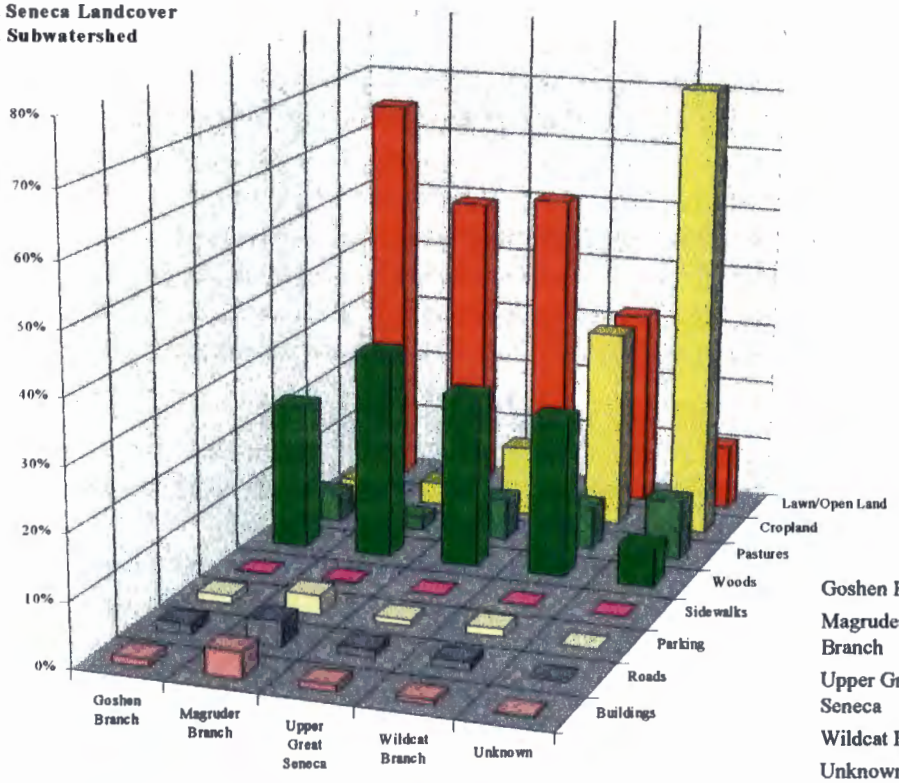
Watershed Restoration Areas

Magruder Branch has been impacted from older developed areas and high density uses associated with the growth of Damascus and streams exhibit varying levels of habitat degradation. Many of the newer communities contain stormwater controls, and much of the stream valley is protected by large tracts of forested parkland.

Watershed Management Strategy

- A comprehensive approach to overall restoration is recommended; the potential for successful habitat improvement projects is quite good, particularly if opportunities exist to retrofit controls in older developments and very high density areas.

Upper Great Seneca Landcover by Type and Subwatershed

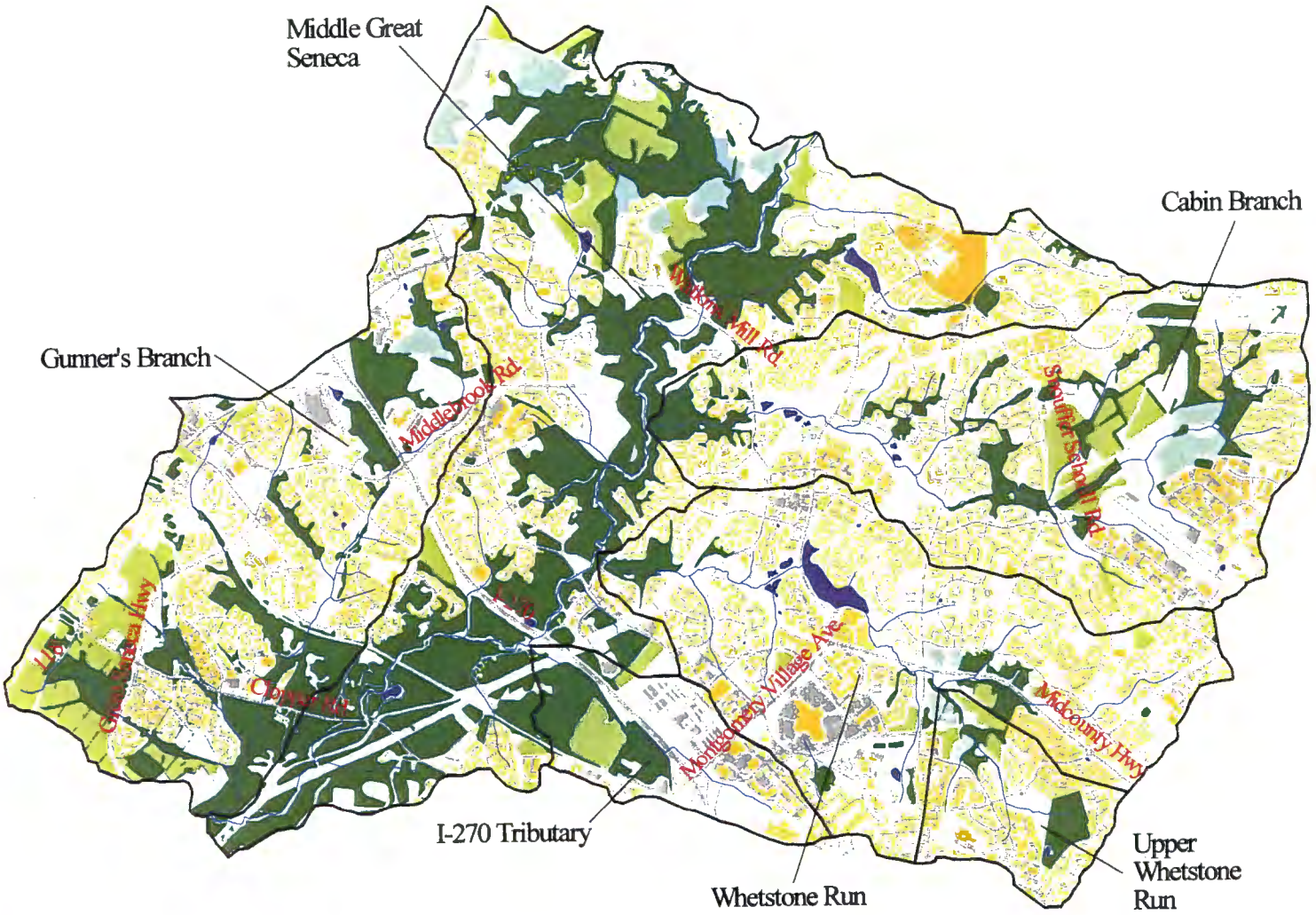


	Acres	Stream miles
Goshen Branch	4906.3	28.2
Magruder Branch	2259.8	11.5
Upper Great Seneca	7473.0	9.1
Wildcat Branch	2256.0	9.1
Unknown	108.4	0.6
Watershed totals	17003.5	58.6

Middle Great Seneca

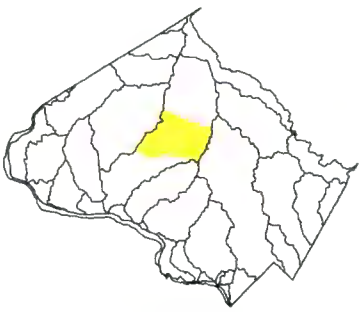
Middle Great Seneca Creek Watershed

Map 1
Land Cover



Land Cover

- Lawns/Open Land
- Woodlands
- Pasture
- Cropland
- Buildings
- Parking Lots
- Roads

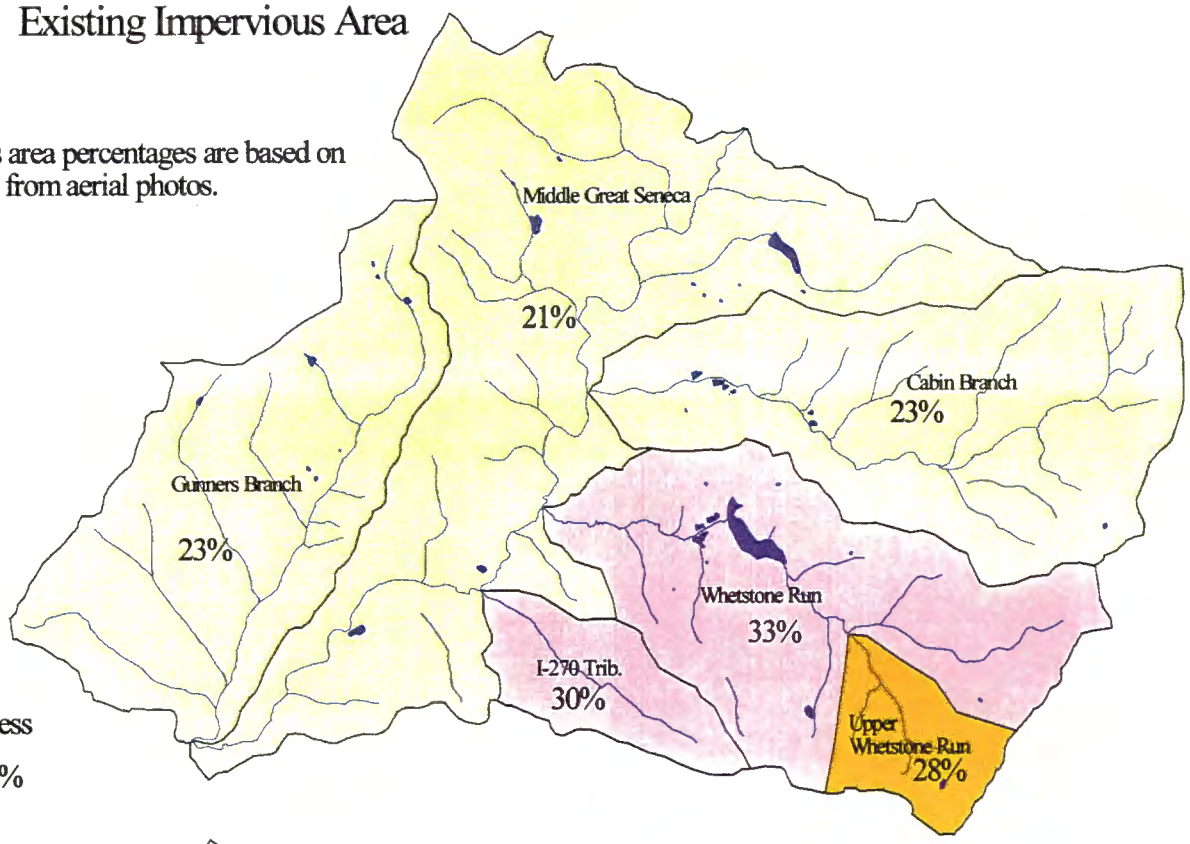


Middle Great Seneca Impervious Area Analysis

Map 2

Existing Impervious Area

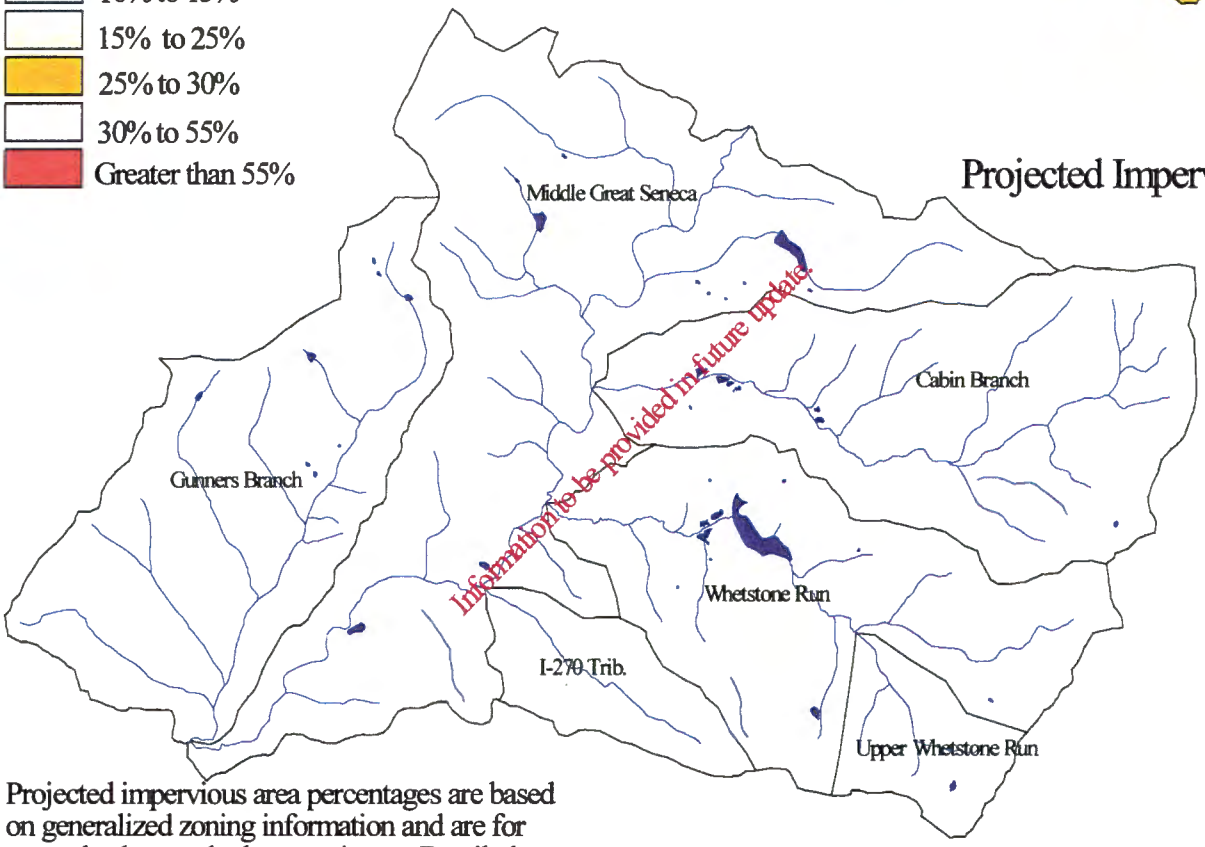
Existing impervious area percentages are based on actual ground cover from aerial photos.



Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Projected Impervious Area

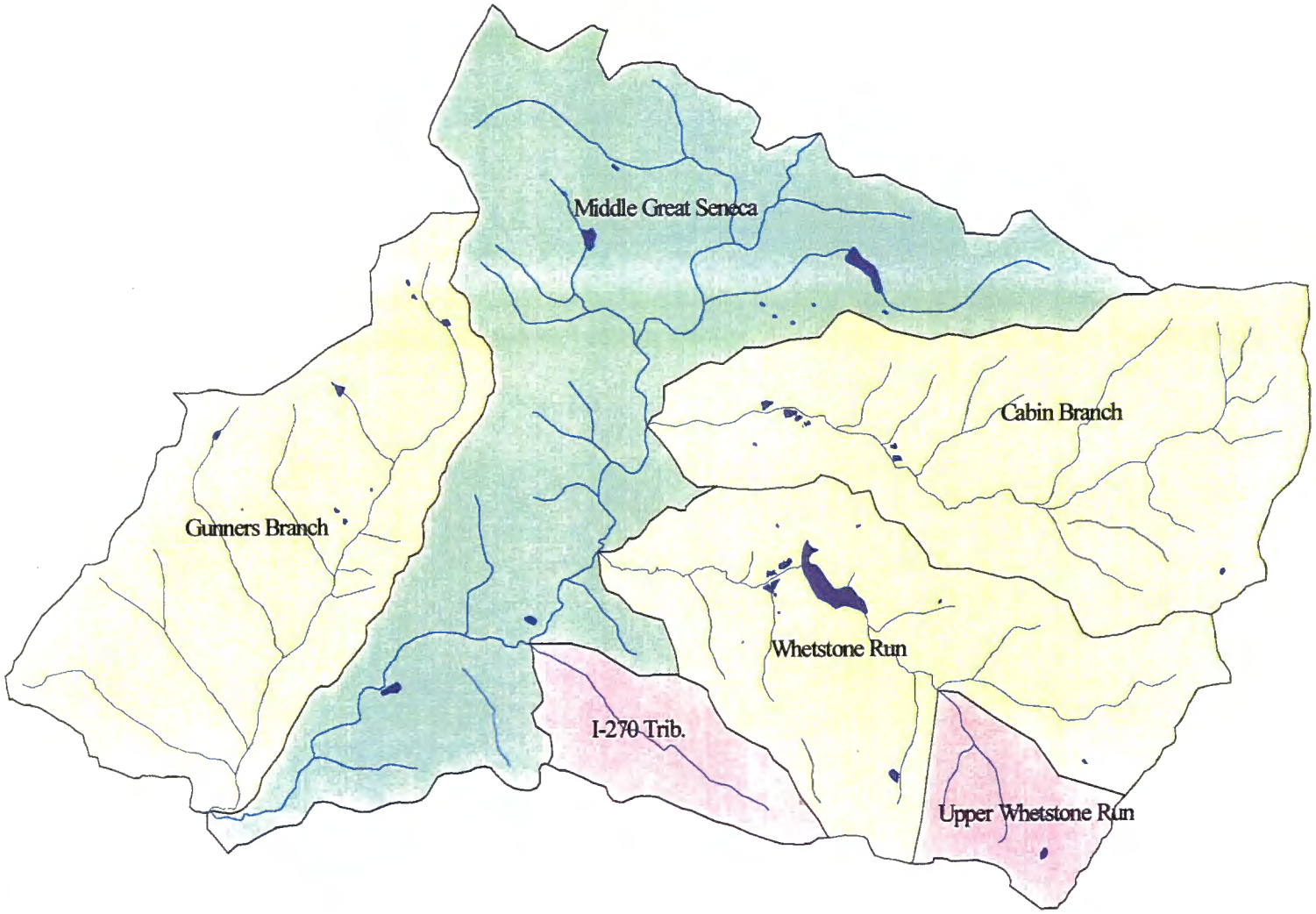


Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Middle Great Seneca Creek Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

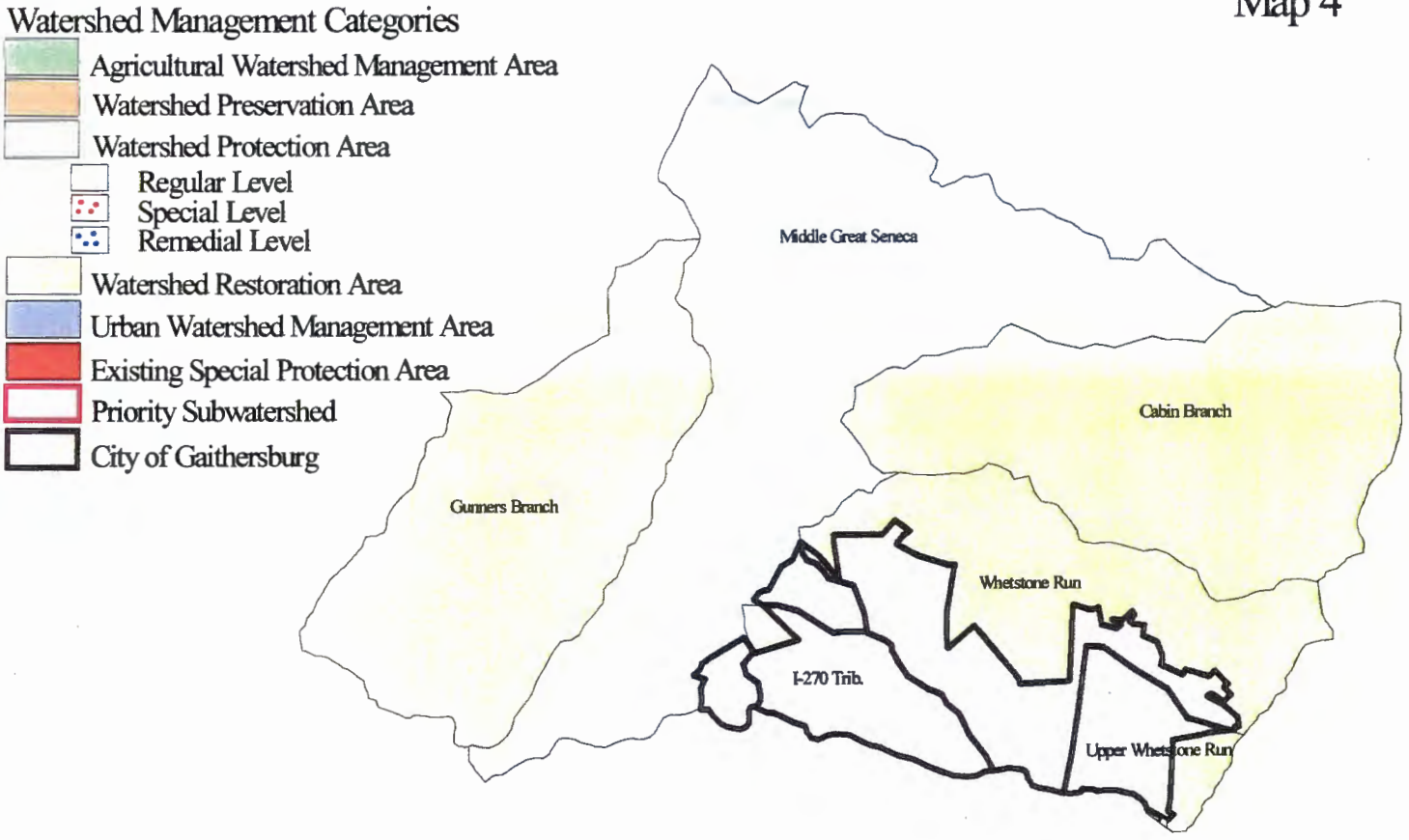
Creek chub
Blacknose dace
White sucker
Yellow bullhead
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter
Fantail darter

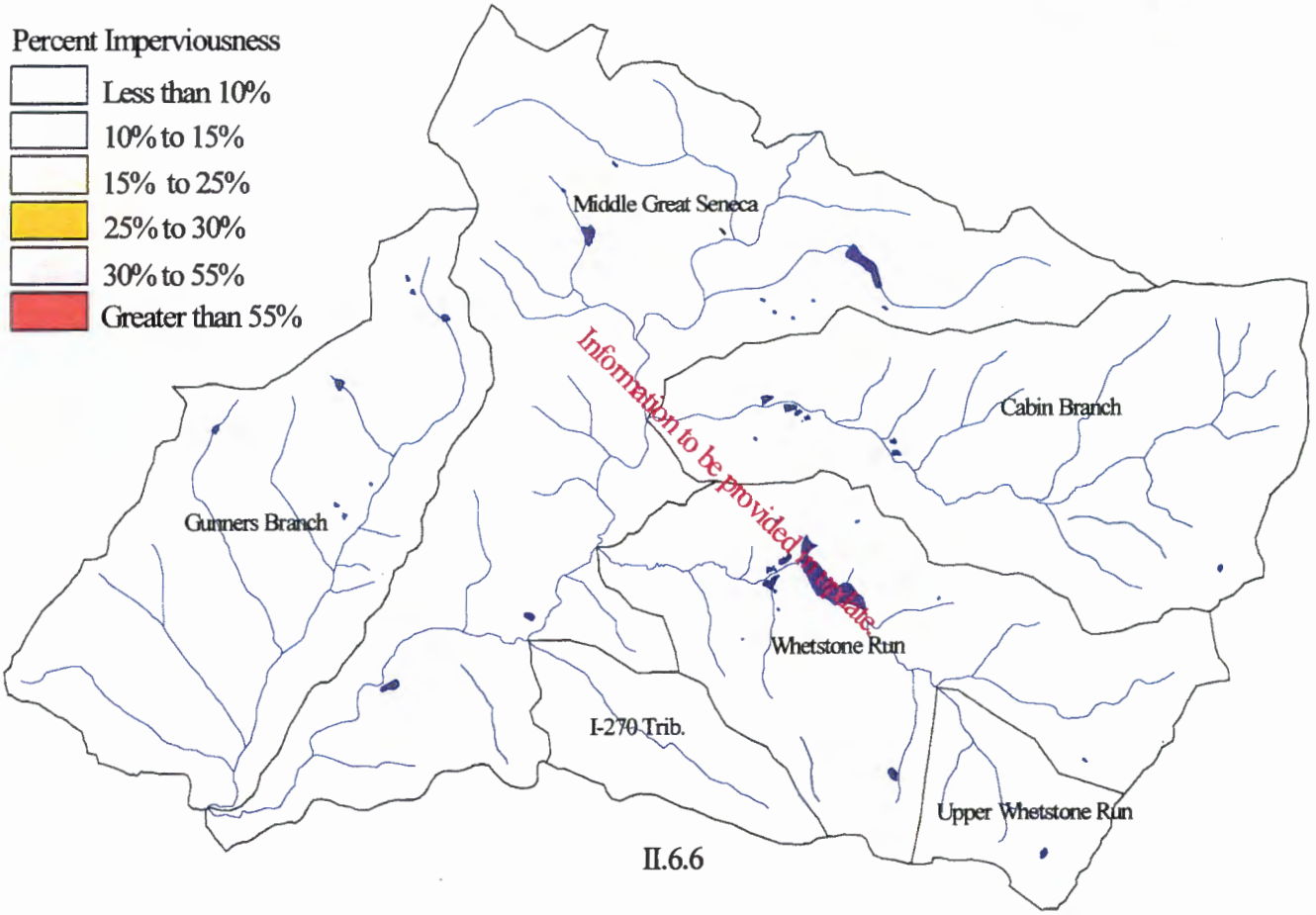
Middle Great Seneca Creek Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
DEP will be conducting baseline monitoring in Middle Great Seneca in 1998. This assessment is based on reconnaissance samples and MDE Maryland Biological Stream Survey data.			
Middle Great Seneca - GOOD (preliminary)	GOOD overall (preliminary) FAIR in lower section below 355	Good riparian buffer in general; however, extensive clearing along ROW has adversely affected mainstem below Rte 355.	Watershed Protection Area - regular (outside the City of Gaithersburg)
Cabin Branch - FAIR (preliminary)	FAIR (preliminary)	Older developed areas with no runoff controls has resulted in impaired stream reaches. Conditions improve below Watkins Mill Rd.	Watershed Restoration Area
Whetstone Run - FAIR (preliminary)	FAIR - (preliminary)	Uncontrolled runoff in upper reaches, and regional stormwater control structures affect conditions. Similar problems observed throughout the Montgomery Village area.	Watershed Restoration Area (outside the City of Gaithersburg)
Upper Whetstone Run - POOR - (preliminary)	POOR - (preliminary)	This tributary is draining very high impervious areas at the Gaithersburg Old Town and Lakeforest Mall.	Watershed Restoration Area (outside the City of Gaithersburg)
I-270 Trib. POOR - (preliminary)	POOR - (preliminary)	I-270 crosses over and parallels this tributary for most of its length.	Watershed Restoration Area (outside the City of Gaithersburg)
Gunners Branch - FAIR - (preliminary)	FAIR - (preliminary)	This large tributary drains portions of Germantown which have relatively new developed areas with stormwater controls. Regional controls have been used in some areas	Watershed Restoration Area

Middle Great Seneca Creek Watershed Management Categories and Projected Development Levels

Map 4





Middle Great Seneca Creek Watershed Management Categories

Much of the Middle Great Seneca area is located within the City of Gaithersburg. The City has completed an inventory of stream physical conditions, and is in the process of identifying potential projects to address the identified problems. The County will conduct baseline stream monitoring in 1998, and preliminary assessments and management categories will be updated as necessary.

Watershed Protection Areas (areas outside the City of Gaithersburg)
The mainstem of Middle Great Seneca is generally in good condition. A forested riparian buffer is protected by parkland, and there are numerous stormwater management facilities, both on-site and regional, in the tributaries draining to this area, so that effects of runoff from impervious areas in these tributaries are mitigated to some extent. Many of the communities making up Montgomery Village drain to this portion of the watershed, and have predominately been built utilizing stream valley protection and stormwater management approaches.

Watershed Management Strategy

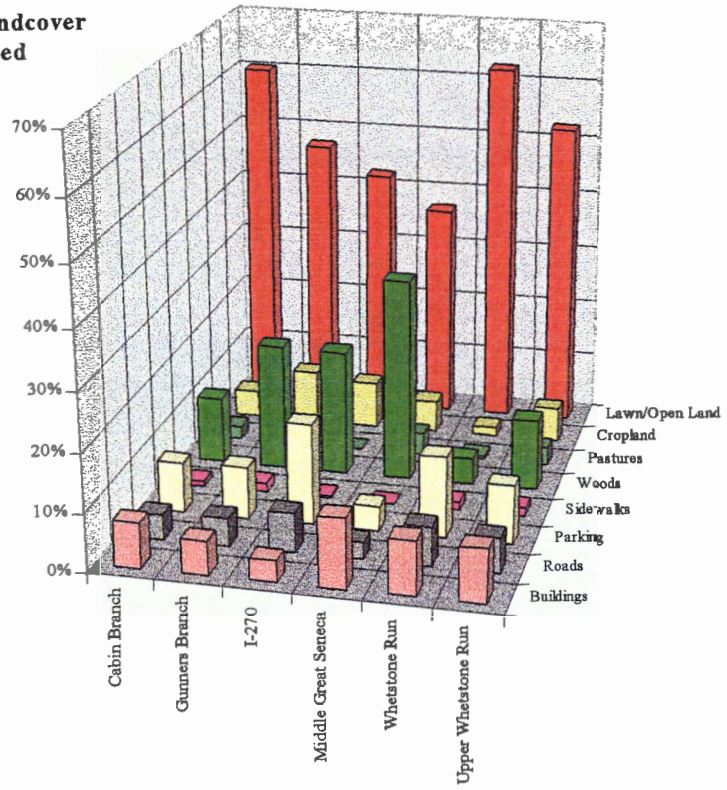
- Continued application of current environmental guidelines and regulations and other regular protection tools.

Watershed Restoration Areas (areas outside the City of Gaithersburg)
These subwatersheds include Cabin Branch, Whetstone Run, the I-270 tributary and Gunners Branch. Impervious surfaces in these subwatersheds have had an effect on the stream conditions. Areas developed without stormwater controls, and stream reaches above regional facilities where runoff is not controlled until reaching the regional structure have been particularly impacted.

Watershed Management Strategy

- Pursue watershed-based restoration approach including study and implementation of feasible projects, stream habitat improvements, and pubic education and volunteer projects.
- Conduct baseline monitoring and update preliminary stream condition assessments to further target restoration needs.
- The City of Gaithersburg has conducted a detailed habitat assessment of areas within its boundaries and is in the process of identifying potential projects to address problem areas.

Middle Great Seneca Landcover by Type and Subwatershed

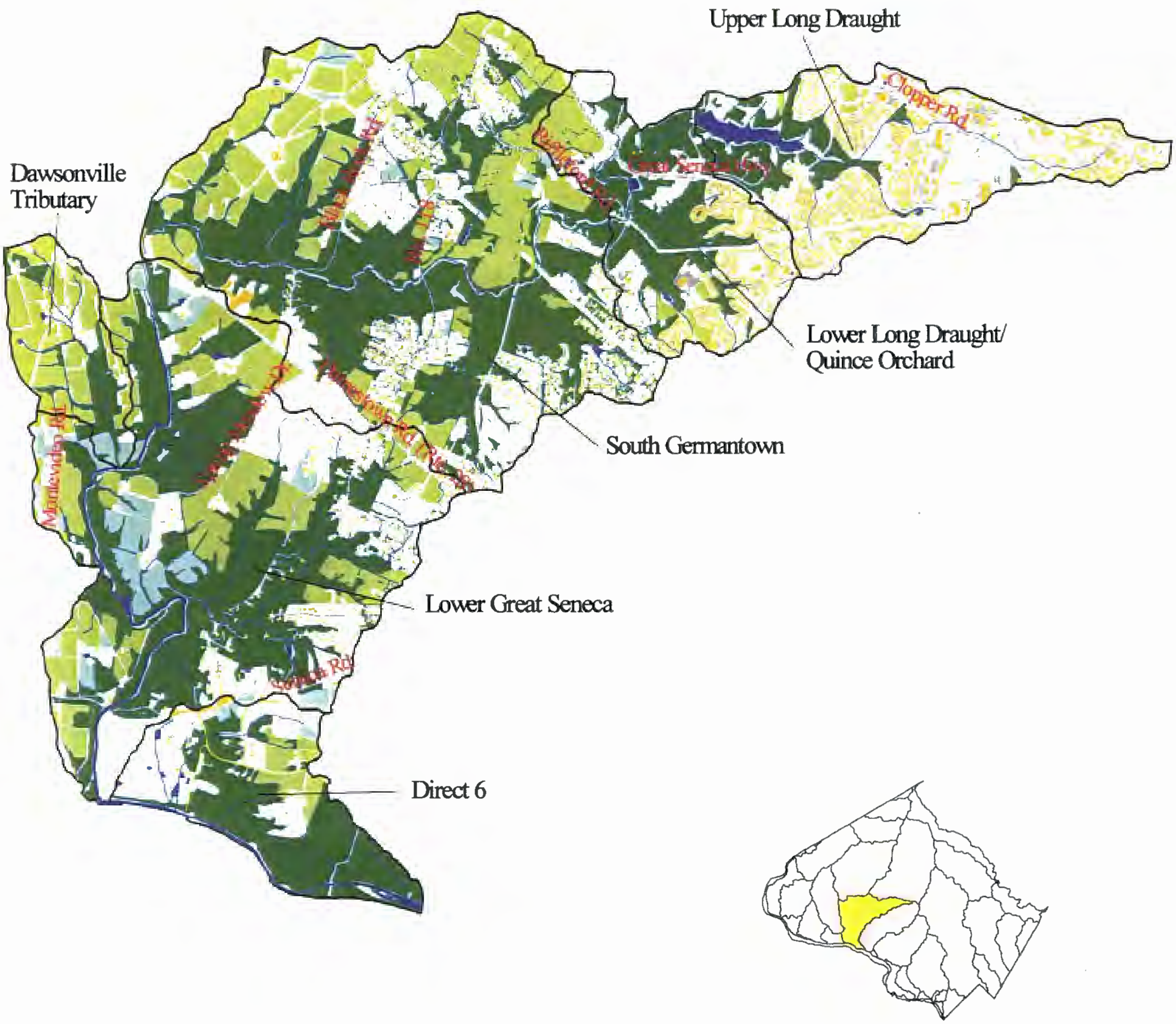


	Acres	Stream miles
Cabin Branch	3060.1	13.2
Gunners Branch	2844.1	11.3
I-270	646.3	2.4
Middle Great Seneca	5020.5	27.4
Whetstone Run	2528.2	10.3
Upper Whetstone Run	552.0	2.1
Watershed totals	14651.2	66.8

Lower Great Seneca

Lower Great Seneca Watershed

Map 1
Land Cover



Land Cover

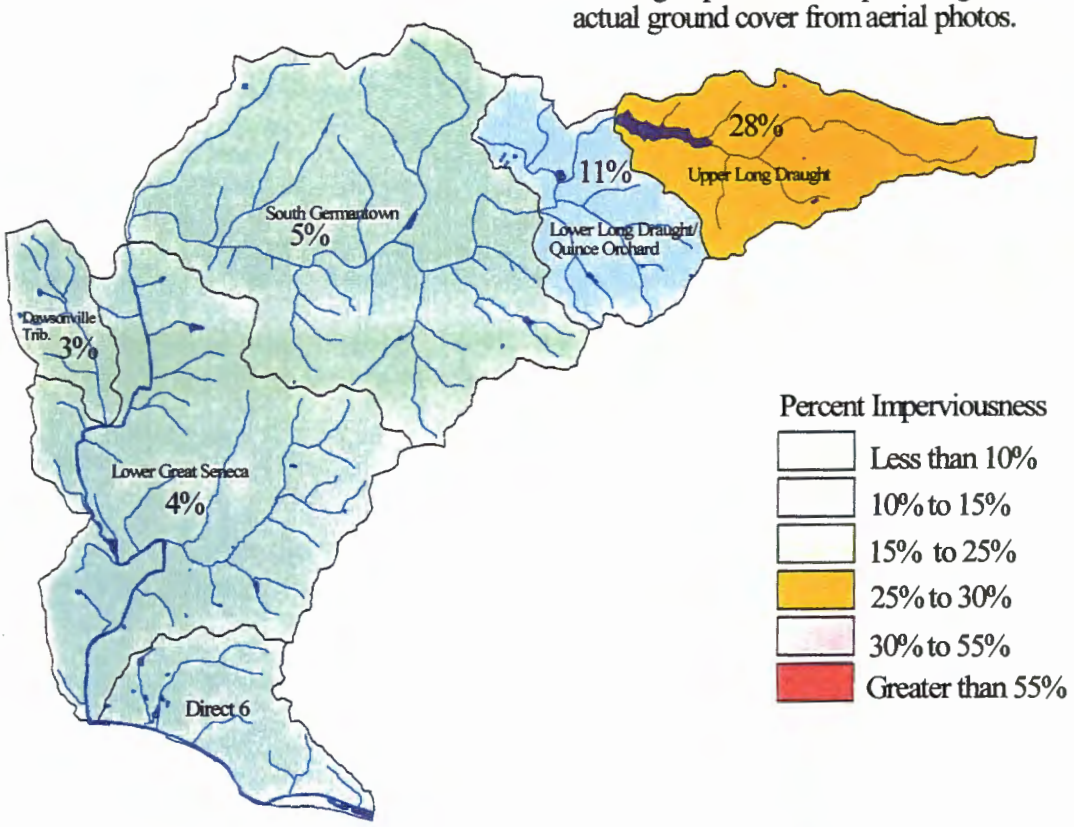
- Lawns/Open Land
- Woodlands
- Pasture
- Cropland
- Buildings
- Parking Lots
- Roads

Lower Great Seneca Impervious Area Analysis

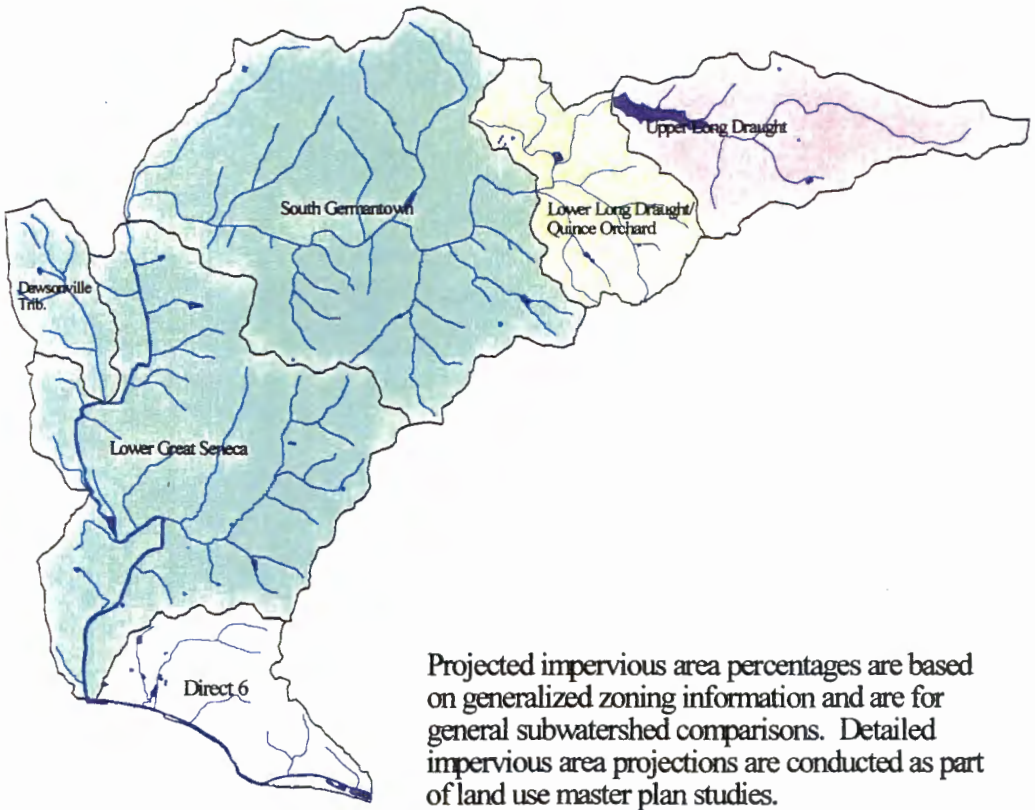
Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



Projected Impervious Area

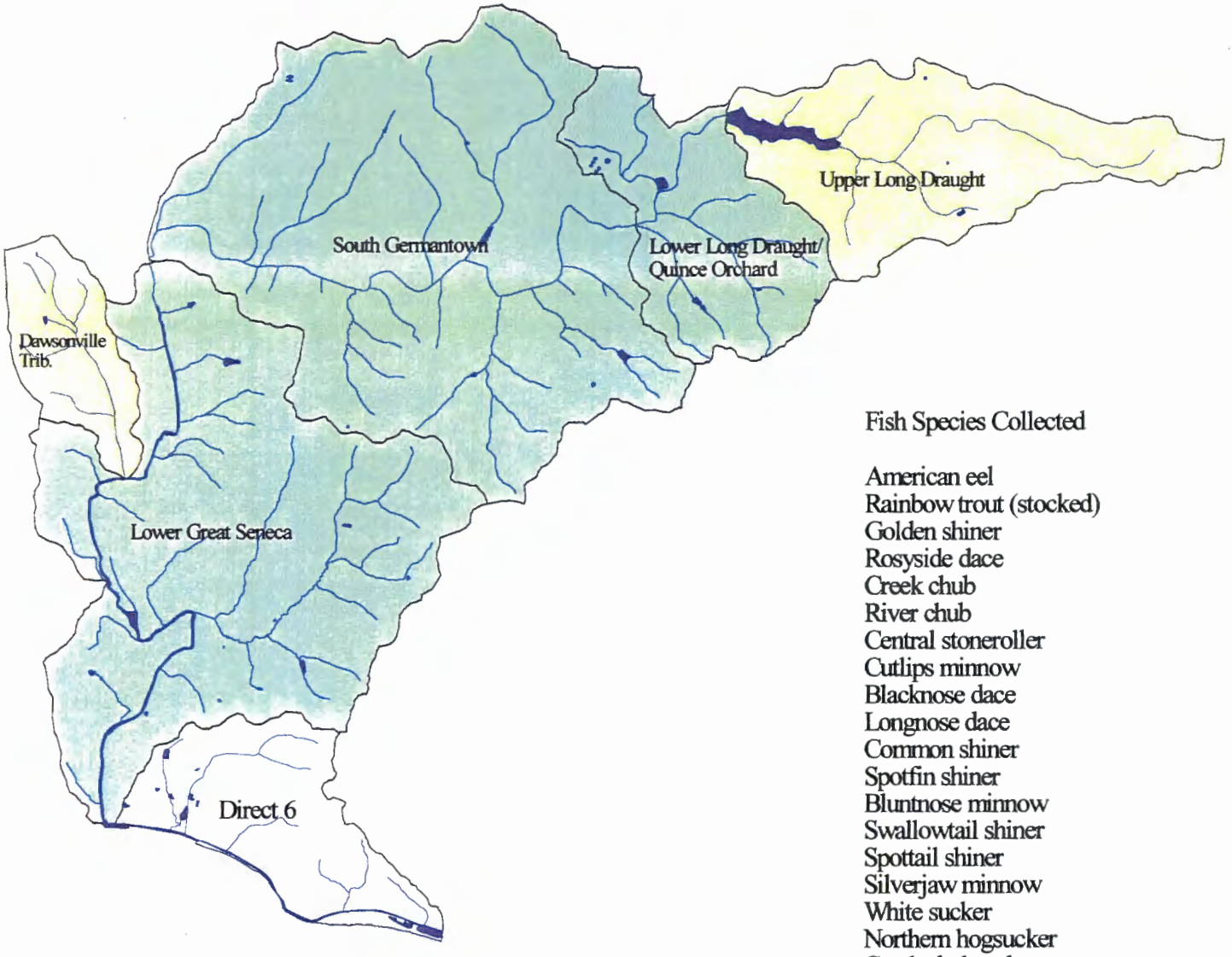


Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Lower Great Seneca Creek Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

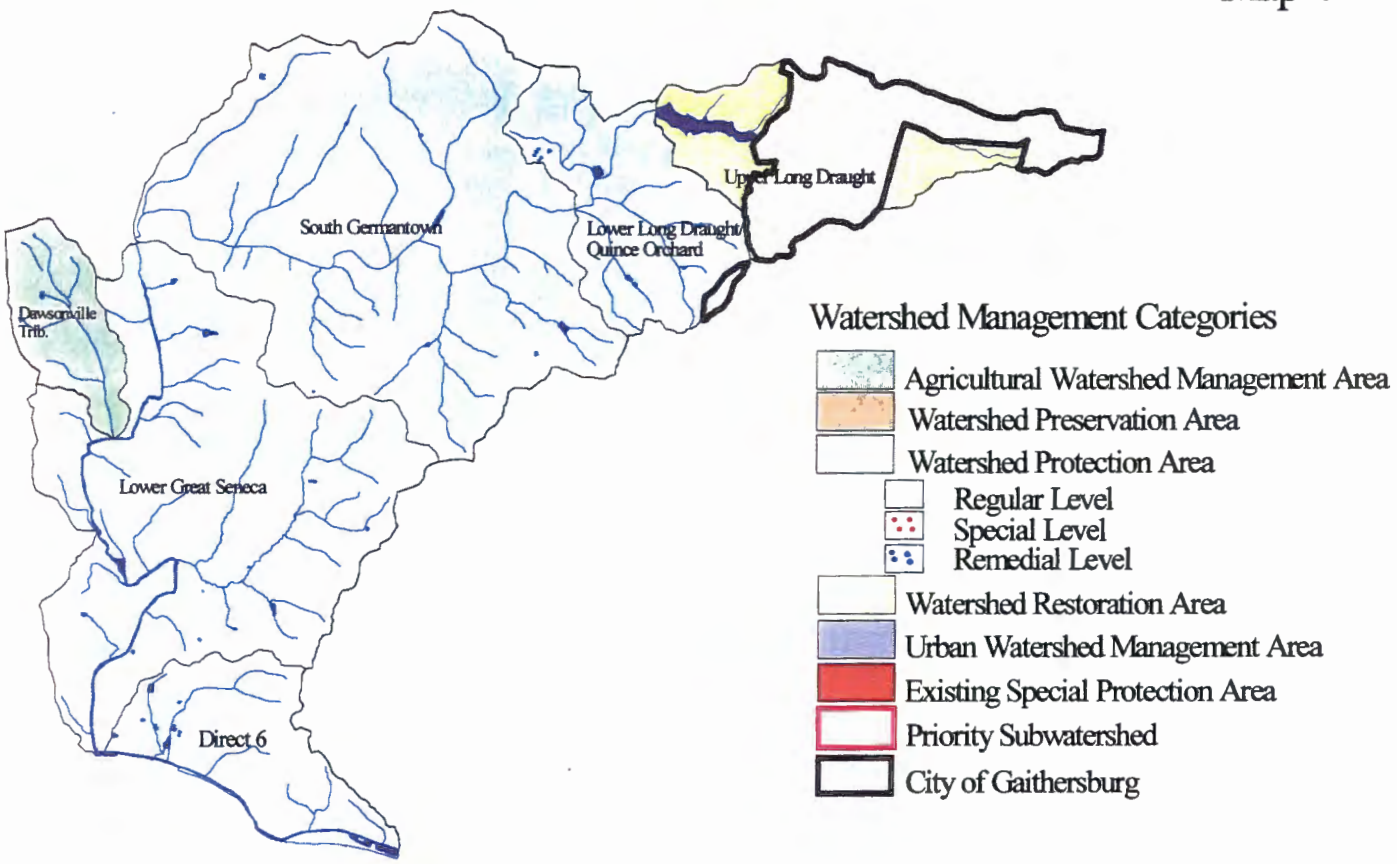
American eel
Rainbow trout (stocked)
Golden shiner
Rosyside dace
Creek chub
River chub
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
Silverjaw minnow
White sucker
Northern hogsucker
Creek chubsucker
Yellow bullhead
Margined madtom
Mottled sculpin
Potomac sculpin
Rock bass
Smallmouth bass
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
White crappie
Tessellated darter
Greenside darter
Fantail darter

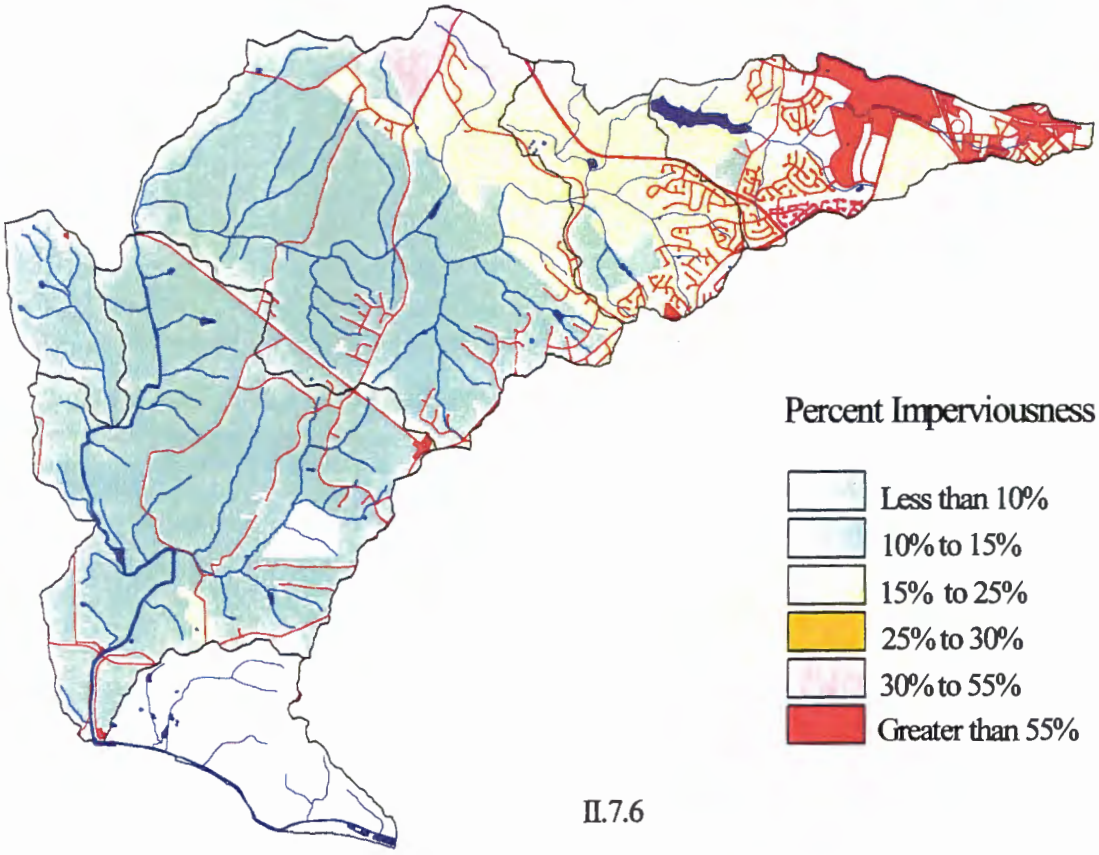
Lower Great Seneca Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
DEP will be conducting baseline monitoring in Lower Great Seneca in from 1996 to 1999. This assessment is based on DEP reconnaissance stations, and MDE Maryland Biological Stream Survey monitoring stations.			
Upper Long Draught FAIR - (preliminary)	FAIR above Clopper Lake - (preliminary)	High density areas in Gaithersburg, including commercial areas and the National Institute of Standards and Technology drain to this tributary. Many of these areas do not have on-site runoff controls, as regional controls were widely used when the area developed.	Watershed Restoration Area (outside the City of Gaithersburg)
Lower Long Draught/Quince Orchard - GOOD (preliminary)	GOOD - (preliminary)	A wastewater discharge treatment plant is located in this area. DEP will be monitoring the stream in the vicinity of the WWTP beginning in 1997 as part of County's NPDES permit requirements.	Watershed Protection Area - regular level (outside the City of Gaithersburg)
South Germantown - GOOD - (preliminary)	GOOD - (preliminary)	Land uses transition back to lower densities in this area, and on-site stormwater controls are more common, since development is generally newer.	Mainstem is a put and take trout management area. Watershed Protection Area - regular level
Lower Great Seneca - GOOD (preliminary)	GOOD - (preliminary)	Large areas in this section are in parkland and forest cover is prevalent.	Watershed Protection Area - regular level
Dawsonville Trib. - FAIR	FAIR	Sparse riparian buffer, sediment deposition in pools and runs, and eroded streambanks affect conditions.	Agricultural Watershed Management Area

Lower Great Seneca Watershed Management Categories and Projected Development

Map 4





Lower Great Seneca Creek Watershed Management Categories

Watershed conditions in Great Seneca Creek generally improve in a downstream direction, as land use densities decrease and the area within County and State parkland increases substantially. Baseline stream monitoring results will be used to update preliminary assessments and re-evaluate watershed management approaches as necessary in the 2000 CSPS update.

The Potomac Subregion Master Plan Study is currently underway which will include an examination of land use and stream condition relationships in the subwatersheds in that planning area. Watershed management approaches will be updated in the CSPS as necessary to repond to land use recommendations.

Watershed Protection Areas

The lower portion of Long Draught and the mainstem of Great Seneca below this point, including all the tributaries except Dawsonville tributary are designated Watershed Protection Areas with a regular level of protection. The stream conditions in these areas are good, and substantial portions of the stream valley are protected within parkland. As land uses within the watershed change from higher to lower densities, impacts from imperviousness decrease. A regular level of protection is expected to continue to protect these streams and maintain the good stream conditions, including the application of existing standard environmental guidelines, including stream buffer requirements, and stormwater and sediment control regulations. Much of the developed area in these lower reaches is either low density on large lot areas or was constructed relatively recently and employs stream valley protection measures and stormwater management controls.

Watershed Management Strategy

- Continued application of current environmental guidelines and regulations and other regular protection tools.
- Further evaluate relationships between land use and stream conditions through the Potomac Subregion Master Plan Study.

Agricultural Watershed Management Area

The Dawsonville tributary contains land uses of an agricultural character, and the use of best management practices, particularly expanded riparian buffers, would improve conditions in this subwatershed.

Watershed Management Strategy

- Pursue educational efforts to improve best management practices and stewardship among private landowners.

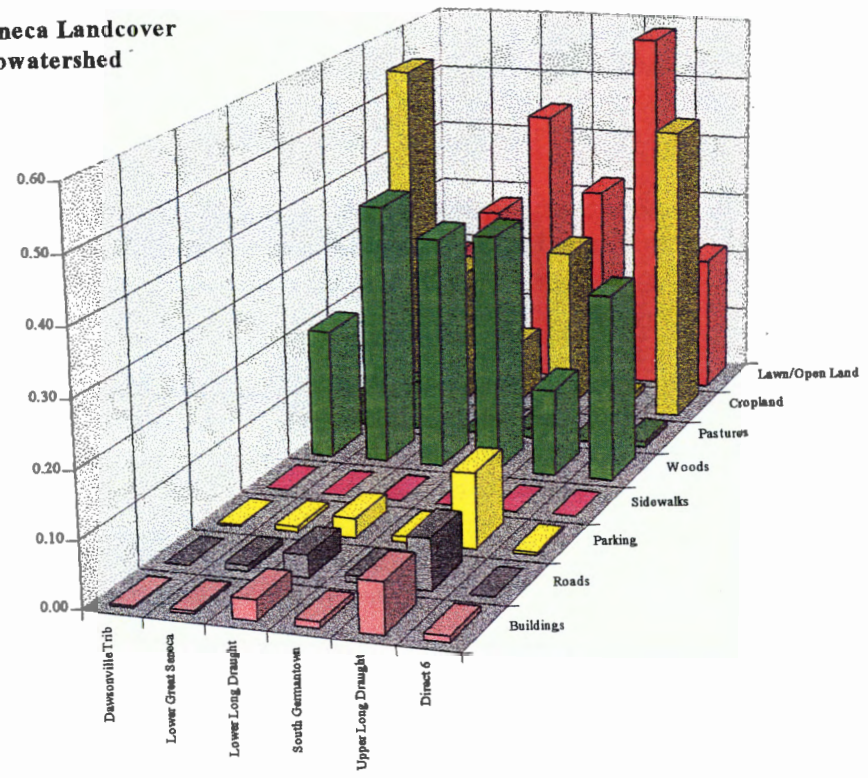
Watershed Restoration Areas

The Upper Long Draught subwatershed contains high imperviousness in the upper reaches which has contributed to habitat degradation in the streams, resulting fair stream conditions. There are a number of older communities that developed without stormwater controls. Portions of the northern reaches are controlled by a regional stormwater management facility, but areas above the structure are affected by uncontrolled runoff.

Watershed Management Strategy

- The City of Gaithersburg has conducted a detailed habitat assessment of areas within its boundaries and is in the process of identifying potential projects to address problem areas.

Lower Great Seneca Landcover by Type and Subwatershed



	Acres	Stream miles
Dawsonville Trib	658.3	3.1
Lower Great Seneca	4620.0	26.5
Lower Long Draught	1481.3	9.4
South Germantown	5370.3	31.8
Upper Long Draught	1894.8	6.2
Direct 6	2111.6	9.4
Watershed totals	16136.2	86.3

The Hawlings River Watershed

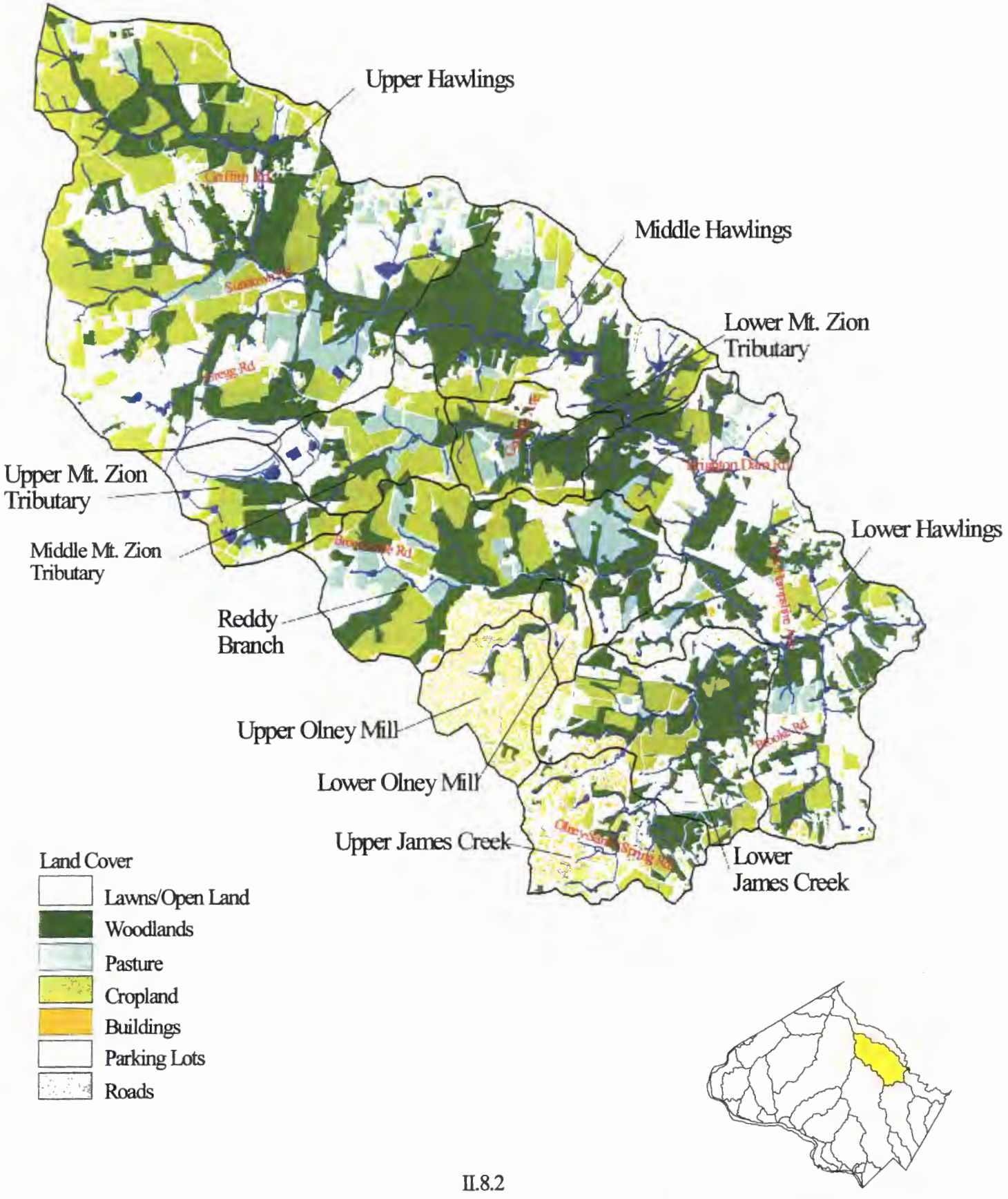
The Hawlings River, located in the northeastern part of the County, originates near Etchison just below the intersection of Routes 108 and 650. The Hawlings flows into the Patuxent River between the Triadelphia and Rocky Gorge reservoirs. As a major tributary to the Patuxent, the Hawlings plays an important role in the overall efforts to reduce nutrient and sediment loadings to this river, and in particular, to the Rocky Gorge reservoir, a public drinking water supply. Much of the Hawlings River watershed, particularly above the Reddy Branch tributary, is agricultural land, parkland with old farmhouses, and newer large lot residential areas. The Hawlings River and its tributaries are included in the Patuxent Primary Management Area (PMA). The PMA is a stream buffer and transition zone within which land uses are closely managed in order to reduce nonpoint source pollution and improve and protect stream conditions. The ultimate goal for the PMA is to maintain low-density, low intensity land uses within 1/4 mile of the Hawlings River mainstem and within 1/8 mile of tributaries and to actively establish a minimum 50' forested buffer strip immediately adjacent to all streams. The PMA guidelines are applied to development projects submitted to M-NCPPC for subdivision and/or site plan review, and are otherwise voluntarily implemented and strongly encouraged on remaining parcels throughout the watershed.

The Hawlings River passes through three distinct land uses. The upper watershed above Sundown Rd. is in rolling agricultural lands east of Laytonsville. This headwater area has many small tributaries that flow to create the Hawlings River mainstem. The middle section passes through a narrow, rocky valley area where the velocity of the stream increases. Within Rachel Carson Conservation Park, there is some of the best stream habitat in the watershed. Below Georgia Avenue, the stream passes through a sandy loam floodplain. The change to sandy soils and the addition of uncontrolled storm flows from the Olney Mill tributary has resulted in severe bank erosion and scour pools. The tributaries flowing into the Hawlings from the southwest, including James Creek and the Olney Mill tributary in Reddy Branch, contain much higher densities than in the rest of the watershed as a result of development in and around the Olney Town Center. The resulting higher impervious conditions and regional in-stream stormwater ponds have contributed to degradation of stream conditions in certain areas. Regional in-stream ponds control runoff from large areas, through one large regional facility rather than many on-site structures. Streams above the facility are often exposed to high uncontrolled runoff velocities from areas with high imperviousness. Stream banks above such facilities frequently need to be protected with armoring such as rip-rap, which displaces natural in-stream habitat. Stream restoration activities to address some of the problems stemming from high density development associated with the Olney Town Center area have been undertaken in Reddy Branch and are planned for James Creek

Throughout the watershed, a coolwater fish community may be found. Shield darters are found here, in the Patuxent River mainstem, and have been reported in the Little Paint Branch, but are found nowhere else in the County. Large sunfish and fallfish are found in the lower reaches of the Hawlings. Some reports of wild trout being caught usually end up as large feisty creek chubs that have risen to the bait and lures of local anglers. Overall, the Hawlings River, particularly the mainstem, continues to maintain good resource conditions. The state designation Use IV-P is based on temperature and dissolved oxygen standards which could support adult trout (the -P indicates that this area drains to a public drinking water supply). Below Georgia Ave., however, stream habitat conditions degrade with large areas of bank erosion, scour pools and sediment deposition. A combination of approaches is necessary for this watershed in order to protect, improve, and restore biological resource conditions.

Hawlings River Watershed

Map 1
Land Cover



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Hawlings River Watershed

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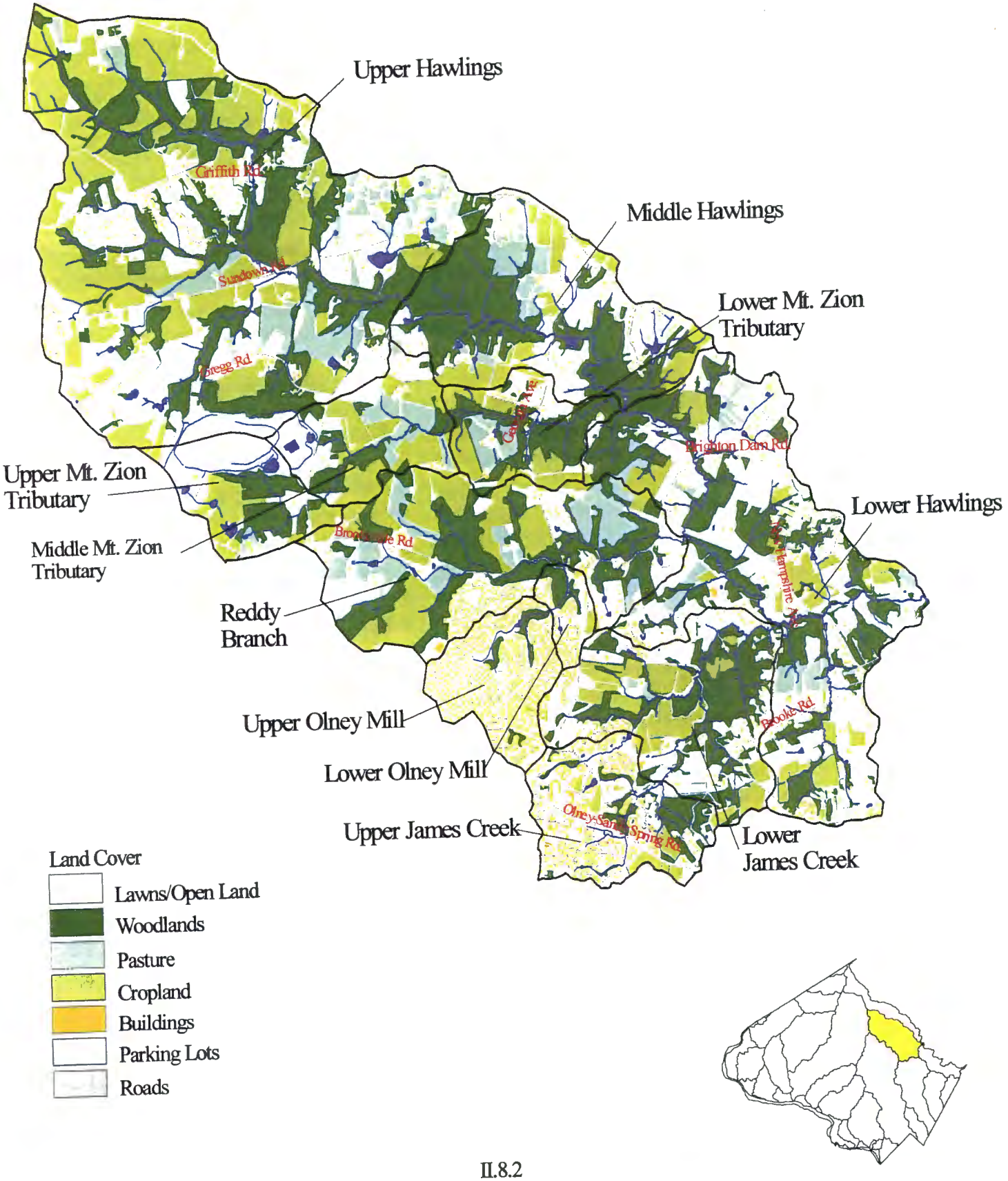
Land Cover

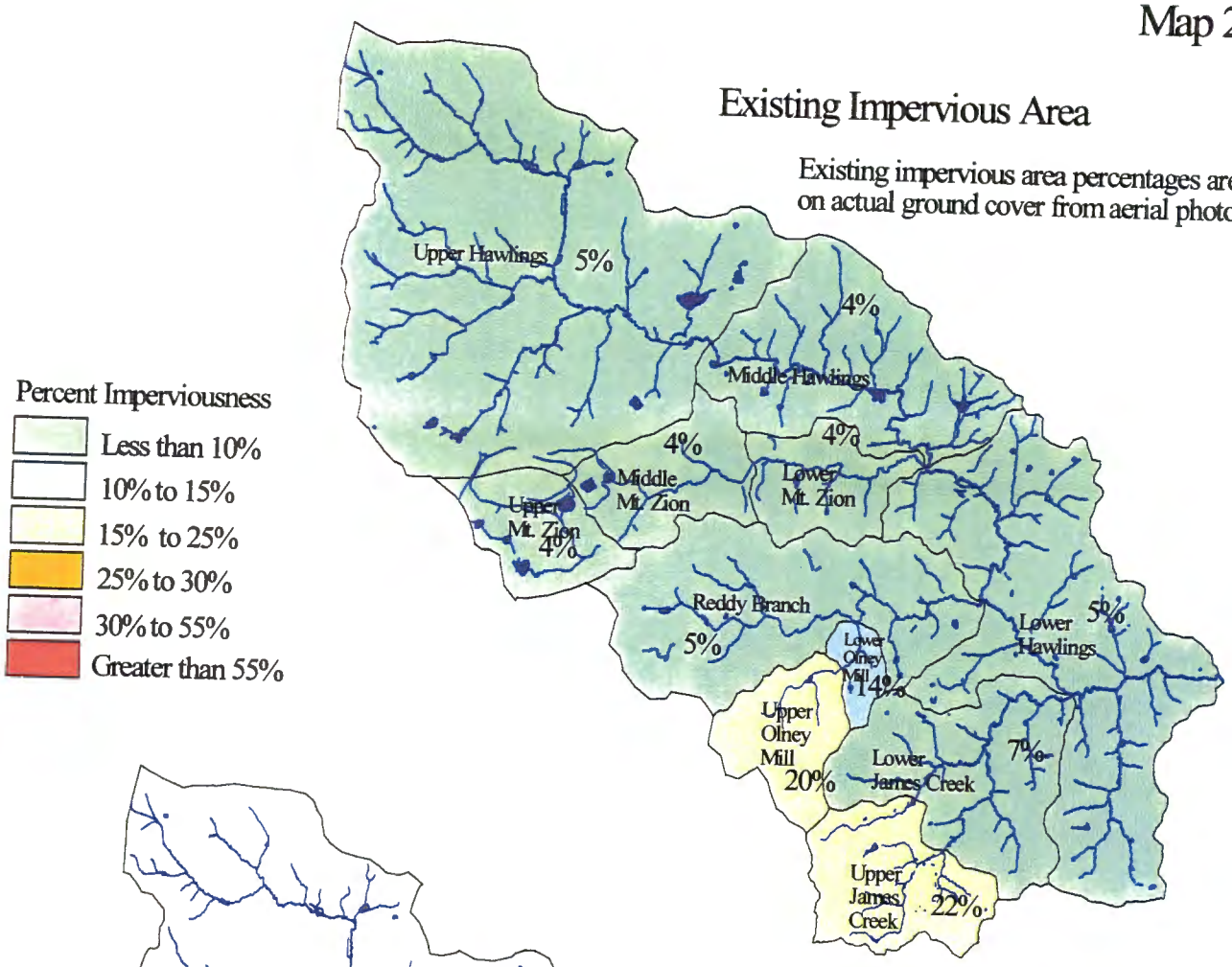


Hawlings River Impervious Area Analysis

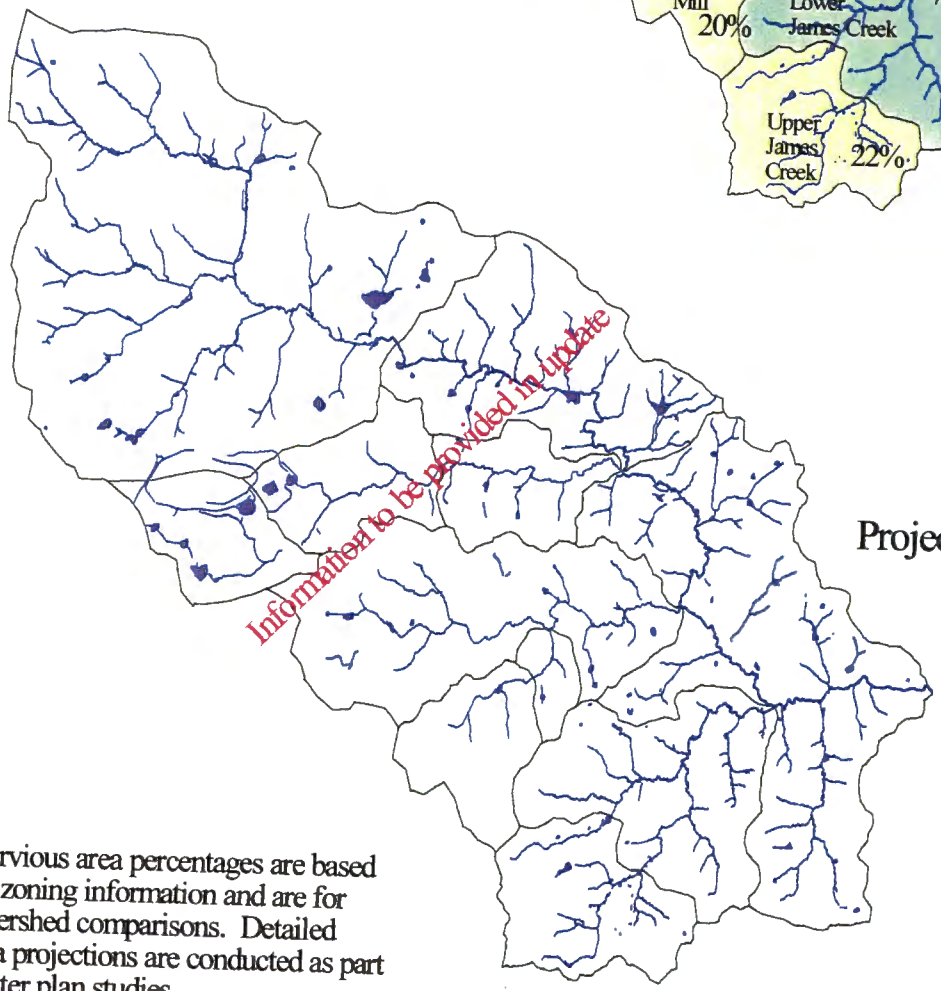
Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



Projected Impervious Area

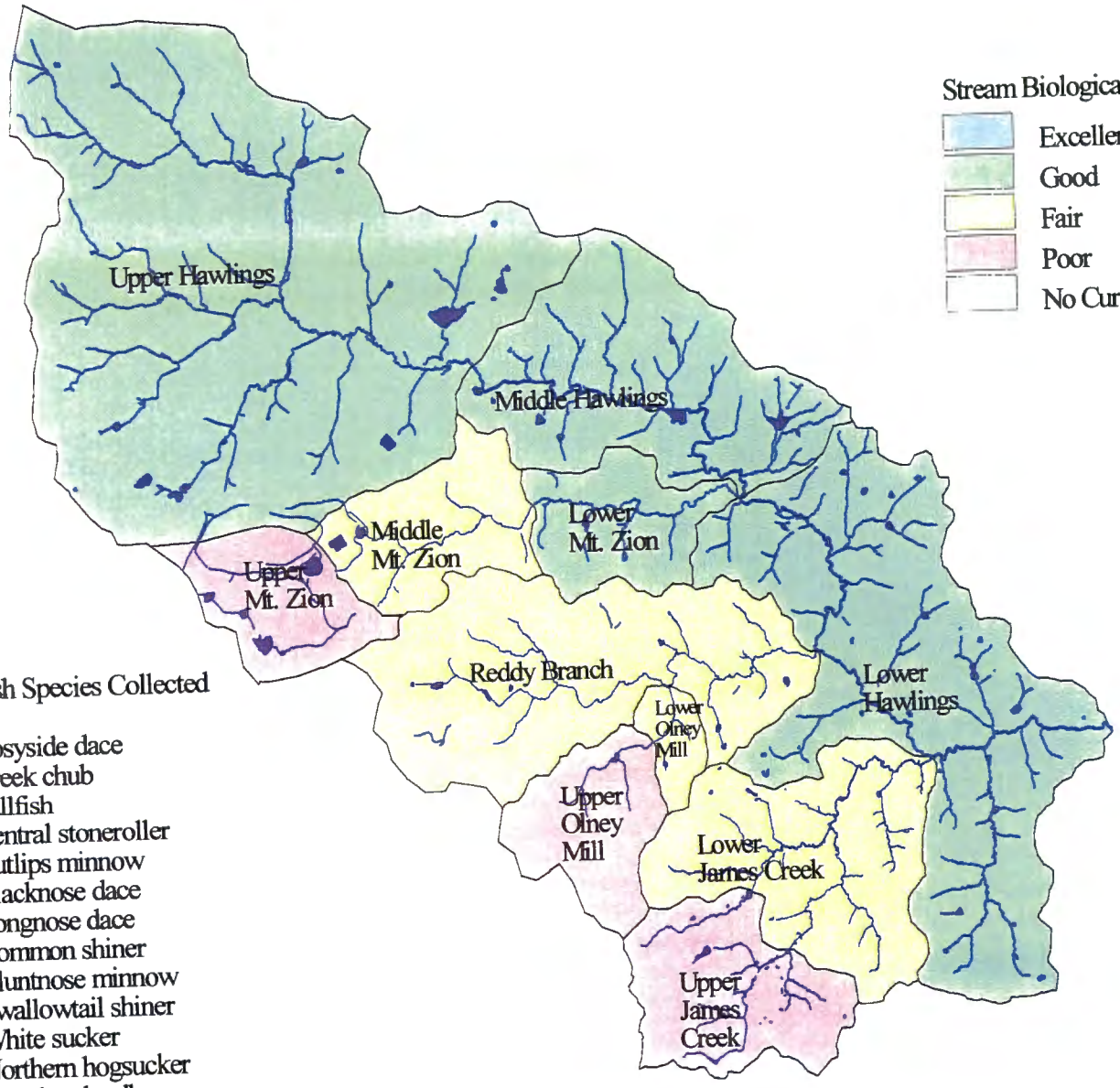


Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Hawlings River Stream Condition

Based on biological indicators.
See Appendix 1 for details.

Map 3



Fish Species Collected

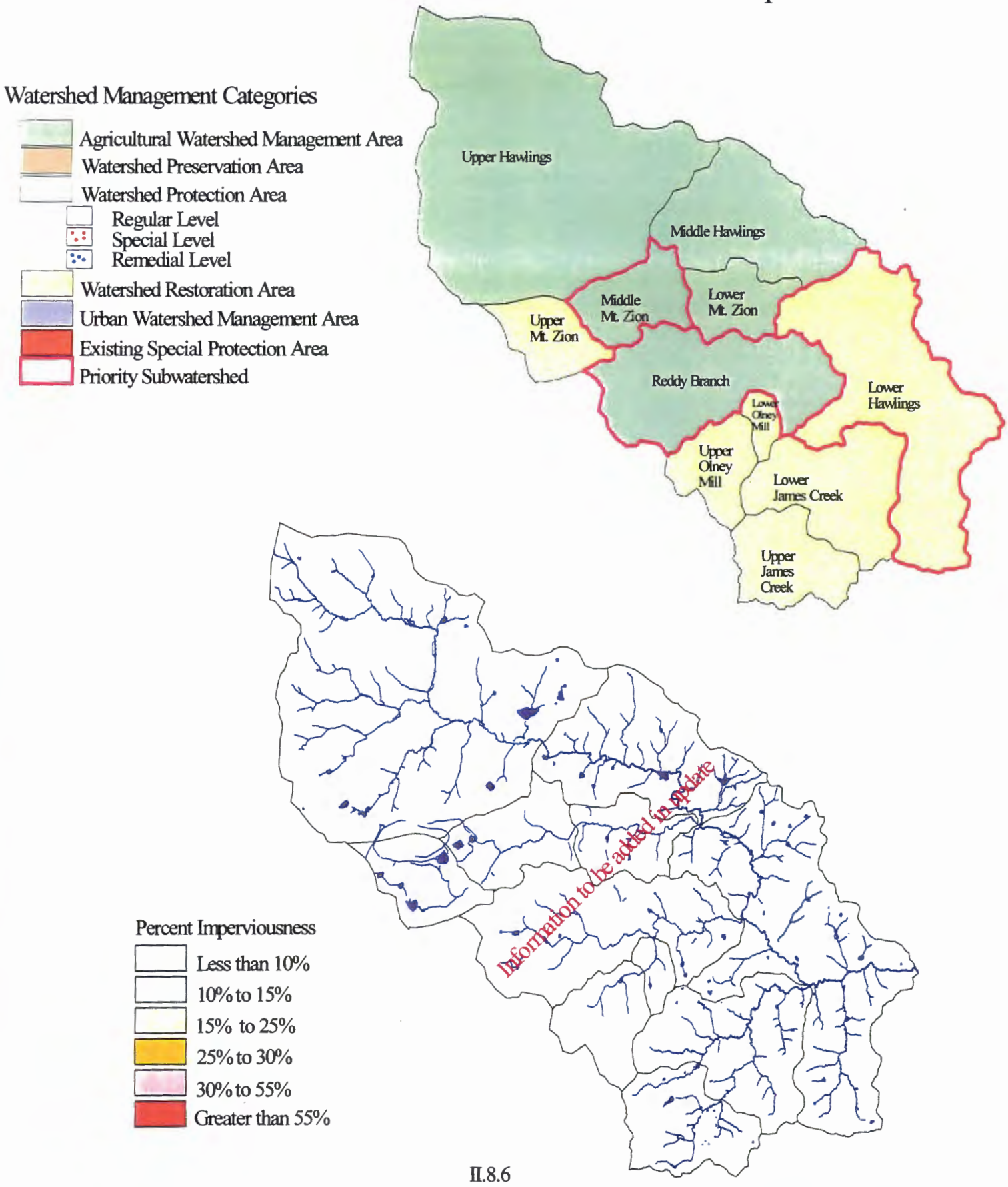
Rosyside dace
Creek chub
Fallfish
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Bluntnose minnow
Swallowtail shiner
White sucker
Northern hogsucker
Shorthead redhorse
Margined madtom
Mottled sculpin
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Yellow perch
Shield darter
Tessellated darter
Greenside darter

Hawlings River Stream Condition, Habitat Condition, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
DEP Baseline Monitoring of Hawlings River was conducted in 1997. The current assessment is based on DEP reference stations and reconnaissance efforts to locate reference stations; M-NCPPC data; land use characteristics; and DNR monitoring in 1993.			
Upper Hawlings - GOOD (preliminary)	GOOD (preliminary)	Preliminary assessment is based on similarity with land uses in the middle section where monitoring stations are located. Habitat is expected to be less than excellent due to reduction in forested buffer area.	Agricultural Watershed Management Area
Middle Hawlings - GOOD	EXCELLENT	Large areas of conservation parkland protect the riparian area in this section.	Agricultural Watershed Management Area
Lower Hawlings - GOOD	FAIR	Scoured banks and sediment deposition were reported by DNR in 1993. Conditions in the lower Hawlings are influenced by the cumulative drainage entering from the more developed southern tributaries. Soils below Georgia Ave. become more sandy and erodible.	A healthy population of shield darters has been identified in this stream section. Watershed Restoration Area
Upper Mt. Zion Trib. - POOR (preliminary)	POOR (preliminary)	Reconnaissance indicated poor habitat conditions for both fish and macroinvertebrates. Predominant land uses include the Oaks Landfill, farm conversion to a golf course, and a PEPCO ROW and substation containing large areas of wetlands.	Watershed Restoration Area
Middle Mt. Zion Trib. - FAIR (preliminary)	FAIR (preliminary)	Reconnaissance indicates conditions improve below Mt. Zion Rd., with a great deal of beaver activity affecting habitat. High sedimentation noted .	Agricultural Watershed Management Area
Lower Mt. Zion Trib. - GOOD	EXCELLENT	Fish community rated lower than macroinvertebrates despite availability of habitat.	Agricultural Watershed Management Area
Reddy Branch - FAIR (preliminary)	FAIR (preliminary)	Fish samples conducted in lower watershed indicate fair conditions. Land uses are predominately agricultural in most of Reddy Branch, although runoff from the Olney Mill trib. has had an impact on Reddy Branch below its confluence. High sediment deposition	Agricultural Watershed Management Area
Upper Olney Mill Trib. - POOR	POOR	Above regional pond uncontrolled runoff from residential areas has led to channel erosion and habitat degradation. M-NCPPC has implemented a stormwater retrofit and restoration project to treat stormwater and restore stream channels.	Watershed Restoration Area
Lower Olney Mill Trib. - FAIR	FAIR	Habitat conditions improve to fair downstream of Olney Mill SWM pond.	Watershed Restoration Area
Upper James Creek - POOR (preliminary)	POOR (preliminary)	Residential land uses and the Olney Town Center in the headwaters have regional runoff controls. The stream reaches above these facilities have been degraded by uncontrolled flows and channelization.	Watershed Restoration Area
Lower James Creek - FAIR (preliminary)	FAIR (preliminary)	Conditions improve downstream of the regional stormwater control facilities.	Watershed Restoration Area

Hawlings River Watershed Management Categories and Projected Development

Map 4



Hawlings River Watershed Management Categories

Management of the stream resources in the Hawlings River occurs through state and county park systems, and through private landowners. The Patuxent Primary Management Area guidelines are applied to new development. DEP baseline monitoring was completed during the Spring and Summer of 1997. Possible refinements to preliminary stream biological and habitat condition ratings and to the draft management category designations will occur as more information is obtained.

Agricultural Watershed Management Areas

This category covers part of the mainstem - Upper, and Middle Hawlings - and Middle and Lower Mt. Zion tributaries, and Reddy Branch (not including Olney Mill Trib.) These subwatersheds are part of the agricultural reserve and are expected to remain in primarily agricultural or large-lot land uses. The land uses in Lower Hawlings are primarily agricultural, resulting in the agricultural watershed management designation, however, stream restoration efforts are needed in the Lower Hawlings to repair damage that has resulted from flows entering the mainstem from the Reddy Branch and James Creek stream systems.

Watershed Management Strategy

- Pursue educational efforts to encourage voluntary implementation of the Patuxent Primary Management Area guidelines through the Patuxent Reservoir Protection Strategy.
- Investigate and improve conditions which are limiting the biological communities in Middle Hawlings and Lower Mt. Zion through cooperative efforts.

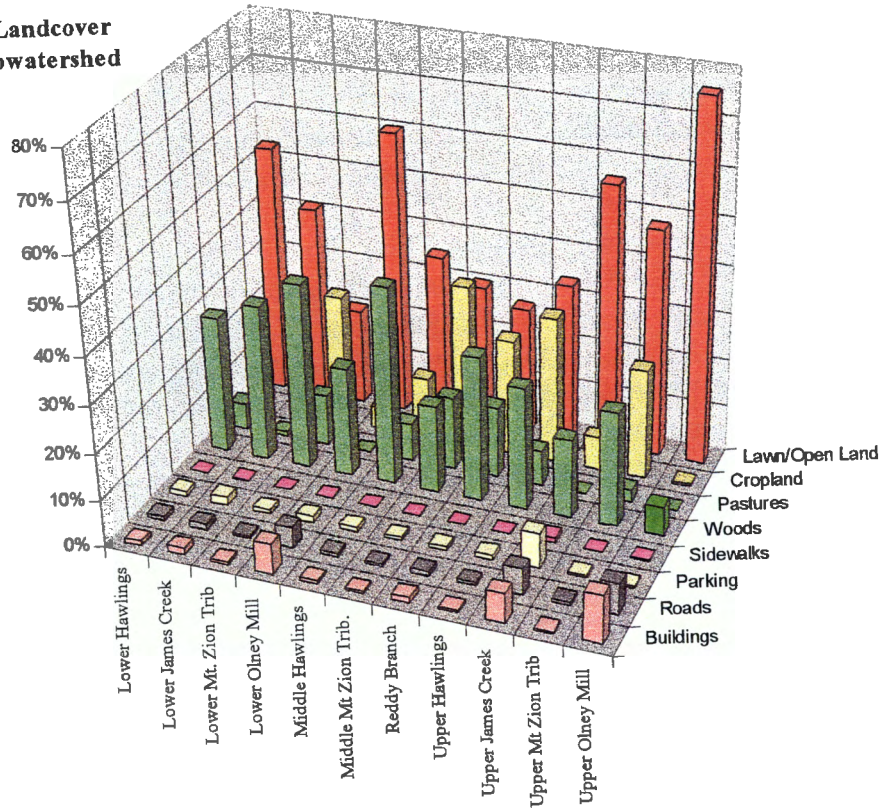
Watershed Restoration Areas

This category includes the Lower Hawlings, Upper Mt. Zion Tributary, Upper and Lower Olney Mill Trib., Upper and Lower James Creek. Higher densities and intensities of land uses within these subwatersheds have resulted in degradation to the stream systems. Further investigation is needed to determine cause of impairment in the Mt. Zion tributary headwaters. Impairment in the Olney Mill and James Creek headwaters is related primarily to development in these areas, either from a lack of stormwater controls or from regional stormwater facilities which resulted in habitat loss upstream of these facilities.

Watershed Management Strategy

- Investigate opportunities to improve conditions in the Lower Hawlings as part of the Upper Patuxent Reservoir effort.
- Continue implementation of restoration approaches in Olney Mill Trib. and James Creek in order to improve conditions in the Lower Hawlings mainstem.
- Increase stream stewardship and pollution prevention efforts through public education and outreach for urban and suburban areas in the Olney vicinity.

Hawlings River Landcover by Type and Subwatershed



	Acres	Stream miles
Lower Hawlings	3187.6	21.8
Lower James Creek	1457.8	9.5
Lower Mt. Zion Trib	626.6	3.5
Lower Olney Mill	179.5	0.9
Middle Hawlings	1771.9	13.8
Middle Mt Zion Trib.	762.9	3.6
Reddy Branch	2070.7	4.8
Upper Hawlings	5767.8	30.1
Upper James Creek	916.3	5.0
Upper Mt Zion Trib	631.1	3.8
Upper Olney Mill	644.7	1.5
Watershed totals	18016.9	98.2

The Little Falls Watershed and Minnehaha Branch

The Little Falls watershed is one of the County's most urban stream systems, with part of its drainage from the northwest portion of the District of Columbia. This watershed contains some of the oldest developed areas of the County. There are several historic elements in the watershed such as Battery Bailey (a landmark fortification from the Civil War), the route of the old trolley line, the Washington Aqueduct, and the C&O Canal, all of which have played a role in shaping the watershed's landscape.

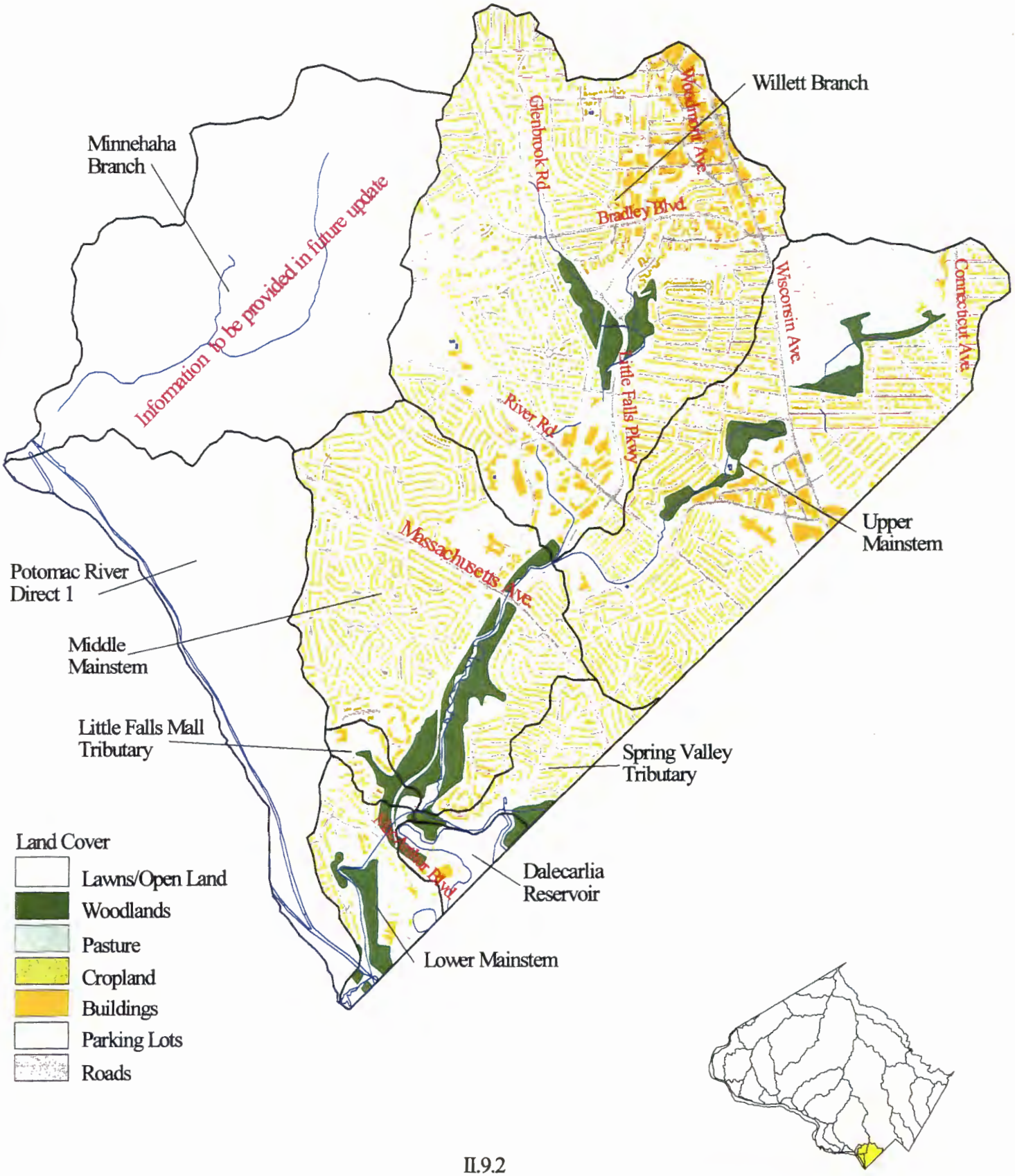
Most of the development in this watershed occurred prior to today's requirements for natural stream buffer, wetland, and floodplain protection, and for stormwater runoff controls. The original drainage pattern of Little Falls has been extensively altered, with much of the original headwaters and tributaries enclosed in storm drain pipes or channelized. What remains of the headwaters now receives drainage from highly impervious areas in the Bethesda Central Business District and Friendship Heights. Channelized and piped areas throughout the watershed deliver flows into downstream channels at accelerated velocities and often with very high temperatures after flowing through open concrete channels or across paved surfaces warmed by the summer sun. These stormflows seriously impact the remaining natural channels downstream.

Several catastrophic pollution events have also influenced watershed conditions, including a large oil spill which ignited and burned for two days in 1959 (melting the Massachusetts Ave. Bridge), chlorine discharges associated with treatment of drinking water supplies, chronic sewer line problems, and an underground oil leak which was discovered and repaired over the last two years. As a consequence of inadequately controlled runoff and periodic pollution events, stream resource conditions are poor, with the exception of the lower reach of Little Falls below MacArthur Blvd. A study conducted in 1976 found no life in Little Falls (Dietermann, 1976). In 1994, Maryland Biological Stream Survey monitoring found American eel, longnose dace, river chub and redbreast sunfish in the lower mainstem below MacArthur Blvd. Above Massachusetts Ave., only three individuals of the very pollution tolerant blacknose dace were found. Macroinvertebrate species found above MacArthur are all pollution tolerant. Below MacArthur Blvd., the macroinvertebrate population is somewhat more diverse, however, the number of individuals, or abundance, remains low. The biological community in Little Falls will be re-examined in 1999 as part of the County's rotating watershed monitoring program. Only recently can it be said with any level of confidence that some major water pollution impacts have been corrected. Sources of apparent illicit discharges throughout the watershed are currently being investigated and, once determined, will be stopped.

Due to the highly developed nature of the watershed, few site opportunities exist to add remedial stormwater controls. Possible incremental restorations are being studied that could improve conditions, particularly water quality, to help restore a more stable aquatic community. Now that water pollution impacts are being better managed, biological resources in this watershed may very well be on the verge of a turn-around, particularly in the lower mainstem where habitat conditions can still support an aquatic community. The best opportunities for restoring a more balanced aquatic community are in the reaches from Massachusetts Ave. downstream to the Potomac River because this area still contains stream habitat capable of supporting fish, aquatic insects, and other aquatic organisms. The high population density and many recreational opportunities, including the extensive trail system and linkage to the National C&O Canal Park, make this area a potential showcase of our ability to blend urban life with the natural environment.

Little Falls and Minnehaha Branch Watersheds

Map 1
Land Cover

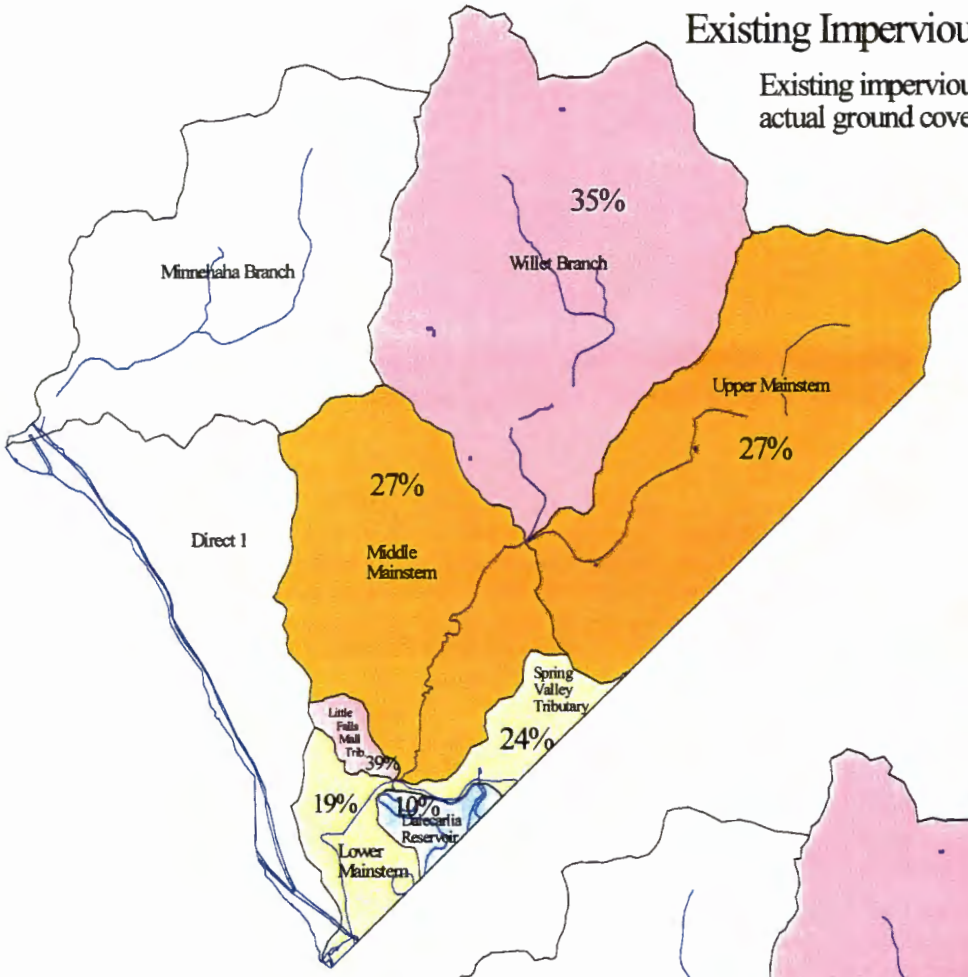


Little Falls and Minnehaha Branch Impervious Area Analysis

Map 2

Existing Impervious Area

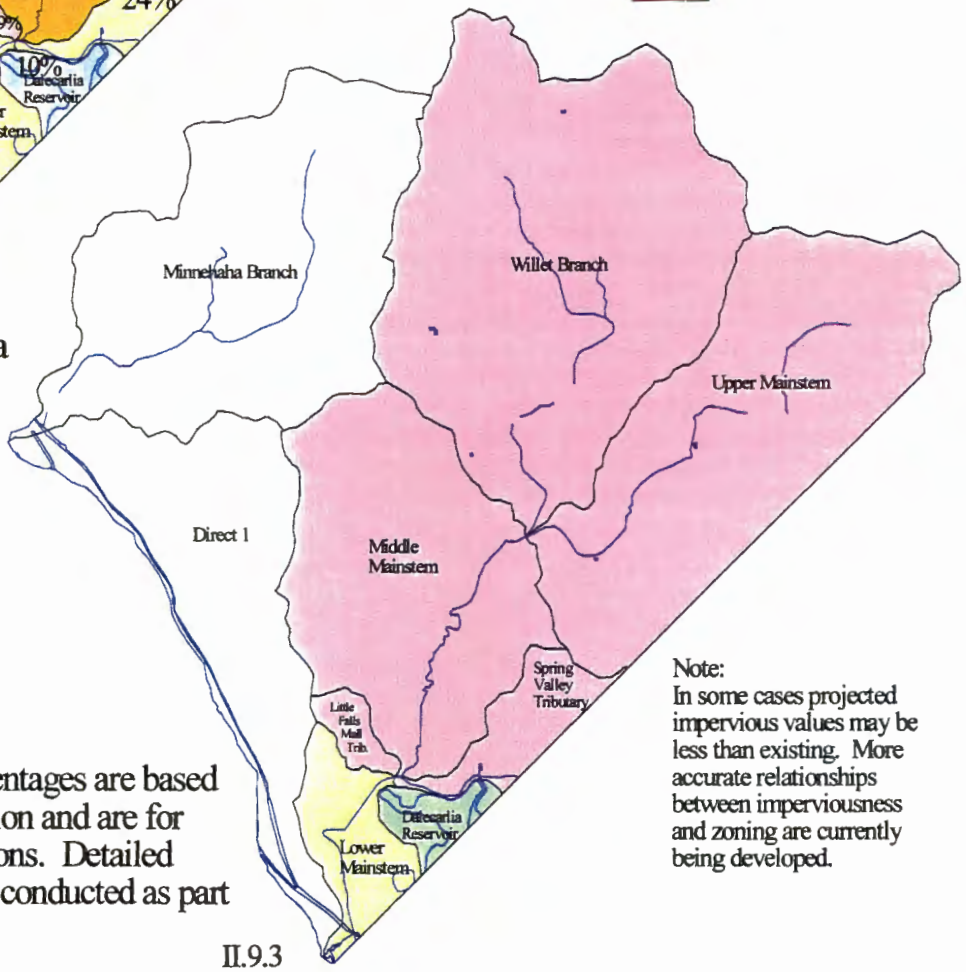
Existing impervious area percentages are based on actual ground cover from aerial photos.



Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Projected Impervious Area



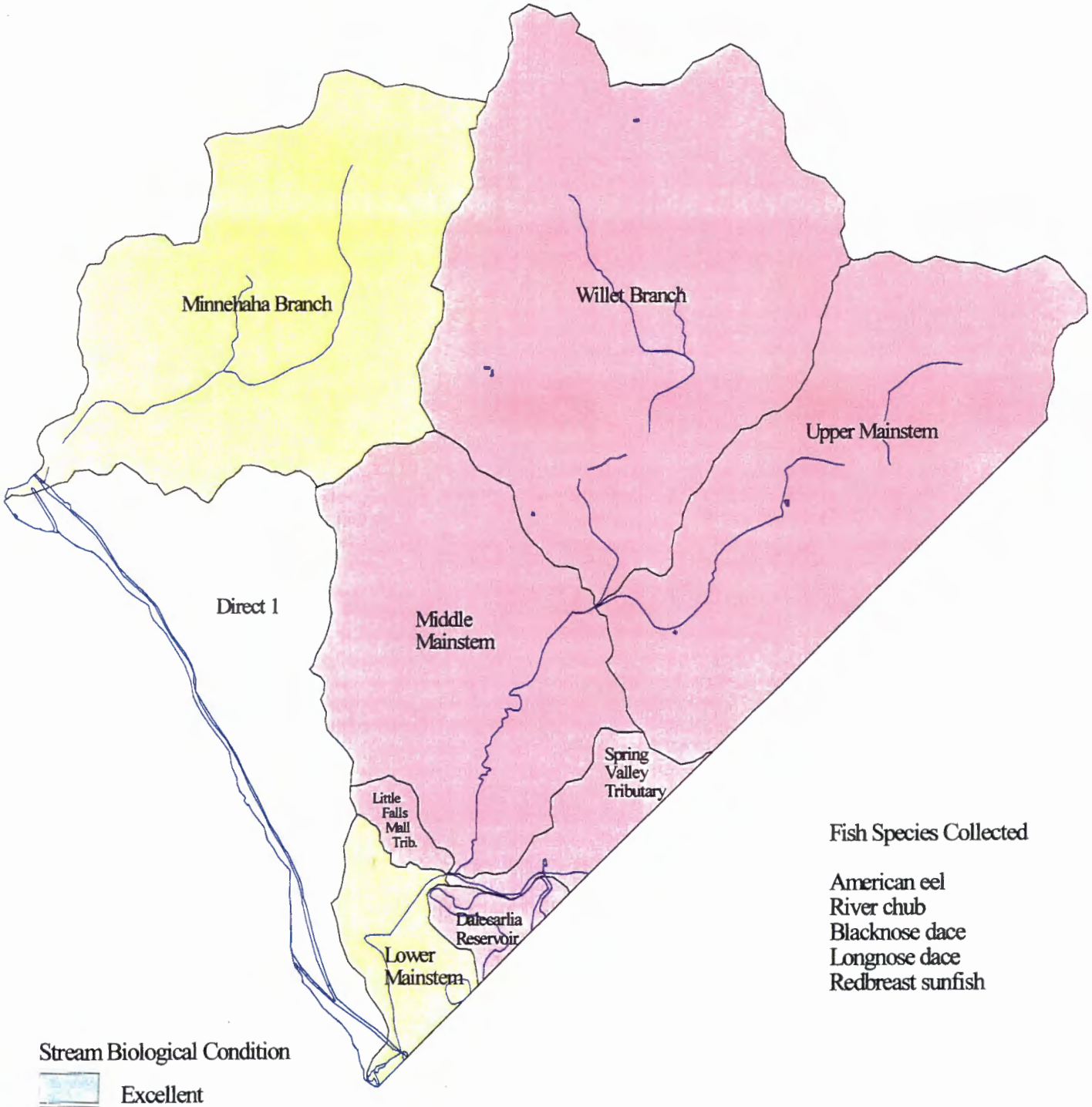
Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Note:
In some cases projected impervious values may be less than existing. More accurate relationships between imperviousness and zoning are currently being developed.

Little Falls and Minnehaha Branch Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.

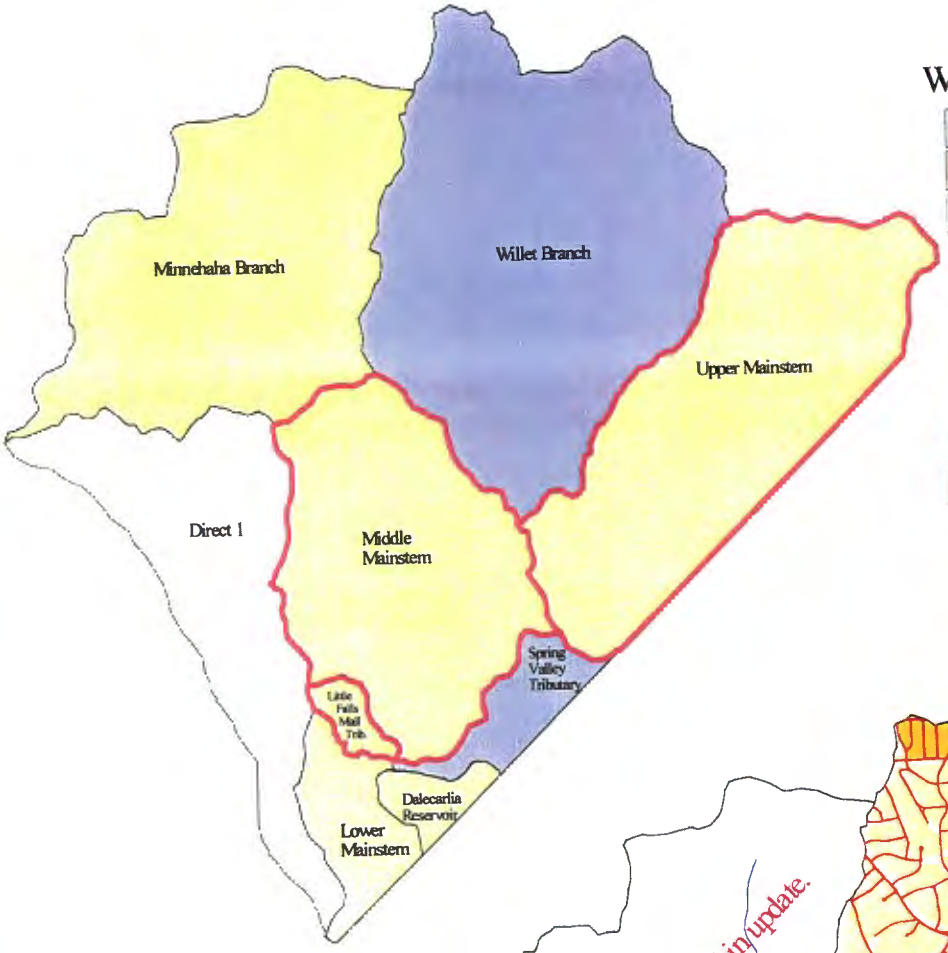


Little Falls Biological Stream Condition, Habitat Conditions, and Watershed Management Category

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique or Special Chacteritics and Management Category
Willet Branch	POOR Overall	70% of stream channel is enclosed in storm drains or lined with a concrete ditch. High velocity uncontrolled runoff a major impact which will be difficult to mitigate due to limited sites available for new stormwater controls.	The Capital Crescent Trail and Hiker/Biker Trail make this one of the most visited stream valley areas in the County; however, few residents even know the stream is running right alongside them. Urban Watershed Management Area
Upper Mainstem	FAIR Overall, except POOR in channelized sections	Forested riparian buffer through Town of Somerset and the Town's efforts to stabilize and improve habitat conditions has helped to maintain habitat conditions. Chronic pollution sources from storm drain outfalls are being addressed and water quality impacts should be improving.	Watershed Restoration Area
Middle Mainstem	FAIR to POOR Overall	This section of the watershed has experienced the least amount of channel alteration and has a good riparian zone. Frequently occurring high storm flows continue to impact channel stability . Erosion and sediment deposition cause significant habitat impairment.	Both the Capital Crescent Trail and Little Falls Hiker/Biker Trail bring many visitors to this stream valley. During the Civil War, the view from Battery Bailey extended far into Virginia. Since then this stream valley has become reforested. Watershed Restoration Area
Little Falls Mall Trib.	FAIR to POOR	This small tributary drains a very highly impervious area. The stream channel has been altered, is extremely incised, and has severe erosion problems.	This stream valley has a high quality forested buffer and provides a frequently used connection to the Capital Crescent Trail system. Restoring and protecting this area from further degradation is a top priority within the context of the Little Falls Restoration efforts. Watershed Restoration Area
Lower Mainstem	GOOD to FAIR	The lower mainstem channel is naturally stabilized by rocky conditions and bedrock. Embeddedness, channel stability, and riparian conditions are generally good. Potential chlorine discharges.	This section of the watershed has the potential to support a higher quality biological community. Recent changes to discharge practices from the reservoir are expected to result in an improvement in the biological conditions in this area. Watershed Restoration Area
Dalecarlia Trib. (Preliminary)	FAIR (Preliminary)	Alteration of the stream valley for the reservoir and lack of a riparian buffer influence conditions here.	Watershed Restoration Area
Spring Valley Trib.	FAIR	The majority of the drainage flows from highly urbanized areas in the District of Columbia. High level of channel alteration in the District and inadequate riparian buffer impair conditions.	Urban Watershed Management Area
Minnehaha Branch - FAIR (preliminary)	FAIR (preliminary)	Inadequate riparian buffer, uncontrolled runoff, and high imperviousness affect this tributary.	Extensive channel restoration was conducted after catastrophic erosion caused extensive damage to the stream below MacArthur Blvd. Watershed Restoration Area

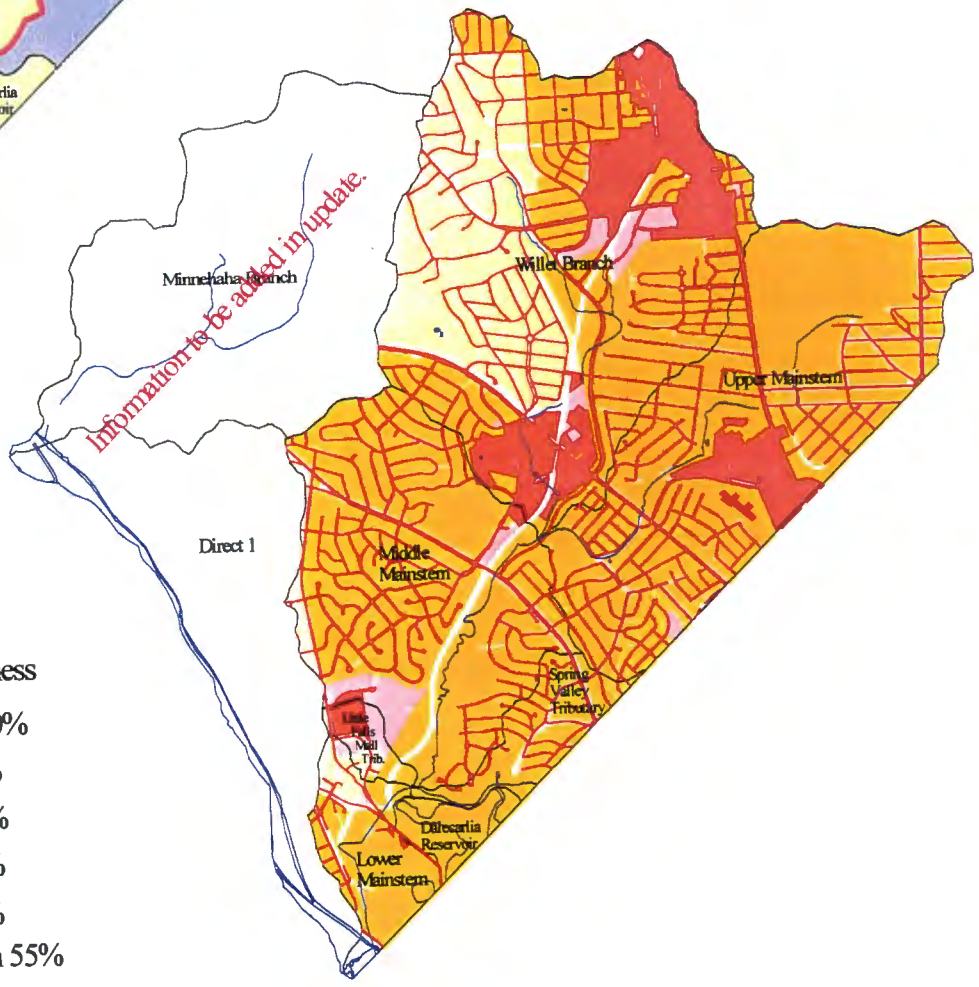
Little Falls and Minnehaha Branch Watershed Management Categories and Projected Development

Map 4



Watershed Management Categories

- Agricultural Watershed Management Are
- Watershed Preservation Area
- Watershed Protection Area
  - Regular Level
  - Special Level
  - Remedial Level
- Watershed Restoration Area
- Urban Watershed Management Area
- Existing Special Protection Area
- Priority Subwatershed



Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Little Falls Watershed Management Categories

The current management efforts in Little Falls include the development of the Little Falls Watershed Restoration Action Plan which is currently in progress, and ongoing discharge investigations and pollution prevention efforts. The Action Plan will incorporate the approaches outlined below, with more detailed implementation and benchmark components to help improve watershed conditions and biological resources in the watershed.

The overall management approach in the Little Falls watershed includes aggressive pollution prevention measures coupled with projects to stabilize and restore, where feasible, the areas of natural stream channel that still have the potential to support an aquatic community, albeit a hardy and pollution tolerant one.

The limiting factor on the level to which this stream system will support a more diverse aquatic community is our ability to mitigate the effects of uncontrolled stormwater runoff. Because the watershed is very nearly fully developed, there simply are very few places suitable for cost effective stormwater retrofit projects. Efforts will be focused on providing treatments to small areas where feasible, in order to create "refugia" where organisms can take shelter during storm events, and stabilizing other areas to help limit further erosion and channel downcutting. The continued downcutting of channels must be addressed to reduce ongoing infrastructure repair costs, such as exposed and damaged sewer lines and eroding park trails, and to lessen delivery of sediments downstream.

Urban Watershed Management Area
This management category includes Willet Branch and Spring Valley Tributary.

Watershed Management Strategy

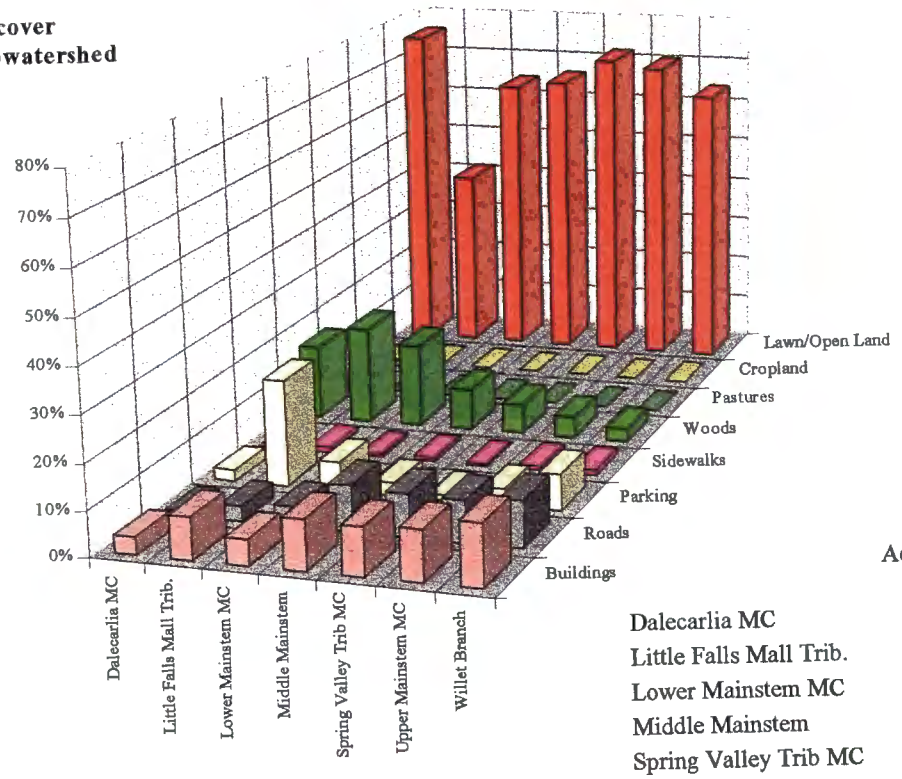
- Continue working with Clean Water Partners and expand program as feasible.
- Continue Pipe Detectives stormdrain outfall monitoring.
- Support cost-effective stormwater controls on redevelopment sites, particularly quality controls, in conjunction with watershed-wide facilities if determined to be feasible.

Watershed Restoration Area
This category includes the Upper Mainstem, Middle Mainstem, Dalecarlia subwatershed, Little Falls Mall Tributary, and the Lower Mainstem

Watershed Management Strategy

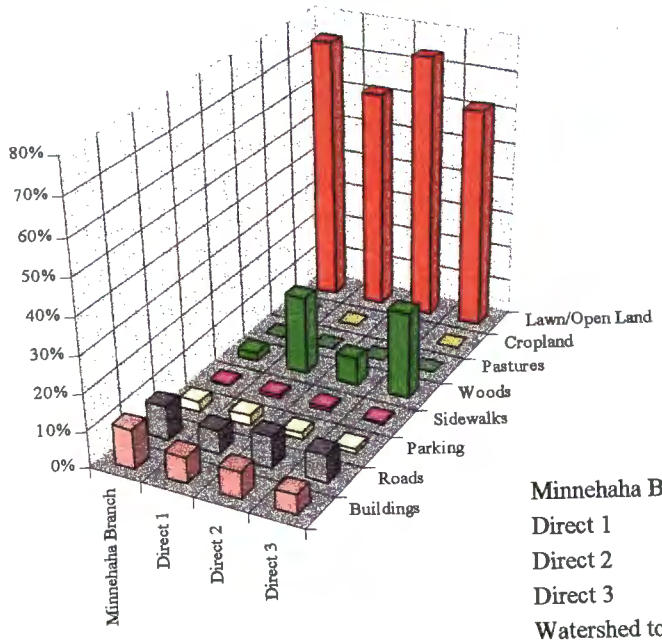
- Continue efforts to identify and implement stream restoration opportunities, working with the Little Falls watershed advisory group, Town of Somerset, and private landowners. A state grant has been secured to implement stream restoration projects in the stream channels below Massachusetts Ave.
- Continue working with Clean Water Partners and Pipe Detectives volunteers to identify and better manage storm drain discharges throughout the watershed.

Little Falls Landcover by Type and Subwatershed



	Acres	Stream miles
Dalecarlia MC	56.6	0.0
Little Falls Mall Trib.	39.0	0.0
Lower Mainstem MC	147.7	0.1
Middle Mainstem	706.1	1.3
Spring Valley Trib MC	113.9	0.1
Upper Mainstem MC	880.4	1.8
Willet Branch	1239.8	2.0
Watershed totals	3183.5	5.4

Minnehaha Branch Landcover by Type and Subwatershed



	Acres	Stream miles
Minnehaha Branch	909.0	2.4
Direct 1	564.7	9.3
Direct 2	347.3	2.4
Direct 3	548.7	7.6
Watershed totals	2369.7	21.6

The Little Monocacy, Furnace Branch and Monocacy River Watersheds

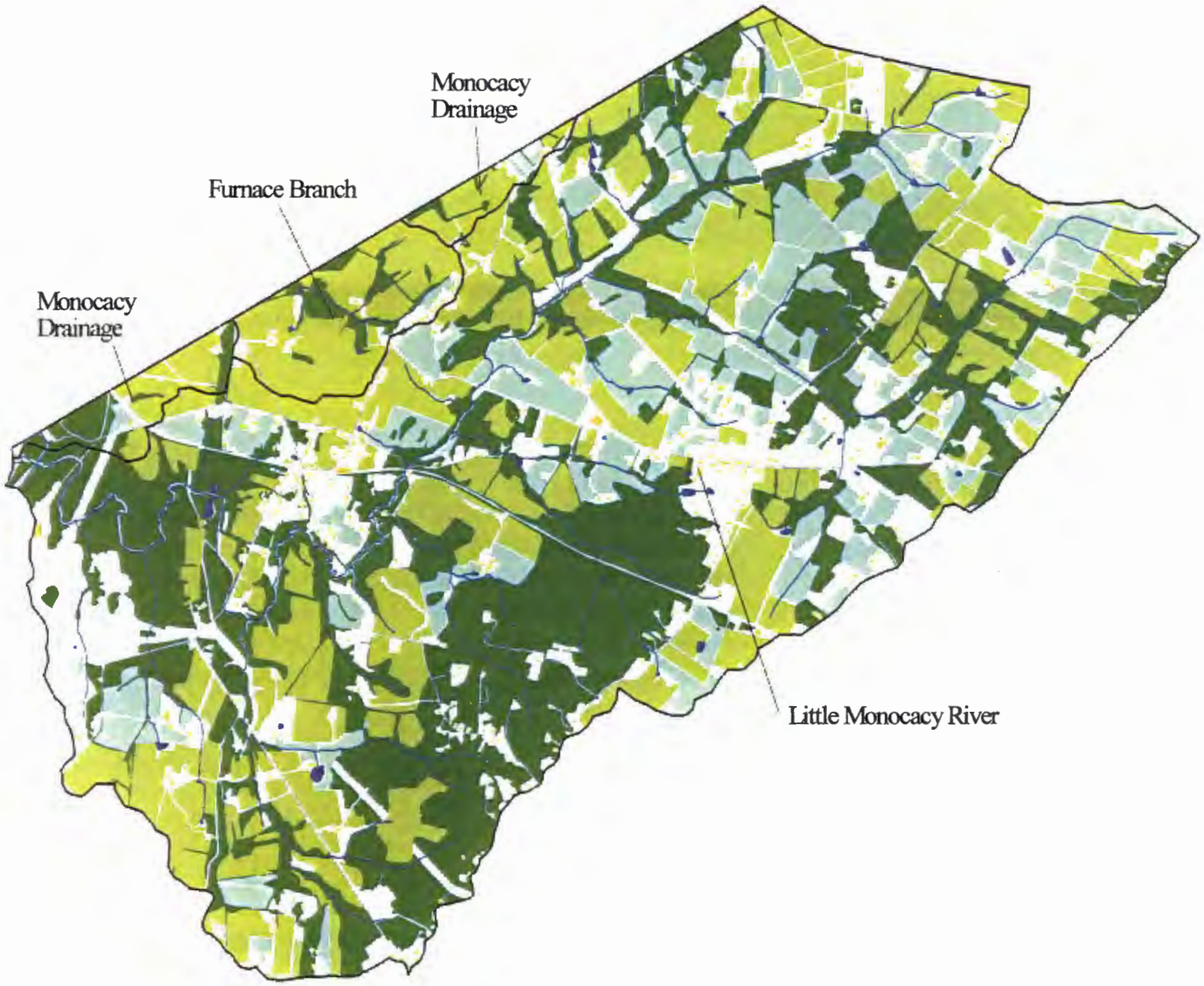
These tributaries of the Potomac River are located in the far western area of the County and consist of primarily agricultural and wooded areas. Furnace Branch is a tributary of the Monocacy, flowing into this large stream within Frederick County. The Little Monocacy River is located almost entirely within Montgomery County and does not flow into the Monocacy River as the name suggests (and many people believe!). The Little Monocacy enters the Potomac River just downstream of where the Monocacy River joins the Potomac River in Frederick County.

The headwaters of the Little Monocacy watershed begin in the rural countryside along Comus Road southwest of the town of Comus. This watershed is one of the most scenic rural watersheds in Montgomery County. Numerous farms maintain the rural nature of this watershed for the full length of the stream system as many of the County's farms are located in this area. The small towns of Barnesville, Sellman, and Dickerson, all located in this watershed, represent the only concentrated areas of imperviousness in the Little Monocacy. Portions of the Little Monocacy drain Sugarloaf Mountain in Frederick County, with many of the headwater tributaries well forested.

By the time the Little Monocacy passes under Route 28 near the town of Dickerson, it has grown into a wide, rapidly flowing cool water stream. Deep pools and high velocity riffles help to maintain a diverse cool water fish community here. Nineteen fish species were found here in 1996! Two species of darters were found, greenside darter and fantail darter. Rock bass and bluegills were found in the pools and Silverjaw minnows swam along sandy bottom runs. Large central stonerollers and longnose dace were found in water flowing so fast that the monitoring crew had trouble remaining standing. Baseline monitoring of this watershed will occur in the year 2000. DEP staff also explored the watershed in the Spring of 1997 in order to look for least-impaired stream reaches to add to the reference stream inventory.

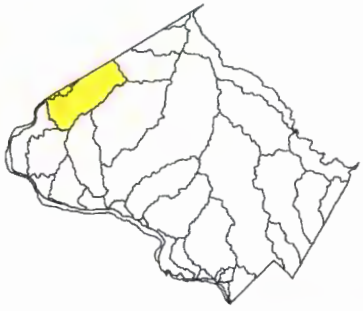
Little Monocacy River, Furnace Branch Watersheds, and Monocacy Direct Drainage

Map 1
Land Cover



Land Cover

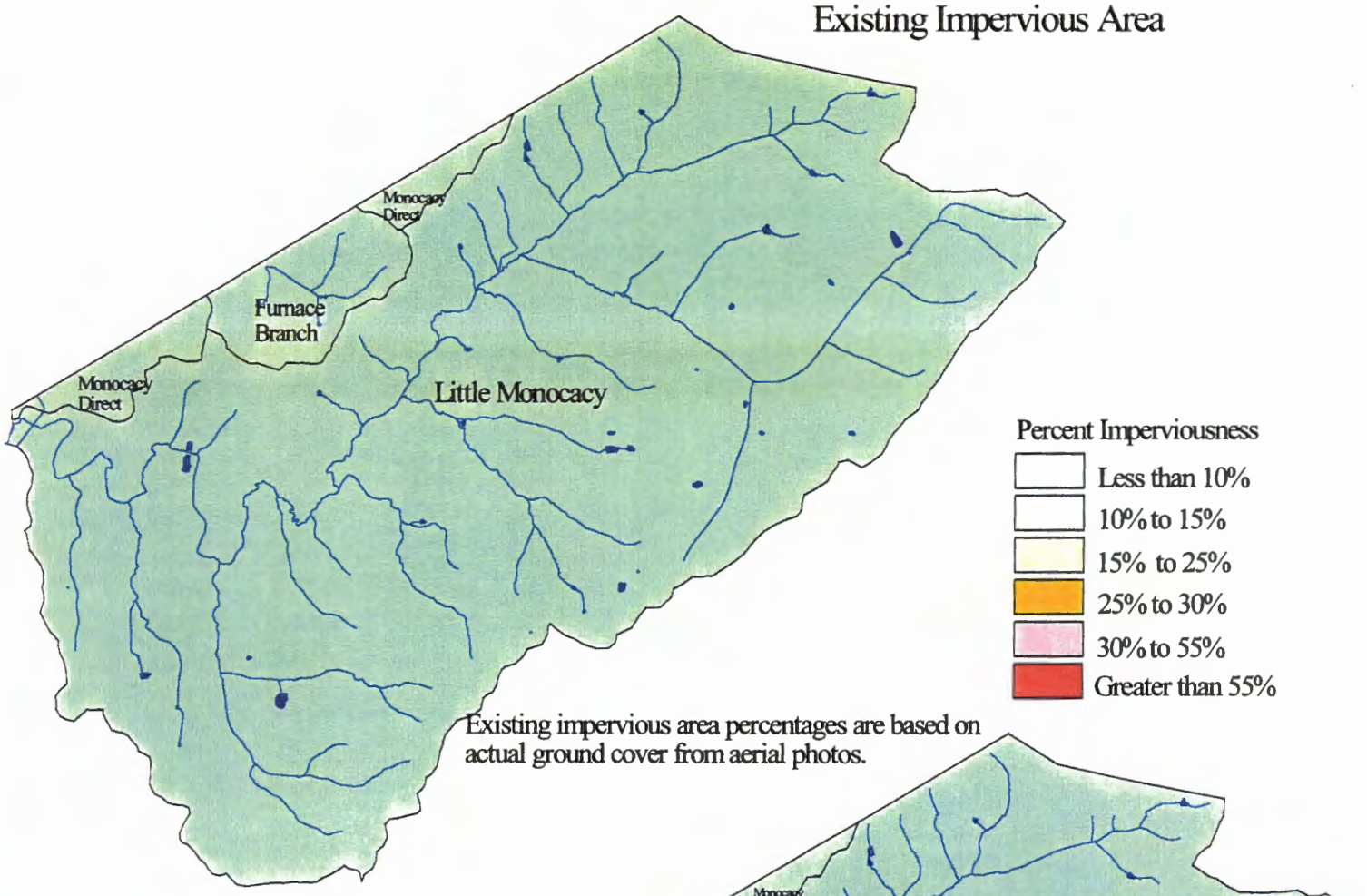
- Lawns/Open Land
- Woodlands
- Pasture
- Cropland
- Buildings
- Parking Lots
- Roads



Little Monocacy River and Monocacy Drainage Impervious Area Analysis

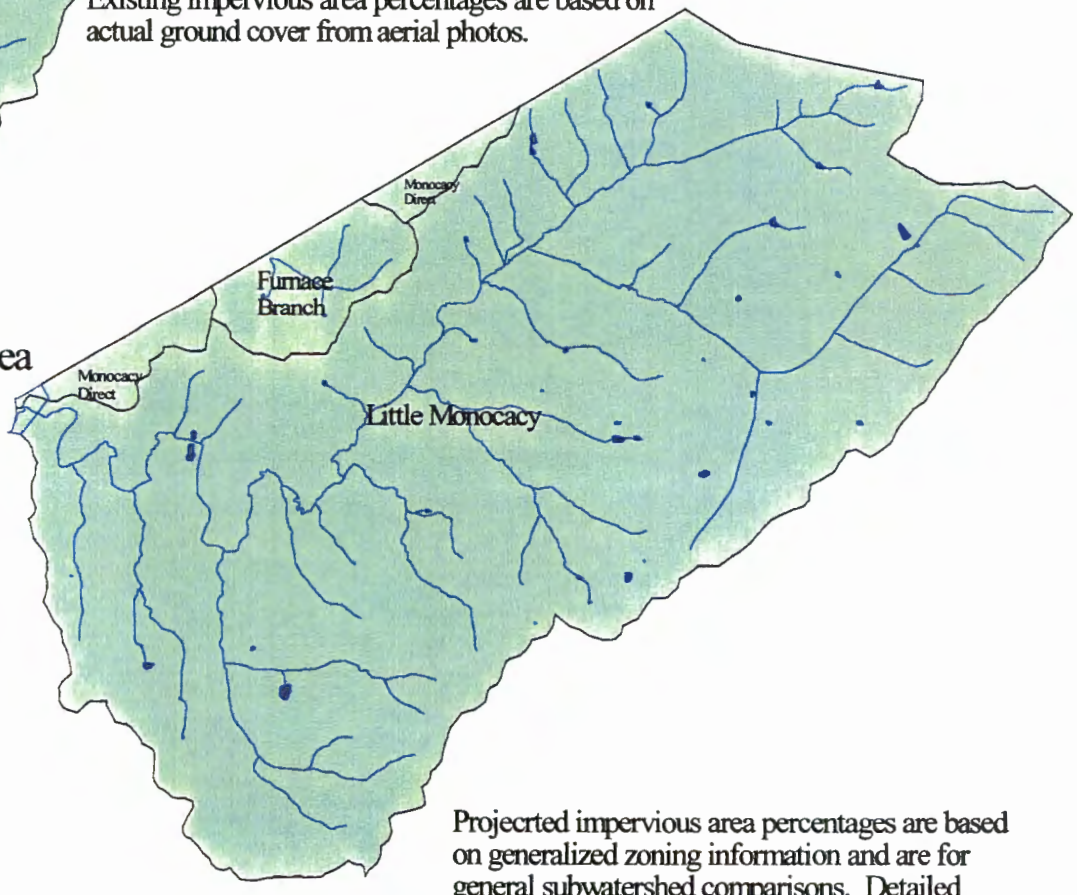
Map 2

Existing Impervious Area



Existing impervious area percentages are based on actual ground cover from aerial photos.

Projected Impervious Area

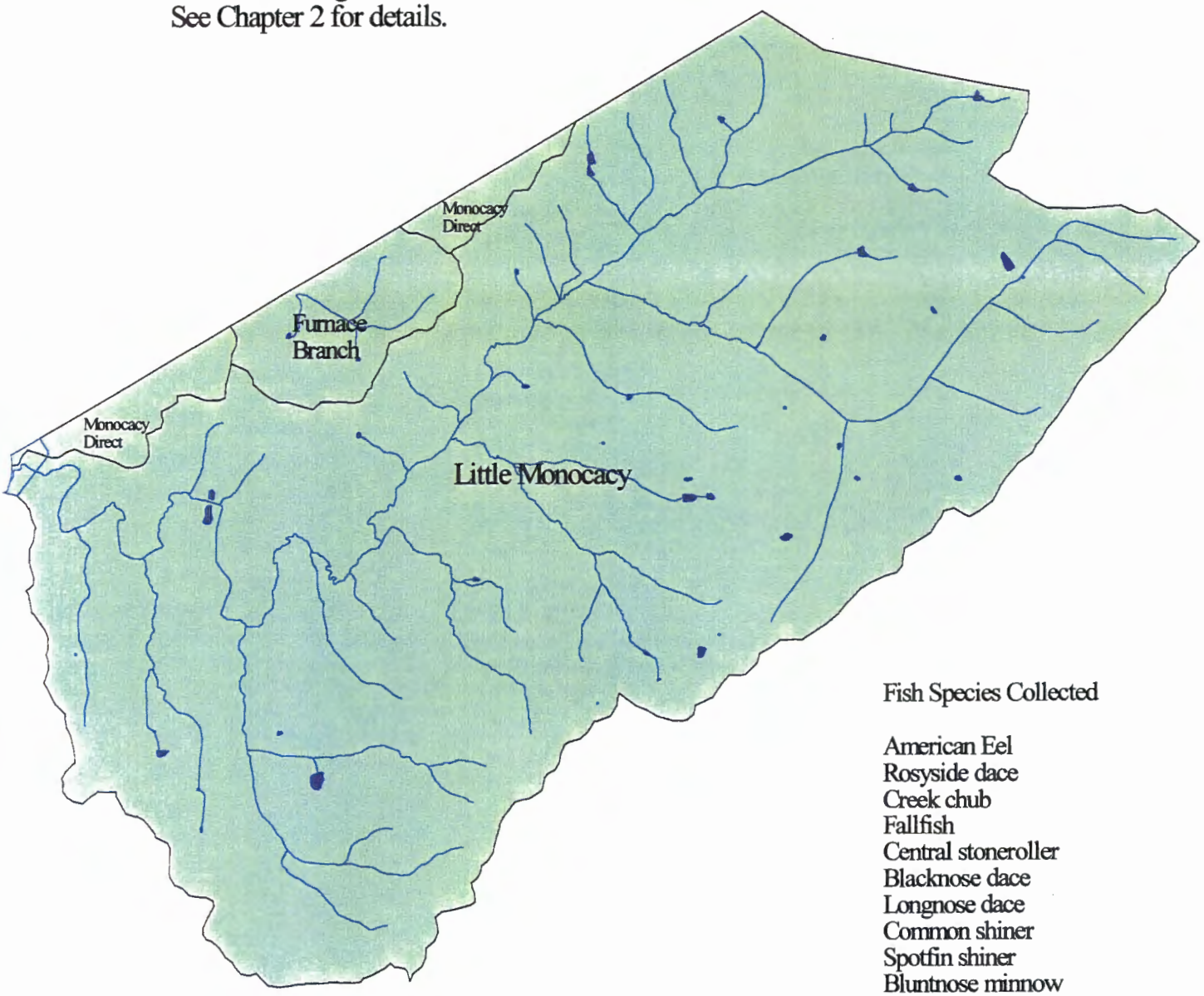


Projecrted impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Little Monocacy, Furnace Branch and Monocacy Drainage Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

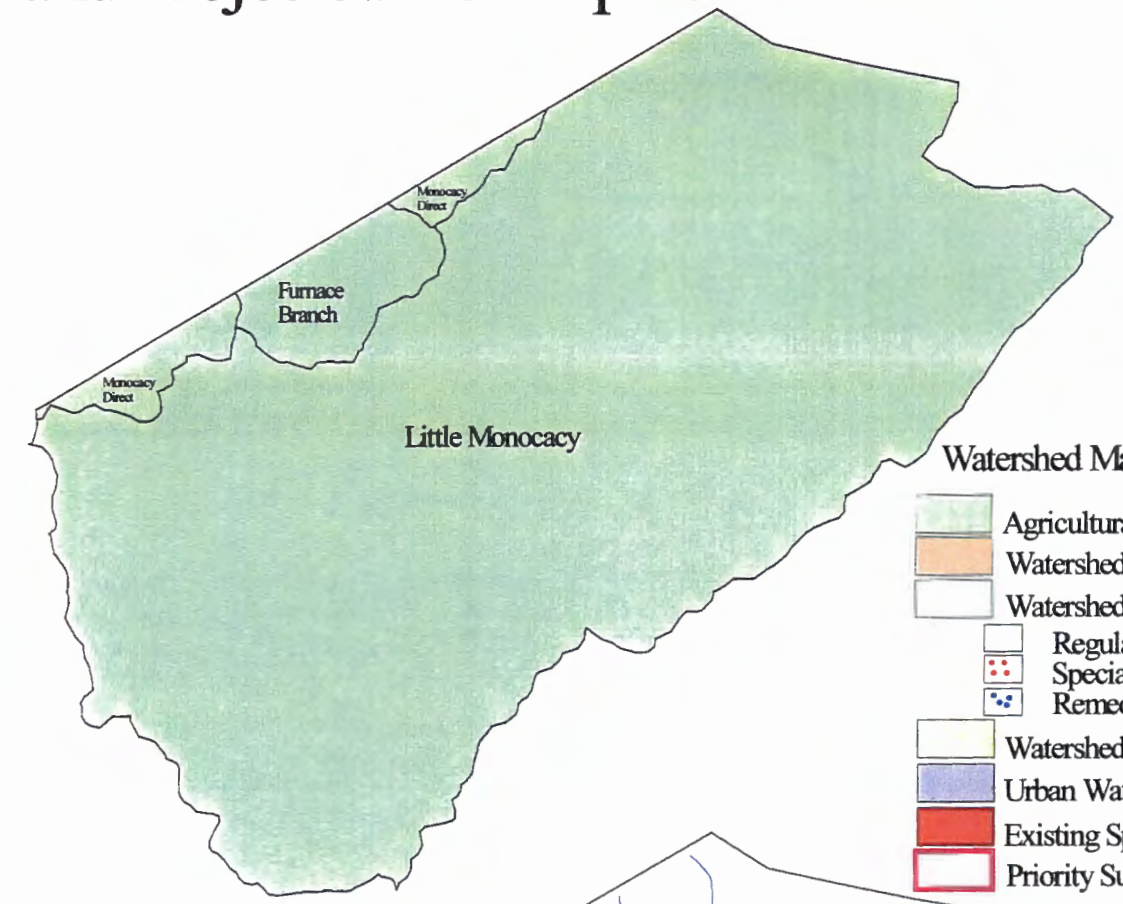
American Eel
Rosyside dace
Creek chub
Fallfish
Central stoneroller
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Bluntnose minnow
Silverjaw minnow
White sucker
Northern hogsucker
Mottled sculpin
Potomac sculpin
Rock bass
Green sunfish
Bluegill
Tessellated darter
Greenside darter
Fantail darter

Little Monocacy, Furnace Branch and Monocacy River Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
DEP baseline monitoring will occur in 2000. This assessment is based on a reconnaissance station.			
Little Monocacy River - GOOD (preliminary)	GOOD - (preliminary)	The fish community in this watershed is diverse. Overall biological community and habitat indicated good conditions	Agricultural Watershed Management Area
Furnace Branch - GOOD (preliminary)	GOOD - (preliminary)	High % of forest cover. Headwaters are in good to excellent condition.	Agricultural Watershed Management Area
Monocacy River tributaries	No current data		Agricultural Watershed Management Area

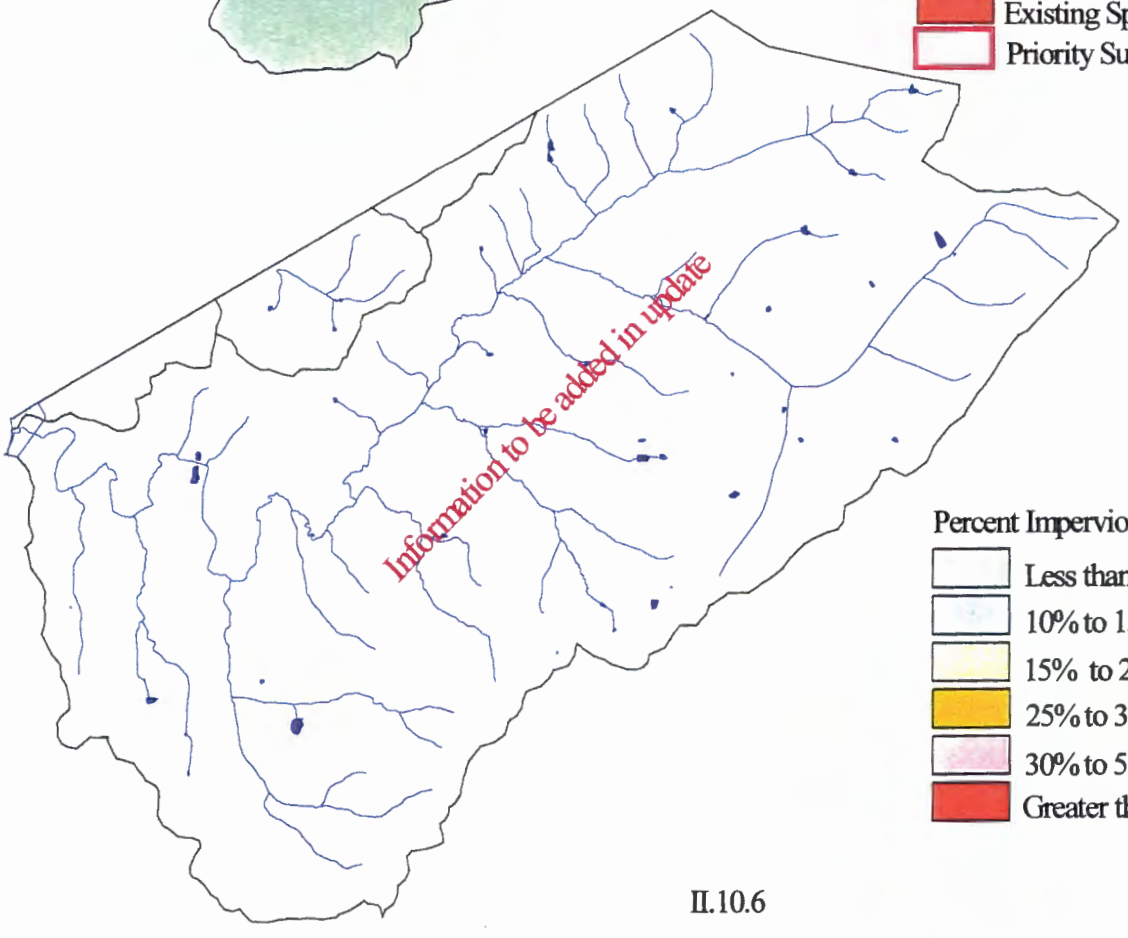
Little Monocacy, Furnace Branch and Monocacy Drainage Watershed Management Categories and Projected Development

Map 4



Watershed Management Categories

- Agricultural Watershed Management Area
- Watershed Preservation Area
- Watershed Protection Area
  - Regular Level
  - Special Level
  - Remedial Level
- Watershed Restoration Area
- Urban Watershed Management Area
- Existing Special Protection Area
- Priority Subwatershed



Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Little Monocacy, Furnace Branch and Monocacy River Watershed Management Categories

Management of these stream systems occurs almost exclusively through voluntary actions among agricultural and large lot land owners.

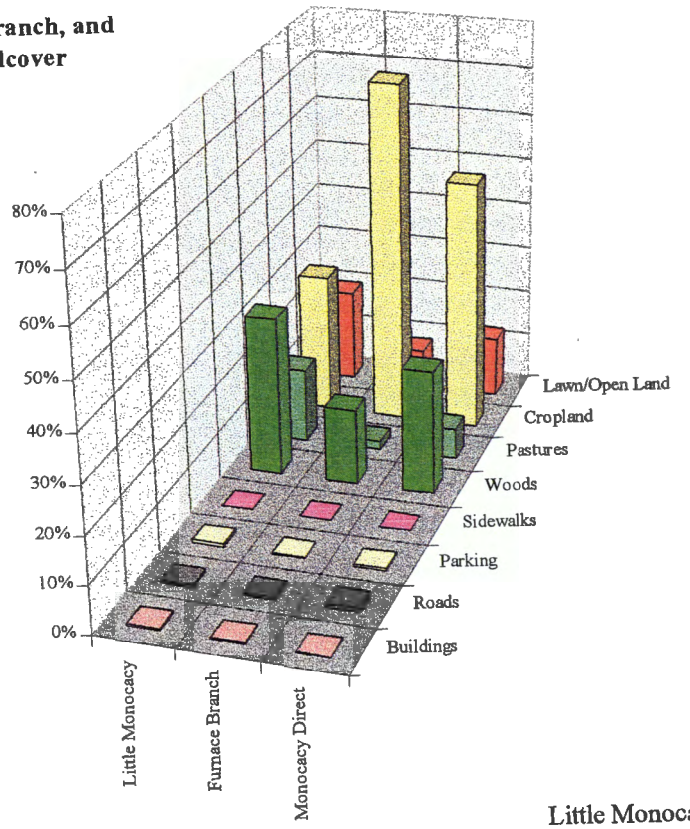
Agricultural Watershed Management Areas

These watersheds are all located in the agricultural preserve area of the County and are several of our most scenic agricultural watersheds.

Watershed Management Strategy

- Continue current practices.
- Use of agricultural BMPs and the application of environmental guidelines and regulations for limited areas that develop.
- Acquire additional information on the stream conditions in these areas through baseline monitoring in 2000.

Little Monocacy, Furnace Branch, and Monocacy River Direct Landcover by Type and Subwatershed



	Acres	Stream miles
Little Monocacy	11571.2	68.3
Furnace Branch	492.5	2.8
Monocacy Direct	339.6	0.9
Watershed totals	12403.3	72.0

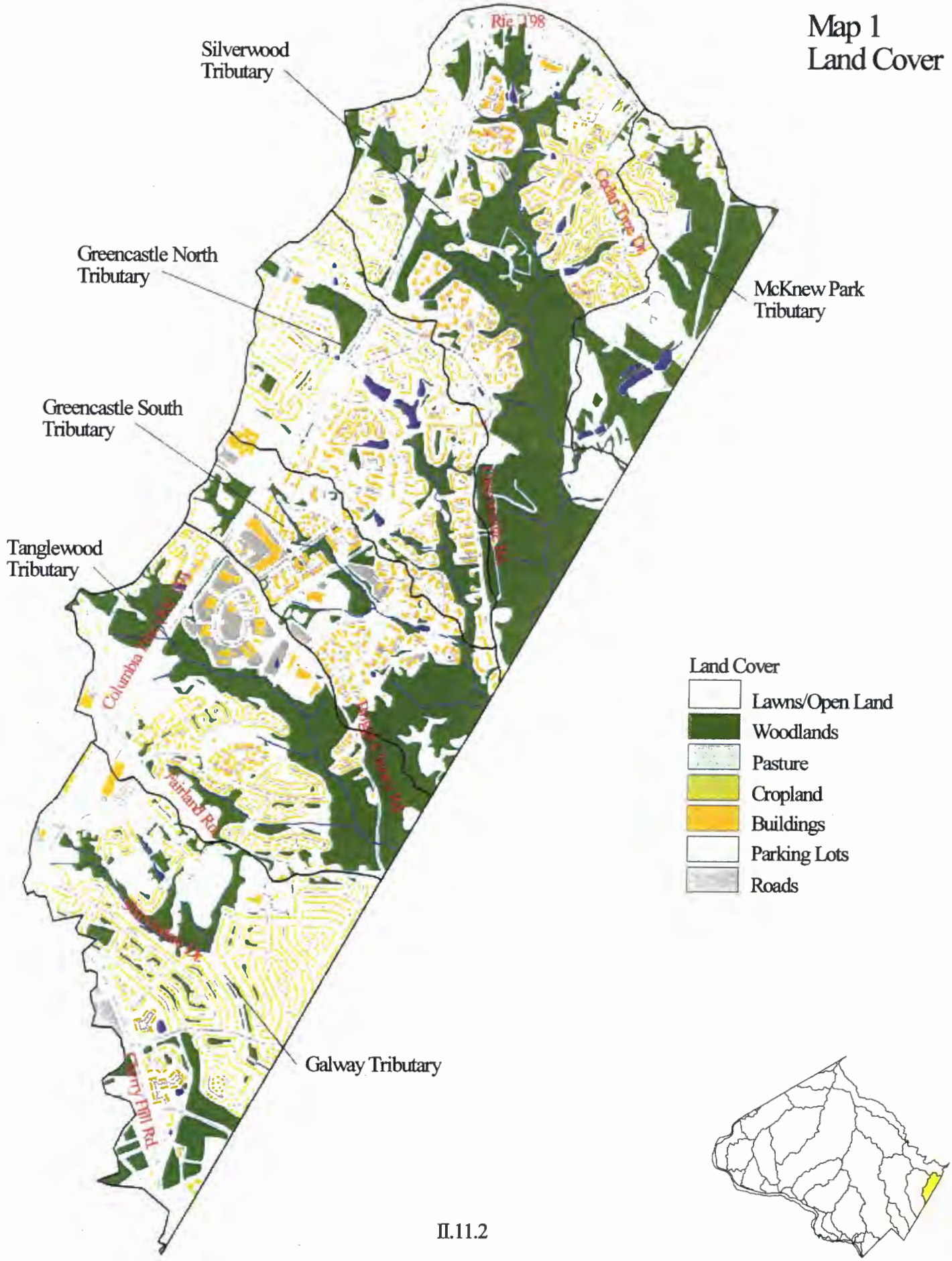
The Little Paint Branch Watershed

The Little Paint Branch watershed is located in the easternmost area of the County. It flows into Prince Georges County where it joins Paint Branch which then continues to the Anacostia River. The Little Paint Branch watershed has the unique characteristic of being a transition area between the Piedmont ecoregion and the Coastal Plain ecoregion, and it's biological community reflects this transition. Streams in the Piedmont generally are faster flowing on steeper gradients with a more rocky substrate. Coastal Plain streams generally are slower, more meandering, with a sandier substrate. Stream resource conditions range from poor in the lower tributaries of Little Paint Branch, fair in the middle reaches below Greencastle Rd., to good above Greencastle Rd.

The Little Paint Branch watershed is transected by the major transportation corridor of Route 29, one of the County's major suburban communities, providing many opportunities for jobs and housing, and containing many of the County's important industrial/commercial complexes. Much of this watershed has received regional stormwater controls to mitigate the effects of high density land uses, particularly above Briggs Chaney Rd. The lower reaches in Little Paint Branch were developed prior to requirements for stormwater control. The high densities and lack of available land on which to place remedial facilities will make it difficult to mitigate the degraded conditions in the lower tributaries.

Maintaining and improving conditions in the Little Paint Branch is an important component of the overall Anacostia restoration effort, particularly in the efforts to improve water quality from high-intensity land uses. The Maryland Department of Natural Resources (DNR), with an interagency work group, has coordinated the development of a report on the condition of the entire Little Paint Branch based on the current state of knowledge from many sources. The watershed contains high quality stream reaches in its northern tributaries within Montgomery County that are a high priority for protection to maintain a functioning stream system.

Little Paint Branch Watershed

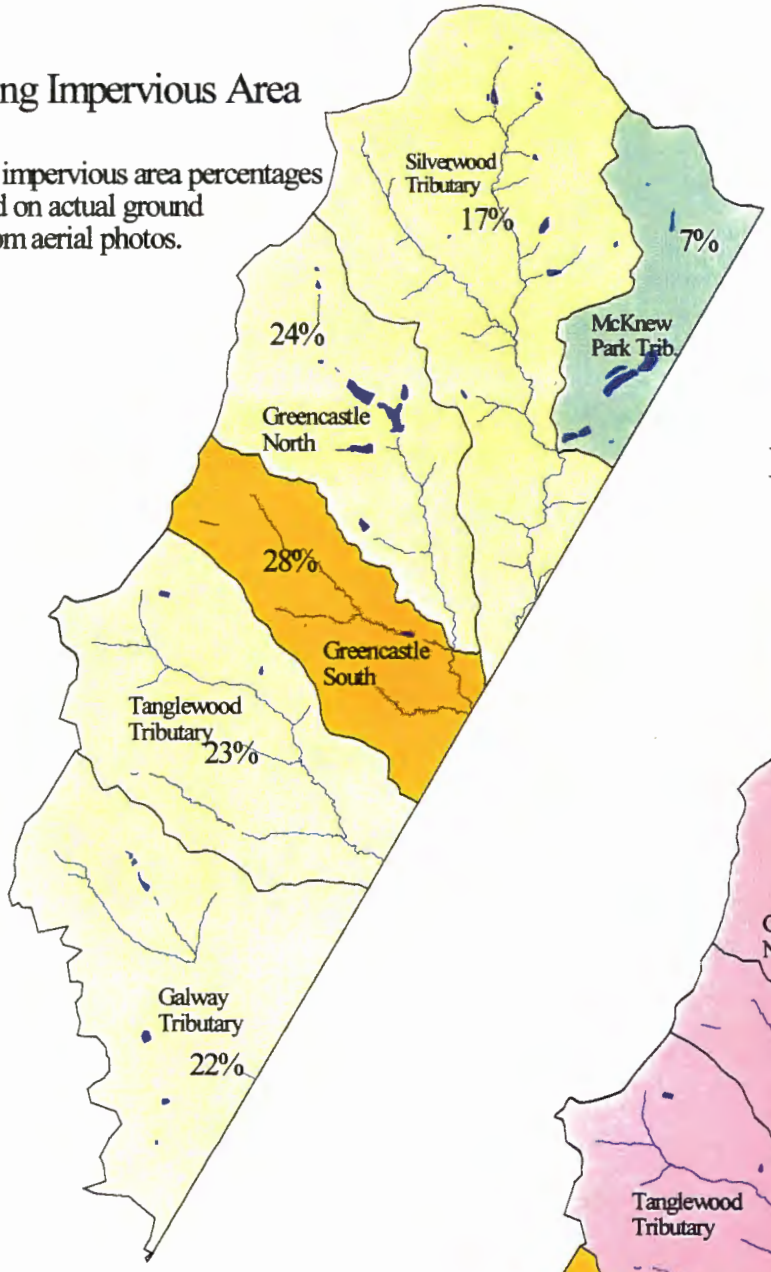


Little Paint Branch Impervious Area Analysis

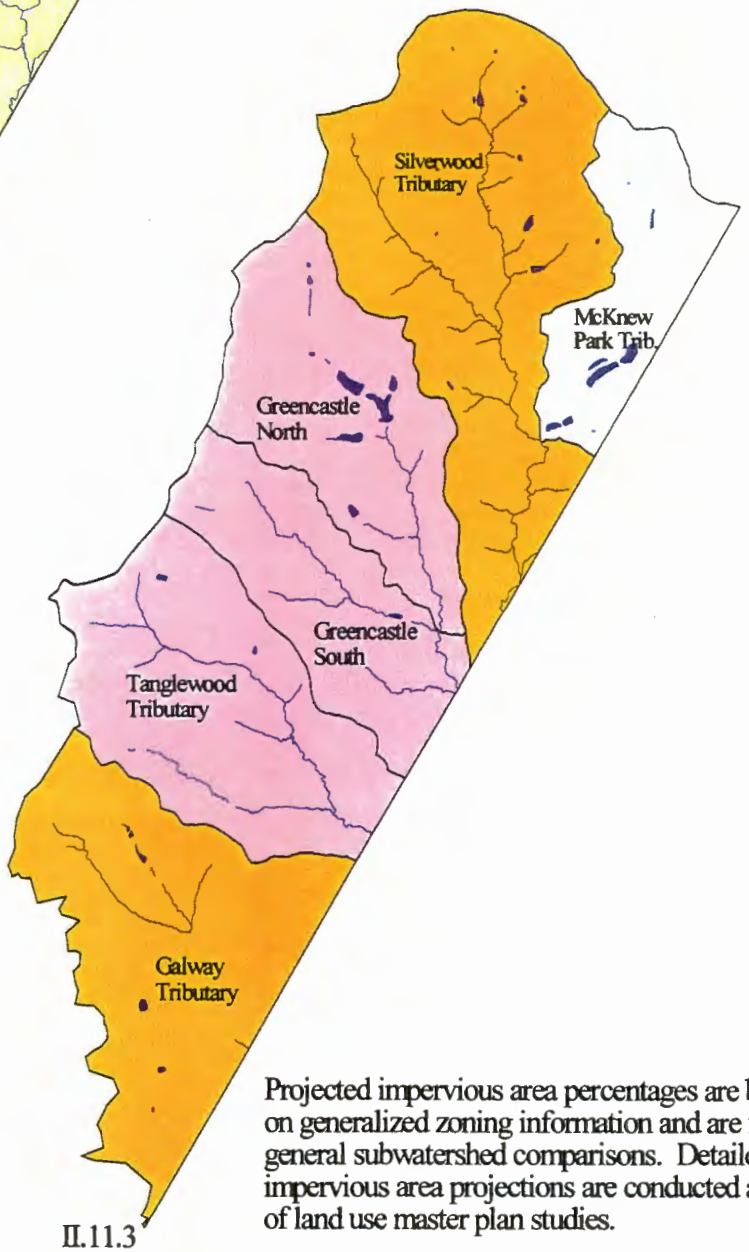
Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



Projected Impervious Area



Percent Imperviousness

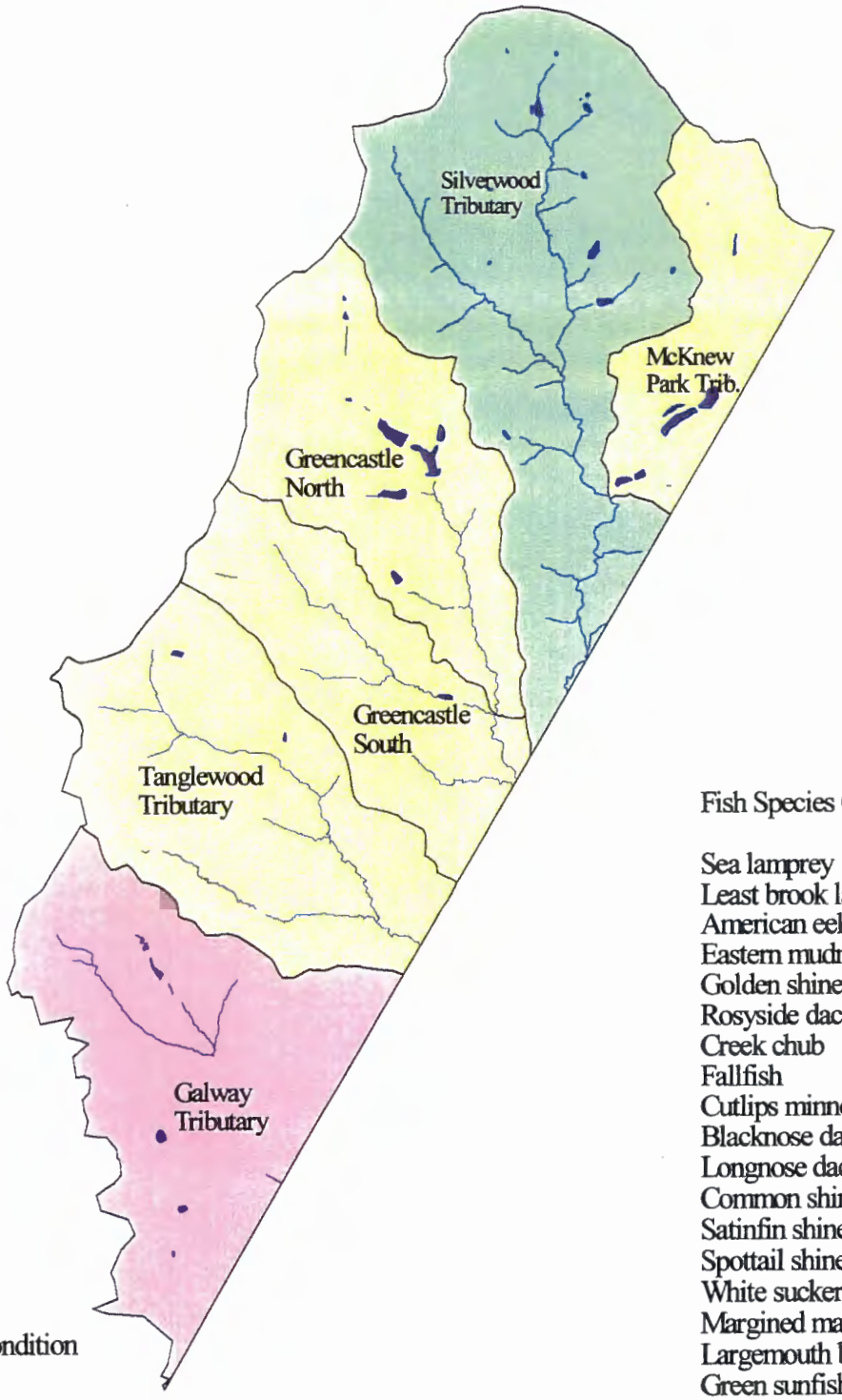
- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Little Paint Branch Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

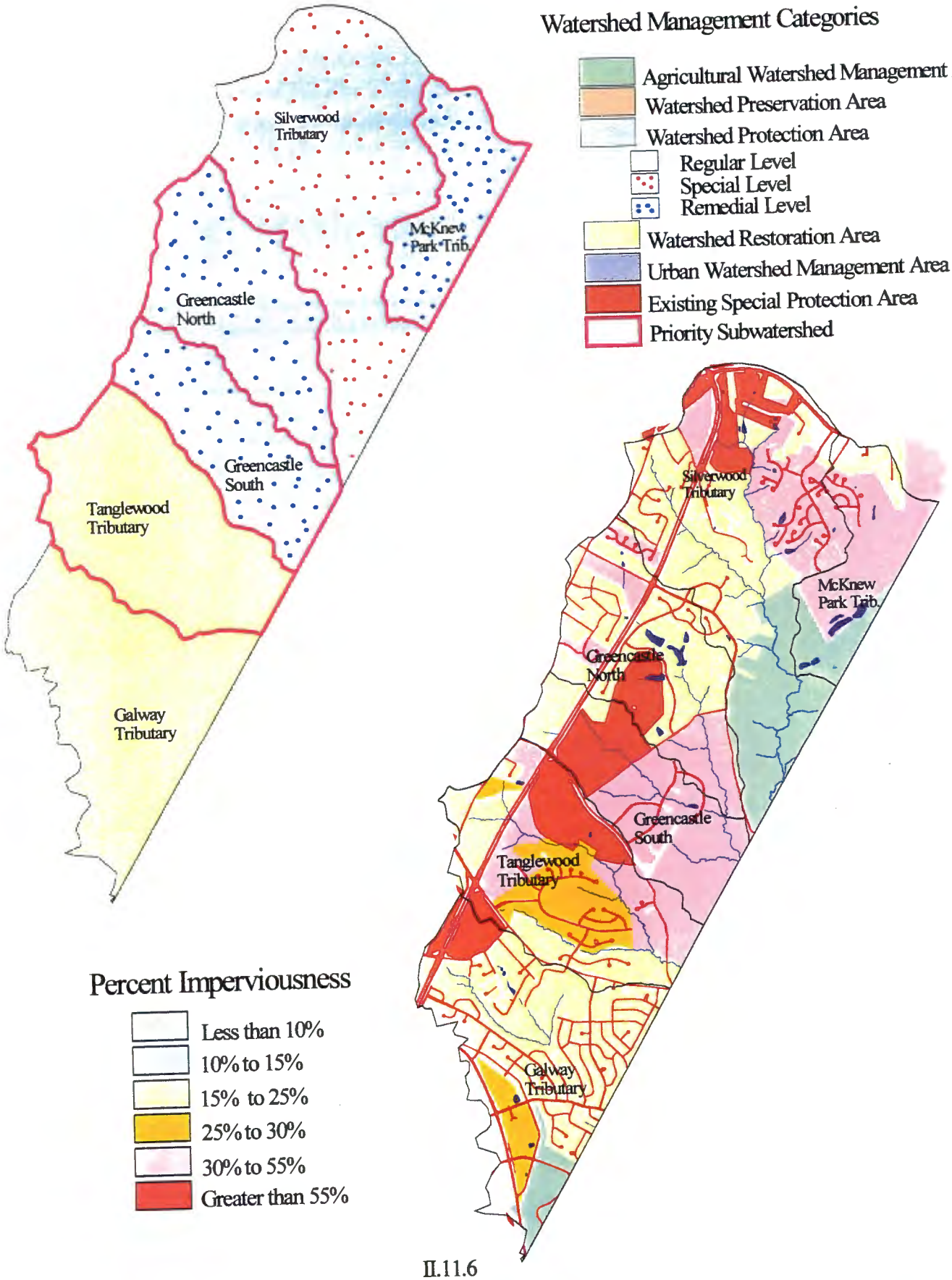
Sea lamprey
Least brook lamprey
American eel
Eastern mudminnow
Golden shiner
Rosyside dace
Creek chub
Fallfish
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Satinfin shiner
Spottail shiner
White sucker
Margined madtom
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Tessellated darter

Little Paint Branch Stream Condition, Habitat Conditions, and Watershed Management Category Designation

Subwatershed / Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
Silverwood Trib. - GOOD	GOOD overall some areas exhibit higher habitat condition	The forested stream valley buffer and presence of numerous springs and seeps in this area help maintain good conditions.	Despite high levels of development this area supports a cool-water fish community Watershed Protection Area - special level
McKnew Park Trib. -FAIR (preliminary)	GOOD (preliminary)	Coastal plain conditions occur above the quarries.	Watershed Protection Area - remedial
Greencastle Trib. North and South- FAIR	GOOD	High density development and imperviousness influence conditions. Unstable banks and sediment deposition common.	Watershed Protection Area - remedial
Tanglewood Trib. - FAIR	GOOD	High density development and imperviousness influence conditions. Unstable banks and sediment deposition common.	Watershed Restoration Area
Galway Trib. - POOR	FAIR	This area developed prior to stormwater management requirements and many stream reaches have been piped or channelized.	Watershed Restoration Area

Little Paint Branch Watershed Management Categories and Projected Development

Map 4



Little Paint Branch Watershed Management Categories

Many of the subwatersheds in Little Paint Branch have transferrable development right (TDR) receiving areas, an important implementation tool in the County's agricultural preservation program. Higher density uses in these areas allow the County to transfer development rights from land in the Agricultural Reserve and locate housing and jobs in parts of the County that have or are planned for more intensive infrastructure improvements.

Watershed Protection Areas - Special level of protection

The subwatersheds located in the top of the watershed, including Silverwood, have developed more recently than the lower reaches, and stormwater controls have been more widely used in these areas. Imperviousness is expected to increase considerably in the Silverwood tributary and special protection tools are recommended for this area to ensure that the stream quality, which contains areas of high quality habitat, is protected.

Watershed Management Strategy

- Increase educational efforts to inform residents and developers of the sensitive stream resource.

Watershed Protection Areas - Remedial level of protection

Also found in the upper tributaries are areas that are exhibiting problems from older development and previous land uses. In the McKnew Park Tributary and Greencastle Tributary, remedial measures to address specific problem areas can help to ensure that conditions do not worsen. In the Greencastle Tributary, large areas of the subwatershed are treated by regional stormwater facilities and opportunities to improve runoff controls are limited.

Watershed Management Strategy

- Utilize regular protection tools and increased public education, along with efforts to repair damage to stream channels.
- Continue efforts as part of the overall Anacostia Watershed Restoration Project to identify and implement stream restoration and habitat improvement projects.

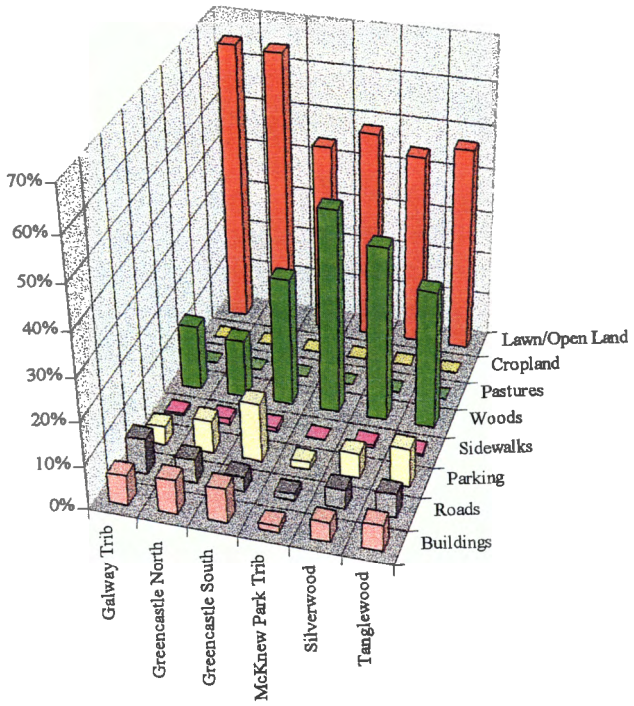
Watershed Restoration Areas

The subwatersheds in the lower part of the watershed, Tanglewood and Galway Tributaries, have undergone more development than the upper tributaries, and varying levels of impairment are seen in these areas, particularly around concentrated areas of development, such as the Briggs Chaney Rd. area. In the Tanglewood area, regional stormwater controls have been installed to help protect downstream reaches. In all of these areas, watershed restoration approaches including stream restoration to address erosion and stream bank instability are recommended, and are underway in several areas.

Watershed Management Strategy

- Continue efforts as part of the overall Anacostia Watershed Restoration Project to identify and implement stream restoration and habitat improvement projects.

Little Paint Landcover
by Type and Subwatershed



	Acres	Stream Miles
Galway Trib	688.6	1.4
Greencastle North	503.7	1.5
Greencastle South	399.1	2.2
McKnew Park Trib	296.1	0.1
Silverwood	977.6	6.1
Tanglewood	631.2	3.3
Watershed totals	3496.4	14.6

The Little Seneca Creek Watershed

The Little Seneca Creek watershed is a large sub-basin of the Great Seneca watershed and drains a significant portion of the western part of the County. The stream system originates slightly south of Damascus and drains areas of Clarksburg, Germantown, and Boyds before flowing into Great Seneca Creek just above Route 28 at Dawsonville. Little Seneca Lake, located near Boyds, is a large regional impoundment that serves as an emergency water supply source. This lake is the focal point of the Black Hill Regional Park and is known regionally as a prime location to view wintering waterfowl. The lake has been stocked with tiger muskie, largemouth bass, bluegill and channel catfish. Little Seneca Creek upstream of the lake is designated recreational trout waters by the state (Use IV-P) due to temperature and dissolved oxygen standards which make it suitable for an adult trout "put-and-take" population. Downstream of the Little Seneca Lake dam, coldwater discharges from the deeper part of the lake water column enable a natural trout waters designation (Use III-P) to the confluence with Bucklodge Branch. Rainbow and brown trout are found in this section, as well as a diverse cold-water community. Beaver have impounded large areas of Little Seneca below the lake and massive beaver dams can be found 5 to 6 feet high.

Portions of Upper Little Seneca Creek and Ten Mile Creek have been shaped by geological forces unique to this part of the County. A fracture fault line runs through these and the adjacent Little Bennett watersheds. These fault lines have influenced the channel morphology dramatically. The Ten Mile Creek watershed has an incredibly diverse and sensitive benthic macroinvertebrate community. Many different stoneflies and mayflies can be found in this high quality stream. During warm winter days in late February, winter stoneflies emerge in large numbers and can be seen flying against the snow.

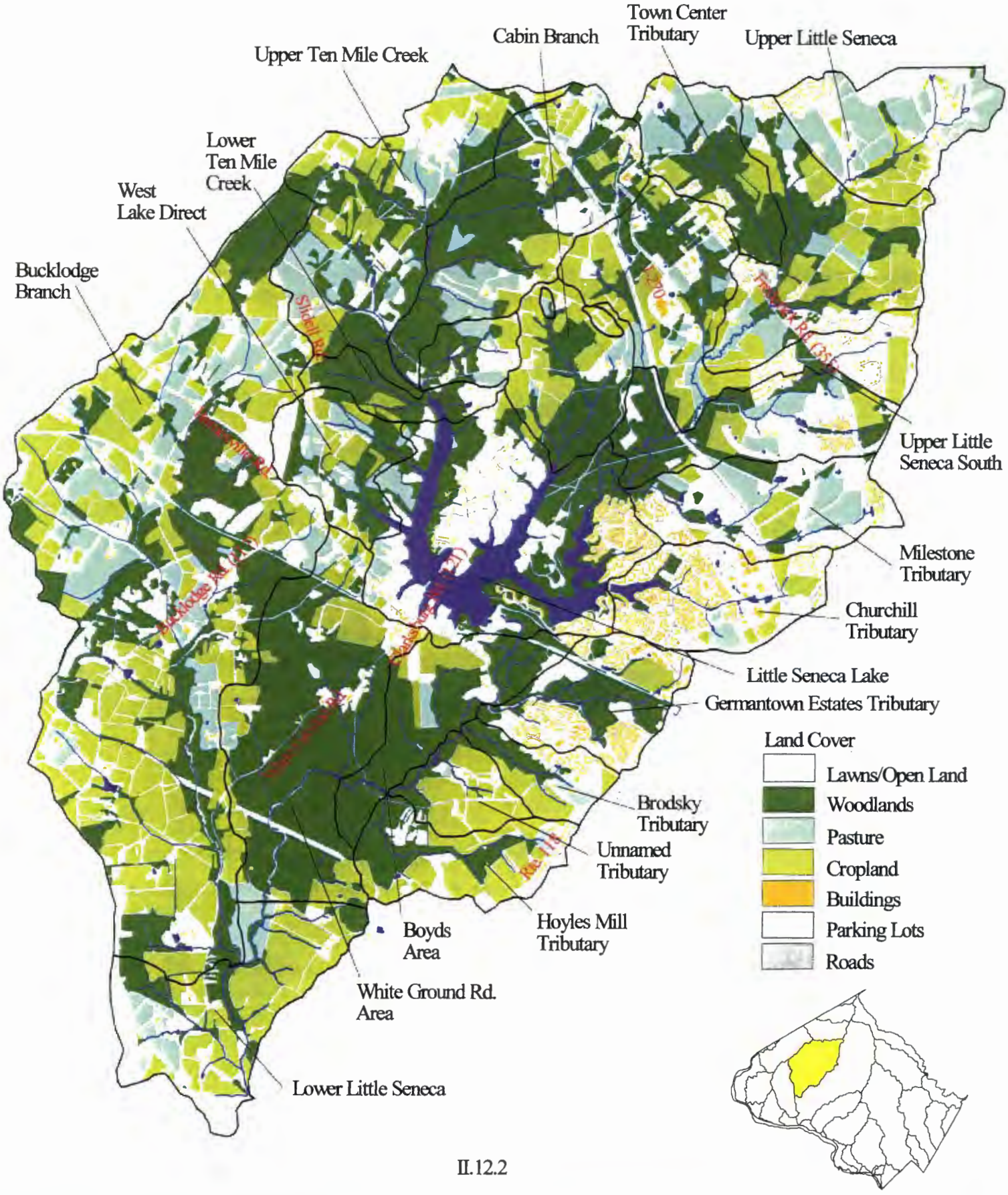
The Little Seneca watershed has a very mixed character of land uses, including rural areas around Boyds and the west side of Clarksburg, and higher density land uses in Germantown proper. Located along I-270, both Clarksburg and Germantown are "corridor communities" in the County's General Plan, and contain existing and planned development in support of the County's housing and job needs. Southwest of Germantown, land uses in the watershed are typical of the agricultural reserve, with a mixture of farms and large-lot residential areas, interspersed with commercial uses at several cross-roads.

Extensive planning efforts have occurred as part of the Germantown Master Plan and Clarksburg Master Plan to protect stream quality in Little Seneca Creek. These efforts include density limitations, stream valley park acquisition and dedication, reforestation, and designation of a part of Clarksburg as a Special Protection Area (SPA). SPA regulatory requirements include enhanced plan review, stream monitoring, and BMP performance monitoring for new development.

Over time, the character of the watershed will change considerably, as the corridor cities develop. The upper sections of the watershed are still in good condition and should benefit greatly from the planning efforts that have occurred to protect water quality. Efforts taken now to address existing channel erosion and instability in the downstream reaches will be valuable in protecting the overall stream system from smaller cumulative impacts as the headwaters develop. This is particularly important for the tributaries in the Germantown area that discharge downstream of the lake. These tributaries have a much more direct effect on the portion of Little Seneca now designated as natural trout waters (Use III-P).

Little Seneca Creek Watershed

Map 1
Land Cover



Little Seneca Creek Impervious Area Analysis

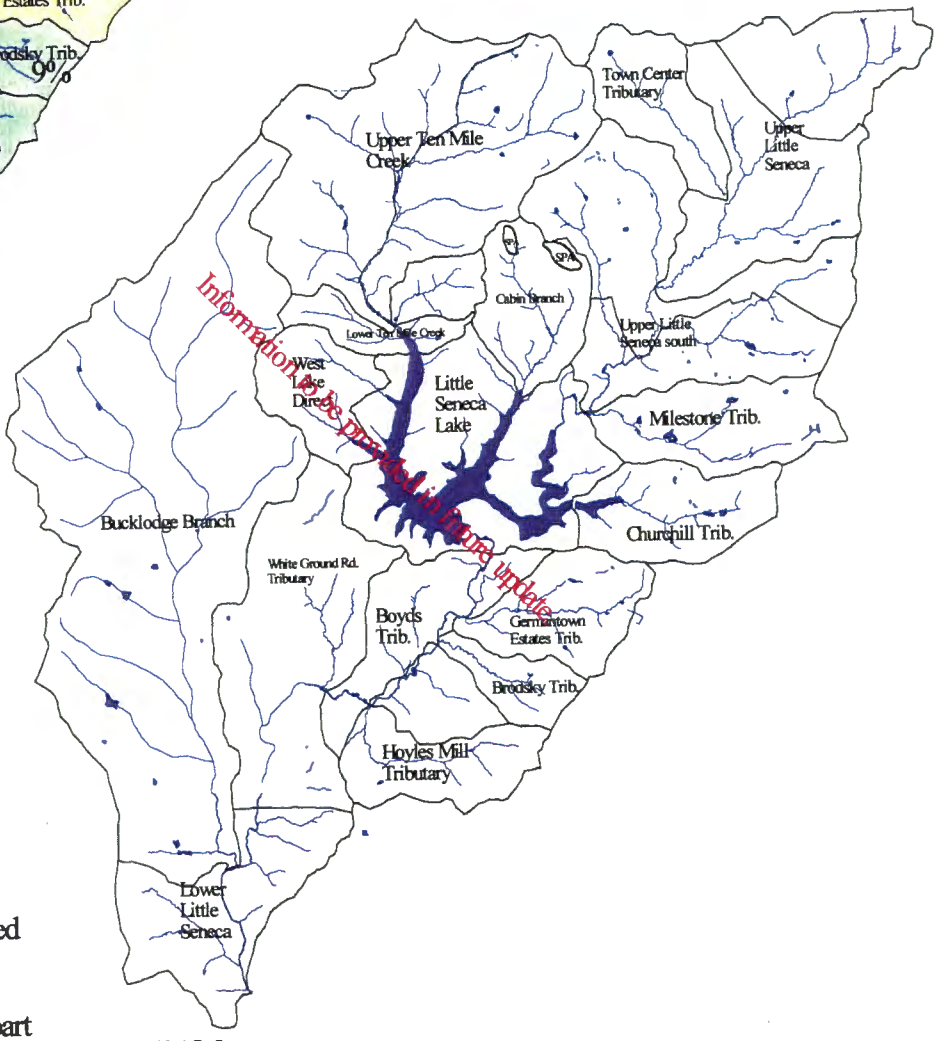
Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.

Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%



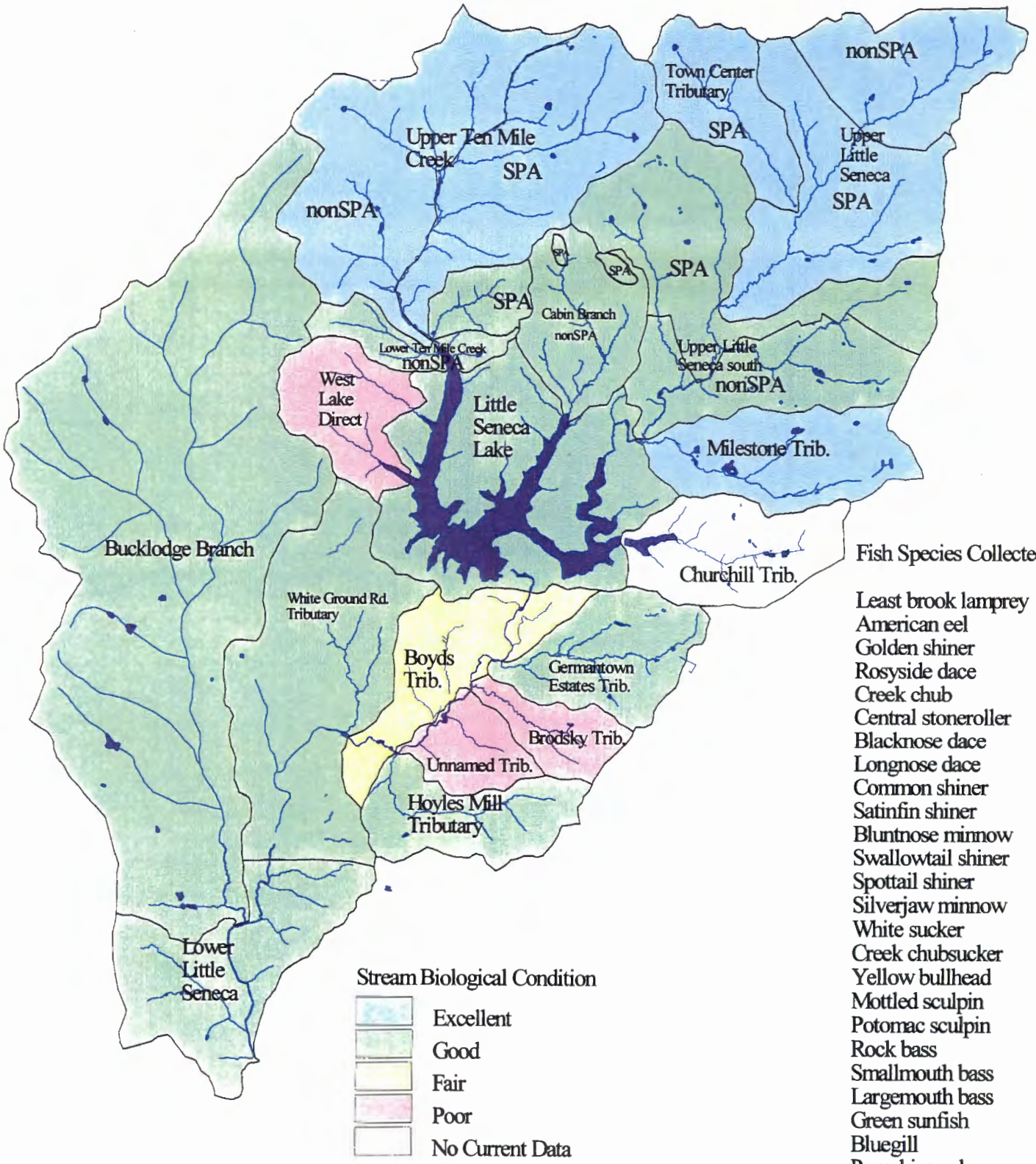
Projected Impervious Area

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Little Seneca Creek Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3



Fish Species Collected

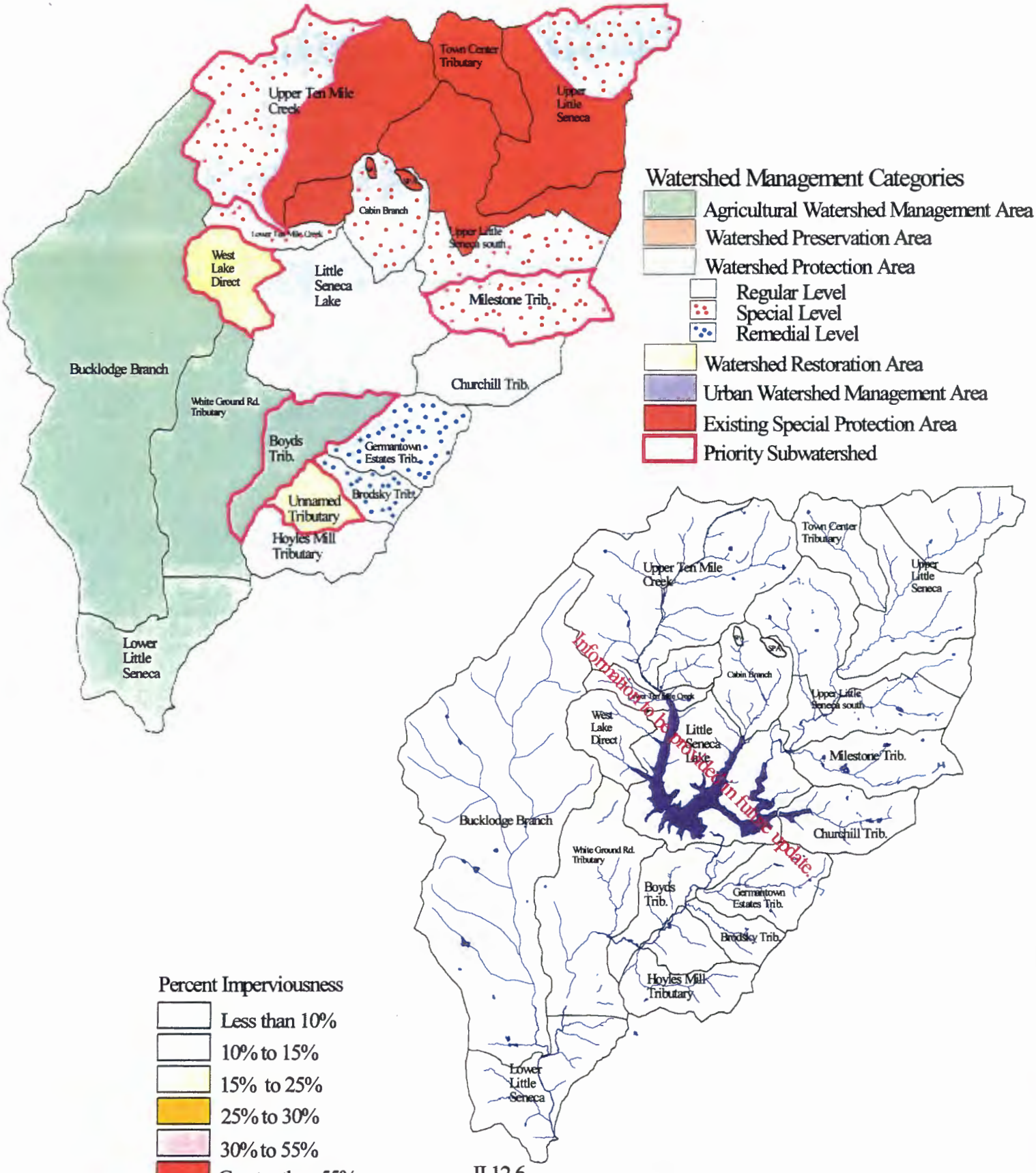
Least brook lamprey
American eel
Golden shiner
Rosyside dace
Creek chub
Central stoneroller
Blacknose dace
Longnose dace
Common shiner
Satinfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
Silverjaw minnow
White sucker
Creek chubsucker
Yellow bullhead
Mottled sculpin
Potomac sculpin
Rock bass
Smallmouth bass
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter
Greenside darter
Fantail darter

Little Seneca Creek Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
Upper Little Seneca nonSPA - EXCELT	EXCELLENT	Forested areas are prevalent and headwaters are currently protected in Ovid Hazen Wells Park.	Area contains many springsand seeps. Watershed Protection Area - special
Upper Little Seneca SPA EXCELLT.	EXCELLENT	Headwaters portion of Little Seneca downstream of Ovid Hazen Wells Park.	Existing Regulatory Special Protection Area
Upper Little Seneca South - GOOD	GOOD		Existing Regulatory Special Protection Area (part)/Watershed Protection Area - special (part)
Town Center Trib. - EXCELLENT	GOOD	Years of agricultural use have added fine sediment to the stream.	Existing Regulatory Special Protection Area
L. Seneca - White Ground - GOOD	GOOD	Stream bank condition and riparian zone changes from excellent in the upper reaches to good as the stream passes through agricultural areas in this section.	Agricultural Watershed Management Area
Cabin Branch - GOOD	GOOD	Upper reaches are in open agricultural fields - some forested stream buffers.	Water temps observed to be in UseIII range 1994. Watershed Protection Area - special
Upper Ten Mile Creek - EXCELLENT	EXCELLENT to GOOD downstream	Upper reaches are heavily forested with numerous springs and seeps.	Fracture/fault geology influenced stream morphology. Existing Regulatory Special Protection Area (part)/Watershed Protection Area - special (part)
Lower Ten Mile Creek - GOOD	GOOD	Backwater from the lake has caused sediment deposition/bank slumping.	Watershed Protection Area - regular
West Seneca Lake - POOR	FAIR	Poor bank stability and high levels of sediment deposition. The rural density transfer zoning in this area will limit future increases in impervious area.	Watershed Restoration Area
Milestone Trib. - EXCELLENT (Preliminary)	EXCELLENT (Preliminary)	Land use in this area includes the Milestone Development Area with significant areas of high density commercial and residential areas.	A unique wetland of special state concern - the Germantown Bog (which is actually a fen) - is located in this area. This type of wetland community is typically found further west in the state associated with the Allegheny Plateau. Significant efforts have been made to protect the area from impacts of master-planned land uses. Watershed Protection Area - special
Churchill Trib.	no current data	Land use in this area includes the Germantown Town Center with significant areas of high density commercial and residential areas.	Watershed Protection Area - regular
Germantown Estates Trib. - GOOD (prelim.)	FAIR (preliminary)		Watershed Protection Area - remedial
Brodsky Trib. - POOR (prelim.)	GOOD (preliminary)		Watershed Protection Area - remedial
Boyds Tribs. - FAIR (preliminary)	FAIR (preliminary)	Channel exhibiting signs of accelerated downcutting with limited access to floodplain, resulting in entrenchment and channel erosion.	Agricultural Watershed Management Area
Unnamed Trib. - POOR (prelim.)	POOR (preliminary)	Unpermitted landfill in operation during early '90s.	Watershed Restoration Area
Hoyles Mill Trib. - GOOD	GOOD	Sediment problem in pools in upper reaches. Lower stream reach is forested wetland.	Agricultural Watershed Management Area
Bucklodge Branch - GOOD	GOOD	Some sediment deposition and embeddedness problems occurring.	Reference site for Md. DNR Agricultural Watershed Management Area
Lower Little Seneca - GOOD (prelim.)			Agricultural Watershed Management Area

Little Seneca Creek Watershed Management Categories and Projected Development Levels

Map 4



Little Seneca Creek Watershed Management Categories

Until fairly recently, much of this watershed consisted of rolling farmland. Changes from agricultural to suburban land use bring inevitable increases in impervious area. However, due to the planning efforts undertaken and improvements in environmental regulations and guidelines, these changes in Little Seneca will be accompanied by stormwater management, stream buffers and reforestation of riparian areas. Unlike many older areas of the County which developed without stormwater management, this should mitigate development impacts substantially. Existing problem areas showing instability from past land use and clearing activities need to be addressed to help avoid stream degradation as changes in hydrology occur in response to increased watershed development.

Watershed Protection Areas

Special level of protection - **Existing Regulatory Special Protection Area**

The County Council designated portions of Upper Little Seneca within the Clarksburg Planning Area as a Special Protection Area (SPA) in recognition of the special level of protection that would be needed to protect stream resources in the vicinity of the Town Center. Areas east of I-270 and portions of Ten Mile Creek west of I-270 were included in the SPA designation. Ten-Mile Creek is an example of a sensitive area needing special protection where two different management approaches were combined to achieve the end result. SPA designation protects the drainage where high density land uses were located along I-270, and low density land use zoning was employed on the western side of Ten-Mile Creek.

Watershed Management Strategy

- Application of Special Protection Area regulations for stream protection (Chapter 19, Art.V)

Special level of protection

This category includes the areas above Seneca Lake outside the designated SPA, and the Milestone Tributary. The Milestone tributary is identified as needing special levels of protection, which has been provided through various efforts in the Germantown Master Plan and modeling, monitoring, and unique stormwater management controls designed to help ensure that the fragile Germantown bog area is not detrimentally impacted by proposed development.

Watershed Management Strategy

- Continue efforts through implementation of master plan recommendations and development review procedures to protect this sensitive area.
- Provide targeted public education for residents, businesses and developers about the subwatershed resources and stewardship opportunities.

Remedial level of protection

The Germantown Estates tributary and Brodsky tributary are recommended for remedial management efforts to address existing problems in these stream reaches.

Watershed Management Strategy

- Continue monitoring efforts through development review requirements and DEP baseline monitoring program to assess subwatershed conditions and effects of new environmental protection features such as stream buffers and state of the art stormwater controls.

Regular level of protection

The Churchill tributary is placed in this management category until further monitoring data is available to identify stream condition and refine a management approach.

Little Seneca Creek Watershed Management Categories (cont'd)

Watershed Management Strategy

- Further study stream condition and land use relationships to refine management approach.
- Continue application of environmental guidelines and regulations and other regular protection tools.

Agricultural Watershed Management Areas

South of Boyds, land uses remain predominately agricultural in character, however, several areas of large-lot residential uses are cropping up. Efforts to improve riparian buffers, particularly in the area below Route 117 are particularly needed, as well as measures to address entrenched channel conditions. Efforts have shown that allowing a forested buffer to develop adjacent to streams is very effective in lessening the severity of channel erosion and instability problems on cultivated areas.

Watershed Management Strategy

- Promote voluntary implementation of best management practices, particularly establishment of forested riparian buffers.
- Public education and outreach to landowners to increase awareness of the importance of stream valley buffers, which are a key feature of environmental protection in these areas developing with larger lot sizes.

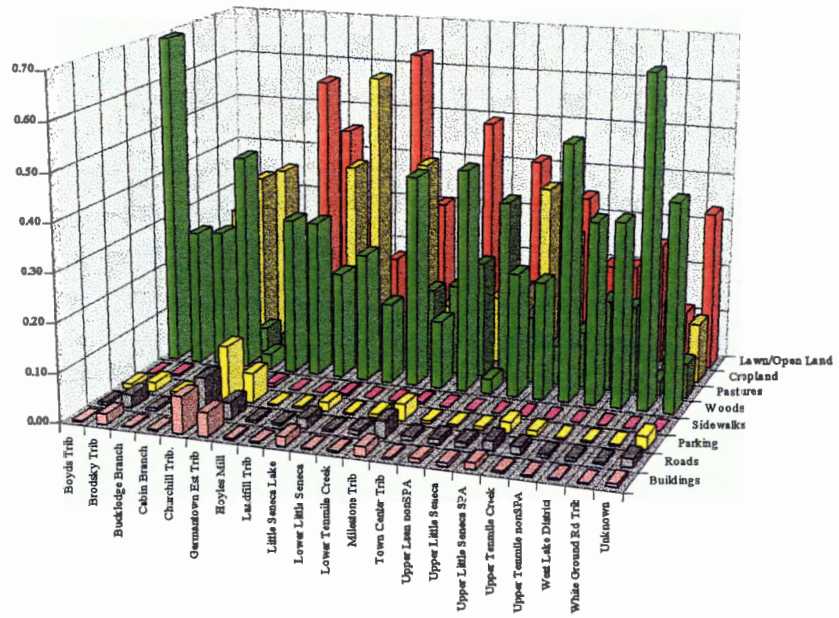
Watershed Restoration Areas

Two areas have been identified as needing restoration to address serious problems which have led to poor stream conditions: West Seneca Lake tributary and Unnamed tributary.

Watershed Management Strategy

- Pursue cooperative partnerships with individual land owners and the County to provide improvements in these areas, as well as pollution prevention education and efforts.

Little Seneca Landcover by Type and Subwatershed



	Acres	Stream miles
Boyds Trib	744.9	4.1
Brodsky Trib	326.7	2.0
Bucklodge Branch	5846.0	21.7
Cabin Branch	663.5	4.2
Churchill Trib.	776.9	2.5
Germantown Est Trib	723.8	4.2
Hoyles Mill	642.6	2.9
Landfill Trib	351.0	2.0
Little Seneca Lake	2079.9	3.9
Lower Little Seneca	1163.7	6.3
Lower Tenmile Creek	246.6	1.8
Milestone Trib	864.0	3.4
Town Center Trib	632.7	2.3
Upper Lsen nonSPA	834.0	2.8
Upper Little Seneca	1259.0	5.5
Upper Little Seneca SPA	1369.3	4.9
Upper Tenmile Creek	1385.2	9.5
Upper Tenmile nonSPA	1569.4	6.2
West Lake District	579.2	2.3
White Ground Rd Trib	1846.8	5.3
Unknown	1240.3	7.7
Watershed totals	25145.3	105.4

The Muddy Branch Watershed

Muddy Branch originates in the City of Gaithersburg and, like many of the tributaries of the mid-Potomac basin in Montgomery County, has been influenced by development which occurred early in the County's history along major transportation corridors such as Route 355 and the railroad. Developed areas with the highest levels of imperviousness are located in the headwaters of the watershed, and development densities decrease steadily in a downstream direction. Not surprisingly, stream conditions improve in a downstream direction as well.

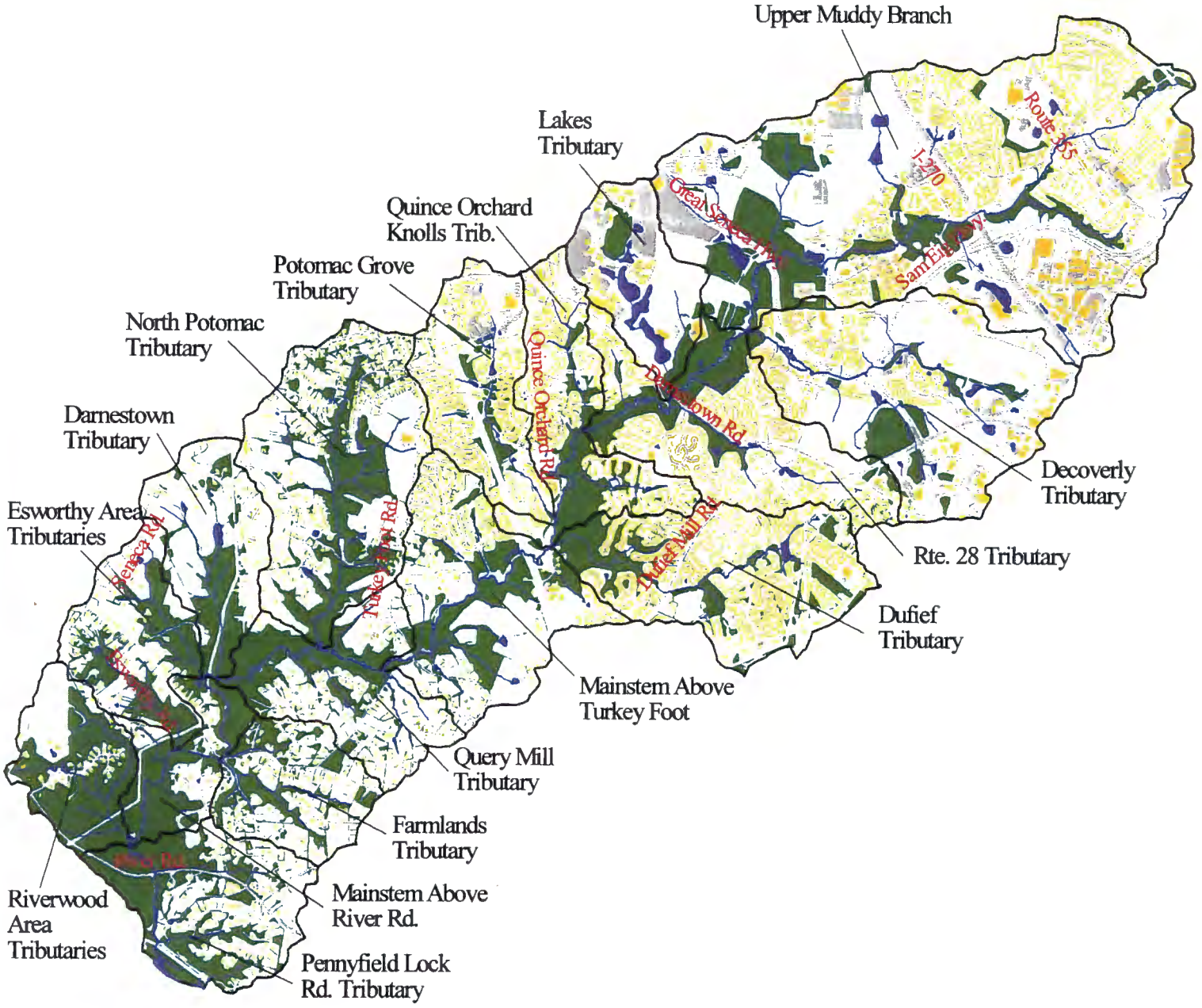
Muddy Branch supports a warm-water fish community. Bluntnose minnow, swallow-tail shiner and redbreast sunfish are abundant. Also found in Muddy Branch are greenside and fantail darters and large Potomac sculpins. The large flat rocks found in Muddy Branch riffles support some of the largest (and most fierce!) hellgramites in this area.

Large areas of the Muddy Branch stream valley have been purchased as parkland by the M-NCPPC to protect adjacent landowners from flooding, and providing a valuable natural resource in a fairly urban area. The floodplain of the middle and lower portions of Muddy Branch support a rich and diverse Spring wildflower community.

Muddy Branch has seen a very rapid pace of development, with most of the development outside the City of Gaithersburg having occurred since 1972. The watershed hydrology is still adjusting to these relatively new land use changes, and areas of instability are common. Many of the communities in the lower part of the watershed have developed with some level of environmental protection, although only the most recent developments have incorporated the full complement of stream valley buffers and on-site stormwater controls. Higher in the watershed, a number of regional stormwater ponds have been constructed, particularly along the eastern tributaries. These regional facilities control much of the high imperviousness associated with the Shady Grove R&D and commercial corridor.

Muddy Branch Watershed

Map 1
Land Cover

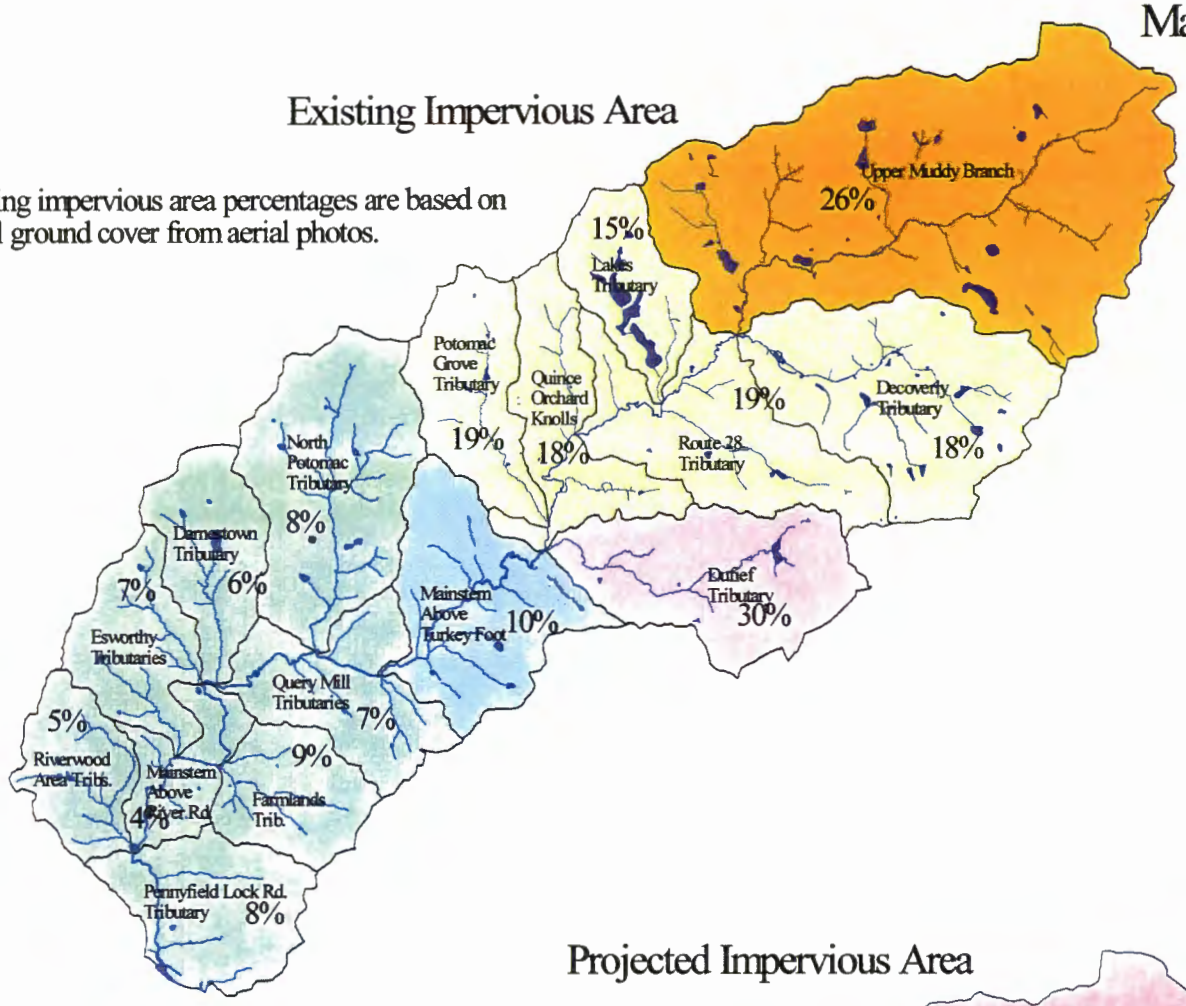


Muddy Branch Impervious Area Analysis

Map 2

Existing Impervious Area

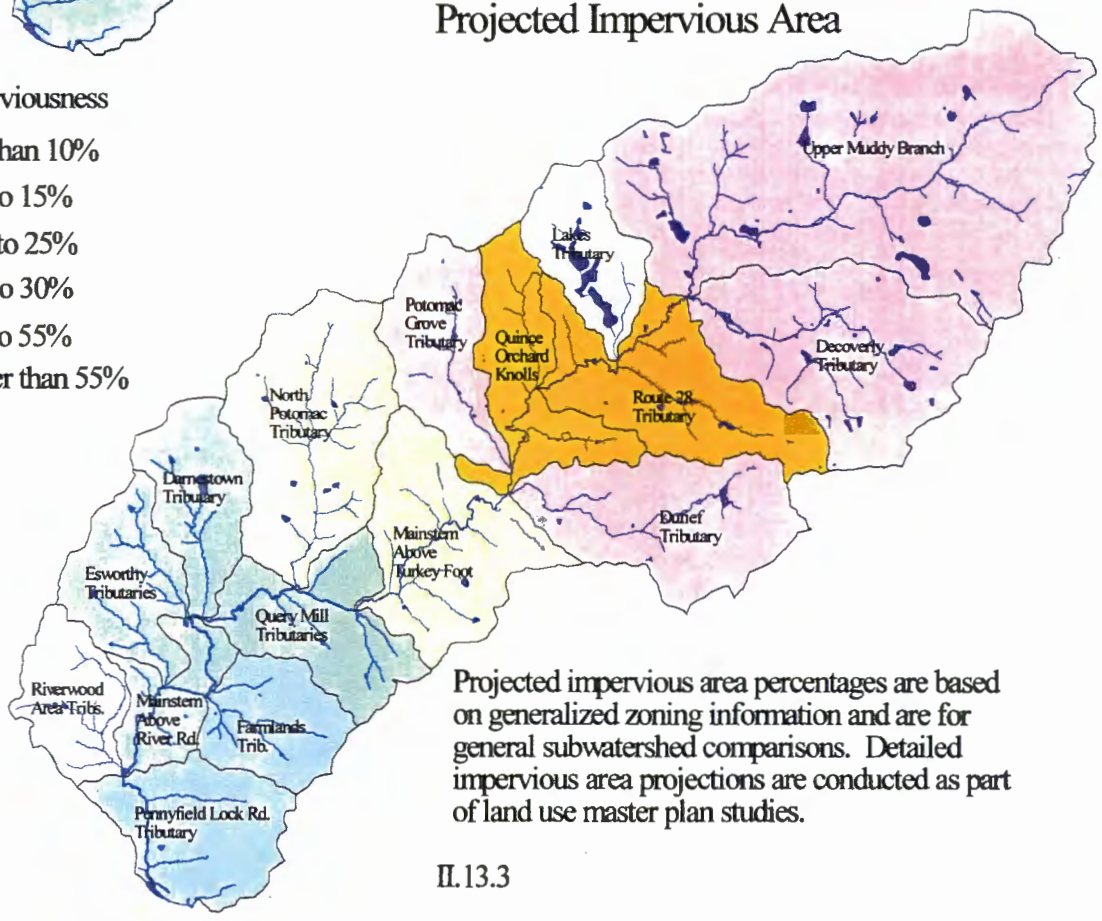
Existing impervious area percentages are based on actual ground cover from aerial photos.



Projected Impervious Area

Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%



Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Muddy Branch Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3

Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

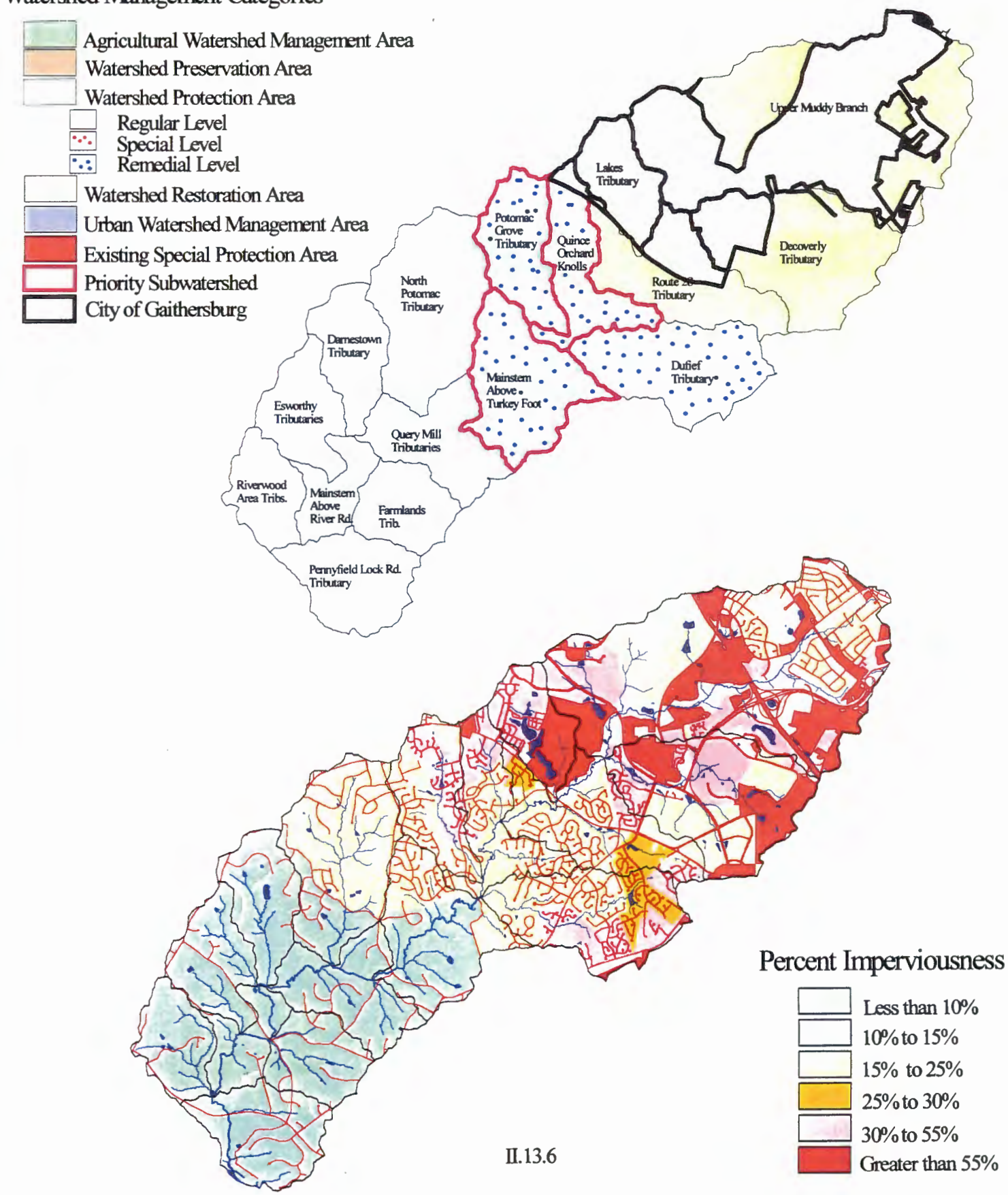
American eel
Golden shiner
Rosyside dace
Creek chub
Fallfish
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Satinfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
Silverjaw minnow
White sucker
Northern hogsucker
Golden redhorse
Yellow bullhead
Brown bullhead
Banded killifish
Mosquitofish
Mottled sculpin
Potomac sculpin
Smallmouth bass
Largemouth bass
Warmouth
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Longear sunfish
Tessellated darter
Greenside darter
Fantail darter

Muddy Branch Stream Condition, Habitat Conditions, and Management Category Designations

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
DEP Baseline monitoring is to occur in Muddy Branch during 1997. This assessment is based on DEP mainstem stations and watershed reconnaisance.			
Upper Muddy Branch - FAIR (preliminary)	FAIR overall (preliminary)	Stream channel is incised and bank stability is poor. Sediment deposition and embeddedness problems observed in the mainstem. High levels of imperviousness and inadequate riparian buffers in the headwaters have affected streams over time.	Watershed Restoration Area - applies to areas outside the City of Gaithersburg
Decoverly Trib. - FAIR (preliminary)			Watershed Restoration Area - applies to areas outside the City of Gaithersburg
Lakes Trib. - FAIR (preliminary)			Watershed Restoration Area - applies to areas outside the City of Gaithersburg
Route 28 Trib - FAIR.			Watershed Restoration Area - applies to areas outside the City of Gaithersburg
Quince Orchard Knolls - GOOD (preliminary)	GOOD overall (preliminary)	Stream banks are actively eroding, and sediment deposition and embeddedness are high. Much of the stream substrate is bedrock so channel downcutting is less of a problem than in upstream areas.	Watershed Protection Area - remedial
Dufief Trib. - GOOD (preliminary)			Watershed Protection Area - remedial
Potomac Grove Trib. - GOOD (preliminary)			Watershed Protection Area - remedial
Mainstem above Turkeyfoot - GOOD			Watershed Protection Area - remedial
North Potomac - GOOD (preliminary)	GOOD overall (preliminary)	Bank stability and vegetative protection are the most serious habitat problems. Sediment deposition, embeddedness and a shifty substrate limit the biological community.	Watershed Protection Area - regular
Query Mill Trib. - GOOD (preliminary)			Watershed Protection Area - regular
Esworthy Area - GOOD (preliminary)	Good overall (preliminary)	Bank stability, sediment deposition and embeddedness problems are limiting factor. Large forested areas create good riparian buffer, except where clearing activities have impacted adjacent stream valley.	Watershed Protection Area - regular
Farmlands Trib. - GOOD (preliminary)			Watershed Protection Area - regular
Mainstem above River Rd. - GOOD	GOOD	Stable reach	Watershed Protection Area - regular
Riverwood Area - GOOD (preliminary)	GOOD overall (preliminary)	Low densities and large forested areas in parkland protect the lower sections. Clearing within a WSSC ROW has detrimentally impacted riparian buffer in some areas. Bank instabilty and sediment deposition noted.	Watershed Protection Area - regular
Pennyfield Lock Rd. Trib. - GOOD (preliminary)			Watershed Protection Area - regular

Muddy Branch Watershed Management Categories and Projected Development

Map 4



Muddy Branch Watershed Management Categories

A clear demarcation occurs in mainstem conditions on Muddy Branch around Route 28. Above this point development patterns are much more urban with high densities and mixed uses. Results of baseline monitoring of Muddy Branch, conducted in 1997, will allow refinement, if necessary, to the stream condition rating and management category designation.

The Potomac Subregion Master Plan Study is currently underway which will include an examination of land use and stream condition relationships in the subwatersheds in that planning area. Watershed management approaches will be updated in the CSPS as necessary to respond to land use recommendations.

Watershed Protection Areas

The subwatersheds below Rte. 28 fall into this management category, with two different levels of protection, reflecting the extent to which stream channels have been impacted by higher densities of land use. The Potomac Subregion Master Plan Study is currently underway and will include detailed study of land use and stream condition relationships in these areas.

Remedial level of protection

This management category includes the area between Rte. 28 and Turkeyfoot Rd. Conditions improve significantly in a downstream direction on Muddy Branch, and this trend is reflected in the management category designation for the streams. Preliminary assessment of the mainstem in the central portion and tributaries indicates high levels of bank erosion occurring, most likely in response to conditions upstream which have impacted this area. Development in this area has occurred largely with on-site stormwater management controls, and remedial efforts to correct previously impacted areas are recommended. This could help to restore some level of stability to these stream reaches which have been adversely affected by storm flows from high density areas upstream.

Watershed Management Strategy

- Continue application of environmental guidelines and regulations for new development.
- Detailed analysis of stream monitoring data gathered in 1997 will occur in 1998 and will be used to thoroughly evaluate conditions and update preliminary assessment.
- Further evaluate relationships between land use and stream conditions thorough the Potomac Subregion Master Plan Study.

Regular level of protection

Below Turkeyfoot Rd., land use gradually changes to larger residential lots, where stream buffers are a primary environmental protection feature. Stream conditions gradually improve through this section and large forested tracts further protect the stream valley. Imperviousness is not expected to increase greatly in this area and stream conditions are deemed adequately protected by existing guidelines and regulations. Within the context of a regular protection level, small areas of habitat improvement may be necessary to correct instability, particularly where riparian impacts have occurred.

Muddy Branch Watershed Management Categories (cont'd)

Watershed Management Strategy

- Continued application of environmental regulations and guidelines for new development and other regular protection tools.

- Detailed analysis of stream monitoring data gathered in 1997 will occur in 1998 and will be used to thoroughly evaluate conditions and update preliminary assessment.

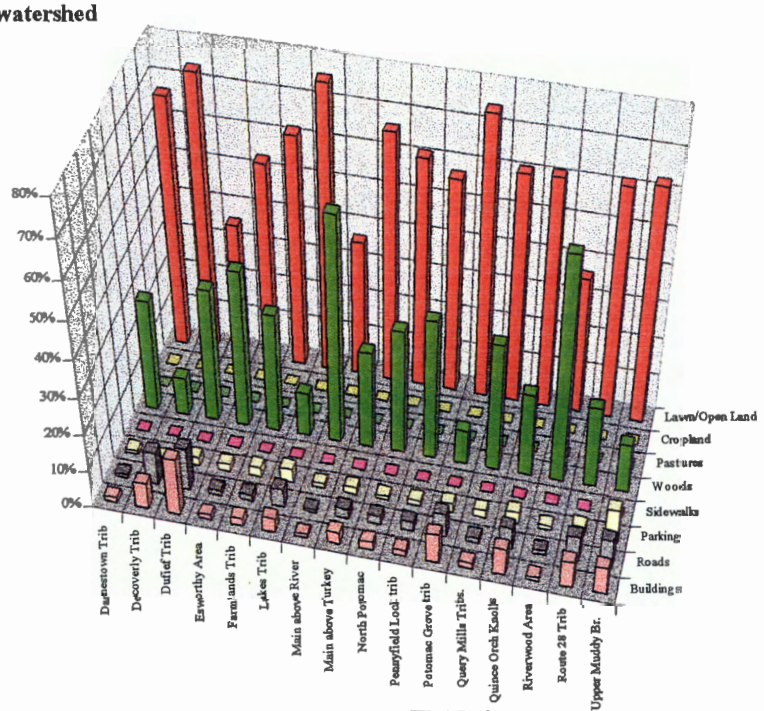
Watershed Restoration Areas

This management category includes the mainstem and tributaries above route 28. This designation was selected because of the need to comprehensively address degraded stream conditions stemming from high imperviousness and channel erosion. Several areas of newer development and redevelopment include regional stormwater controls which help to mitigate the effects of the high imperviousness in the upper watershed, however, extensive areas of channel instability remain, particularly in downstream channels.

Watershed Management Strategy

- The City of Gaithersburg has conducted an inventory of stream conditions within their jurisdiction and is in the process of identifying potential projects to address observed problems.
- Detailed analysis of stream monitoring data gathered in 1997 will occur in 1998 and will be used to thoroughly evaluate conditions and update preliminary assessment.

Muddy Branch Landcover by Type and Subwatershed



	Acres	Stream miles
Damestown Trib	476.9	2.3
Decoverly Trib	1085.8	3.5
Dufief Trib	506.0	3.2
Esworthy Area	476.7	3.6
Farmlands Trib	436.0	2.4
Lakes Trib	429.4	1.1
Main above River	316.1	2.4
Main above Turkey	834.3	5.3
North Potomac	1052.3	5.6
Pennyfield Lock trib	625.8	3.3
Potomac Grove trib	551.3	1.9
Query Mills Tribs.	609.6	3.9
Quince Orch Knolls	575.7	2.7
Riverwood Area	402.5	3.1
Route 28 Trib	834.7	3.9
Upper Muddy Br.	2949.9	10.1
Watershed totals	12162.9	58.3

The Northwest Branch Watershed

The Northwest Branch, located in the eastern part of the County, is the largest of the County's three contributing watersheds to the Anacostia (Northwest Branch, Paint Branch, and Little Paint Branch). Land uses differ greatly from the headwaters downstream to where the Northwest Branch flows into Prince George's County. Different development patterns have shaped the watershed, affecting the stream system to different degrees. Tributaries in the upper part of the watershed, particularly the headwaters, support the few remaining streams with excellent and good conditions in the Northwest Branch watershed.

The fish community found in Northwest Branch includes rosyside dace, northern hogsuckers, and five species of shiners. Although the same species can be found throughout the watershed, the community composition varies dramatically in response to habitat, flow, and pollutant stressors.

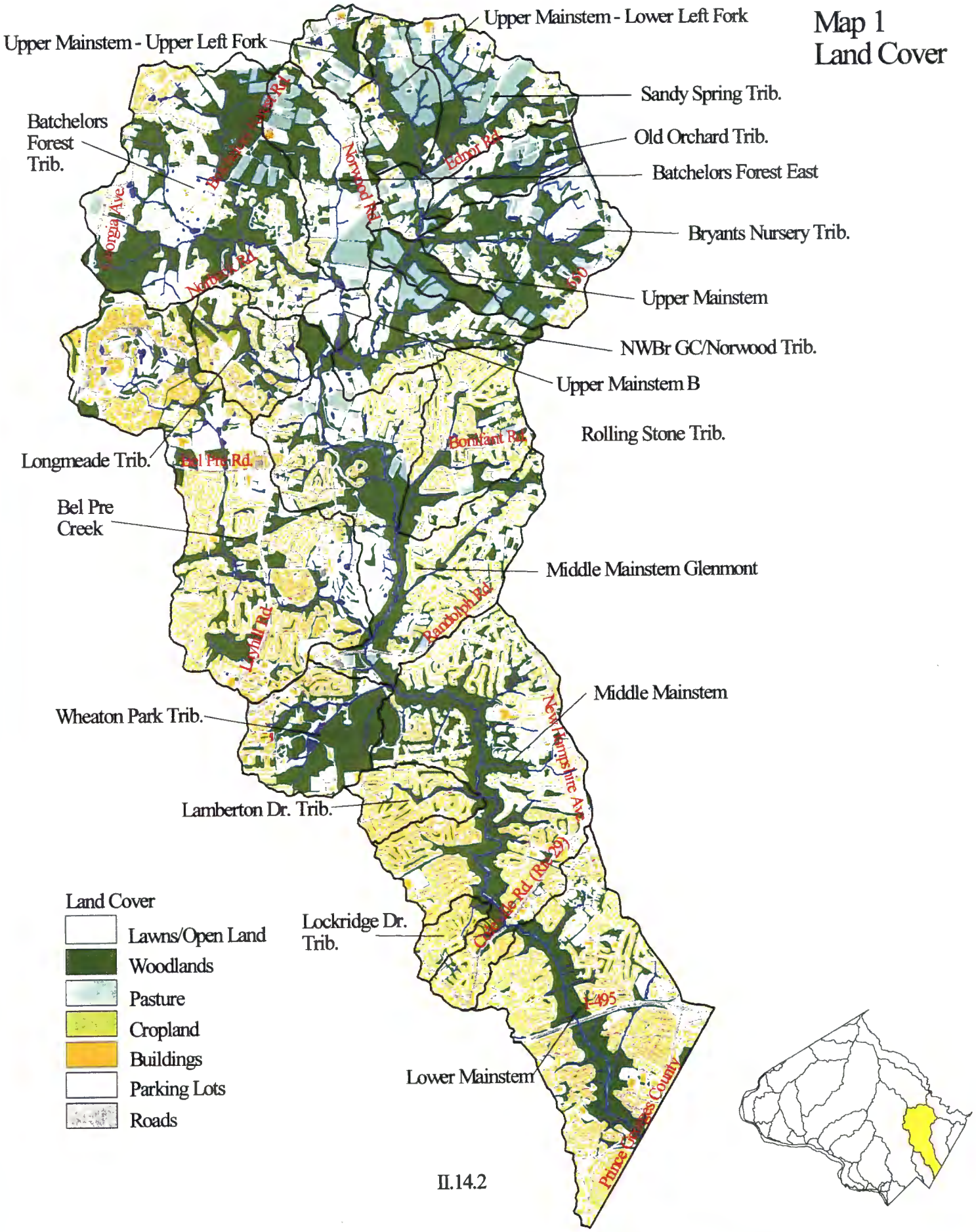
In the upper reaches, low density land uses are predominant and the landscape is in a transition from formerly widespread agricultural land uses to a more suburban landscape. The streams in this area are also in a transition, from carrying sediment loads and nutrients associated with past farming activities, to a watershed condition that includes less widespread land disturbance, but higher imperviousness. As this area develops and the imperviousness increases, today's environmental standards will provide forested buffers, floodplain and wetland protection, and management of stormwater runoff. However, even with application of modern stormwater controls, some changes in watershed hydrology are inevitable.

The middle section of the watershed contains a mix of moderate to higher density land uses along with large areas of forested parkland. Inadequate stream buffers on the tributaries and altered hydrology are common in this section. More of this area developed with stormwater controls than in the lower reaches; however, in many areas the stormwater management technologies used are not as effective as methods used today. Bel Pre Creek contains many such older controls, and is a focus of efforts underway to identify areas for improvements in runoff controls and stream channel restoration. The Rolling Stone tributary is the site of a relatively new stormwater retrofit project that has been successful in improving runoff controls in a previously developed area, modifying and updating structure performance and enhancing pond appearance.

The lower reaches of Northwest Branch contain older and more concentrated development, where communities developed long before requirements for stream valley protection or stormwater management. The hydrology in these areas has been significantly altered and the stream condition is generally poor or fair. However, also to be found in this part of the watershed is a stream section described as "the most scenic and rugged section of the Anacostia watershed". This is the beginning of the torrent and gorge section of the Northwest Branch that begins just below Route 29. This is a transitional area where the Northwest Branch leaves the Piedmont and passes through the fall line before entering the slower reaches of the Coastal Plain. This area contributed significantly to the state of Maryland identifying the Anacostia as a state "Scenic and Wild River" in 1984, under the Maryland Scenic and Wild Rivers Act.

Northwest Branch Watershed

Map 1
Land Cover

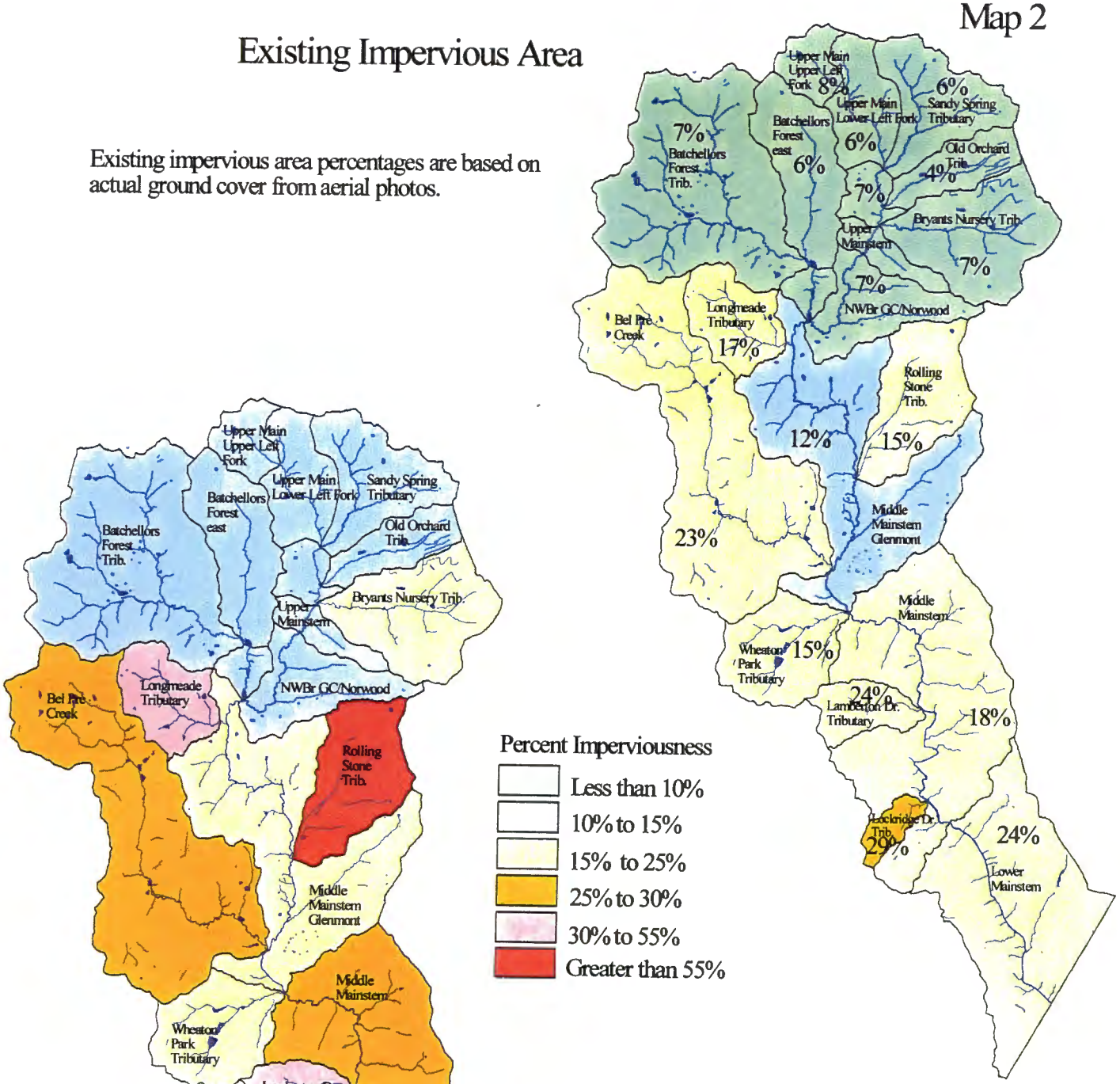


Northwest Branch Impervious Area Analysis

Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



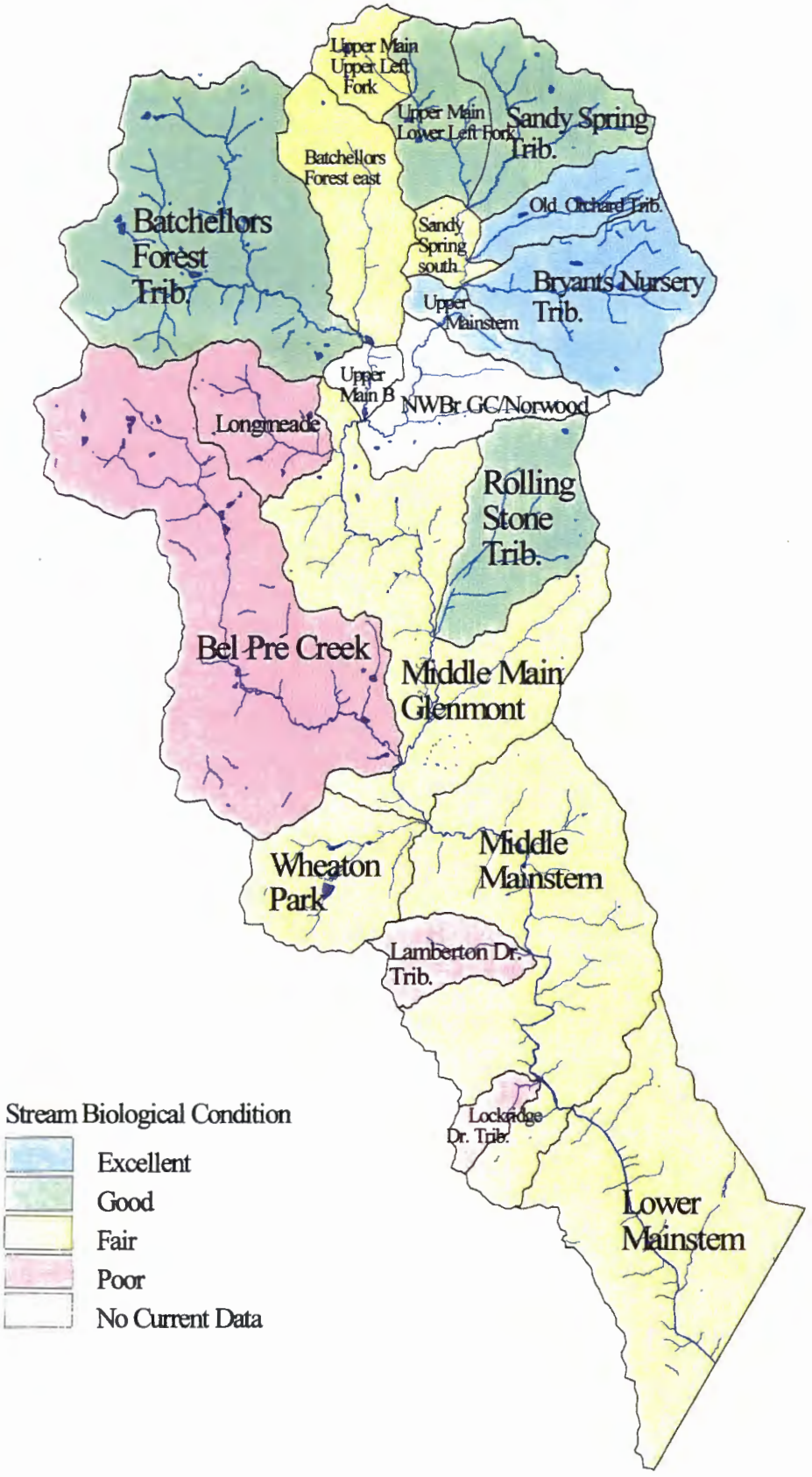
Projected Impervious Area

Projected impervious area percentages are based on generalized zoning infomration and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Northwest Branch Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

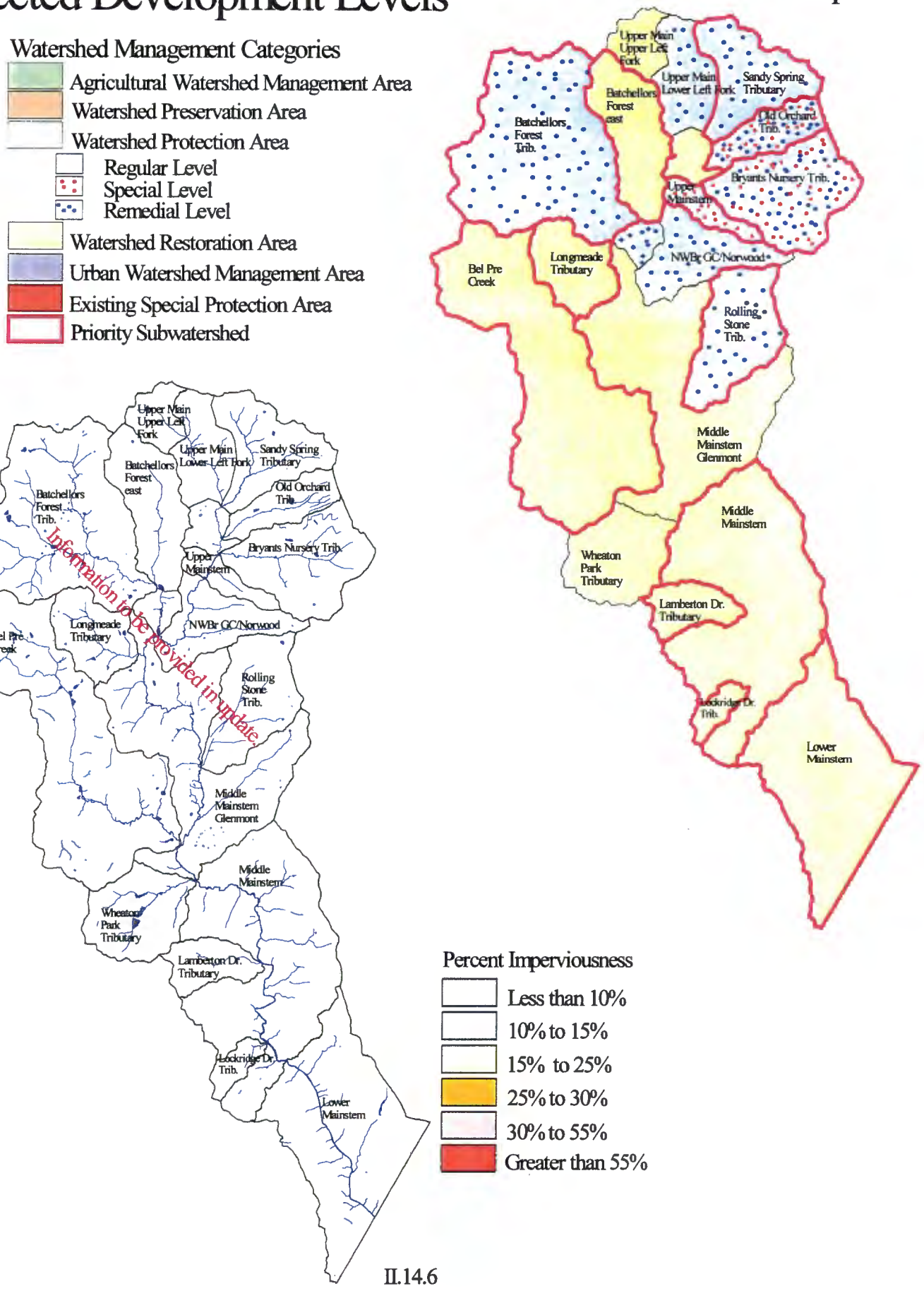
American eel
Brown trout
Golden shiner
Rosyside dace
Creek chub
Fallfish
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Satinfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
Silverjaw minnow
White sucker
Northern hogsucker
Brown bullhead
Margined madtom
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter
Fantail darter

Northwest Branch Stream Condition, Habitat Conditions and Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category Designation
Sandy Spring Trib. GOOD (Preliminary)	GOOD (Preliminary)	Problems with bank stability, sediment deposition and embeddedness are causing habitat impairment.	Watershed Protection Area - remedial
Upper Main -Upper Left Fork FAIR	FAIR	Problems with bank stability, sediment deposition and embeddedness are causing habitat impairment.	Watershed Restoration Area
Upper Mainstem - Lower Left Fork GOOD	GOOD	Sediment deposition and bank erosion adversely affecting habitat.	The Sandy Spring for which the area is named is located in this subwatershed. Watershed Protection Area - remedial level
Old Orchard Trib. EXCELLENT	GOOD	Tributary is very shallow, limiting fish habitat, but has excellent benthic habitat. Some sediment deposition and bank erosion is occurring due to highly erodible soils.	Watershed Protection Area - special and remedial
Bryants Nursery Trib. EXCELLENT	GOOD Overall	Bank stability and sediment deposition problems observed.	Impacts related to previous agricultural use have created areas of channel instability which may make this tributary more sensitive to changes in hydrology. Watershed Protection Area - special and remedial
Bachelors Forest Trib. GOOD	GOOD Overall	Bank stability, sediment deposition and embeddedness problems observed. Inadequate riparian buffer is limiting factor.	Watershed Protection Area - remedial
E. Bachelors Forest FAIR (Preliminary)	GOOD (Preliminary)	Problems with bank stability, sediment deposition and embeddedness are causing habitat impairment.	Watershed Restoration Area
Rolling Stone Trib. GOOD	FAIR Overall Fish habitat poor	Tributary contains a highly erodible sand substrate which affects all habitat parameters, particularly fish habitat. Benthic community is rated excellent	Watershed Protection Area - remedial Level
Upper Mainstem EXCELLENT	GOOD	Condition is on margin of good rating - problems include embeddedness, sed. deposition, and bank stability. Substrate is sandy and unstable.	Watershed Protection Area - special
Upper Main B	no current data		Watershed Protection Area - remedial level
NWBr GC/Norwood	no current data		Watershed Protection Area - remedial level
Longmeade Trib. POOR (preliminary)	GOOD (Preliminary)	Problems with bank stability, sediment deposition and embeddedness are causing habitat impairment.	Watershed Restoration Area
Bel Pre Creek - POOR	FAIR to GOOD Overall	Habitat indicates flow related problems including marginal bank stability, sediment deposition, and embeddedness.	Watershed Restoration Area
Middle Mainstem Glenmont - FAIR	FAIR Overall	Bank stability is fair to poor at most stations and the amount of sandy bedload material is affecting habitat for both fish and macroinvertebrates.	Watershed Restoration Area
Wheaton Park Trib. - FAIR	GOOD	Some embeddedness and deposition occurring. Upstream pond is influencing aquatic community.	Section between Brookside Nature Center and Kemp Mill Rd. in good condition. Watershed Restoration Area
Middle Mainstem - Colesville - FAIR	GOOD Overall	Problems with bank stability, embeddedness, deposition are affecting fish and benthic habitat.	Watershed Restoration Area
Lamberton Dr. Trib. - POOR	FAIR	High imperviousness and uncontrolled runoff has severely affected habitat for both fish and macroinvertebrate communities. Poor bank stability.	Within memory of some residents, stream has downcut from a small "step over" stream to one with 12' banks. Watershed Restoration Area
Lockridge Dr. Trib. - POOR	FAIR	High imperviousness and uncontrolled runoff has severely affected habitat. Poor bank stability.	A very steep gradient and channel downcutting has exposed a bottom substrate that now consists of primarily bedrock and unstable depositional material. Watershed Restoration Area
Lower Mainstem - FAIR	GOOD Overall	Epifaunal substrate and fish cover improve in this section.	This section includes the beginning of the "torrent and gorge" area of the Northwest Branch and has been identified as the "most scenic and rugged section of the Anacostia watershed". Watershed Restoration Area

Northwest Branch Management Categories and Projected Development Levels

Map 4



The Northwest Branch Watershed Management Categories

A study is currently underway as part of the Anacostia Restoration Project, Phase II to examine opportunities throughout Northwest Branch for stormwater retrofit and stream restoration projects. This study is being conducted cooperatively by the MCDEP, M-NCPPC and the Army Corps of Engineers Baltimore District. A comprehensive watershed restoration action plan will result from this study. The management strategy outlined below is generally consistent with preliminary assessments in the study. It will be refined as the study progresses.

Watershed Protection Areas

These areas include the Lower Left Fork of the Upper Mainstem, the Sandy Spring tributary, the Upper Mainstem, Old Orchard tributary, Bryants Nursery tributary, Batchellor's Forest tributary, and the Rolling Stone tributary.

Special level of protection

Three subwatersheds with excellent stream conditions are placed in this category - Old Orchard tributary, Bryants Nursery tributary and Upper Mainstem. Due to existing and planned land uses, these three subwatersheds are not "preserved" in such a way that conditions are expected to remain excellent without some level of management to protect the resource from anticipated. The level of new development anticipated will increase imperviousness requiring special management tools to ensure that the stream conditions remain in the excellent range. Despite relatively low existing levels of imperviousness, these areas are experiencing erosion and stream bank instability problems that are believed to be associated with past clearing activities and land uses, as well as the erodibility of the soils. Bank instability and sediment deposition problems are pronounced in the Old Orchard tributary and Bryants Nursery tributary, and these two subwatersheds are identified as needing remedial protection tools as well as a special level of protection.

Watershed Management Strategy

- Continue current efforts to closely monitor and apply state of the art BMPs to new development projects.
- Develop and implement targeted public education program for residents, businesses and developers about the high quality stream resources and special subwatershed management needs.

Remedial level of protection

Remedial protection tools are recommended for much of the headwaters of Northwest Branch, including Batchellors Forest tributary, the Lower Left Fork, Sandy Spring tributary, Old Orchard tributary, Bryants Nursery tributary, and Upper Main B, NWBr GC/Norwood tributary, and Rolling Stone tributary. The stream channels in these areas of the upper reaches of Northwest Branch, despite excellent and good biological community conditions, have been destabilized by past erosion and accelerated downcutting associated with land clearing activities without adequate best management practices, particularly the use of forested buffers. Many areas in these headwaters also have erodible soils that tend to make channels more susceptible to accelerated downcutting. These areas that have a combination of erodible soils and poor or marginal bank stability will benefit greatly from remedial efforts to re-stabilize channel morphology and facilitate the system's return to a stable condition.

Watershed Management Strategy

- Identify and implement stream restoration and habitat improvement projects in conjunction with the Northwest Branch Watershed restoration effort and Action Plan currently underway.
- Provide targeted public education for residents, businesses and developers about the subwatershed resources and stewardship opportunities.

Northwest Branch Weatershed Managmeent Categories (cont'd)

Watershed Restoration Areas

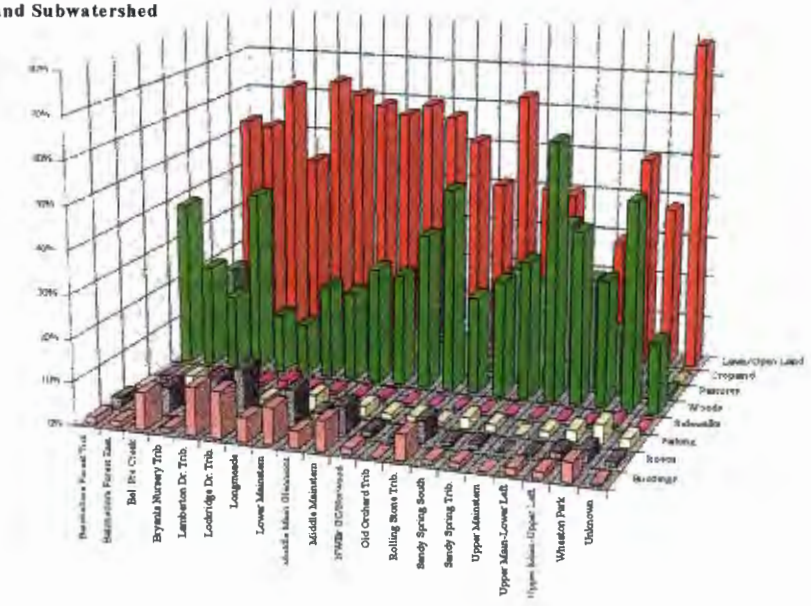
The Northwest Branch mainstem and tributaries from the Northwest Branch Golf Course downstream are designated restoration areas, with the exception of the the Rolling Stone tributary. In much of the area within this category, imperviousness levels are already high and are not expected to increase greatly. Highly impervious land uses occur throughout much of the lower watershed and stream conditions have been widely affected by uncontrolled runoff. Several of these subwatershed, particularly Bel Pre Creek have stormwater management controls which predate our current methods and therefore are frequently less effective.

The Lockridge Dr. subwatershed has been extensively piped and channelized, and where the stream re-emerges into a natural channel, extreme downcutting has occurred, in places to the bedrock. No opportunities exist to substantively improve the quantity of stormwater runoff in this subwatershed, however, small incremental improvements may be achieved through voluntary actions to slow runoff from yards and roof-drains. A stream restoration project is planned to stabilize the channel and guard against continued degradation. Efforts targeted at controlling non-point source pollutants, such as nutrient control from yards and pet waste, and small voluntary improvements to control yard runoff will help to improve runoff quality from this subwatershed.

Watershed Management Strategy

- Identify and implement stormwater retrofit, stream restoration and habitat improvement projects in conjunction with the Northwest Branch watershed restoration effort currently underway.
- Develop Northwest Branch Watershed Restoration Action Plan to implement stormwater retrofit and stream restoration projects and comprehensive watershed education and stewardship program.

Northwest Branch Landcover by Type and Subwatershed



	Acres	Stream miles
Batchellors Forest Trib	2235.5	11.7
Batchellors Forest East	792.6	2.0
Bel Pre Creek	2869.6	10.8
Bryants Nursery Trib	1030.4	5.3
Lamberton Dr. Trib.	349.0	1.0
Lockridge Dr. Trib.	157.5	0.6
Longmeade	541.3	2.7
Lower Mainstem	2080.4	7.9
Middle Main Glenmont	2226.4	10.6
Middle Mainstem	2615.2	10.7
NWBr GC/Norwood	641.7	3.6
Old Orchard Trib	393.1	2.8
Rolling Stone Trib.	846.3	3.1
Sandy Spring South	191.6	0.8
Sandy Spring Trib.	751.0	3.9
Upper Mainstem	215.5	1.0
Upper Main-Lower Left	508.7	2.8
Upper Main-Upper Left	263.1	0.6
Wheaton Park	758.0	3.9
Unknown	136.5	1.2
Watershed Totals	19603.4	86.7

The Paint Branch Watershed

Located in the eastern area of Montgomery County, Paint Branch is one of three major County watersheds draining to the Anacostia River, a major tributary of the Potomac River. The other watersheds are the Northwest Branch (which includes the Sligo Creek drainage) and Little Paint Branch. Paint Branch supports a unique County and regional resource - an urban cold-water fishery and wild brown trout population in close proximity to the Nation's capital and surrounded by suburban development. The upper reaches of the watershed and, in particular, Good Hope and Gum Springs, provide spawning/nursery areas and cold clean baseflow for young trout. The Right Fork and lower portion of the Left Fork provide adult habitat and food supply as well as cold-water baseflow and an important refugia for the biological community during times of stress or impact to the streams. The Lower Paint Branch also supports a diverse fish community, including rosyside dace, fallfish, and common shiner, and is used as adult trout habitat down to Interstate 495.

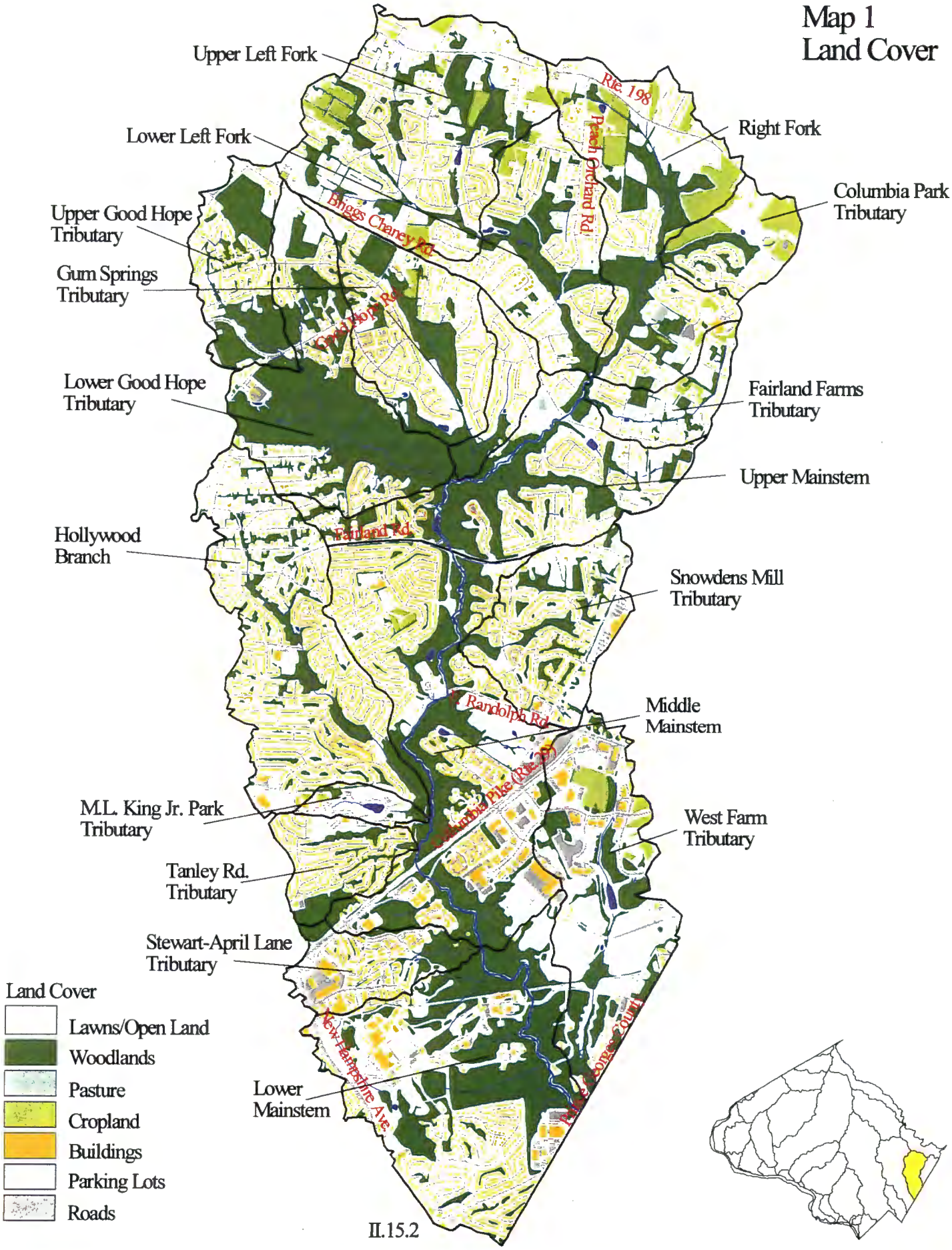
Land uses in the Upper Paint Branch include low and medium density residential communities interspersed with some commercial and agricultural activities. Much of the development in this area was built before the requirement for stormwater controls. As a result, streams in these older developed areas show signs of impairment, though on a much smaller scale than the lower parts of the watershed. Large areas of forested parkland serve to protect the riparian area throughout much of Upper Paint Branch as well as to keep overall watershed imperviousness relatively low. Resource conditions range from excellent to good in this area.

Tributaries in the Lower Paint Branch watershed have suffered impairment over the years from older development and land uses that do not have adequate stormwater controls. The lower watershed contains significant areas of high impervious commercial land use as well as medium to high density residential areas built largely without any on-site runoff controls. Forest cover in the lower watershed is largely confined to the stream valleys but does help to prevent the stream temperatures from heating beyond the upper temperature limits of the adult brown trout found here. Resource conditions in Lower Paint Branch range from good to poor.

Because of the unique cold-water community in this watershed, one of the few remaining in Montgomery County, the Paint Branch has received much attention over the years and has been the focus of many innovative efforts to address the effects of land use on the stream resource. A primary goal of land use planning efforts, starting with the 1981 Master Plan, has been to protect the streams from the effects of development. These efforts continue at many levels today. Large areas of Upper Paint Branch have been acquired for parkland to limit overall watershed imperviousness. The upper watershed (above Fairland Rd.) was designated a Special Protection Area in 1995 and development built after the implementation of this legislation is limited to a 10% impervious area cap.

County biologists, working cooperatively with others, continue to investigate the condition of the streams and the success various BMPs have in preserving this unique area. Apart from protecting this watershed for the benefit of our County's natural heritage, maintaining the unique quality and diversity of this area preserves a healthy arm and refugia for the overall Anacostia which may someday prove valuable in restoring biological conditions in this regional watershed.

Paint Branch Watershed

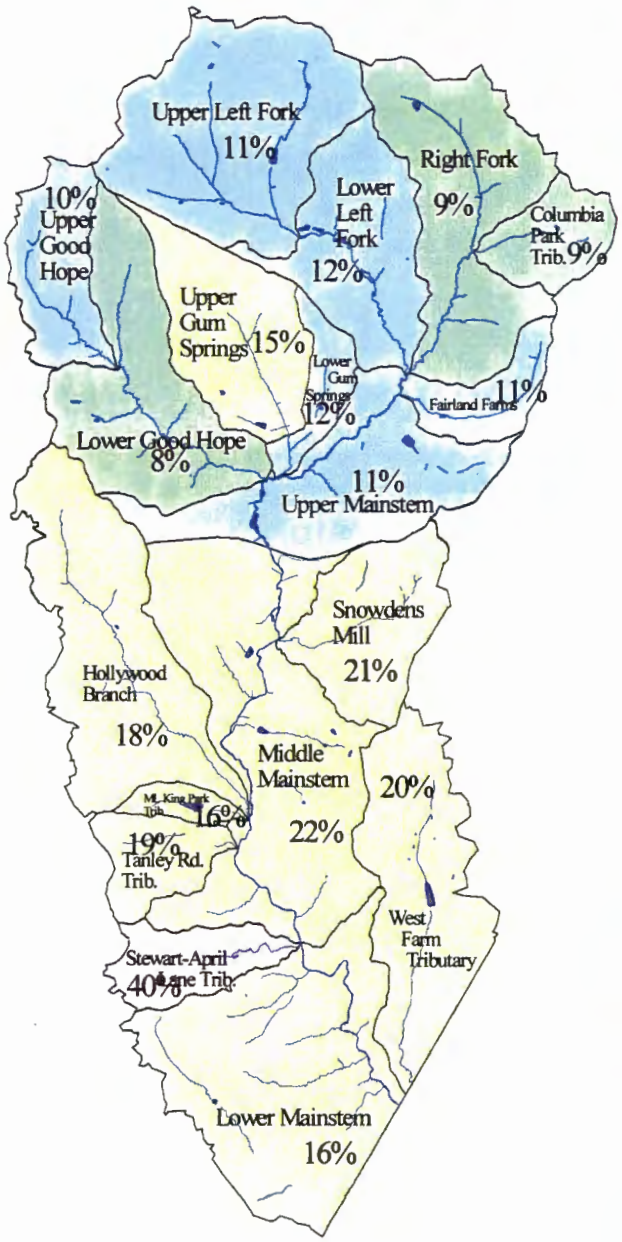


Paint Branch Impervious Area Analysis

Map 2

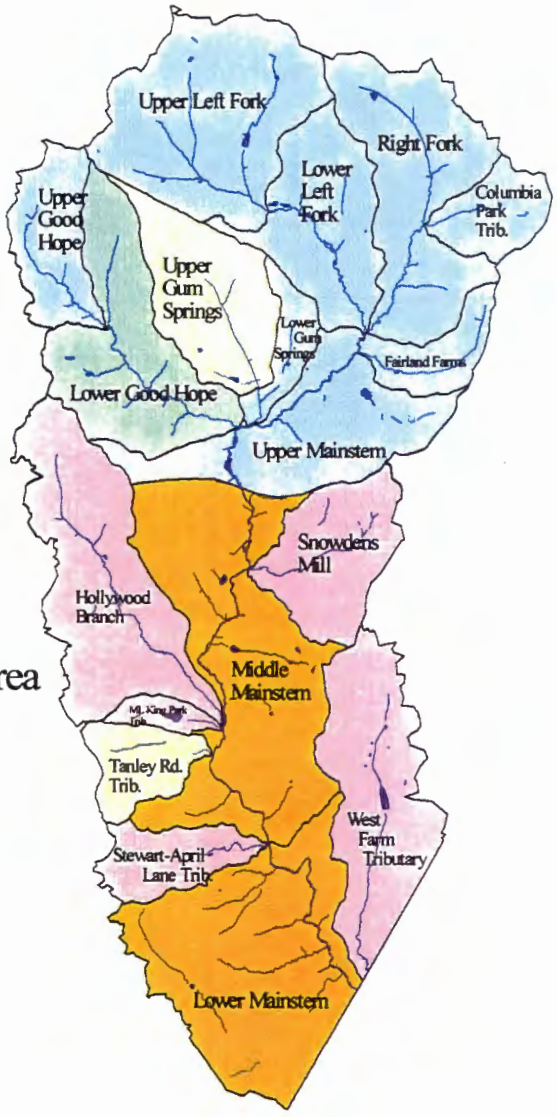
Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%



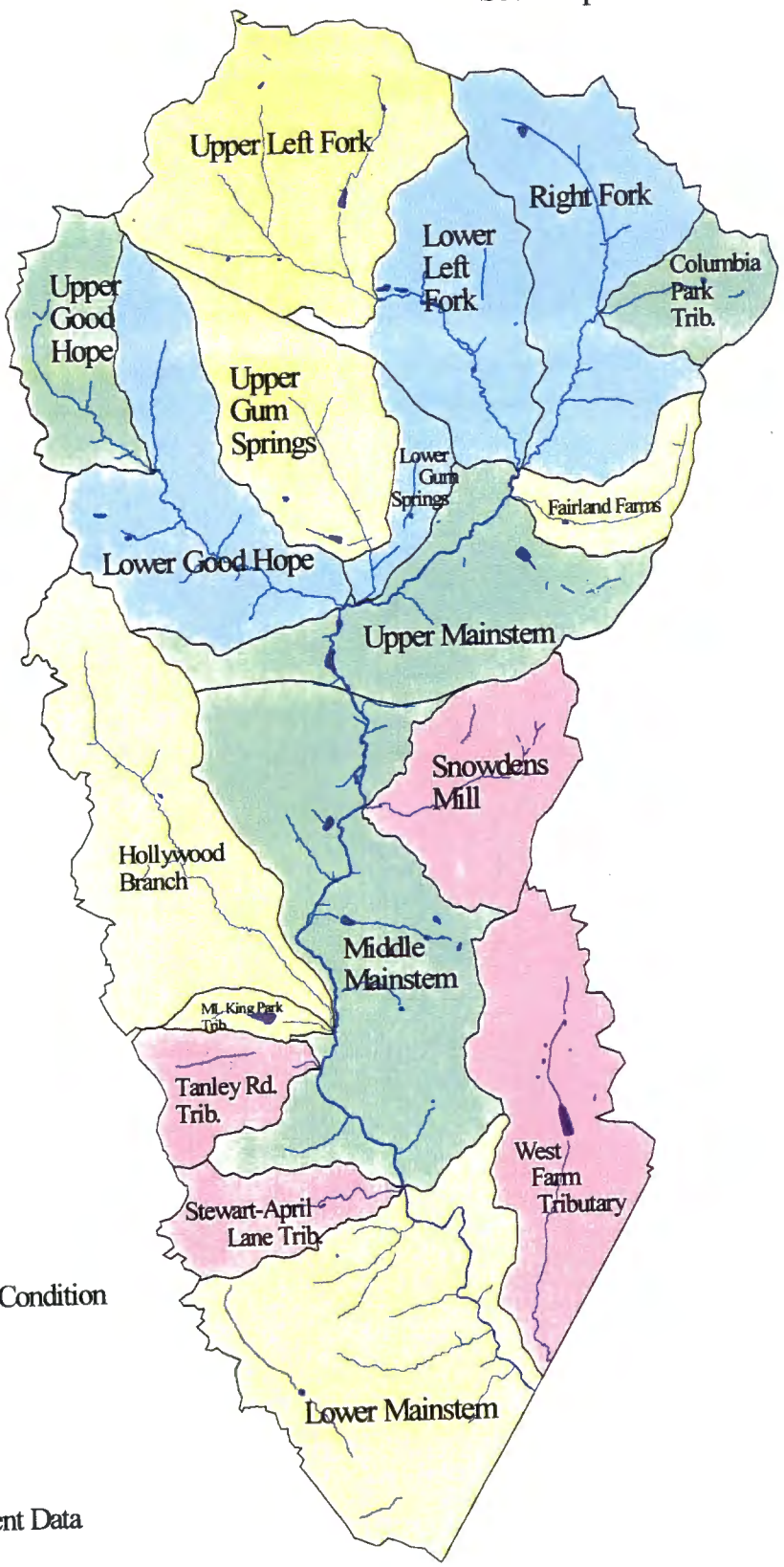
Projected Impervious Area

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Paint Branch Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

Sea lamprey
American eel
Brown trout
Rosyside dace
Creek chub
Fallfish
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Swallowtail shiner
White sucker
Northern hogsucker
Brown bullhead
Margined madtom
Mottled sculpin
Green sunfish
Bluegill
Redbreast sunfish
Tessellated darter

Paint Branch Stream Condition, Habitat Condition and Management Category Designation

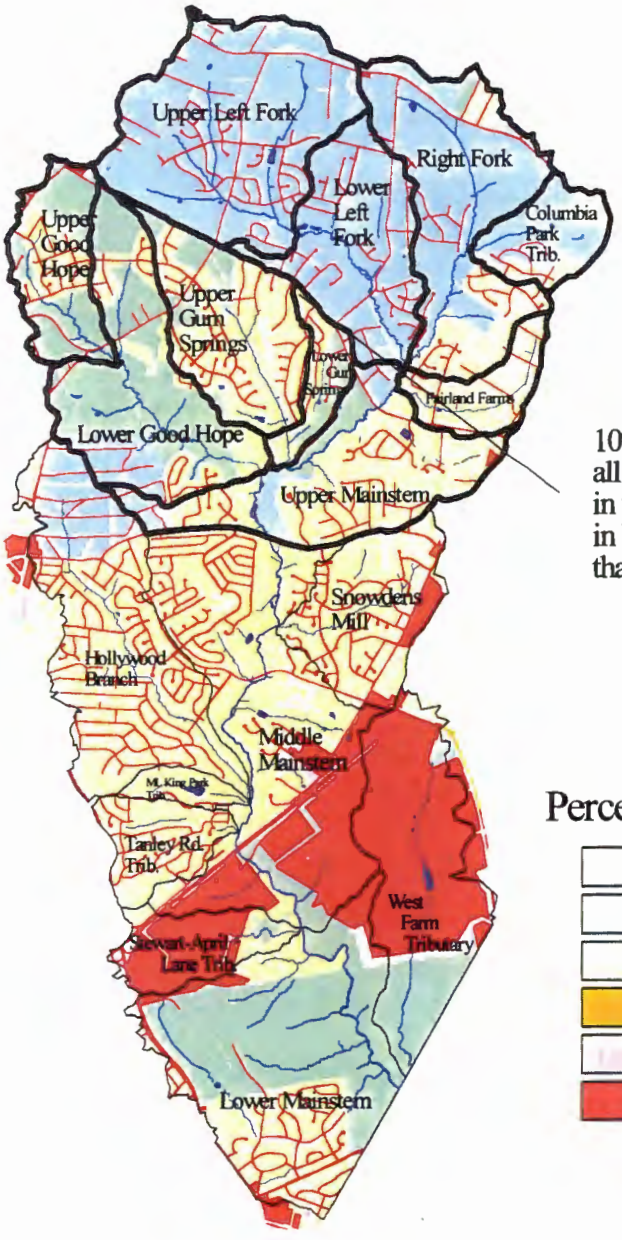
Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
Upper Good Hope - GOOD	GOOD/EXCELLENT overall Bank Stability POOR in areas	Fish community shows impacts of riffle sedimentation. Channel widening and sedimentation occurring. Lack of stormwater control in headwaters.	Important spawning areas for wild brown trout. Existing Special Protection Area
Lower Good Hope - EXCELLENT	GOOD/EXCELLENT overall Bank stability POOR in areas	Biological community remains diverse despite channel widening/sedimentation.	Important spawning areas for wild brown trout. Existing Special Protection Area
Upper Gum Springs - FAIR	GOOD overall In-stream Fish cover suboptimal - poor sinuosity	Recent pollution events have impacted aquatic life resulting in Fair biological integrity. Log drop structures improve habitat somewhat.	Provides spawning habitat, cold baseflow and refugia. Existing Special Protection Area
Lower Gum Springs - EXCELLENT	GOOD/EXCELLENT	Consistently Excellent biological community. Temperature impacts have been identified from the Oak Springs SWM facility. Plans are underway to pipe pond flows around the important habitat areas in this tributary, into the mainstem.	Important spawning and adult habitat for wild trout. Existing Special Protection Area
Upper Left Fork - FAIR	FAIR overall	Moderate to severe bank erosion and incised channels from lack of stormwater control affect aquatic habitat. Fish barrier exists at Maydale.	Upper reaches contribute to maintenance of baseflow. Existing Special Protection Area
Lower Left Fork - EXCELLENT	GOOD/EXCELLENT overall	High quality riparian area and floodplain improve conditions. Stormwater controls mitigate runoff impacts.	Provides adult trout habitat and refugia. Existing Special Protection Area
Right Fork - EXCELLENT	GOOD overall	Highest water quality and abundant food source results in excellent aquatic life. Channel somewhat entrenched with sediment deposition noted. Lack of spawning in this area believed to be due to substrate conditions.	Provides adult habitat, cold baseflow, and refugia. Existing Special Protection Area
Columbia Park Trib. - GOOD	GOOD overall	Uncontrolled stormflows affecting stream condition.	Existing Special Protection Area
Fairland Farms - FAIR (preliminary)	FAIR (preliminary)	Riparian area heavily impacted and sediment deposition high.	Existing Special Protection Area
Upper Mainstem - GOOD	GOOD		Existing Special Protection Area
Hollywood Branch - FAIR	FAIR overall Embeddedness and sediment deposition POOR	Riparian area heavily impacted. Uncontrolled stormwater runoff and sediment deposition problems.	Construction of a peat/sand filter has recently been completed to improve runoff entering mainstem. Watershed Restoration Area
M.L.King Trib. - FAIR (preliminary)	GOOD overall (preliminary)	Problems with sediment deposition and bank stability in some areas.	Watershed Restoration Area
Snowden's Mill - POOR	GOOD overall	Problems with embeddedness, sediment deposition, and riparian area impacts.	Watershed Restoration Area
Tanley Rd. Trib. - POOR (preliminary)	Reconnaissance indicates poor habitat condition (preliminary)	Recurring pollution events have had an impact on this trib.	Watershed Restoration Area
Stewart-April Lane Trib. - POOR	GOOD overall	Despite good habitat, no fish were found at sample site. Sediment deposition a problem. Recurring pollution events a possible cause for impairment .	Very high imperviousness and high intensity land uses. Watershed Restoration Area
Middle Mainstem - GOOD	GOOD overall	A good riparian buffer continues to protect this stream section however uncontrolled runoff continues to have an impact and sediment deposition is a consistent problem.	Important cold-water fish habitat including adult trout habitat. Watershed Protection Area - Remedial Level
West Farm Trib. - POOR (preliminary)	Reconnaissance indicates poor habitat conditions (preliminary)		Watershed Restoration Area
Lower Mainstem - FAIR	Adequate habitat just below Stewart-April Lane trib. - conditions worsen downstream	Despite presence of adequate habitat, biological conditions deteriorate as imperviousness, fish blockages, and uncontrolled runoff increase.	Watershed Restoration Area

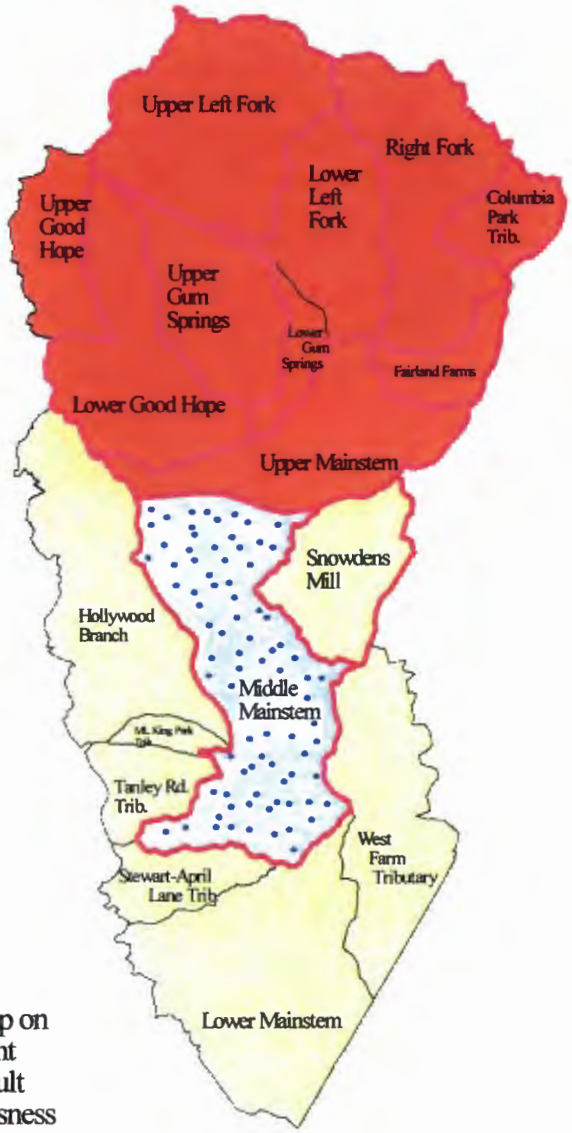
Paint Branch Watershed Management Categories and Projected Development

Map 4

Watershed Management Categories

- Agricultural Watershed Management Area
- Watershed Preservation Area
- Watershed Protection Area
  - Regular Level
  - Special Level
  - Remedial Level
- Watershed Restoration Area
- Urban Watershed Management Area
- Existing Special Protection Area
- Priority Subwatershed





10% impervious cap on all new development in the SPA will result in lower imperviousness than projected zoning.

Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Paint Branch Watershed Management Categories

Two management approaches are necessary to address stream protection needs in the Paint Branch watershed. First, the Upper Paint Branch subwatersheds are fragile and unique headwater areas which require special levels of protection to ensure that the streams are protected. Due to the unique wild trout fishery and high quality cold-water ecosystem, Special Protection Area designation was granted for the Upper Paint Branch subwatershed in 1995. This was done to protect the resource from impacts from new development. Extensive areas of land have also been recommended for acquisition for parkland in order to reduce imperviousness. Second, in areas where stormwater controls do not exist, stormwater retrofit and stream restoration projects are underway to improve conditions to complement the watershed protection approach.

Watershed Protection Areas

Special level of protection

In the Upper Paint Branch watershed above Fairland Rd., all subwatersheds require a special level of protection and Special Protection Area designation was legislatively granted in 1995. Existing watershed management activities include:

Watershed Management Strategy

- Parkland acquisition and land use controls in accordance with adopted Master Plan.
- Special Protection Area regulations on new development.
- DEP's Capital Improvements Program which includes projects to implement a series of stormwater retrofit and stream restoration projects throughout the watershed as part of the Anacostia Watershed Restoration Project.
- Public Education efforts through Eyes of Paint Branch and other local groups to increase stewardship; Pipe Detectives program to involve citizens in pollution prevention efforts and identification of illicit stormdrain discharges.
- Paint Branch Watershed Restoration Action Plan being developed to identify any additional actions to address older developed areas which have no stormwater controls in Upper Paint Branch.
- Continue existing efforts through the Special Protection Area regulations and Master Plan initiatives.
- Increase public education activities, particularly pool operator education, and yard trim recycling.
- Target stormwater retrofit projects and stream restoration activities to solve existing problems.
- Implement impervious area reduction strategies.

Remedial level of protection

This management category includes the Middle Paint Branch mainstem. The middle mainstem is protected by parkland, however, sediment deposition from tributaries and upstream areas affects habitat conditions. Projects to improve habitat and address erosion problems will ensure that the mainstem continues to provide adequate habitat to support the unique fishery in this watershed.

Paint Branch Watershed Management Categories (cont'd)

Watershed Management Strategy

- Continue implementation of habitat improvement efforts through the Anacostia Watershed Restoration effort, and pursue identification of potential projects as part of the development of a Paint Branch Watershed Restoration Action Plan

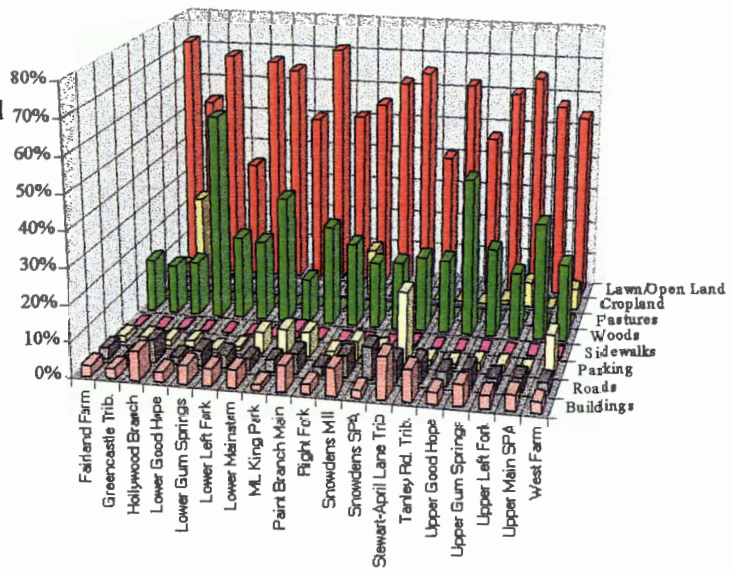
Watershed Restoration Areas

In the lower watershed below Fairland Rd., impacts from previous development have affected all the tributaries to some extent and these areas require an overall restoration approach to restore habitat and protect the tributaries from further damage.

Watershed Management Strategy

- Continue implementation of Capital Improvement Program watershed restoration activities to implement stormwater retrofit and stream restoration projects.
- Public Education efforts through Eyes of Paint Branch and other local groups to increase public stewardship.
- Pipe Detectives program to involve local citizens in pollution prevention efforts and identification of illicit stormdrain discharges.
- Institute Pollution Prevention activities at commercial, industrial, and high density residential uses, particularly those draining to the Stewart-April Lane Trib.
- Increase public education activities, particularly household hazardous waste, yard trim recycling, etc.

Paint Branch Landcover by Type and Subwatershed



	Acres	Stream miles
Fairland Farm	185.4	1.3
Greencastle Trib.	207.7	0.6
Hollywood Branch	844.0	2.9
Lower Good Hope	676.5	3.2
Lower Gum Springs	134.7	0.8
Lower Left Fork	514.8	2.2
Lower Mainstem	1057.6	6.8
ML King Park	72.9	0.4
Paint Branch Main	1183.4	6.1
Right Fork	729.2	2.8
Snowdens Mill	407.3	1.5
Snowdens SPA	17.5	0.0
Stewart-April Lane Trib	223.5	0.6
Tanley Rd. Trib.	205.5	0.5
Upper Good Hope	311.2	1.5
Upper Gum Springs	483.7	1.3
Upper Left Fork	886.5	3.4
Upper Main SPA	650.3	2.4
West Farm	660.9	1.2
Watershed totals	9452.5	39.4

Upper Patuxent River Watershed

The Upper Patuxent River forms the boundary between Montgomery County and Howard County and includes all the land draining to the Patuxent River above the Triadelphia Reservoir. The watershed on both sides of the river includes large forested areas along with agricultural cropland, pasture, and large-lot rural residential development.

For many, it is hard to believe that this small, high quality, clear flowing cold water stream is the same Patuxent River entering the Chesapeake Bay at Solomons, Maryland. Since the 1970's, the Patuxent River and its watershed have been the subject of many planning and technical studies, but until recently these studies have emphasized the tidal and the nontidal to tidal transition areas of the River which are located far downstream.

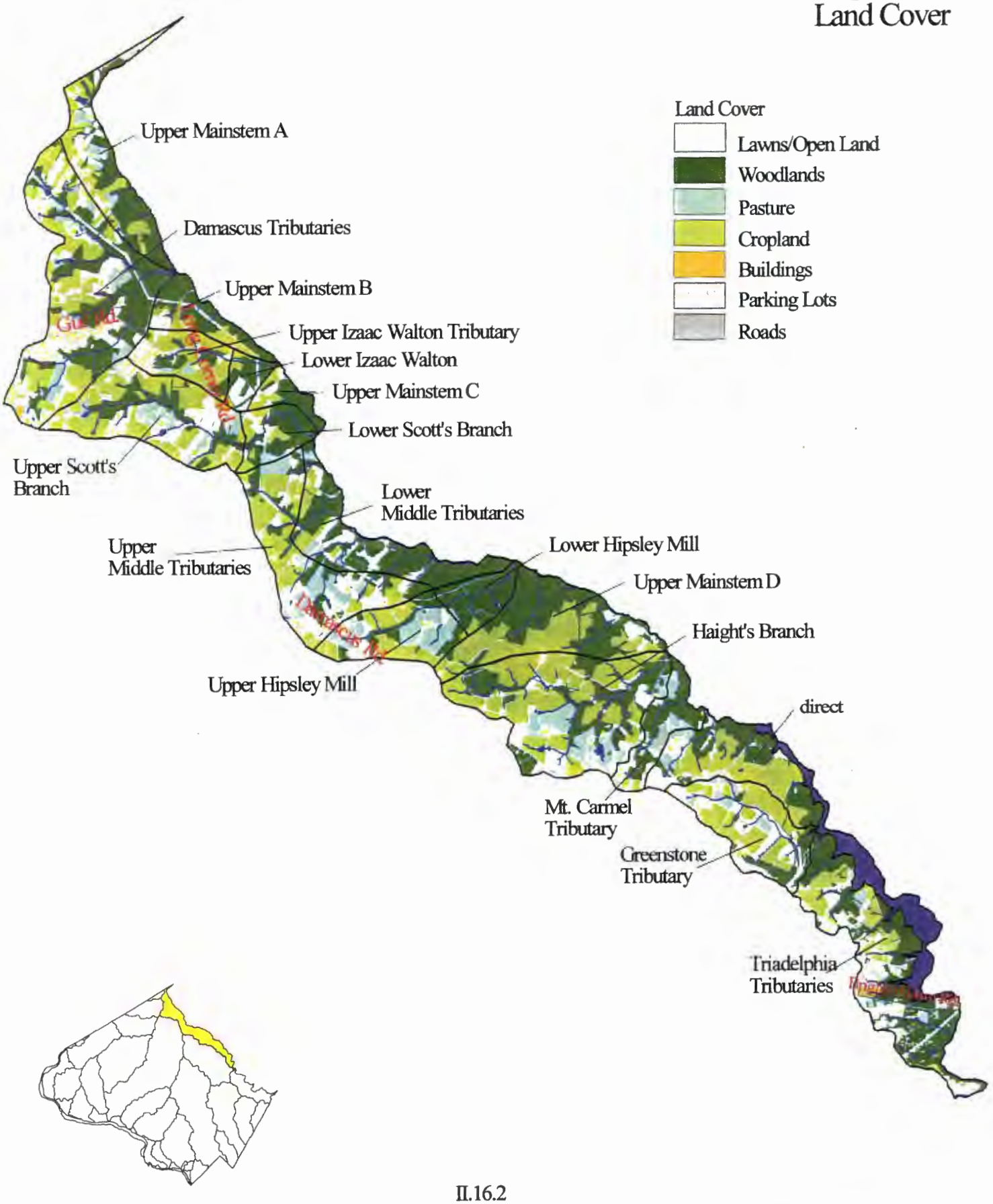
The Patuxent River originates in Frederick County, above the intersection of Route 27 and Windsor Forest Road. In the stream above Route 94 is a naturally reproducing brown trout population. To protect this resource, the Upper Patuxent has been designated a special trout catch and release stream by the Maryland Department of Natural Resources. The brown trout population is part of a generally high quality coldwater fish community, although sculpins, which are usually found in these communities, are absent. Extensive forested areas in the Patuxent River State Park surround the Upper Patuxent. Areas of the state park are or will soon be designated as Maryland Wildlands. The mature floodplain and upland forests support a rich wildlife community with some of the best forest interior breeding bird habitat remaining in the County. The streams in this watershed are among the best remaining in the County and many serve as reference streams for the County's stream monitoring program.

There has been some concern about accelerated rates of sedimentation, elevated nutrient levels, and depressed dissolved oxygen concentrations being observed at Triadelphia and Rocky Gorge Reservoirs. These two reservoirs supply over 11 billion gallons of drinking water to suburban Montgomery County and Prince George's County, and to a limited extent, Howard County. In March 1995, the interjurisdictional Patuxent Reservoir Protection Group published an interim report on the desired components of a Patuxent Reservoir Protection Strategy. In October 1996, an interjurisdictional agreement among Howard, Montgomery, and Prince George's Counties, the M-NCPPC, the WSSC, and the Howard and Montgomery Soil Conservation Districts committed these agencies to develop and implement initiatives for long term protection of the Patuxent Reservoirs watershed including the water supply reservoirs, the Patuxent River and its tributary streams, and associated groundwater resources.

An interagency group has been working with a WSSC consultant to establish a framework for the various components of an integrated long range watershed management plan. These components are expected to include hydrologic investigations, nutrient and sediment load quantification, water quality monitoring, watershed and reservoir model development, public awareness initiatives, control options, and progress tracking. The study and its recommendations were completed in July, 1997 and presented to the Patuxent Agreement signatories in October, 1997. The WSSC is also funding the publication of a newsletter to document recent activities and progress on protecting the reservoirs and their resources. The first newsletter was distributed to watershed residents during the Fall of 1997.

Upper Patuxent River Watershed

Map 1
Land Cover

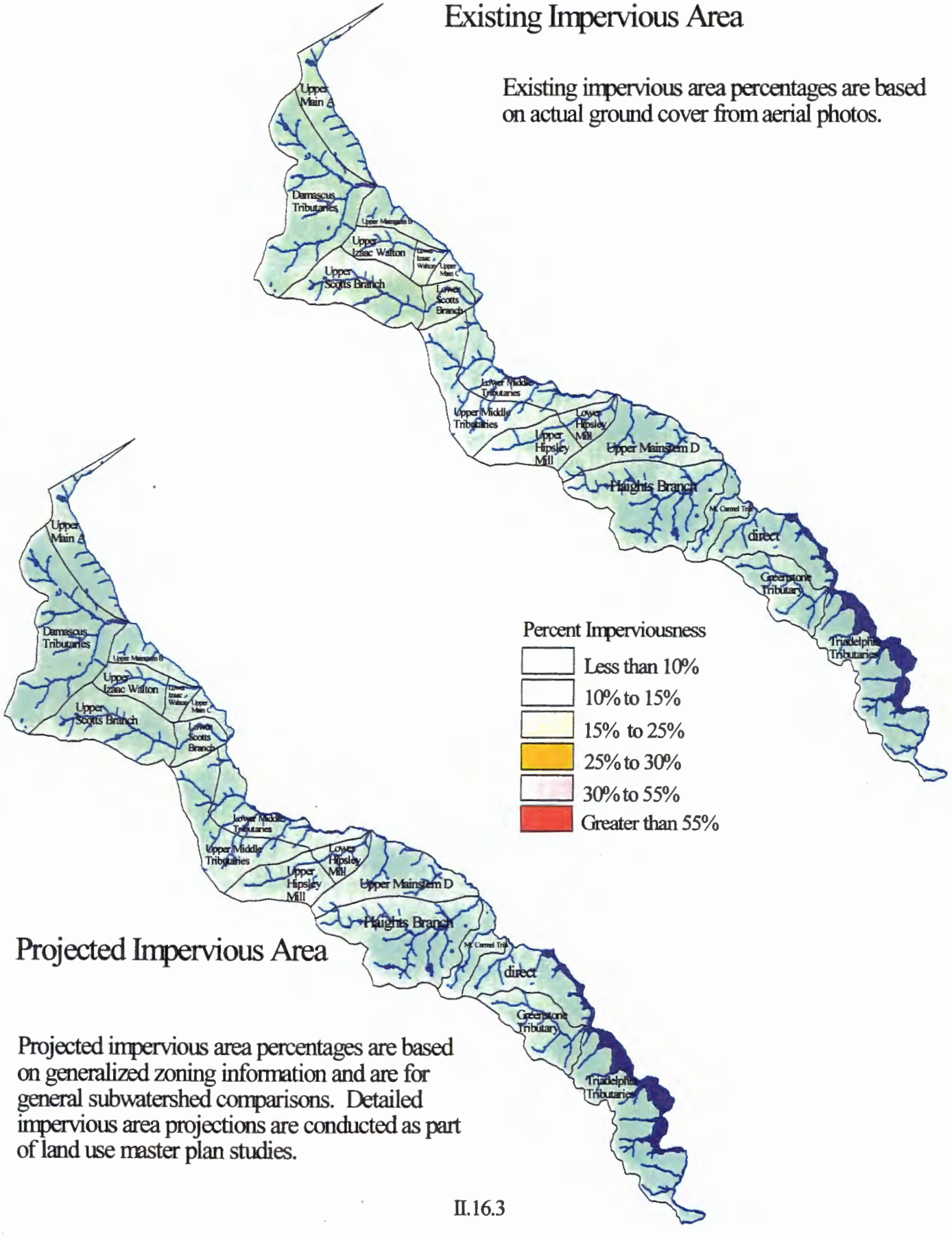


Upper Patuxent Impervious Area Analysis

Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



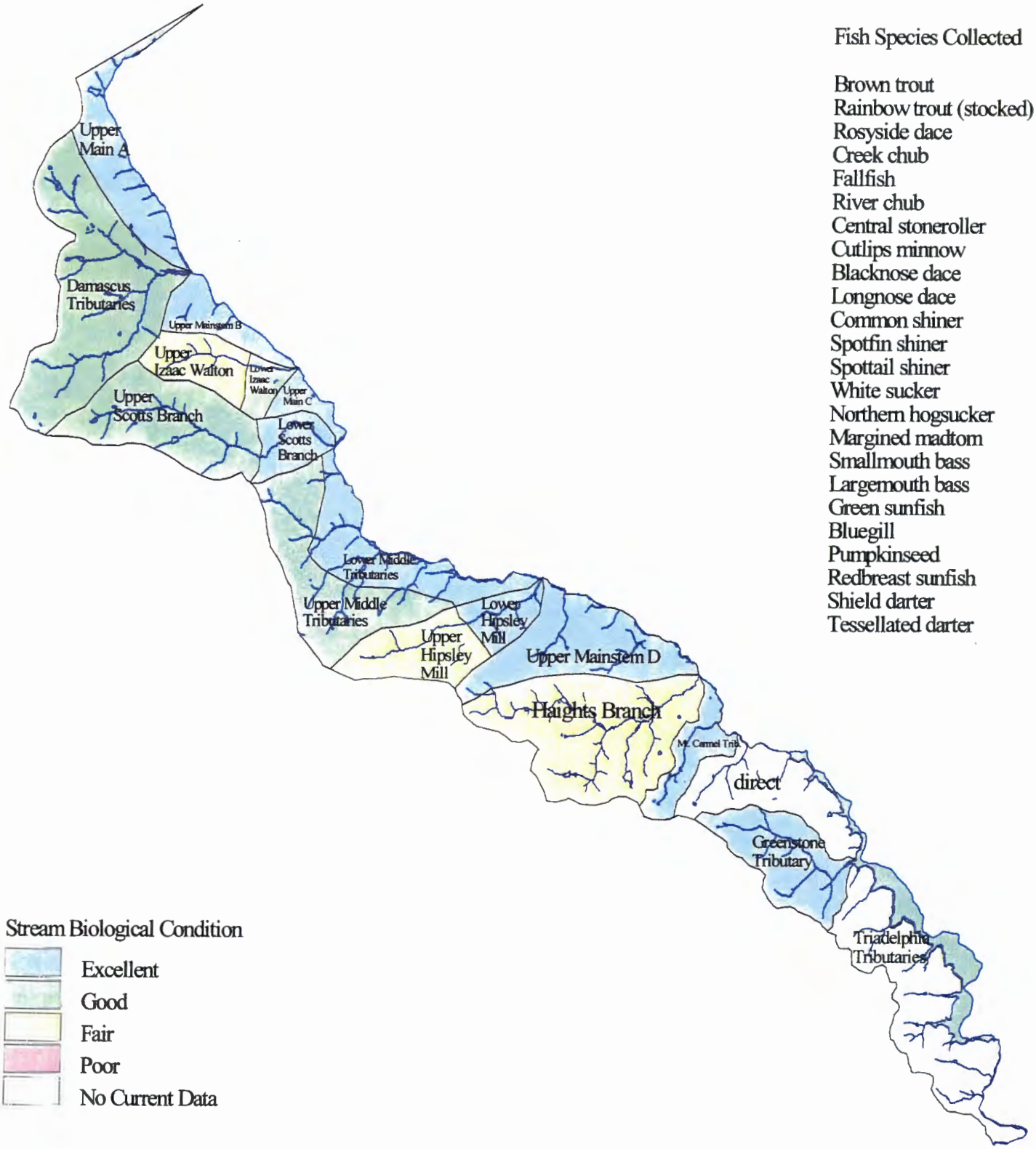
Projected Impervious Area

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Upper Patuxent River Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Fish Species Collected

Brown trout
Rainbow trout (stocked)
Rosyside dace
Creek chub
Fallfish
River chub
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Spottail shiner
White sucker
Northern hogsucker
Margined madtom
Smallmouth bass
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Shield darter
Tessellated darter

Stream Biological Condition

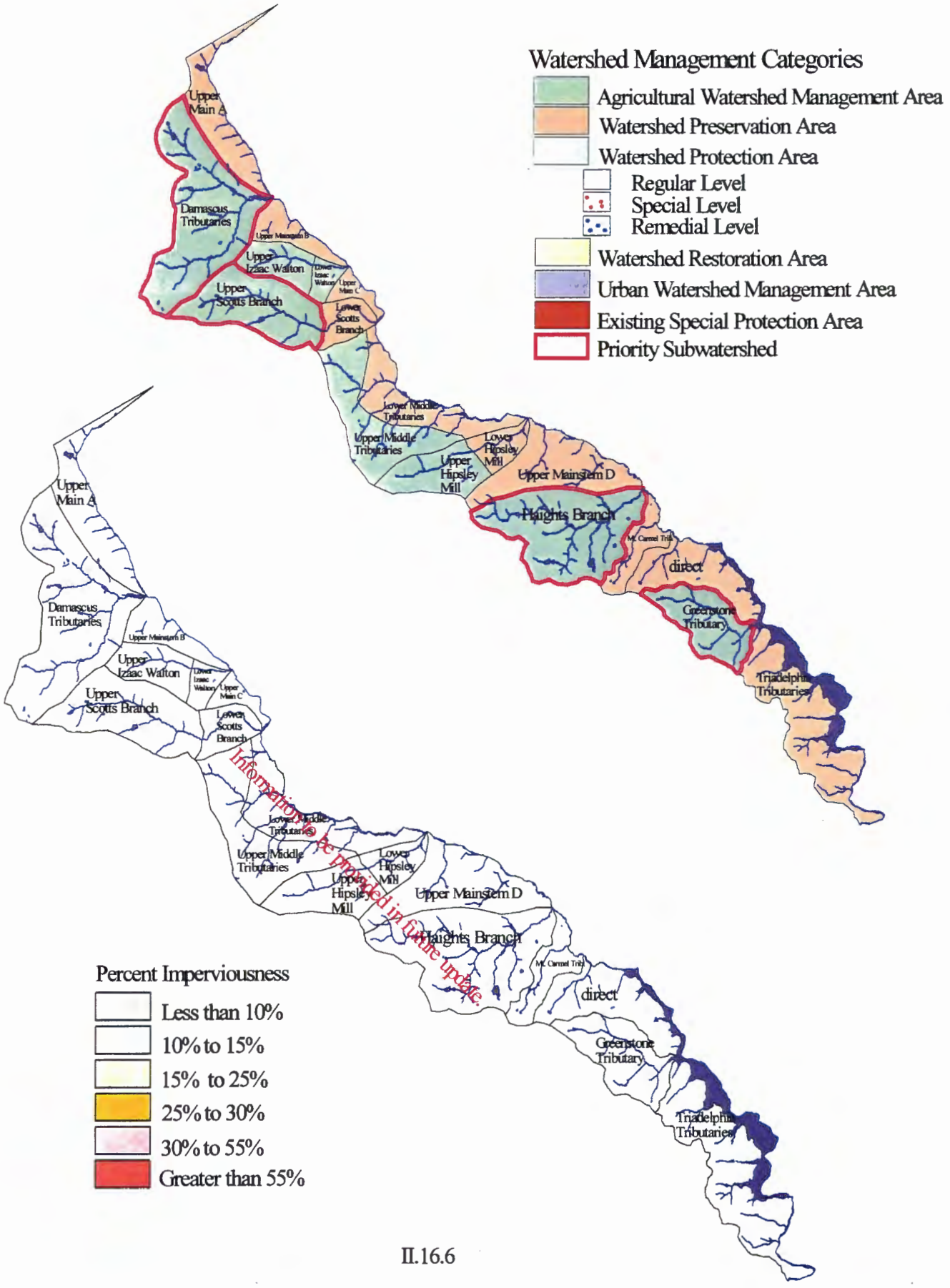
- Excellent
- Good
- Fair
- Poor
- No Current Data

Upper Patuxent River Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
Ratings shown as preliminary are based on a stream reconnaissance effort to locate reference streams, and on land use conditions.			
Upper Patuxent Mainstem - EXCELLENT	EXCELLENT Overall	Mainstem is very well buffered by the Patuxent River State Park and most stations exhibited excellent conditions in all biological and habitat parameters. Several areas of poor bank stability have led to some minor sediment deposition problems.	Naturally reproducing brown trout population found here. Watershed Preservation Area
Damascus Trib. - GOOD (preliminary)	GOOD for most of trib.(preliminary) EXCELLENT conditions in lower reaches (preliminary)	Lower reaches are in Patuxent River State Park. Most of watershed, with exception of headwaters in the southern reach are agricultural uses with low density residential interspersed. Southern reach is impacted by imperviousness in the Damascus Town Center.	Agricultural Watershed Management Area
Upper Izaac Walton Trib. - FAIR (preliminary)	FAIR - (preliminary)	Impacts to riparian zone and floodplain have resulted in fair to poor habitat conditions. A depositional area has formed upstream and a scour pool downstream of the power line access road (fish blockage)	Agricultural Watershed Management Area
Lower Izaac Walton Trib. - GOOD (preliminary)	GOOD (preliminary)	Area is mostly forested and within the Patuxent River State Park	Agricultural Watershed Management Area
Upper Scotts Branch - GOOD	EXCELLENT	Habitat is excellent overall, however, some sediment deposition and embeddedness are creating problems in the substrate.	Agricultural Watershed Management Area
Lower Scotts Branch - EXCELLENT	EXCELLENT	All parameters - macroinvertebrates, fish and habitat, are in excellent condition. Most of this reach is within the Patuxent River State Park	One of the least impaired stream reaches in the County Watershed Preservation Area
Upper Middle Tribs - GOOD (preliminary)	GOOD (preliminary)	Mixed agriculture and forest cover.	Agricultural Watershed Management Area
Lower Middle Tribs - EXCELLENT (preliminary)	EXCELLENT (preliminary)	Predominately forested areas located within the Patuxent River State Park.	Watershed Preservation Area
Upper Hipsley Mill Run - FAIR (preliminary)	FAIR (preliminary)	Bank stability is poor, with high levels of sediment deposition and embeddedness.	Spotted turtle observed here. Agricultural Watershed Management Area
Lower Hipsley Mill Run - EXCELLENT	EXCELLENT	Conditions recover within the Patuxent River State Park. Excellent stream bank stability with clean riffles.	Watershed Preservation Area
Haights Branch - FAIR (preliminary)	FAIR (preliminary)	Very little forest cover. Stream channel is incised with areas of sediment deposition and bank erosion.	Agricultural Watershed Management Area
Mt. Carmel Trib. EXCELLENT (preliminary)	no data available		Watershed Preservation Area
Greenstone Trib. - EXCELLENT (prelim.)	GOOD (preliminary)	Excellent fish community. Embeddedness and sediment deposition shown some impairment.	Agricultural Watershed Management Area

Upper Patuxent River Watershed Management Categories and Projected Development Levels

Map 4



Upper Patuxent River Watershed Management Categories

Watershed Preservation Areas

All of the areas with excellent resource conditions are located almost entirely within the Patuxent River State Park. The protection provided by the park is expected to continue to preserve the excellent conditions in these stream reaches. Improvement of riparian conditions and BMPs in the upper sections of these subwatersheds will further ensure that the lower reaches remain in excellent condition.

Recommended Watershed Management Strategy

- Educational efforts to improve best management practices and stewardship among private landowners.

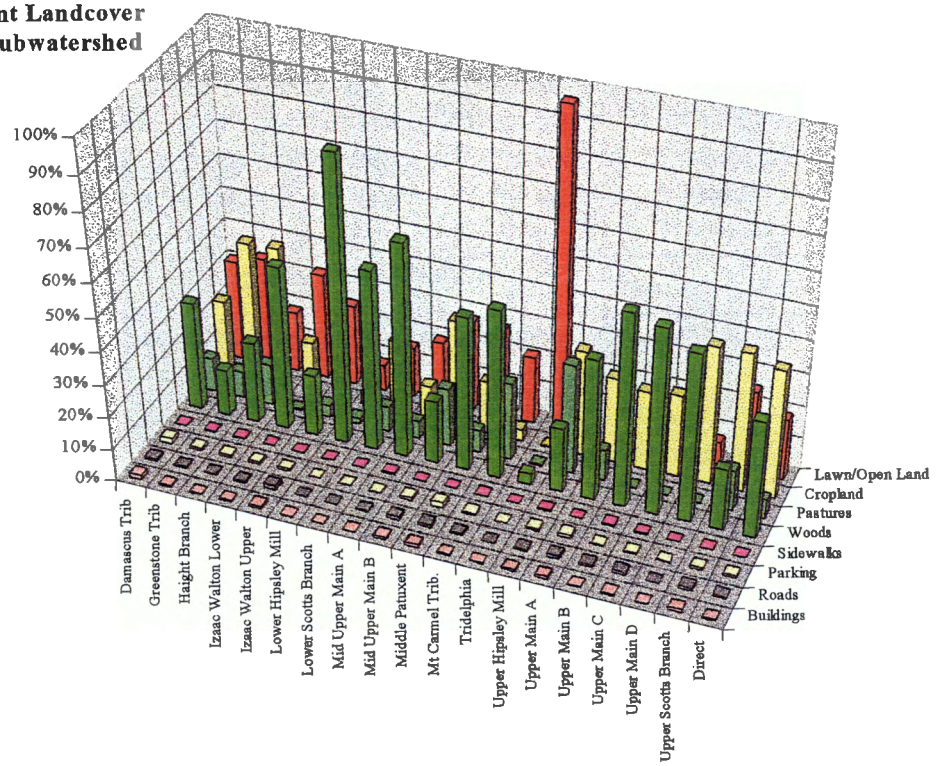
Agricultural Watershed Management Areas

The primarily agricultural character of the upper reaches of streams in the Upper Patuxent is not expected to change significantly, due to current zoning which promotes agricultural uses. These streams, as tributaries to the Patuxent River, are part of the designated Patuxent River Primary Management Area (PMA). Implementation of recommendations for the PMA are voluntary on lands not seeking subdivision or site design approval. Education and outreach efforts to increase the use of the most current BMPs, particularly forested buffers, is currently being pursued as part of the Patuxent Reservoir Protection Strategy effort.

Recommended Watershed Management Strategy

- Continue educational efforts through the Patuxent Reservoir Protection Strategy to improve best management practices and stewardship among private landowners.
- Increase forested buffer area to Primary Management Area standards through educational initiatives and voluntary implementation, and through application of PMA Guidelines on developing lands.

Upper Patuxent Landcover by Type and Subwatershed



	Acres	Stream miles
Damascus Trib	1788.0	9.7
Greenstone Trib	712.2	3.8
Haight Branch	1605.6	9.4
Izaac Walton Lower	148.4	0.6
Izaac Walton Upper	379.9	1.4
Lower Hipsley Mill	260.6	2.0
Lower Scotts Branch	286.8	1.5
Mid Upper Main A	730.2	8.0
Mid Upper Main B	997.9	4.2
Middle Patuxent	1217.1	5.0
Mt Carmel Trib.	354.7	1.9
Tridelphia	381.7	0.1
Upper Hipsley Mill	565.4	2.2
Upper Main A	643.4	4.8
Upper Main B	318.3	2.2
Upper Main C	146.4	1.3
Upper Main D	965.4	4.7
Upper Scotts Branch	1014.2	4.6
Direct	739.4	2.8
Watershed totals	13255.4	70.1

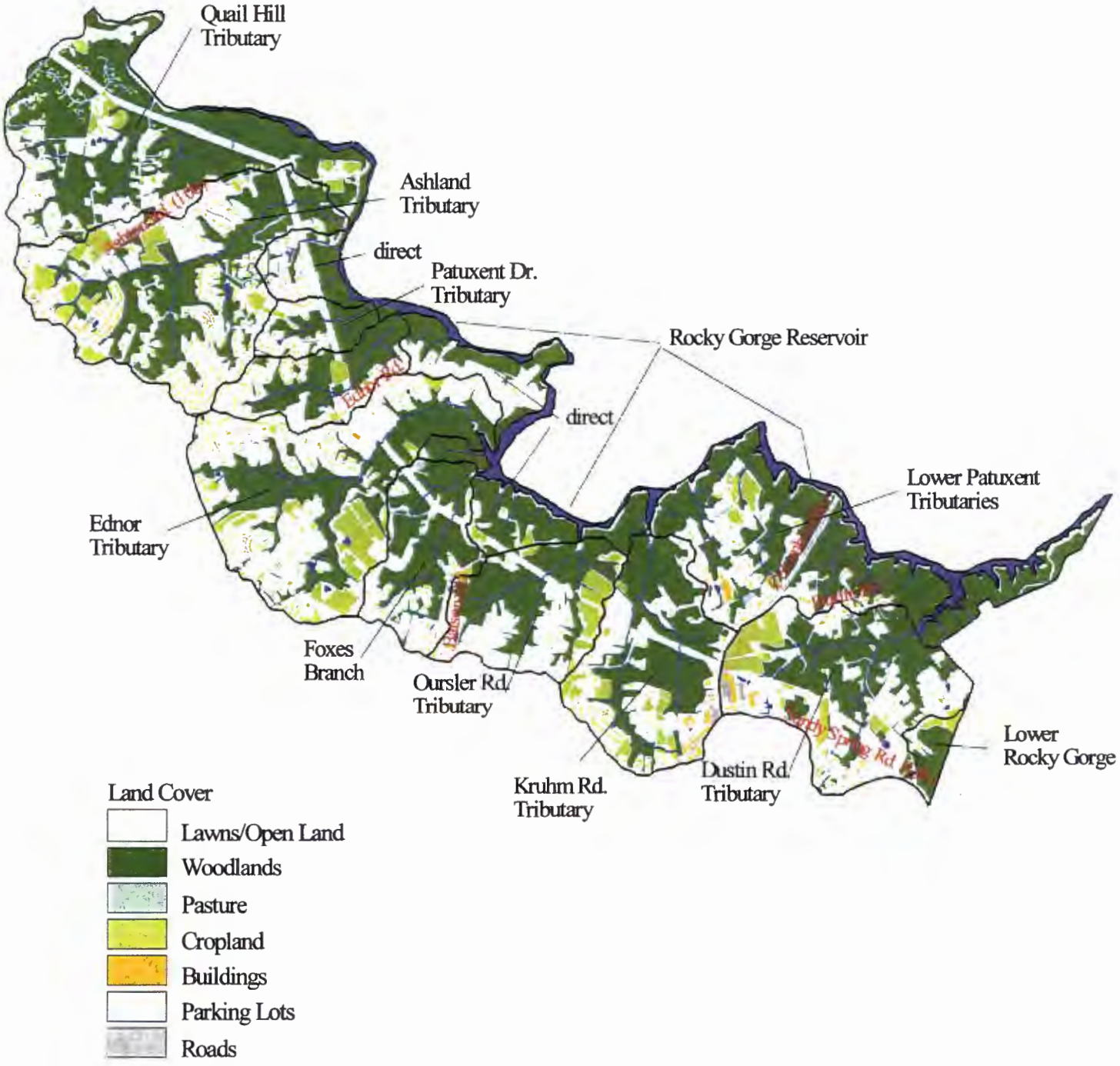
The Lower Patuxent Watershed

The Lower Patuxent watershed in Montgomery County consists of the mainstem and tributaries below the Hawlings River. These streams, like most of the Patuxent watershed in Montgomery County, drain predominately agricultural and large-lot residential areas. The mainstem and the lower reaches of the tributaries are largely protected by state park lands and a buffer area owned by the Washington Suburban Sanitary Commission to protect the reservoirs. The streams in this area, along with the Hawlings River and Upper Patuxent, are part of the Patuxent River Primary Management Area (PMA). The PMA is a stream buffer and transition zone within which land uses are closely managed to reduce non-point source runoff and nutrient loads, and improve and protect stream conditions. The ultimate goal for the primary management areas along the Patuxent River and its tributaries is to maintain low-density, low intensity land uses within 1/4 mile of the mainstem, and within 1/8 mile of tributaries, and to actively establish a minimum 50' forested buffer strip along all streams. The PMA guidelines are applied to development projects which are submitted to M-NCPPC for subdivision and/or site plan review, and are otherwise voluntarily implemented and strongly encouraged on remaining parcels throughout the watershed.

Streams in the lower Patuxent tend to exhibit higher levels of impairment than the tributaries in the upper watershed above Triadelphia. This may be due in part to less forest cover, particularly in upstream reaches.

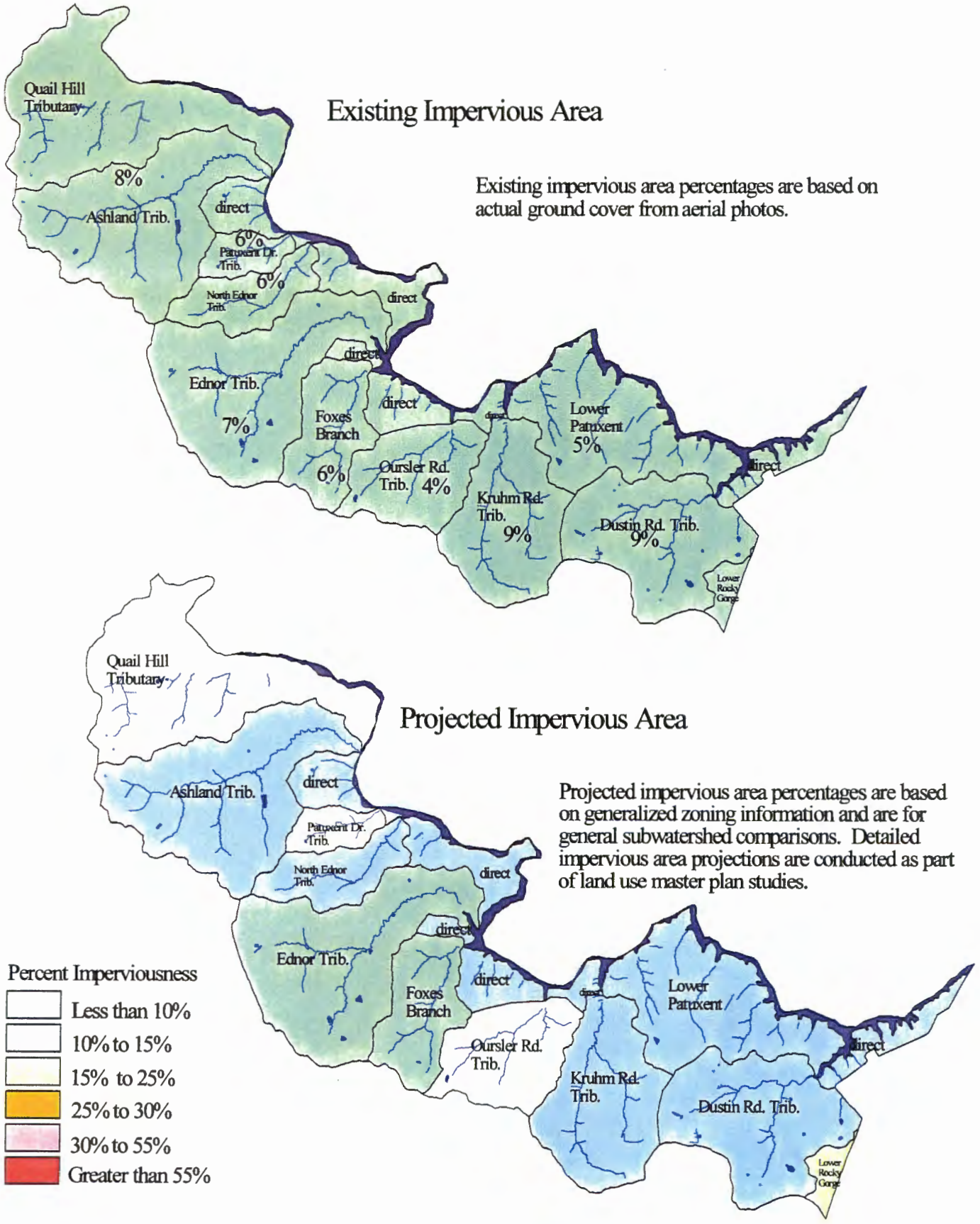
Lower Patuxent River Watershed

Map 1
Land Cover



Lower Patuxent Impervious Area Analysis

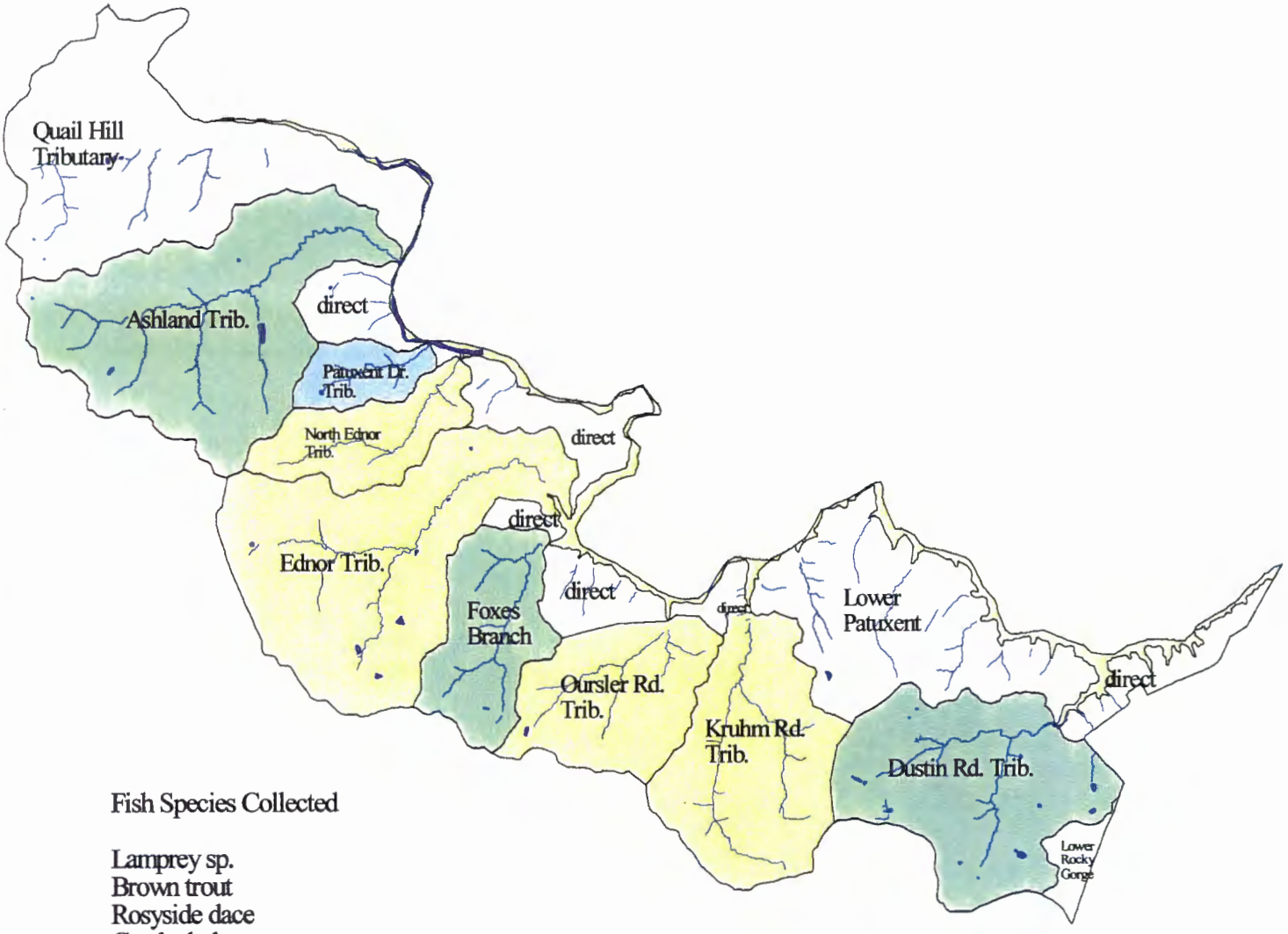
Map 2



Lower Patuxent Watershed Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Fish Species Collected

Lamprey sp.
Brown trout
Rosyside dace
Creek chub
River chub
Central stoneroller
Blacknose dace
Longnose dace
White sucker
Yellow bullhead
Brown bullhead
Mottled sculpin
Smallmouth bass
Green sunfish
Bluegill
Tessellated darter

Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Lower Patuxent Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
Quail Hill Trib. (preliminary)	No current data (preliminary)		Watershed Protection Area - regular level
Ashland Trib. - FAIR (preliminary)	FAIR (preliminary)	Reconnaissance indicated problems with sediment deposition and embeddedness. In-stream cover for fish is very limited.	Watershed Protection Area - regular level
Patuxent Dr. Trib. - EXCELLENT	EXCELLENT	Habitat and benthic community are excellent, however a fish blockage impairs overall biological condition	Most of this small drainage is protected in the Patuxent River Watershed Conservation Park. Watershed Preservation Area
North Ednor Trib. - FAIR (preliminary)	FAIR (preliminary)	High levels of sediment deposition and poor in-stream habitat impair biological community.	Watershed Restoration Area
Ednor Trib. - FAIR (preliminary)	GOOD (preliminary)	Sediment deposition and embeddedness levels high. Bank instability is a problem.	Watershed Protection Area - remedial level
Foxes Branch - GOOD (preliminary)	GOOD - (preliminary)	Sediment deposition and bank erosion affect habitat.	Watershed Protection Area - regular level
Kruhm Trib. - FAIR (preliminary)	FAIR (preliminary)	High levels of sediment in channels. A bridle trail on WSSC property creates a fish blockage, and overall habitat condition in headwaters is poor.	Watershed Restoration Area
Dustin Rd. Trib. - GOOD	EXCELLENT	Some sediment deposition and embeddedness is affecting otherwise excellent habitat. This stream has a steep gradient, and a 10' waterfall creates a natural fish barrier in the lower section.	Watershed Preservation Area
Oursler Rd. Trib.- FAIR (preliminary)	GOOD (preliminary)	Fine sediment depostion in pools and riffles is impacting resource condition.	Watershed Protection Area - remedial level
Lower Patuxent Mainstem	No current data		Watershed Preservation Area

Lower Patuxent Watershed Management Categories and Projected Development

Map 4

Lower Patuxent Watershed Management Categories

Watershed Preservation Areas

The Patuxent Dr. and Dustin Rd. tributaries, and the direct drainage and Lower Patuxent mainstem are designated Watershed Preservation Areas due to the excellent habitat conditions in these two areas. Biological conditions are good rather than excellent in these areas due to barriers to fish migration which affect this component of the biological community. In the case of the Dustin Rd. tributary, this is a natural barrier created by a waterfall. The overall high quality conditions in these tributaries should continue to be preserved by the low density land uses, parkland and conservation areas in these watersheds. The Lower Patuxent mainstem area is also placed in this category due to the large areas currently protected by public land surrounding the reservoir. Baseline monitoring in this area will be used to refine the management approach if necessary

Watershed Management Strategy

- Promote use of best management practices and implementation of the Primary Management Area guidelines in these tributaries to help to address sediment levels in the streams.
- Pursue measures to improve headwater habitat in the Kruhm tributary and to improve fish passage.

Watershed Protection Areas

Remedial level of protection

Both the Ednor tributary and the Oursler Rd. tributary are placed in this category despite their having only fair stream conditions, pending the results of baseline monitoring. They are placed in the remedial level of protection, rather than the Watershed Restoration Area category, due to the good habitat conditions, and preliminary stream assessment. High levels of sediment are found in these streams. Further monitoring will indicate whether more extensive restoration efforts are needed. Currently, remedial improvements to increase forested buffers and stabilize eroding banks are recommended. The Foxes Branch is also placed in this category, in order to target remedial approaches to improve stream habitat, which is fair.

Watershed Management Strategy

- Conduct baseline monitoring, to occur in 1999, to update preliminary assessment and refine watershed management approach.

Regular level of protection

The Quail Hill and Ashland tributaries are in this management category.

Watershed Management Strategy

- Use of existing environmental regulations and guidelines for new development should continue to protect these areas
- Conduct baseline monitoring, to occur in 1999, to update preliminary assessment and refine watershed management approach.

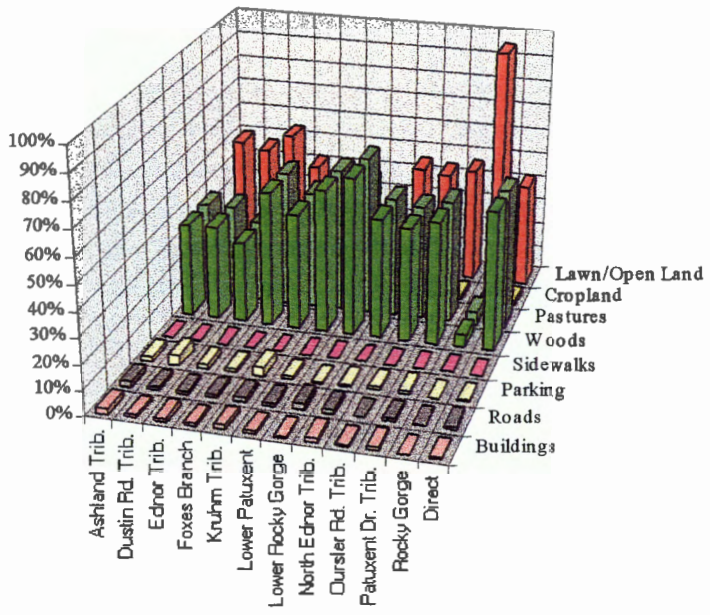
Watershed Restoration Areas

The Kruhm Rd. and North Ednor tributaries are placed in this category, pending the outcome of baseline monitoring, due to the extensive level of sedimentation occurring which has resulted in fair conditions in both biological conditions and stream habitat.

Watershed Management Strategy

- Conduct baseline monitoring, to occur in 1999.

Lower Patuxent Landcover by Type and Subwatershed



	Acres	Stream miles
Ashland Trib.	1016.1	5.1
Dustin Rd. Trib.	762.68	3.0
Ednor Trib.	1014.59	3.8
Foxes Branch	377.02	2.4
Kruhm Trib.	657.23	3.9
Lower Patuxent	1728	6.7
Lower Rocky Gorge	68.58	0.0
North Ednor Trib.	283.85	1.7
Oursler Rd. Trib.	455.04	2.2
Patuxent Dr. Trib.	134.46	1.1
Rocky Gorge	227.45	1.9
Direct	500.88	2.2
Watershed Totals	7225.88	34.0

The Upper Rock Creek Watershed

The rolling fields and farmland in the Upper Rock Creek watershed have changed in recent years as homes and businesses have replaced former dairy farms or corn fields. People can still remember when brown trout were regularly caught in the clear running waters of Rock Creek. Today, brown trout still survive in these streams, but are becoming increasingly harder to find. The Upper Rock Creek watershed contains many miles of small headwater streams unlike Lower Rock Creek and other down-County watersheds, where prior development piped many headwater areas.

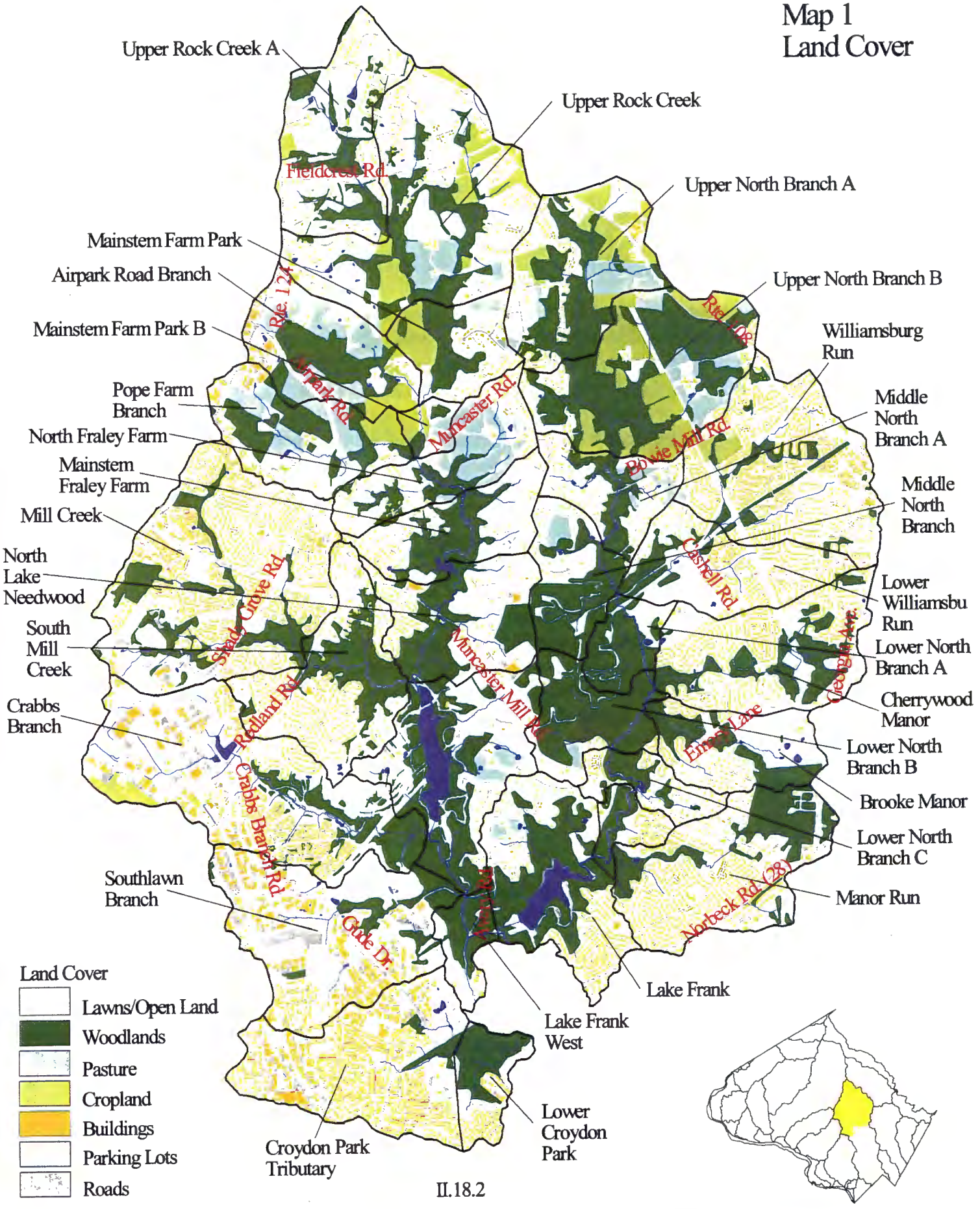
The Upper Rock Creek watershed is located in the central portion of the county and is the first major Potomac tributary west of the Anacostia River drainage. Upper Rock Creek is bounded by Dorsey Road (near Laytonsville) to the north, Olney-Laytonsville Road (Route 108) to the east, Route 28 to the south, and the Gaithersburg-Laytonsville Road (Route 124) to the west.

Rock Creek begins as a small spring emerging from an old spring house in the Laytonsville area. The upper reaches of the watershed (above Fieldcrest Road) are still relatively undeveloped. The County has acquired protective stream valley park land buffers along the upper Rock Creek main stems to help maintain the good to excellent resource conditions currently found here. Relatively unimpaired, this portion of Rock Creek supports several of the County's reference stream reaches. Passing under Fieldcrest Road, Rock Creek soon joins another main headwater tributary just above the Agricultural History Farm Park. The Agricultural History Farm Park was one of the first County parks to be master planned with stream resource protection goals and objectives included in the plan text.

Land uses in the drainage area from Fieldcrest Road downstream to Muncaster Road consist of newly developing large lot residential subdivisions, commercial uses along Route 124, and existing low to medium density residences. Under State law, many of the existing large lot developments have not had to provide stormwater quantity controls, although some have had to provide water quality controls for runoff. Some subdivisions now being constructed will be required to provide full quantity and quality runoff controls. Between Muncaster Road and Muncaster Mill Road, Rock Creek increases in size as its drainage area enlarges. Medium density residential development predominates, although there are still areas of large lot developments in the drainage. The stream valley in this area is in succession from farm fields to young forest.

Mill Creek currently has a poor to fair resource condition reflecting the density of development in its headwaters that was built with little or no SWM controls. This area has a combination of townhouses, single family homes, and apartments. The Crabbs Branch subwatershed has a highly impervious commercial area in its headwaters and the Crabbs Branch Regional Stormwater Pond was constructed to control the runoff from these facilities. The Southlawn Branch has an old industrial area in its headwaters that includes cement mixing facilities and sand and gravel operators. There are few stormwater runoff controls in this area. DEP monitoring at the outfall from the Southlawn Branch industrial area indicated an alkaline pH problem in the discharge. DEP is working with different cement mixing facility owners to improve on-site BMPs to reduce the pollutant discharges from these properties. An old landfill (Gude) in this subwatershed currently has a methane recovery system in place and BMP's to provide control of the runoff from the site. Lake Needwood is eutrophic, and downstream of the lake the water temperature and quality are noticeably impaired.

Upper Rock Creek Watershed



Upper Rock Creek Impervious Area Analysis

Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.

Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%

Projected Impervious Area

Information to be provided in update.

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Upper Rock Creek Stream Condition

Based on biological indicators.
See Chapter 2 for details.

Map 3

Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

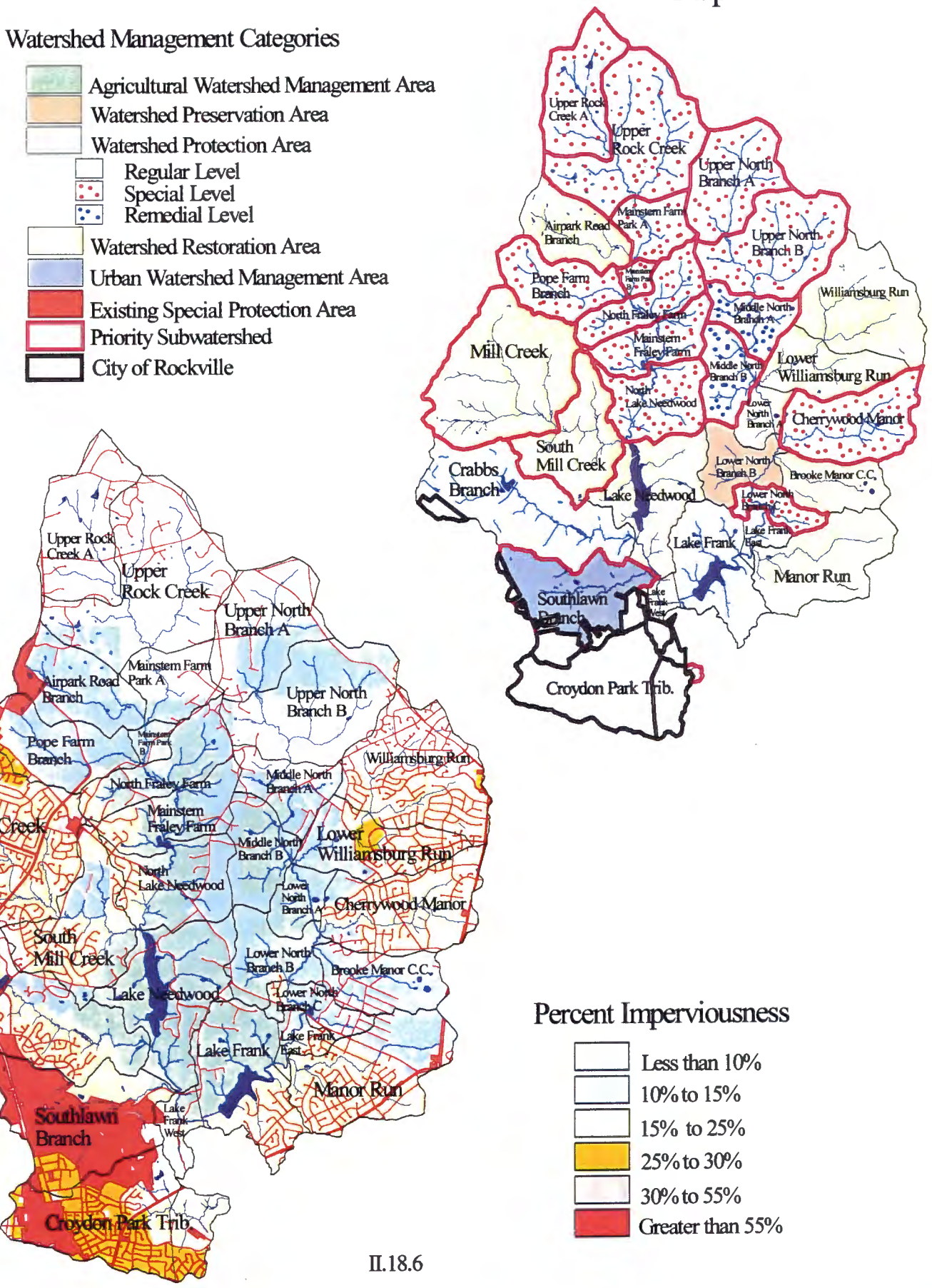
Golden shiner
Rosyside dace
Creek chub
Fallfish
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Satinfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
Silverjaw minnow
White sucker
Northern hogsucker
Yellow bullhead
Brown bullhead
Margined madtom
Mottled sculpin
Potomac sculpin
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter

Upper Rock Creek Stream Condition, Habitat Conditions, and Management Category Designation

Subwatershed/Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
Upper Rock Creek - EXCELLENT (preliminary in upper reaches)	GOOD Overall, Excellent in areas	Problems observed stemming from sediment deposition and embeddedness, most likely from past agricultural activities	Watershed Protection Area - special level
Mainstem Farm Park - GOOD	GOOD	Instream habitat degraded; sediment deposition, bank stability problems	Watershed Protection Area - special level
Mainstem Farm Park B - EXCELLENT	GOOD	Sediment deposition, bank instability in areas; habitat not as impaired as above	Watershed Protection Area - special level
Airpark Road Branch - FAIR	FAIR	Impacts to riparian area and problems with sediment deposition and bank stability	Watershed Restoration Area
Pope Farm Branch -EXCELLENT	GOOD	Flow conditions are a limiting factor; some sediment deposition	Watershed Protection Area - special
North Fraley Farm - EXCELLENT (preliminary)	GOOD (preliminary)	Bank stability problem. Beaver activity noted.	Watershed Protection Area - special
Mainstem Fraley Farm - GOOD (preliminary)	GOOD (preliminary)	Bank stability problems observed. Beaver activity has been noted.	Watershed Protection Area - special
North Lake Needwood - EXCELLENT	GOOD	Aquatic insect community in the high excellent range - some bank stability problems	Watershed Protection Area - special
Mill Creek (Upper) - POOR (preliminary)	GOOD Overall (preliminary)	In-stream habitat conditions a limiting factor - impacts from high imperviousness	Watershed Restoration Area
South Mill Creek - FAIR	GOOD Overall	Bank stability problems, however fish community somewhat improved in this lower section.	Watershed Restoration Area
Lake Needwood Tribs.- FAIR (preliminary)	GOOD Overall (preliminary)	Low imperviousness overall, however lake and recreational facilities have an impact Lake is eutrophic (poor).	Watershed Restoration Area
Crabbs Branch - GOOD (preliminary)	GOOD Overall (preliminary)	Stormwater management facility mitigates impacts from upstream imperviousness - stability and in-stream habitat generally good below pond.	Watershed Protection Area - regular (outside City of Rockville)
Southlawn Branch - POOR (preliminary)	GOOD (preliminary)	In-stream habitat fair. High imperviousness and water quality impacts from industrial uses impact biological community.	Urban Watershed Management Area (outside City of Rockville)
Croydon Park Trib. - FAIR (preliminary)	GOOD to FAIR (preliminary)	High imperviousness in headwaters affects channel stability.	City of Rockville
Lower Croydon - POOR	GOOD Overall	In-stream habitat, particularly substrate, affected by runoff.	City of Rockville
Upper North Branch A - GOOD	GOOD Overall Excellent in areas	Benthic community showing signs of impact - embeddedness and sediment problems.	Watershed Protection Area - special
Upper North Branch B - EXCELLENT	GOOD Overall	Strong indicators in the biological community. Habitat condition may be the result of previous agricultural uses.	Watershed Protection Area - special
Middle North Branch A and B - GOOD(preliminary in lower reach)	FAIR (preliminary in lower reach)	Fish community showing signs of stress. Impairment in areas immediately downstream may be affecting this area.	Watershed Protection Area - remedial
Williamsburg Run - FAIR (preliminary in upper reaches)	FAIR (preliminary in upper reaches)	Very "flashy" stream hydrology - serious problems observed with sediment depositions, embeddedness, bank stability.	Watershed Restoration area
Lower North Branch A - FAIR	FAIR	Serious problems with sed. deposition and bank stability.	Watershed Restoration Area
Cherrywood Manor -EXCELLENT	GOOD	High quality stream reach, but stream banks are showing signs of destabilization.	Watershed Protection Area - special
Lower North Branch B -Excellent	GOOD	Very low existing imperviousness in this area.	Watershed Preservation Area
Lower North Branch C - Excellent	GOOD		Watershed Protection Area - special
Brooke Manor - FAIR(preliminary)	no current data		Watershed Restoration Area
Lake Frank East - GOOD (preliminary)	GOOD Overall (preliminary)	Inadequate riparian buffer in areas.	Watershed Protection Area - regular
Manor Run - POOR	POOR	Problems observed with in-stream habitat.	Watershed Restoration Area
Lake Frank Tribs.	no current data	Lake is eutrophic (poor).	Watershed Protection Area

Upper Rock Creek Watershed Management Categories and Projected Development

Map 4



Upper Rock Creek Watershed Management Categories

The Upper Rock Creek watershed contains many subwatersheds supporting excellent stream conditions. Some of these areas are fragmented by stream sections showing signs of impairment, and the overall resiliency of this high quality headwater system is somewhat compromised by this pattern. Measures to improve and stabilize impacted areas will greatly benefit the overall function of this system. Many of the areas currently supporting "good" stream conditions may be capable of supporting an excellent community through targeted efforts to improve, stabilize and protect areas showing signs of stress. Many of these areas are projected to have only modest increases in imperviousness. Planning efforts in the Upper Rock Creek watershed have emphasized preserving the health of this stream system, as well as protecting the valued recreational resources and maintaining the flood protection benefits provided by Lake Needwood. DEP is in the process of developing a watershed restoration action plan for addressing stormwater retrofit, stream restoration, and habitat improvements comprehensively throughout the watershed. The management approach outlined below will be updated as necessary to incorporate feasibility study results and watershed restoration action plan recommendations.

Watershed Preservation Areas

This category includes the Lower North Branch subwatershed. The low levels of existing and projected imperviousness in Lower North Branch should continue to preserve the excellent conditions found here, in combination with efforts to maintain and improve upstream conditions.

Watershed Management Strategy

- Pursue efforts as part of a comprehensive watershed action plan to address upstream conditions.

Watershed Protection Areas

This designation includes all of the subwatersheds currently assessed as supporting excellent or good stream conditions, with the exception of Lower North Branch which is discussed above.

Special level of protection

Special protection tools are recommended for many of the headwater areas to protect the sensitive resources in these streams where projections of imperviousness indicate the highest levels of subwatershed land use change may occur.

Watershed Management Strategy

- Target efforts to maintain and improve forested riparian buffer areas through various options (e.g. conservation easements, parkland acquisition and/or dedication, targeted off-site forest conservation, voluntary implementation by landowners, etc.)
- Develop and implement public education program residents, businesses and developers to increase awareness of stream resources and special management needs.
- Pursue imperviousness reduction strategies, targeted habitat improvements
- Identify habitat improvement opportunities through development of overall watershed restoration action plan.

Remedial level of protection

Middle North Branch A and B are identified for remedial levels of protection in order to address existing habitat impairment and other problems in these subwatersheds. Imperviousness is not projected to increase to over 10% in these areas, and the potential for restoring these areas to a level supporting excellent stream conditions may exist.

Watershed Management Strategy

- Identify and pursue opportunities for stream restoration and habitat improvement projects as part of development of the overall watershed restoration action plan.

Regular level of protection

Three areas are identified for regular levels of protection, Crabbs Branch, Lake Frank and Lake Frank East. These subwatersheds contain good stream conditions which should continue to be protected by the application of standard environmental guidelines and regulations. Potential habitat improvement or structural improvements at the Crabbs Branch pond will be examined through the Rock Creek watershed feasibility study being conducted by DEP.

Rock Creek Watershed Management Categories (cont'd)

Watershed Management Strategy

- Continue current practices.
- Identify and pursue opportunities for stream restoration and habitat improvement projects as part of development of the overall watershed restoration action plan.

Watershed Restoration Areas

All of the subwatersheds supporting fair or poor stream conditions are identified as watershed restoration areas, with the exception of Southlawn Branch.

Watershed Management Strategy

- Identify and pursue opportunities for stream restoration and habitat improvement projects as part of development of the overall watershed feasibility study and restoration action plan.
- Increase public education and outreach efforts, including involving local citizens in Pipe Detectives and pollution prevention efforts.

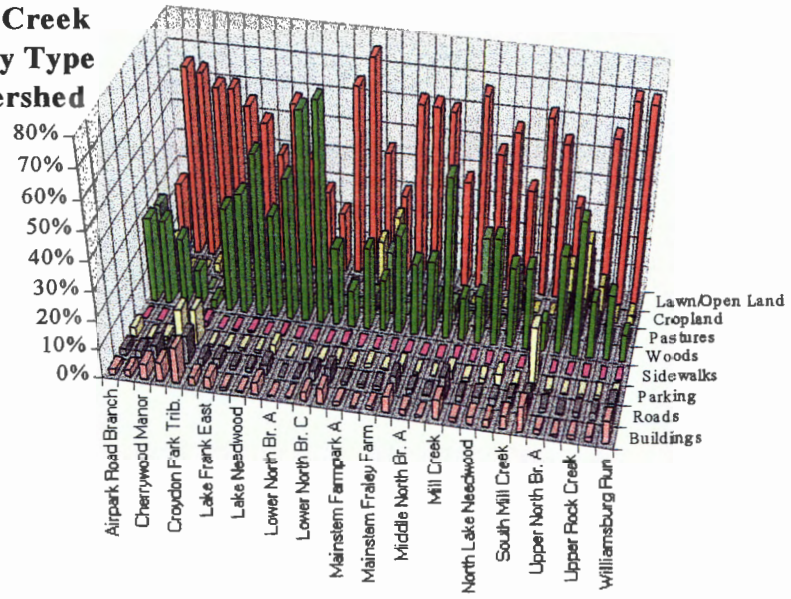
Urban Watershed Management Area

Southlawn Branch is designated an urban watershed management area out of the need to address existing urban water quality impacts in this watershed as a first priority.

Watershed Management Strategy

- Continue efforts to work with businesses in identifying pollution prevention measures to improve water quality conditions.
- Identify and pursue stormwater retrofit opportunities through the overall watershed feasibility study and restoration action plan.

Upper Rock Creek Landcover by Type and Subwatershed



	Acres	Stream miles
Airpark Road Branch	570.9	2.5
Brooke Manor CC	456.1	1.4
Cherrywood Manor	804.6	3.6
Crabbs Branch	1351.8	6.9
Croydon Park Trib.	922.7	1.4
Lake Frank	784.2	3.2
Lake Frank East	143.1	0.9
Lake Frank West	170.0	1.2
Lake Needwood	866.1	3.3
Lower Croydon	228.7	2.0
Lower North Br. A	216.1	1.3
Lower North Br. B	402.7	2.4
Lower North Br. C	218.9	1.5
Lower Williamsburg Run	558.5	2.6
Mainstem Farmpark A	356.3	1.6
Mainstem Farmpark B	94.0	0.5
Mainstem Fraley Farm	468.5	4.0
Manor Run	881.0	3.1
Middle North Br. A	366.0	2.1
Middle North Br. B	393.7	2.7
Mill Creek	1528.7	7.4
North Fraley Farm	486.9	3.3
North Lake Needwood	595.5	3.9
Pope Farm Branch	571.3	2.6
South Mill Creek	752.7	3.4
Southlawn Branch	1035.3	2.9
Upper North Br. A	745.5	2.9
Upper North Br. B	995.5	4.9
Upper Rock Creek	1321.8	5.9
Upper Rock Creek A	727.2	2.6
Williamsburg Run	999.7	3.6
Watershed Totals	20013.8	91.7

The Lower Rock Creek Watershed

Lower Rock Creek consists of the Rock Creek subwatersheds below Norbeck Road (Route 28). The watershed narrows here and the stream flows south through Montgomery County and the District of Columbia, eventually discharging into the Potomac River. Lower Rock Creek was one of the earliest areas of the County to experience development pressure as residents of the District made their summer homes along the Rock Creek corridor. Over the years, the watershed as a whole, and the lower sections in particular, have undergone rapid change as the push for housing and jobs has moved from the city to the suburbs. Today, most of Lower Rock Creek is a heavily urbanized, densely populated area that developed many years before there were requirements for managing stormwater runoff quantity and quality changes resulting from development.

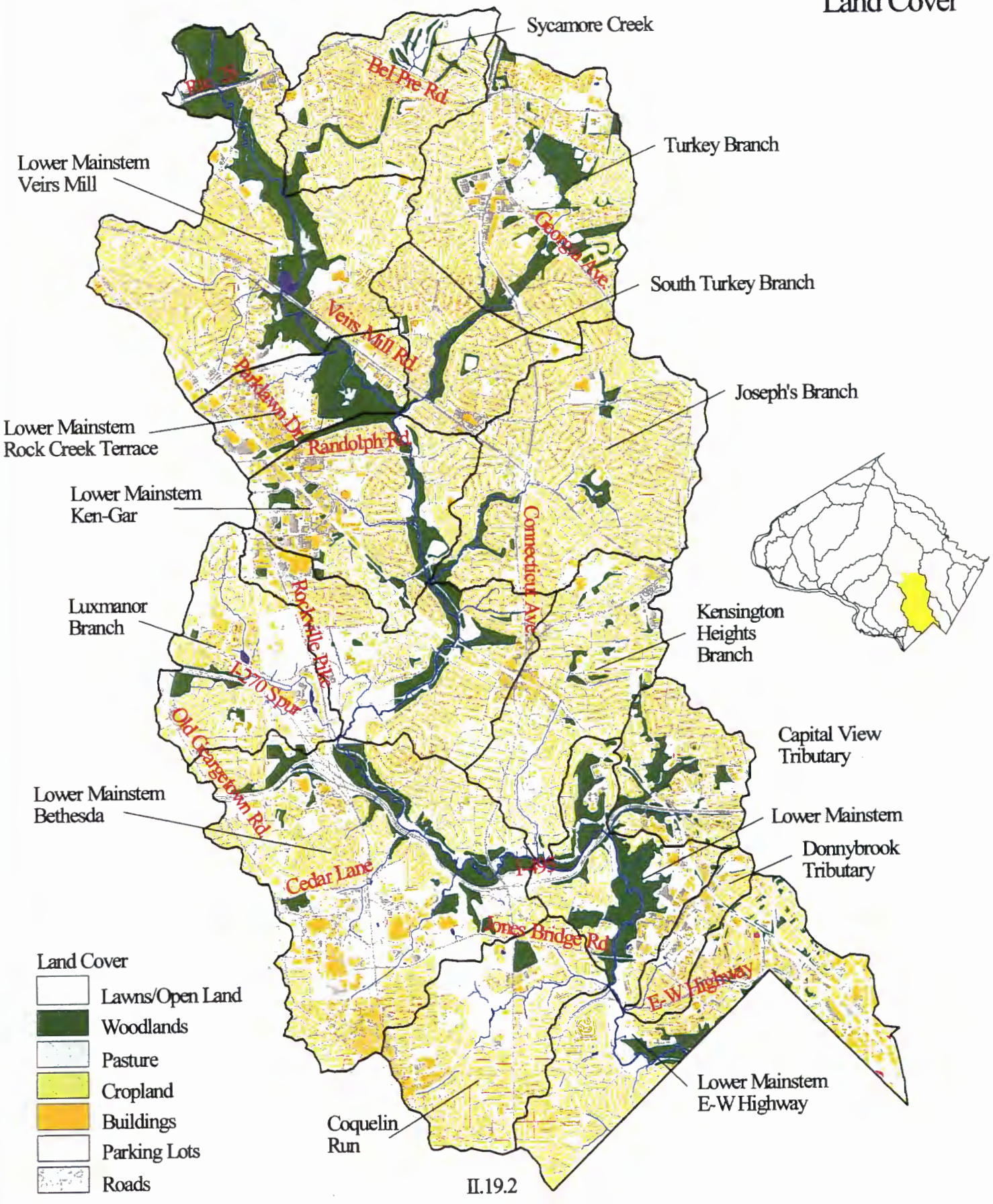
The Lower Rock Creek watershed contains one of the first County stream valley park systems. This park system directly connects to the Rock Creek National Park in the District of Columbia. One of the region's most heavily used and valued recreation corridors- the Rock Creek hiker-biker trail system- runs along the stream valley, linking the Montgomery County suburbs from Lake Needwood all the way down to the National Zoo and beyond. This stream valley park system also provides a protective buffer along the stream, preserving vernal pools and wetlands in the floodplain. Vernal pools near the County line still support a community of amphibians that have all but disappeared in other urban stream valley areas. Spotted salamanders return to the same vernal pools that have supported populations of this long-lived (over 20 years) amphibian for generations. Other amphibian species, such as American toad, wood frog, and spring peeper, are also locally abundant in this urbanized corridor.

The overall resource condition for Lower Rock Creek was fair to poor in 1996. Although conditions immediately upstream (in the Upper Rock Creek Watershed) are rated as good, resource conditions below Route 28 rapidly change to poor. Resource conditions improve to a fair level from the vicinity of Turkey Branch downstream to the vicinity of Kensington Heights, but degrade back to a poor level almost to the Montgomery County line. A preliminary assessment of fair has been assigned to the area from Coquelin Run downstream to the County line based on RSAT results.

Despite the extensive impacts to Lower Rock Creek from intensive development and urban runoff conditions, the mainstem still supports a warmwater fish community, and large redbreast sunfish can be found in many of the scoured out pools. Large hellgramites have also been found in some of the riffles and shallow runs. Rock Creek historically supported an abundant anadromous fish community and there are accounts of the spawning runs of herring and shad observed before the Pierce Mill and other more recent man-made structures blocked these annual fish migrations. Efforts are currently underway by the National Park Service to study options and implement efforts within the District of Columbia to remove fish blockages in the Rock Creek Park, notably at the old Pierce Mill dam. Watershed restoration efforts in Montgomery County are making progress in bringing positive changes to this watershed. These efforts include a watershed restoration feasibility study being conducted by DEP, a similar study by the City of Rockville, and efforts by the National Naval Medical Center to restore Stoney Creek, a tributary on this federal property.

Lower Rock Creek Watershed

Map 1
Land Cover



Lower Rock Creek Impervious Area Analysis

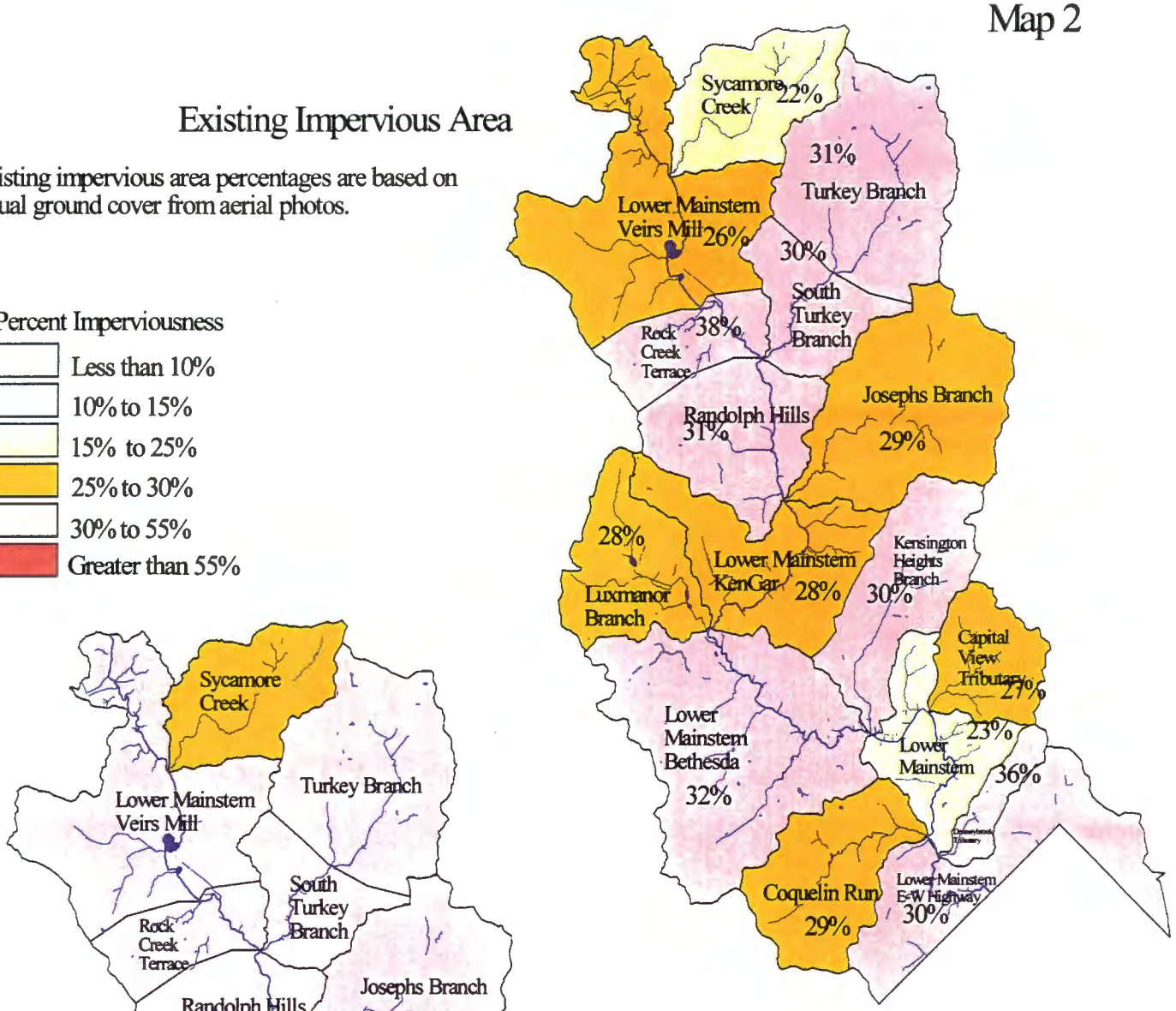
Map 2

Existing Impervious Area

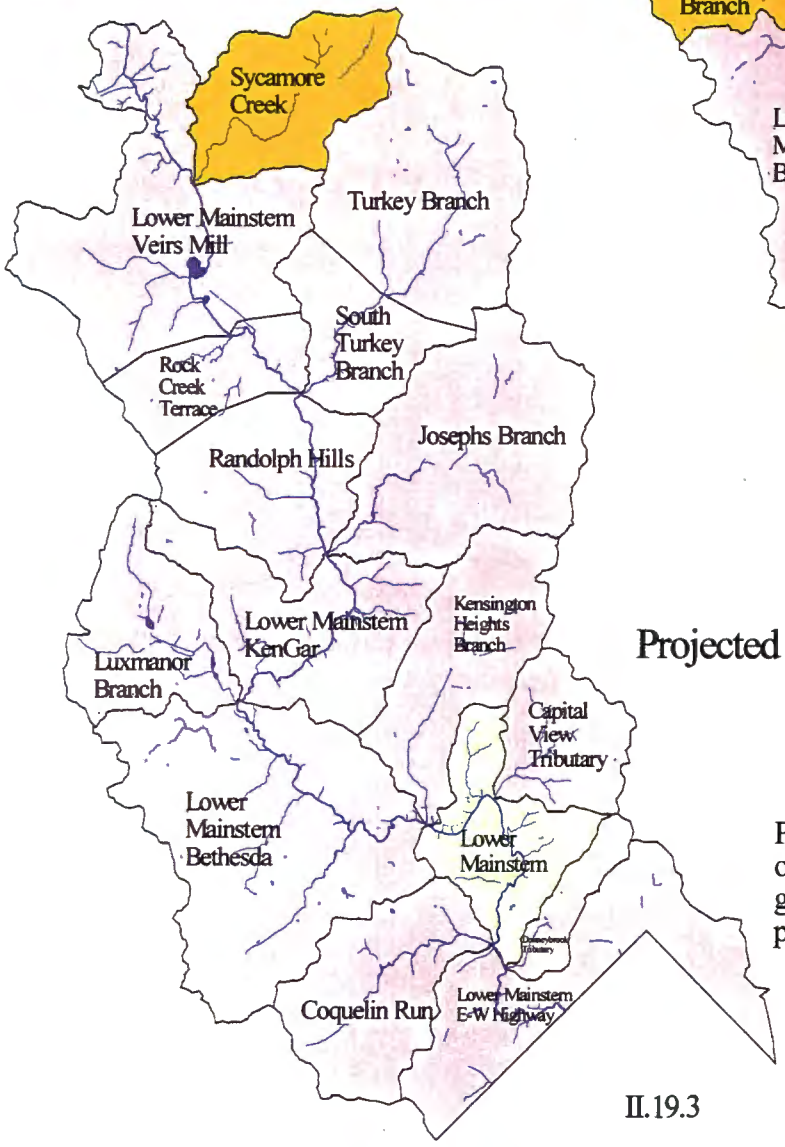
Existing impervious area percentages are based on actual ground cover from aerial photos.

Percent Imperviousness

- Less than 10%
- 10% to 15%
- 15% to 25%
- 25% to 30%
- 30% to 55%
- Greater than 55%



Projected Impervious Area

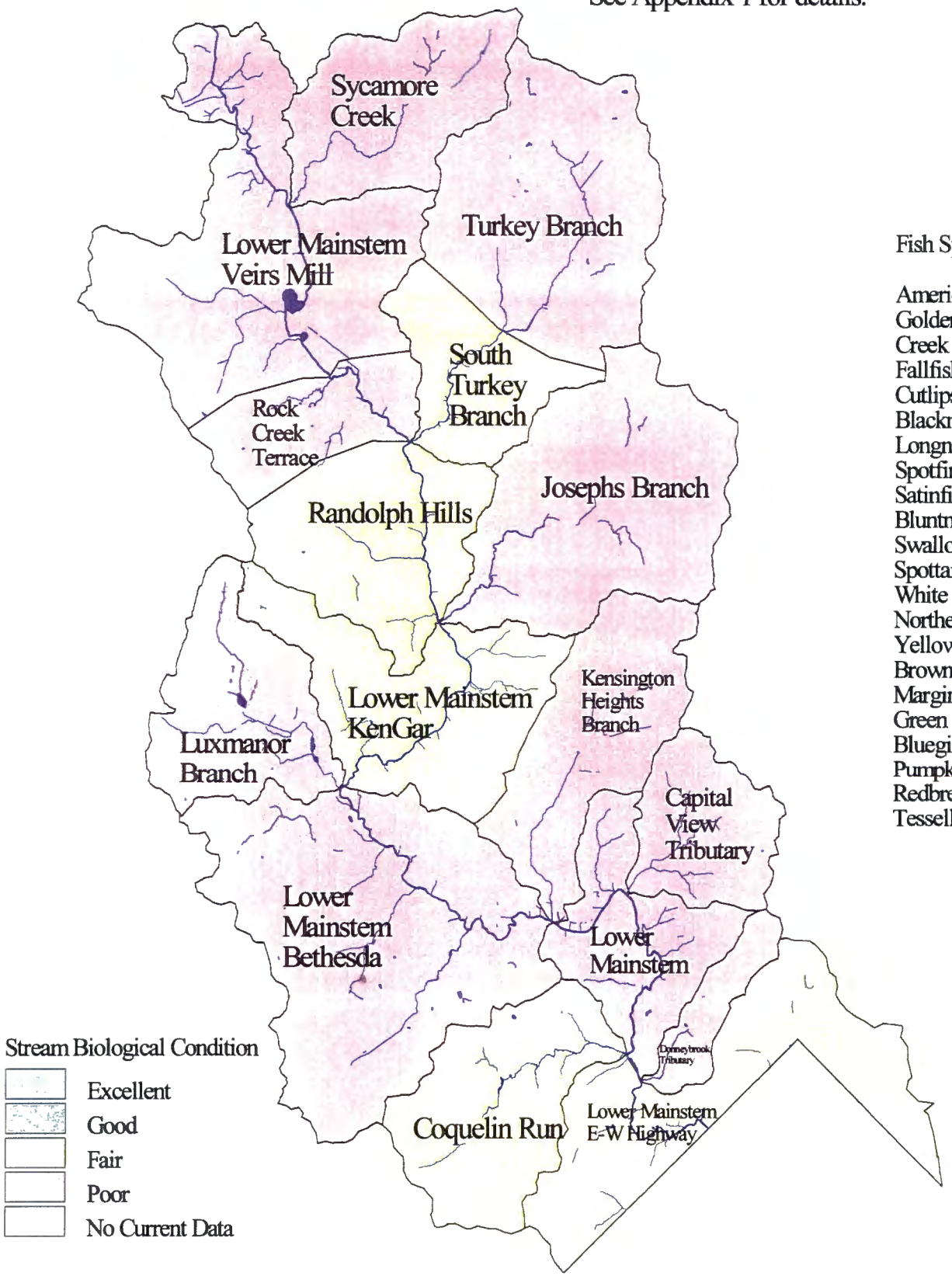


Projected impervious area percentages are based on generalized zoning information and are for general comparison. Detailed impervious area projections are conducted as part of area master plans.

Lower Rock Creek Stream Condition

Map 3

Based on biological indicators.
See Appendix 1 for details.



Fish Species Collected

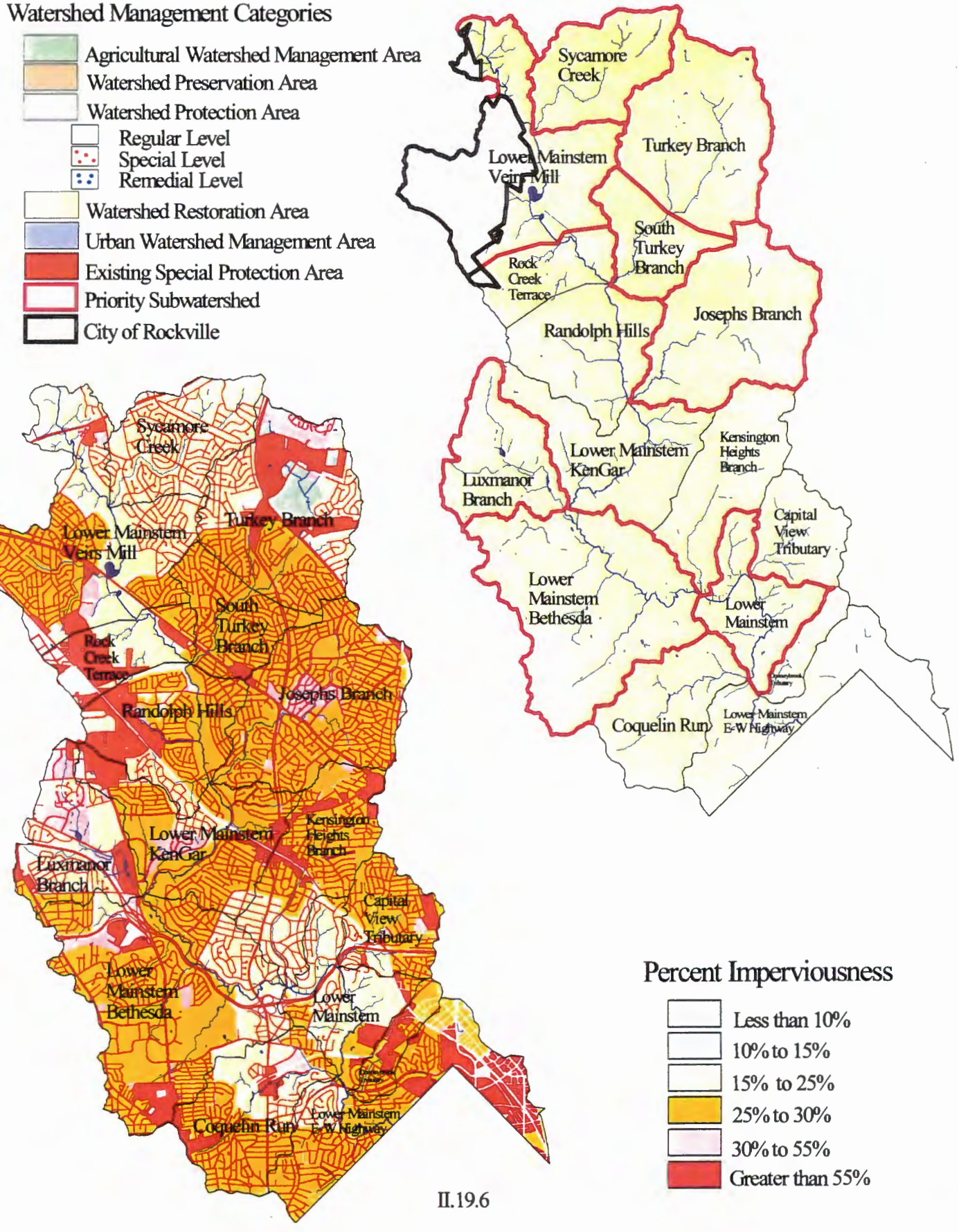
American eel
Golden shiner
Creek chub
Fallfish
Cutlips minnow
Blacknose dace
Longnose dace
Spotfin shiner
Satinfin shiner
Bluntnose minnow
Swallowtail shiner
Spottail shiner
White sucker
Northern hogsucker
Yellow bullhead
Brown bullhead
Margined madtom
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Tessellated darter

Lower Rock Creek Stream Condition, Habitat Conditions and Management Category Designation

Subwatershed/ Stream Condition	Habitat Conditions	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
Preliminary Assessments based on RSAT inventory of stream physical conditions conducted in 1995.			
Lower Mainstem Veirs Mill - POOR	FAIR	Uncontrolled runoff and high storm flows have impaired habitat. Sediment deposition, embeddedness and bank stability problems. Biological indicators seriously impaired (very low abundance).	Watershed Restoration Area (outside City of Rockville)
Sycamore Creek - POOR	FAIR	Similar problems as noted above, as well as inadequate riparian buffer.	Watershed Restoration Area
Turkey Branch - POOR (preliminary)	FAIR (preliminary)	Uncontrolled runoff and channelization have seriously impaired habitat conditions.	Watershed Restoration Area
South Turkey Branch FAIR	FAIR	Biological community somewhat improved in this area.	Watershed Restoration Area
Rock Creek Terrace - POOR (preliminary)	POOR (preliminary)	Uncontrolled runoff, and serious habitat degradation. Marginal channel stability.	Watershed Restoration Area
Randolph Hills - FAIR	FAIR	Quality of fish community improves somewhat in this area; macroinvertebrates still poor. Bank stability problems.	Watershed Restoration Area
Joseph's Branch - POOR	GOOD	Overall condition poor and abundance very low in macroinvertebrate community; fish community somewhat improved, most likely as the result of better habitat.	Watershed Restoration Area
Lower Mainstem Kengar - FAIR	FAIR	Poor macroinvertebrate community. Fish community in the good range. Lack of riffles, poor bank stability and very high sediment deposition impairs habitat.	Watershed Restoration Area
Luxmanor Branch - POOR	FAIR	Both fish and macroinvertebrates poor. Lack of instream cover for fish. Banks unstable; problems with riparian buffer and bank vegetative protection.	Watershed Restoration Area
Lower Mainstem Bethesda - POOR	FAIR	Very high density in the headwaters with very little runoff control.	Watershed Restoration Area
Kensington Heights Branch - POOR	FAIR	Much of this stream system is channelized, creating high runoff velocities from uncontrolled stormflow. Possible illicit discharges.	Watershed Restoration Area
Lower Mainstem - POOR	FAIR	Bank stability problems and high levels of sediment deposition impair biological community.	Vernal pools support a diverse amphibian community. Watershed Restoration Area
Capital View Trib. - POOR (preliminary)	POOR (preliminary)	Channel scouring and sediment deposition very high; uncontrolled runoff and limited riparian buffers.	Watershed Restoration Area
Coquelin Run - FAIR (preliminary)	FAIR (preliminary)		Watershed Restoration Area
Lower Mainstem E/W Hwy - FAIR (preliminary)	FAIR (preliminary)	U.S. National Park Service assessment indicates fish community improved in this section and below.	Watershed Restoration Area
Donnybrook Trib. - POOR (preliminary)	POOR (preliminary)	High imperviousness in headwaters. Problems with channel scouring, sediment deposition, and riparian buffer.	Watershed Restoration Area

Lower Rock Creek Watershed Management Categories and Projected Development

Map 4



Lower Rock Creek Watershed Management Category

Watershed Restoration Area

All of the Lower Rock Creek watershed is designated a restoration area. Efforts will be made to comprehensively examine and address stormwater retrofit, stream restoration and habitat improvement opportunities. Several tributaries have been extensively piped or channelized, but many areas of natural stream channel remain which may provide opportunities for habitat improvement.

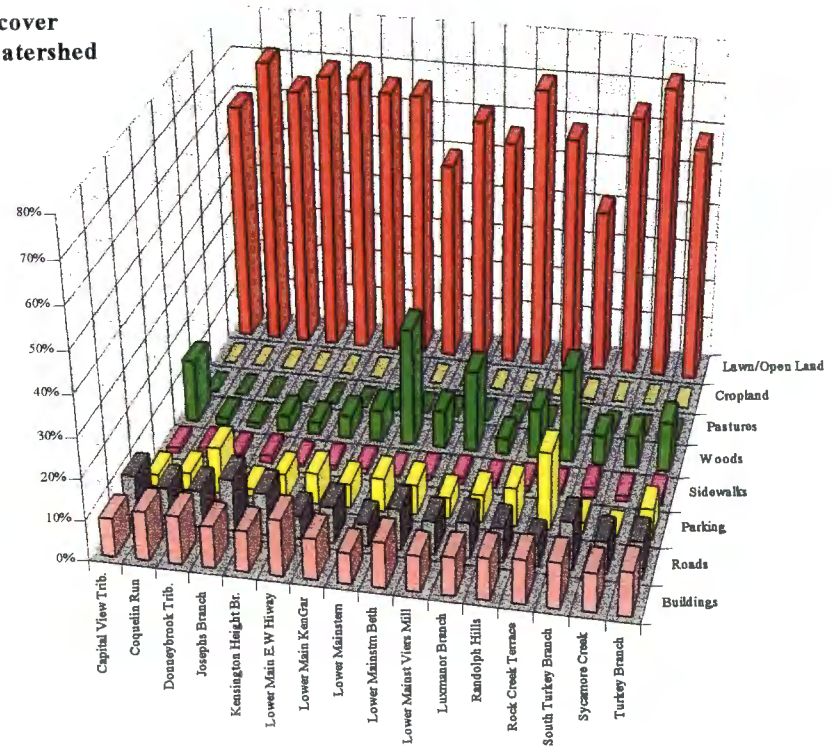
A study is currently being conducted by DEP to study the feasibility of various stormwater retrofit projects in the Rock Creek watershed and develop a Watershed Restoration Action Plan to comprehensively address degraded conditions where this is most feasible. Concurrently, the City of Rockville is undertaking a similar study of restoration and retrofit opportunities in the portions of the watershed within its jurisdiction, and the National Park Service is in the process of identifying enhancements and restoration projects in Rock Creek within the District of Columbia. The U.S. Department of the Navy also has an effort underway to study, design, and implement potential stormwater runoff improvements and habitat restoration on the National Naval Medical Center.

The combination of efforts currently underway to restore aquatic habitat within seriously degraded streams reaches of the Lower Rock Creek watershed are promising. To the extent that runoff conditions can be incrementally improved, and fish barriers removed, a more diverse biological community may someday return to this well known, heavily used, and much treasured recreational resource.

Recommended Watershed Management Strategy

- Continue efforts to develop comprehensive watershed restoration action plan to identify and implement stormwater retrofit and stream restoration projects.
- Pursue targeted educational initiatives for residents and businesses.

Lower Rock Landcover by Type and Subwatershed



	Acres	Stream miles
Capital View Trib.	657.0	2.5
Coquelin Run	1097.7	3.4
Donneybrook Trib.	275.6	0.6
Josephs Branch	1783.5	3.4
Kensington Height Br.	1125.2	3.0
Lower Main E.W Hiway	1363.8	3.6
Lower Main KenGar	1306.8	5.3
Lower Mainstem	851.4	6.0
Lower Mainstm Beth	2567.6	8.0
Lower Mainst Viers Mill	2160.4	9.4
Luxmanor Branch	972.2	3.9
Randolph Hills	1141.6	3.4
Rock Creek Terrace	629.0	2.5
South Turkey Branch	692.8	1.7
Sycamore Creek	991.9	2.9
Turkey Branch	1732.9	3.7
Watershed totals	19349.1	63.2

Rock Run and Potomac River Direct 4

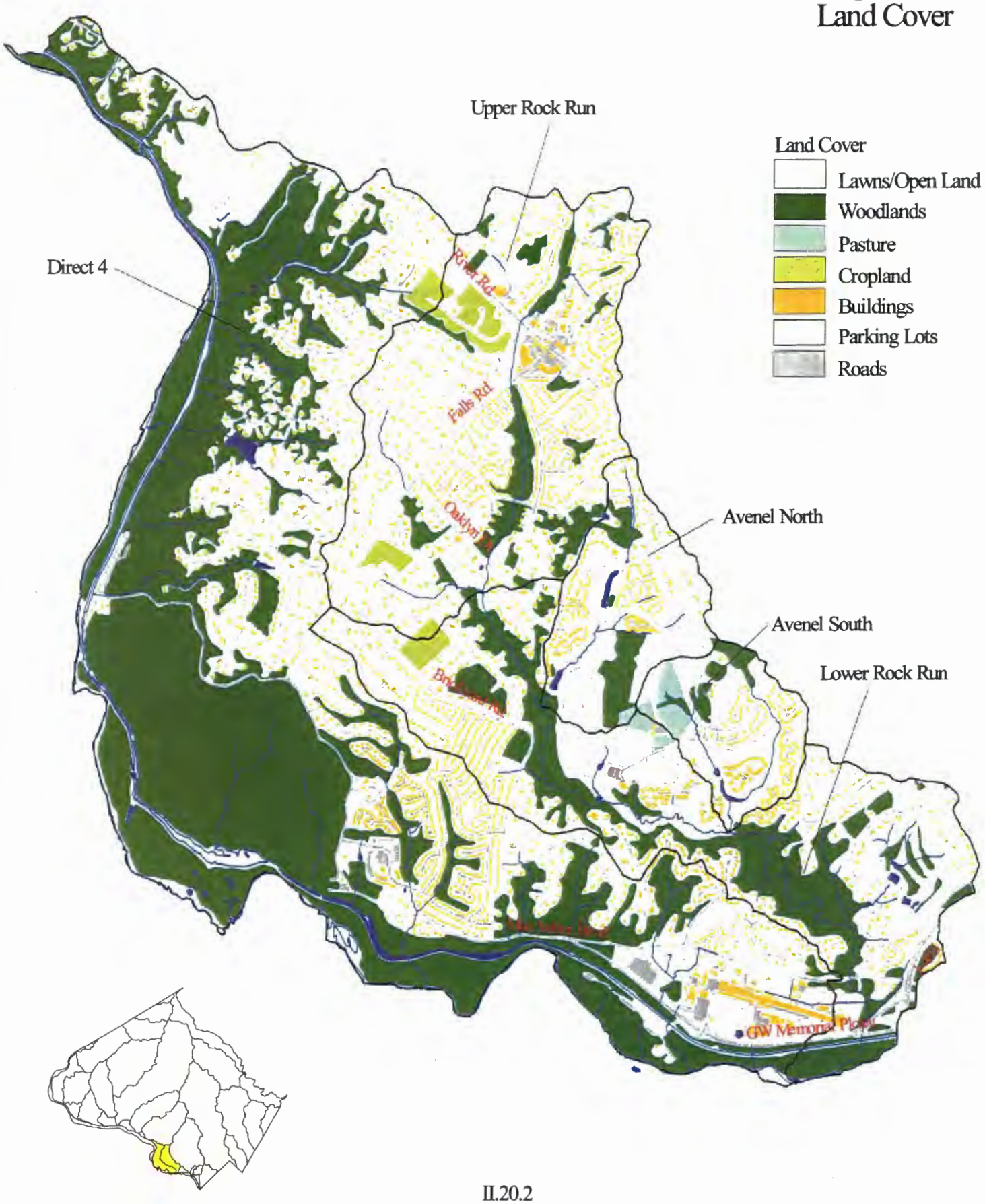
These small watersheds drain primarily residential land uses and have seen some interesting history over the years. The streams in these areas are closely linked to the Potomac River floodplain and C&O Canal corridor. Gold-mining activity occurred in both of these areas in the years following the Civil War. Evidence of this can still be found in areas of the stream valleys, including large excavations, spoil piles, and U-shaped excavated channels where forests are regenerating.

The Rock Run watershed contains a mix of older residential areas interspersed with newer planned communities. Habitat conditions in the streams are generally good, owing to the forested stream valleys and relatively recent nature of large areas of development. Despite generally good habitat, the biological community in this watershed is showing signs of impairment, particularly the macroinvertebrate community which has low abundance.

The fish community in Rock Run is typical of that found in a relatively small watershed in Montgomery County. Fantail darters, rosyside dace, and white suckers were found throughout stations monitored in 1996.

Rock Run Watershed and Potomac River Drainage

Map 1
Land Cover

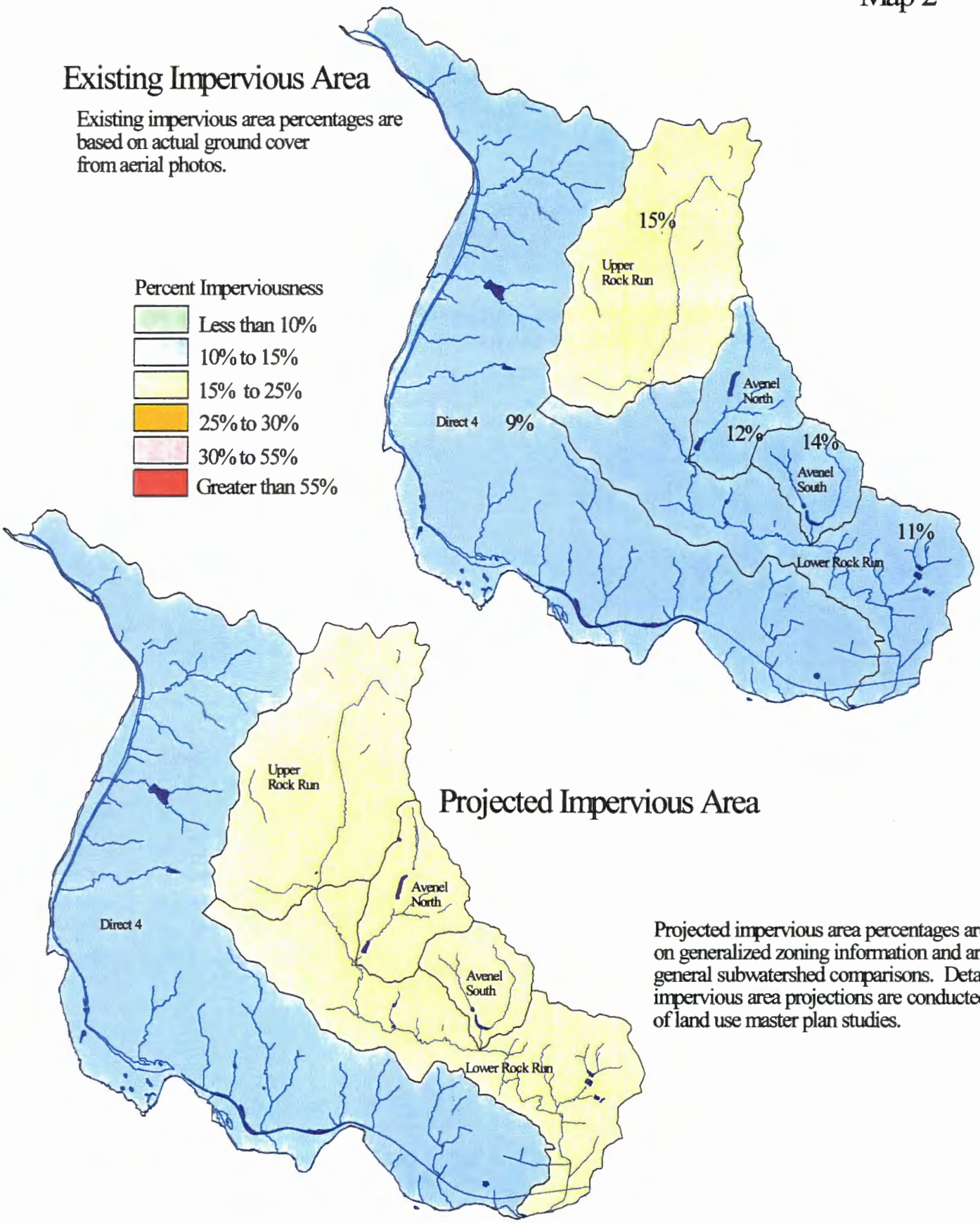


Rock Run Impervious Area Analysis

Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



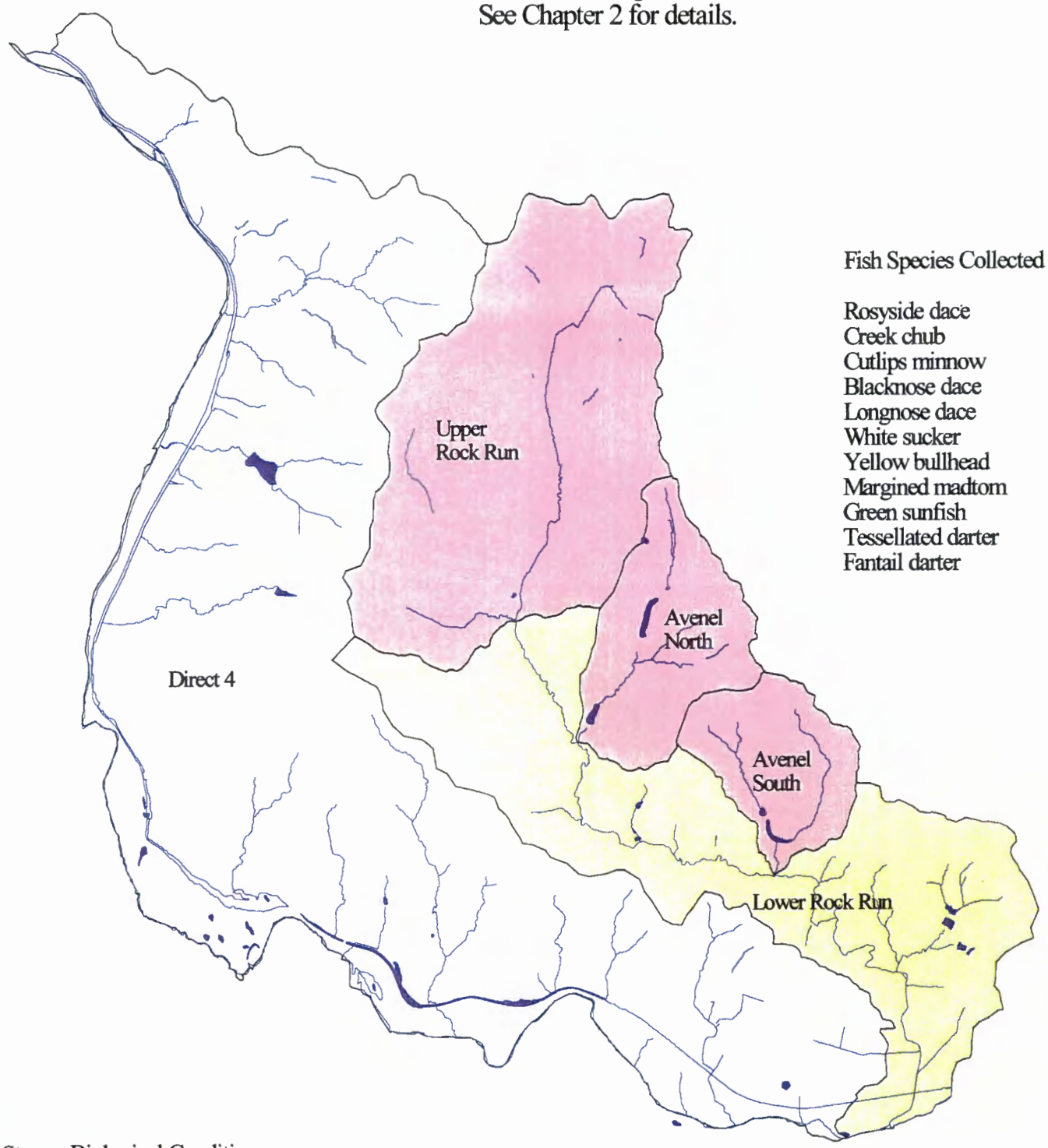
Projected Impervious Area

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Rock Run and Potomac Drainage Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Fish Species Collected

Rosyside dace
Creek chub
Cutlips minnow
Blacknose dace
Longnose dace
White sucker
Yellow bullhead
Margined madtom
Green sunfish
Tessellated darter
Fantail darter

Stream Biological Condition

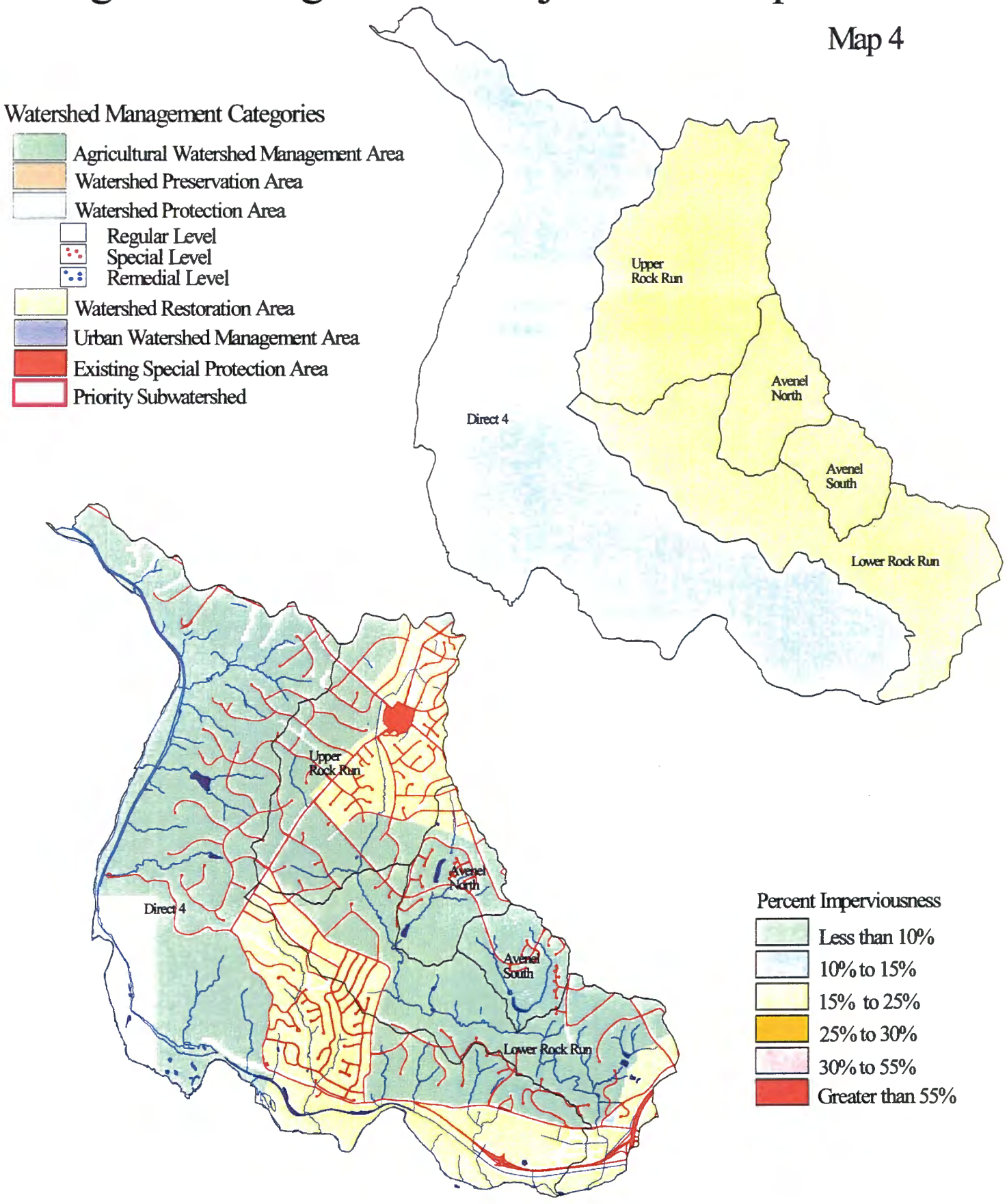
- Excellent
- Good
- Fair
- Poor
- No Current Data

Rock Run Stream Condition, Habitat Conditions, and Management Category Designations

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
Upper Rock Run - POOR	GOOD Overall	Despite good habitat, biological community is poor. High nutrient loads may be contributing to condition.	Watershed Restoration Area
Lower Rock Run - FAIR	GOOD Overall	Fish community improves in this section due to influence from the Potomac River which allows more diverse population of fish to move up into the lower reaches of Rock Run.	Watershed Restoration Area
Avenel Trib. North - POOR (preliminary)	No current data	Preliminary assessment of biological community is based on similarities between stream type and land use compared with Upper Rock Run.	Watershed Restoration Area
Avenel Trib. South - POOR (preliminary)	No current data	Preliminary assessment of biological community is based on similarities between stream type and land use compared with Upper Rock Run.	Watershed Restoration Area
Potomac Direct 4	No current data		

Rock Run and Potomac Direct Watershed Management Categories and Projected Development Levels

Map 4



Rock Run Watershed Management Category

The Potomac Subregion Master Plan Study is currently underway which will include an examination of land use and stream condition relationships. Watershed management approaches will be updated in the CSPS as necessary to respond to land use recommendations.

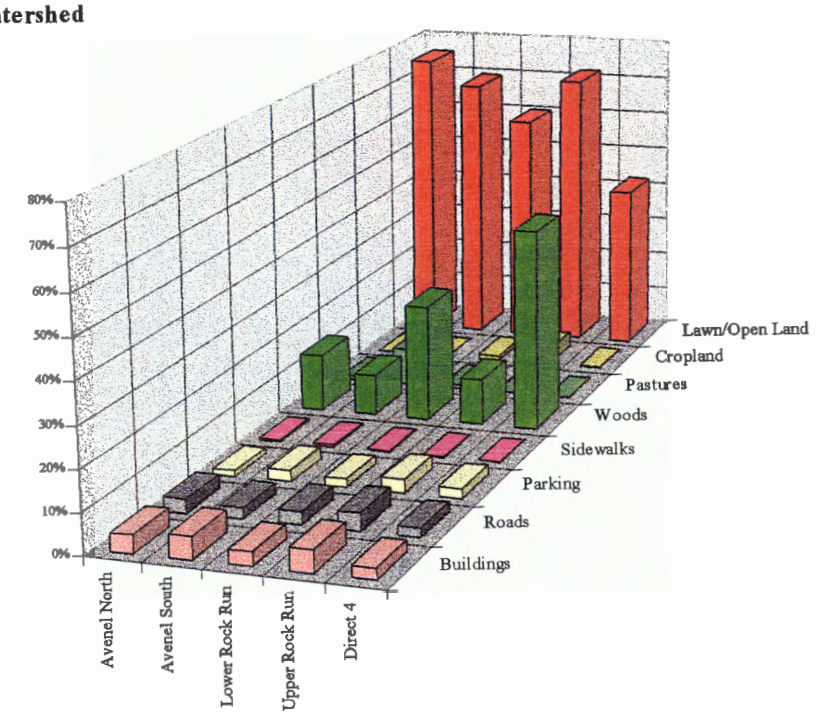
Watershed Restoration Area

All of Rock Run is currently designated as a watershed restoration area due to the impaired biological community and the need to comprehensively examine and address impaired stream conditions throughout the watershed. In Rock Run, biological conditions are worse than would be expected to occur based on the habitat conditions, and possible water quality impairment should be further investigated . The potential for mitigating the effects of high density development located in the Potomac Village area at the intersection of River and Falls Road should also be further investigated. Additional information is necessary to further identify restoration needs in order to target efforts, and baseline monitoring of this watershed is scheduled for 2000. The effects of past gold-mining activities in this water should be closely examined to identify areas where channel restoration may be needed.

Watershed Management Strategy

- Develop targeted public education and outreach program to promote watershed friendly yard care and turf management practices.
- Conduct baseline biological monitoring to occur in 2000 and update preliminary resource conditions.
- Further evaluate relationships between land use and stream conditions through the Potomac Subregion Master Plan Study.

Rock Run Landcover
by Type and Subwatershed



	Acres	Stream miles
Avenel North	370.8	1.6
Avenel South	264.8	1.5
Lower Rock Run	1313.1	8.5
Upper Rock Run	1262.0	3.1
Direct 4	3743.0	33.7
Watershed totals	6953.7	48.4

Sligo Creek Watershed

The Sligo Creek watershed, a tributary to the Northwest Branch of the Anacostia River, is one of the County's most urbanized watersheds. It is also the location of extensive efforts to restore an urban stream system and is notable for the success that is being achieved in controlling urban stormwater runoff and re-establishing a viable biological community. Until just recently, the only fish identified in Sligo Creek were blacknose dace, goldfish and creek chub - species that are highly tolerant of polluted urban conditions. External anomalies found in the fishes sampled, particularly the creek chub population, could be associated with environmental degradation such as chronic, sublethal exposure to contaminants or high levels of suspended solids. Many watershed residents are familiar with signs that used to be posted throughout the watershed, particularly in the lower reaches, warning of polluted water conditions.

Many high density commercial and residential areas are located within the Sligo Creek watershed, including the Wheaton Triangle area and part of the Wheaton Central Business District, large areas of Takoma Park, and much of downtown Silver Spring. These areas and surrounding residential neighborhoods developed rapidly during the 1950's and 60's, before today's environmental standards for stream valley protection and stormwater management. All that remains of Sligo's natural stream network are mainstems of streams with most feeder tributaries paved over and piped into storm drains. The remaining stream system has been heavily armored in many areas to reduce channel erosion. These alterations may improve bank stability, but provide limited habitat value. Areas that have not been armored exhibit varying degrees of bank instability and erosion problems due to uncontrolled stormflows. Efforts to restore the watershed have included an examination of methods to improve flow conditions so that stream channel restoration efforts can occur, rather than completely armoring the stream and displacing all natural habitat.

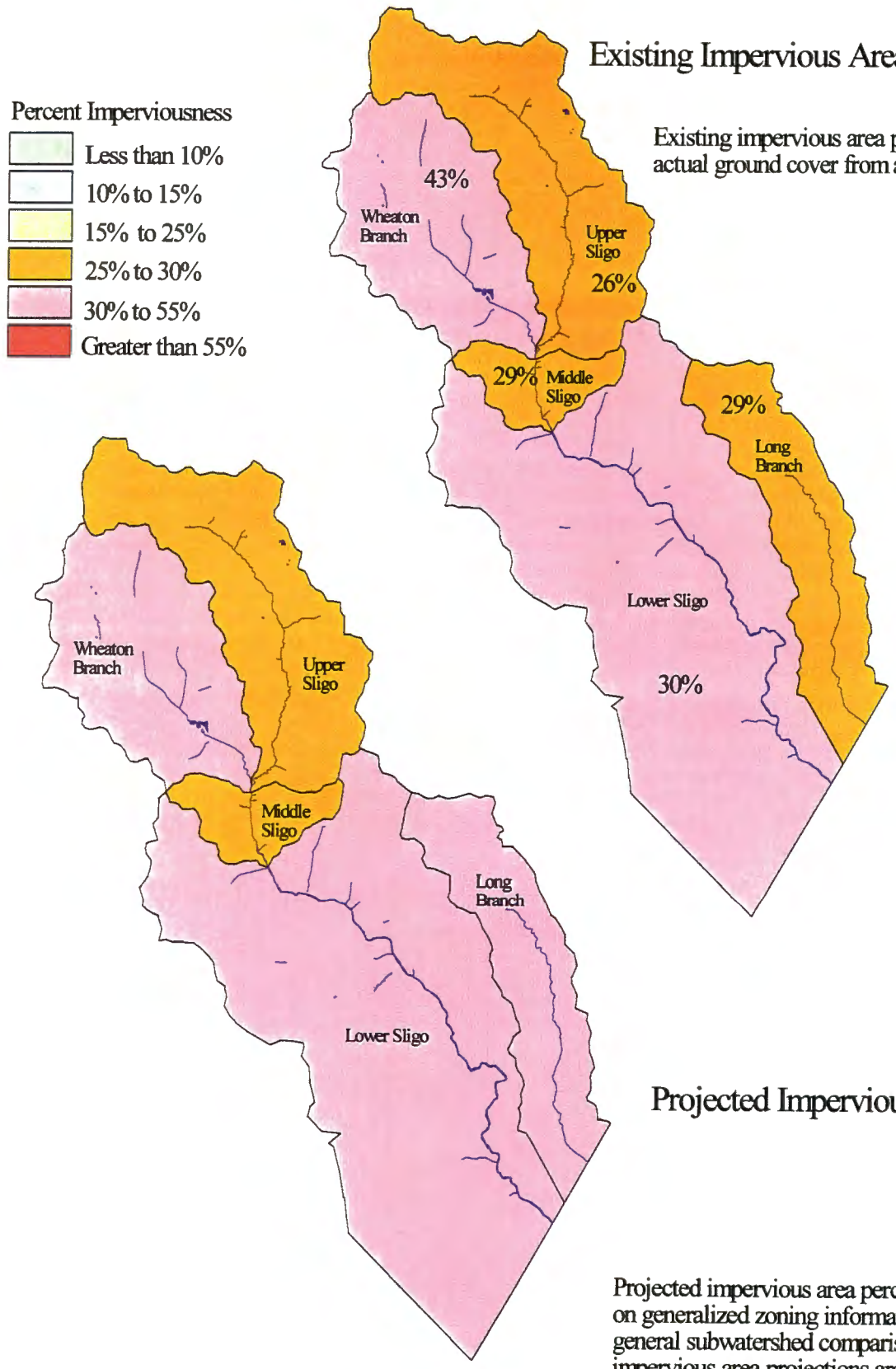
New runoff controls at the Wheaton Branch, the University Boulevard.. and Sligo Golf course retrofit ponds, and improvements to the aged and leaking sanitary sewers are bringing positive changes to the streams. Since completion of the Wheaton Branch pond and associated stream channel restoration, native fish have been transplanted from other similar watersheds in order to augment the recovery of fish populations in Sligo Creek. Existing downstream blockages restrict normal fish movement in Sligo Creek to some degree, preventing the natural re-establishment of a more diverse fish community. Biological monitoring conducted by the Interstate Commission on the Potomac River Basin (ICPRB) indicates that the number of native fish species re-established in the Upper Sligo Creek mainstem has increased from three in 1988 to eleven currently. This is extremely encouraging.

Despite the onslaught of urbanization, the Sligo Creek stream valley park system has preserved a riparian corridor which allows the protection and restoration of pockets of high quality stream habitat. Flow conditions and impaired habitat which have prevented a viable biological community from living in the watershed are being addressed through joint efforts by DEP, M-NCPPC, the ICPRB, and the Metropolitan Washington Council of Governments as part of the regional Anacostia Watershed Restoration Project. Community groups and schools frequently contribute to efforts to clean up streams throughout the watershed. The Sligo Creek stream valley is heavily used by local residents and visitors, and is one of the County's most important urban natural environments. The successes achieved thus far in Sligo Creek are setting the standard for other urban watersheds in and beyond our County, and reflect Montgomery County's emerging national leadership in stream restoration.

Sligo Creek Watershed

Sligo Creek Impervious Area Analysis

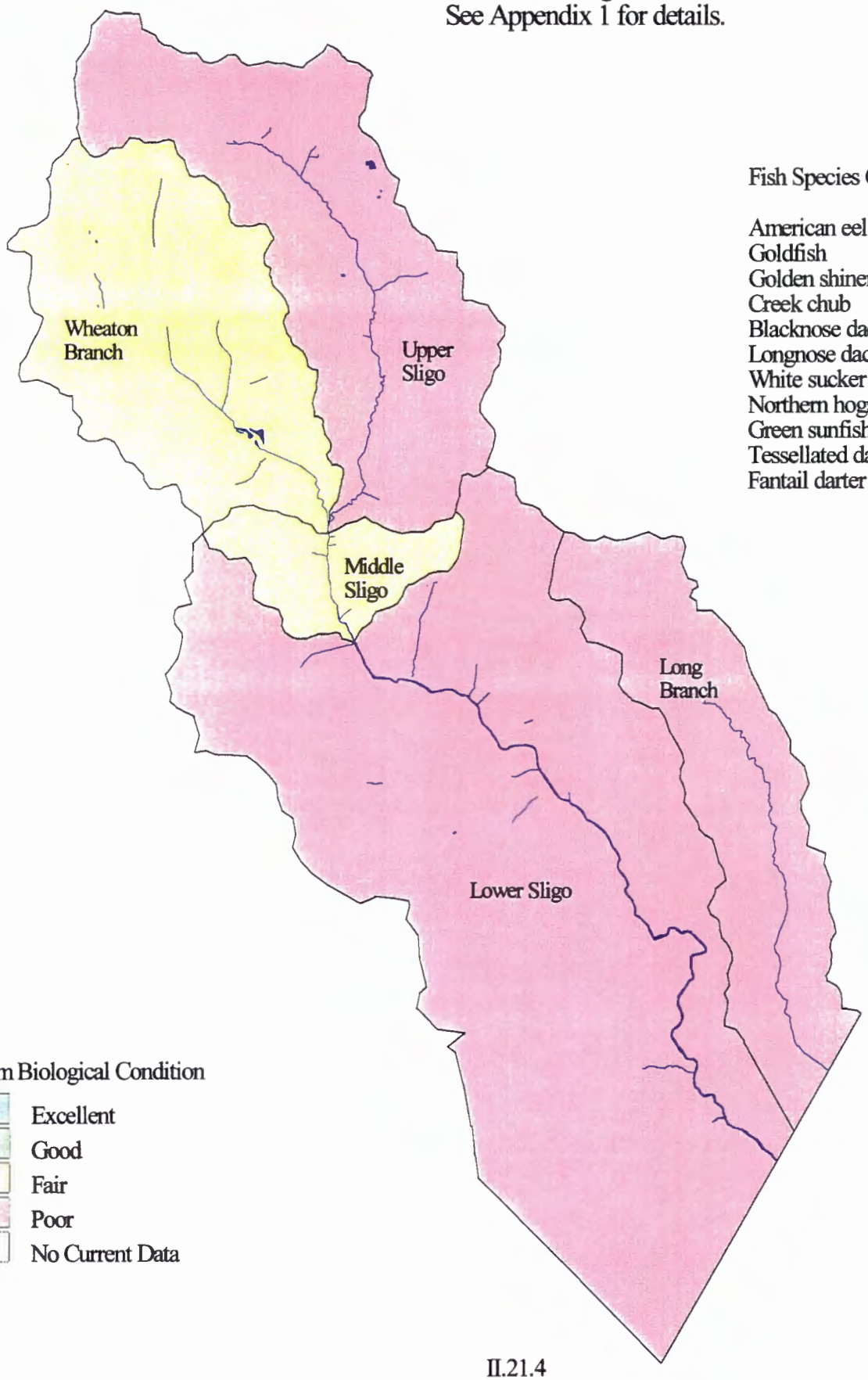
Map 2



Sligo Creek Stream Condition

Map 3

Based on biological indicators.
See Appendix 1 for details.



Fish Species Collected

American eel
Goldfish
Golden shiner
Creek chub
Blacknose dace
Longnose dace
White sucker
Northern hogsucker
Green sunfish
Tessellated darter
Fantail darter

Stream Biological Condition

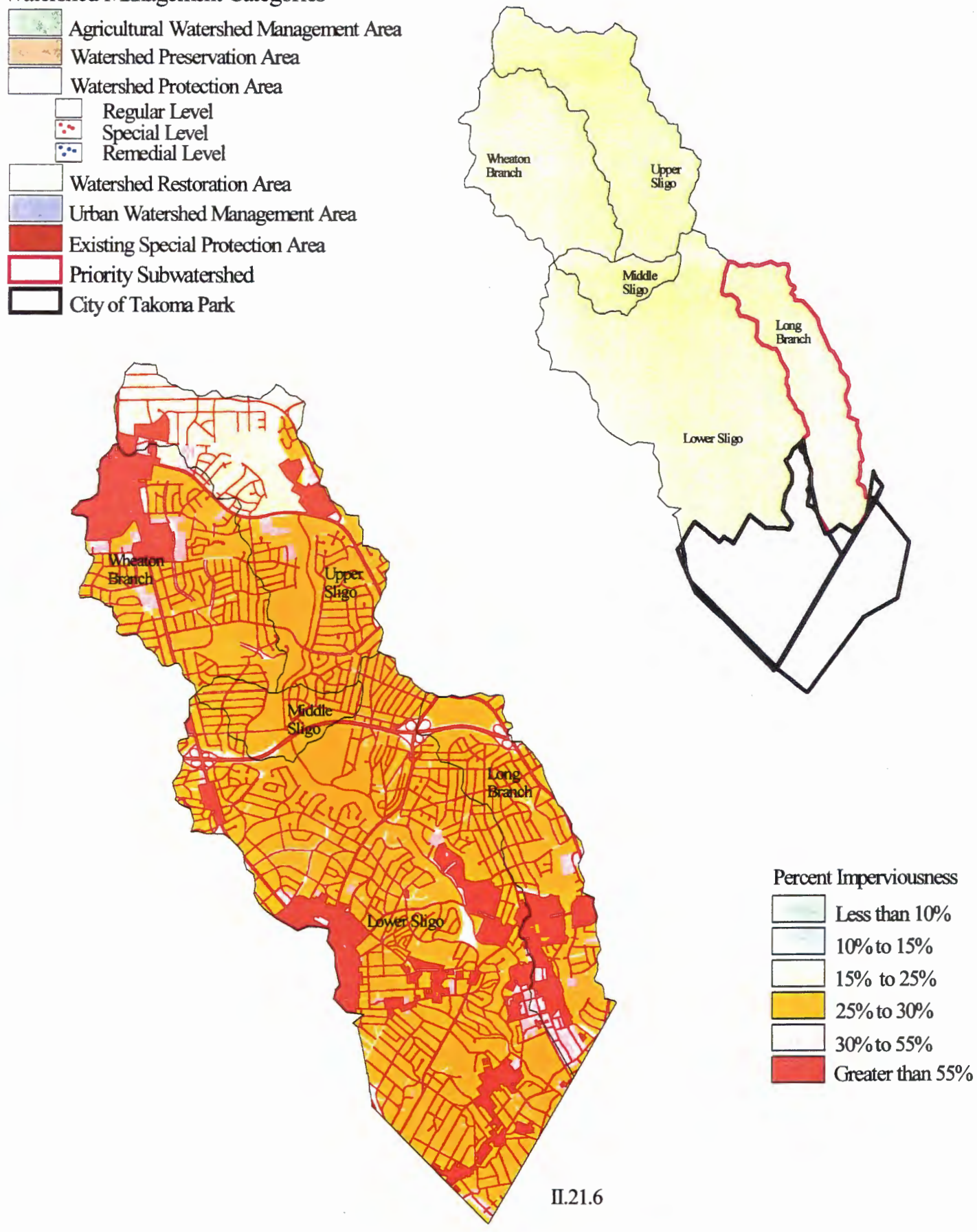
- Excellent
- Good
- Fair
- Poor
- No Current Data

Sligo Creek Stream Condition, Habitat Conditions and Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Designation
Wheaton Branch - FAIR (preliminary)	GOOD	This tributary drains the Wheaton Central Business District and high imperviousness, channel alteration and urban pollutant loads heavily impact the stream system. An innovative stormwater retrofit project on Dennis Ave. has improved conditions dramatically and allowed stream restoration to occur downstream despite highly urban conditions.	The Wheaton Branch stormwater retrofit project has been instrumental in achieving improvements in the biological community in Sligo Creek. Fish communities have been re-established, and downstream of the Wheaton Branch pond, in-stream habitat restoration, and riparian vernal pools and microhabitats supporting amphibians can be observed. Watershed Restoration Area
Upper Sligo - POOR (preliminary)	FAIR to GOOD Overall	High imperviousness from high density residential and commercial areas and channel alteration affect flow conditions and habitat. Embeddedness levels are particularly high and banks are unstable in areas.	A stormwater retrofit project has been undertaken at an existing pond above University Blvd. to improve runoff conditions from this part of the drainage. Watershed Restoration Area
Middle Sligo - FAIR (preliminary)	GOOD	Channel alteration and marginal riparian zone influence habitat conditions, as well as urban runoff conditions typical throughout the watershed. However, this section directly benefits from the upstream improvement in flow conditions associated with the retrofit pond on the Wheaton Branch tributary.	A highly successful habitat improvement project is located in this section just above Forest Glen Rd. A shallow marsh has been created to replace wetland habitat and treat small amounts of road runoff, while simultaneously preserving tree canopy. Watershed Restoration Area
Lower Sligo - POOR (preliminary)	GOOD Overall Flora Lane Trib. FAIR	This section exhibits many of the same problems found throughout the watershed, particularly channel alteration and riparian zone impacts.	Several stormwater retrofit and stream restoration projects are currently being implemented in this section, including a pond on the Sligo Golf course which will improve runoff from the beltway and upstream development. A unique tributary is also found on the west side of the stream which, owing to discharge from an underground spring in a Metro tunnel, has a relatively cool, clean baseflow source. A structure has been placed in the top section of this tributary to by-pass stormflows around the tributary, creating a "refugia" for organisms to retreat to during stormflows. Watershed Restoration Area
Long Branch - POOR (preliminary)	Reconnaissance indicated problems with sediment deposition and embeddedness		Watershed Restoration Area (outside the City of Takoma Park)

Sligo Creek Watershed Management Categories and Projected Development Levels

Map 4



Sligo Creek Watershed Management Category

Watershed Restoration Area

All of the Sligo Creek drainage area is designated as a Watershed Restoration Area. Efforts continue to implement phased retrofit projects throughout the watershed and activities are ongoing to monitor the success of fish re-introduction activities that have occurred over the last several years. Current monitoring results show that the re-established fish community is thriving and the first signs of successful reproduction are being seen in the 1996 data.

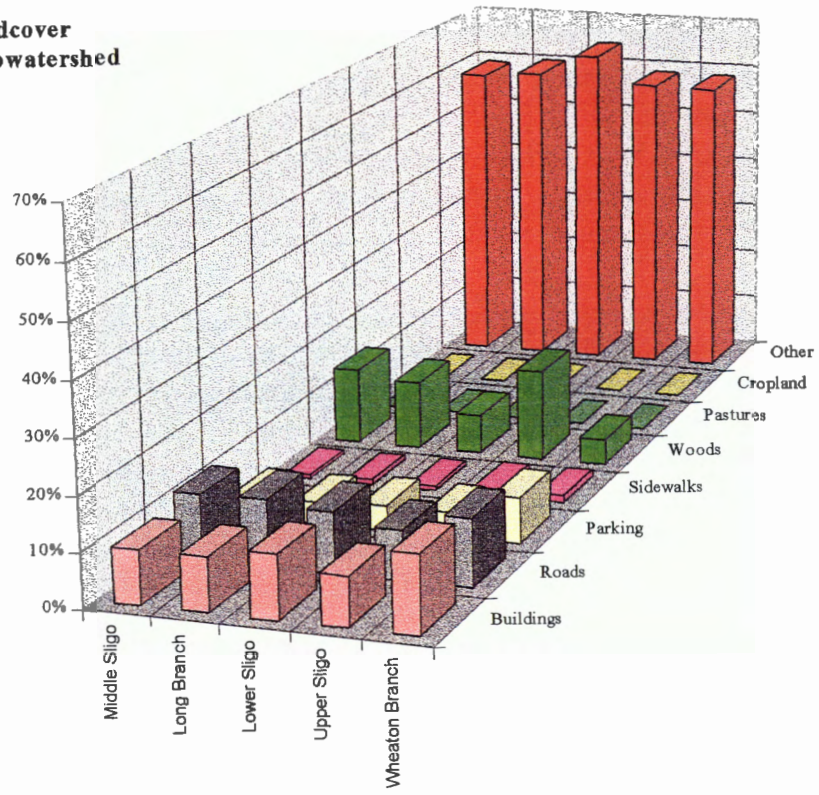
The Sligo Creek watershed has been targeted as an important part of the overall Anacostia watershed restoration effort and has been the focus of efforts to control urban pollutant loadings and restore habitat conditions where possible. Several unique opportunities existed within this watershed to modify two older flood control facilities and improve runoff controls in this heavily urbanized area. Stormwater flow control has been improved at these sites, and water quality controls are being added to reduce urban pollutant concentrations. The ability to achieve flow control has allowed successful stream restoration activities to occur in stream segments where it would otherwise have been infeasible due to very high runoff velocities.

Efforts to control urban runoff in this watershed are limited by the small number of feasible opportunities to modify old flow control structures, or establish new stormwater runoff controls at strategically located sites. Large areas of the watershed remain uncontrolled. To ensure lasting success in re-establishing a viable biological community, strong local stewardship of this watershed must become a central part of the daily activities of watershed residents and businesses.

Watershed Management Strategy

- Implementation of a strong public education program to inform residents about watershed conditions, including pollution prevention education for residents and businesses.
- Continued implementation of Capital Improvement Program Stormwater Retrofit and Stream Restoration activities.
- Seek innovative ways to coordinate stormwater management improvements with Silver Spring Sector and Master Plans in a manner that complements revitalization.

Sligo Creek Landcover by Type and Subwatershed



	Acres	Stream miles
Middle Sligo	216.1	0.7
Long Branch	704.5	1.9
Lower Sligo	2711.2	5.2
Upper Sligo	1008.5	2.8
Wheaton Branch	869.6	2.1
Watershed totals	5509.8	12.8

The Watts Branch Watershed

The Watts Branch watershed is located in the Potomac River basin drainage of Montgomery County and consists primarily of residential land uses. Like many middle Potomac tributaries, this watershed is influenced by historic development patterns that saw the evolution of major cross-roads at high points in the landscape. The City of Rockville occupies the headwaters of Watts Branch, and over time, the I-270 corridor has grown and traverses the upper section of the watershed to connect major County population centers. Pockets of high density commercial and research and development centers, important components of the County's overall economy, are now located in the headwaters of many of the Watts Branch tributaries. Land uses gradually transition to lower densities and predominately residential uses in the downstream reaches of Watts Branch.

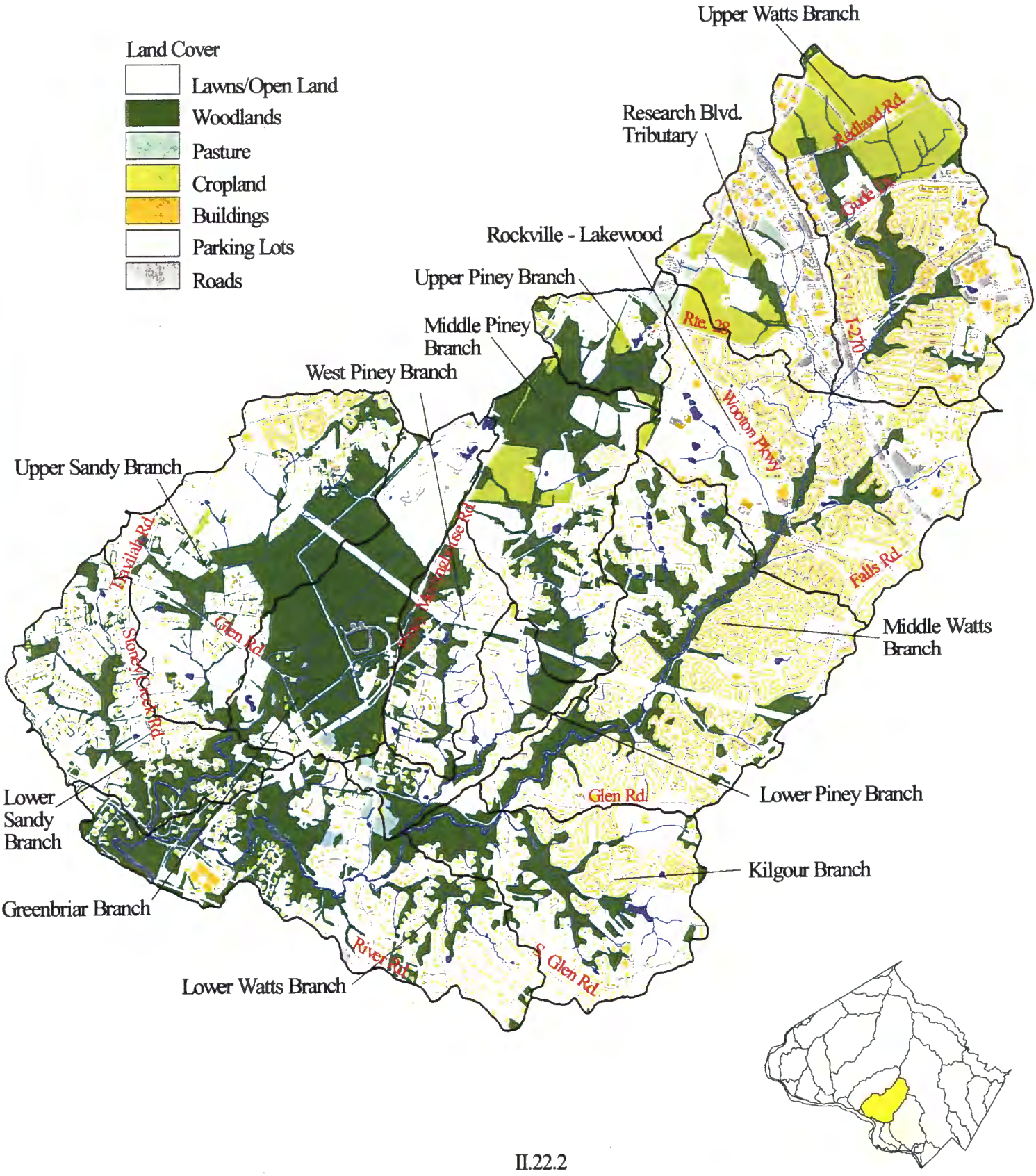
Resource conditions are good in the upper and western tributaries of Piney Branch and the Lower Sandy Branch. Conditions are fair throughout the rest of Watts Branch. This fair condition reflects the observed flow problems stemming from uncontrolled runoff in much of the watershed. Although rated as fair, Lower Watts Branch supports a fish community of approximately 25 species. Many of the more tolerant species are well represented, although some sensitive fish species are found in fewer numbers. Smallmouth bass are found in many of the pools in Watts Branch and colorful greenside darters can be observed in the rocky bottom runs.

The Piney Branch tributary was designated a Special Protection Area in 1995 in recognition of the high quality stream condition in this tributary and the need for special protection measures to protect this resource as its upper reaches developed. The high water quality and cool steady baseflow found in this tributary are important to maintaining conditions downstream in the mainstem. This fragile tributary has a relatively small channel and is particularly sensitive to flow conditions, with very little assimilative capacity to deal with impacts. It is currently undergoing a great deal of stress resulting from drought conditions (1995) and high flows (1996) as well as a sediment discharge problem associated with a malfunctioning sediment control structure which has since been corrected. These stresses to the system have resulted in only fair stream conditions in the mainstem. Careful management and implementation of special protection area requirements should enable this stream to recover from what should be temporary impacts to regain the high quality conditions that led to SPA designation.

Efforts underway and planned by both the City of Rockville and the County are addressing problems in the Watts Branch watershed, primarily in upstream areas where previous development occurred without adequate stormwater management. Detailed analysis of the 1996 monitoring data will provide the basis for establishing measurable goals for restoring stream conditions and will ultimately lead to development of an action plan to address watershed restoration needs. This plan will include the study and implementation of projects to add runoff controls where feasible, restore impaired stream habitat, and reduce further degradation to the extent possible. A Watershed Restoration Action Plan for Watts Branch will be developed with a watershed advisory group made up of local watershed residents and businesses. Work to begin development of the action plan is currently scheduled to begin in 1999 and to be completed in the Spring of 2001. This will be complemented by the efforts underway by the City of Rockville to develop a plan to address conditions in the headwater areas within their jurisdiction.

Watts Branch Watershed

Map 1
Land Cover

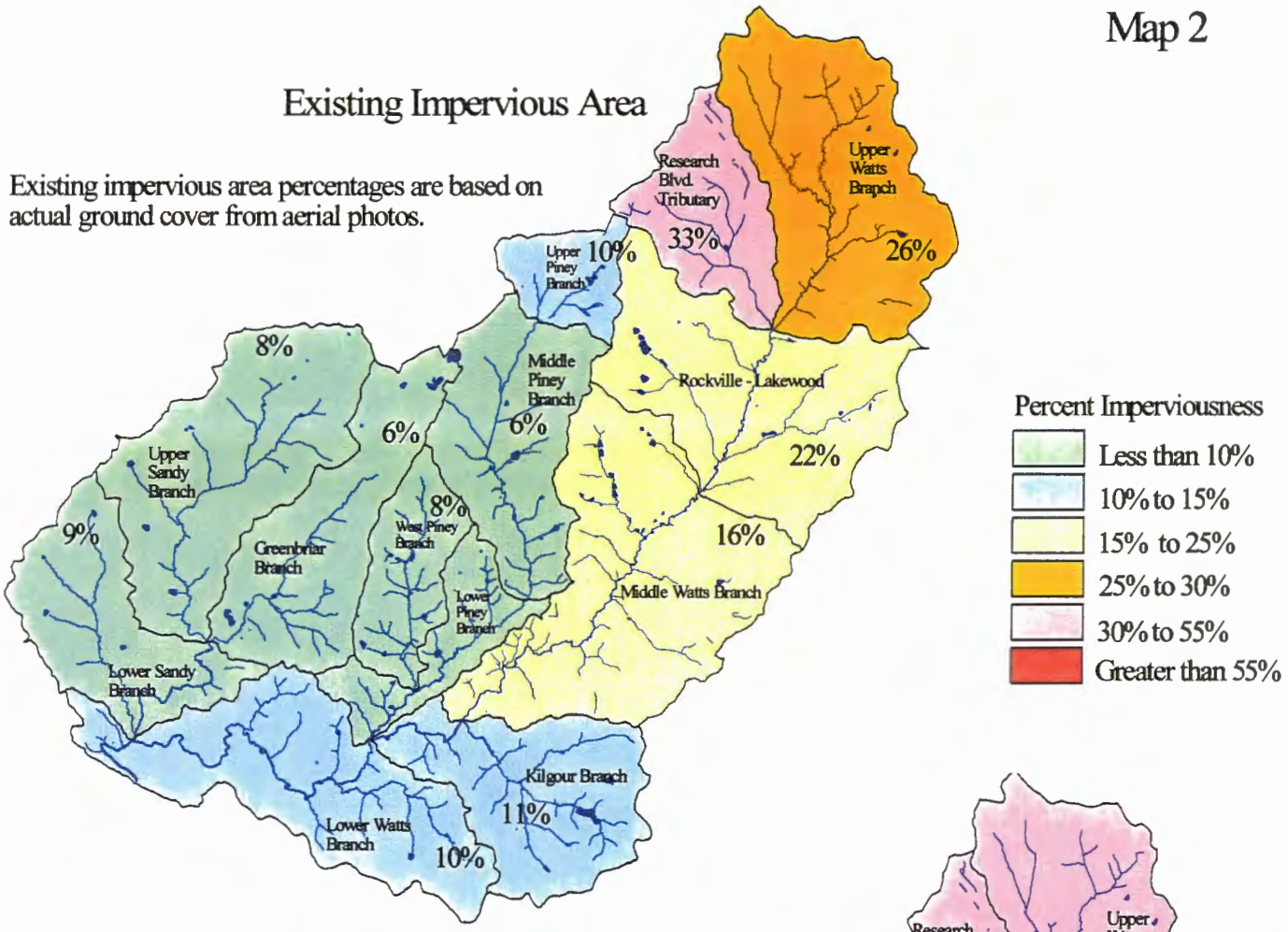


Watts Branch Impervious Area Analysis

Map 2

Existing Impervious Area

Existing impervious area percentages are based on actual ground cover from aerial photos.



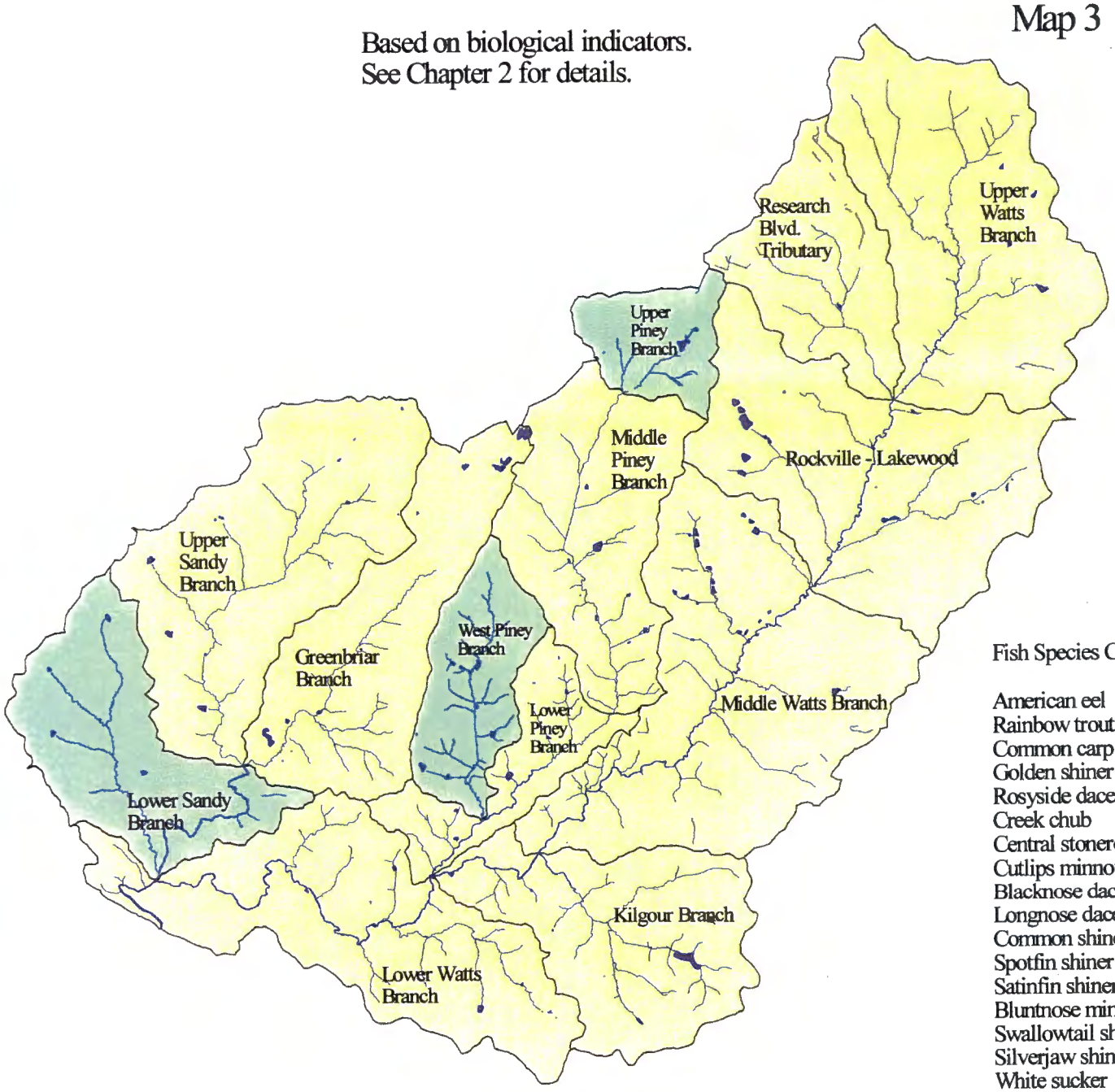
Projected Impervious Area

Projected impervious area percentages are based on generalized zoning information and are for general subwatershed comparisons. Detailed impervious area projections are conducted as part of land use master plan studies.

Watts Branch Stream Condition

Map 3

Based on biological indicators.
See Chapter 2 for details.



Stream Biological Condition

- Excellent
- Good
- Fair
- Poor
- No Current Data

Fish Species Collected

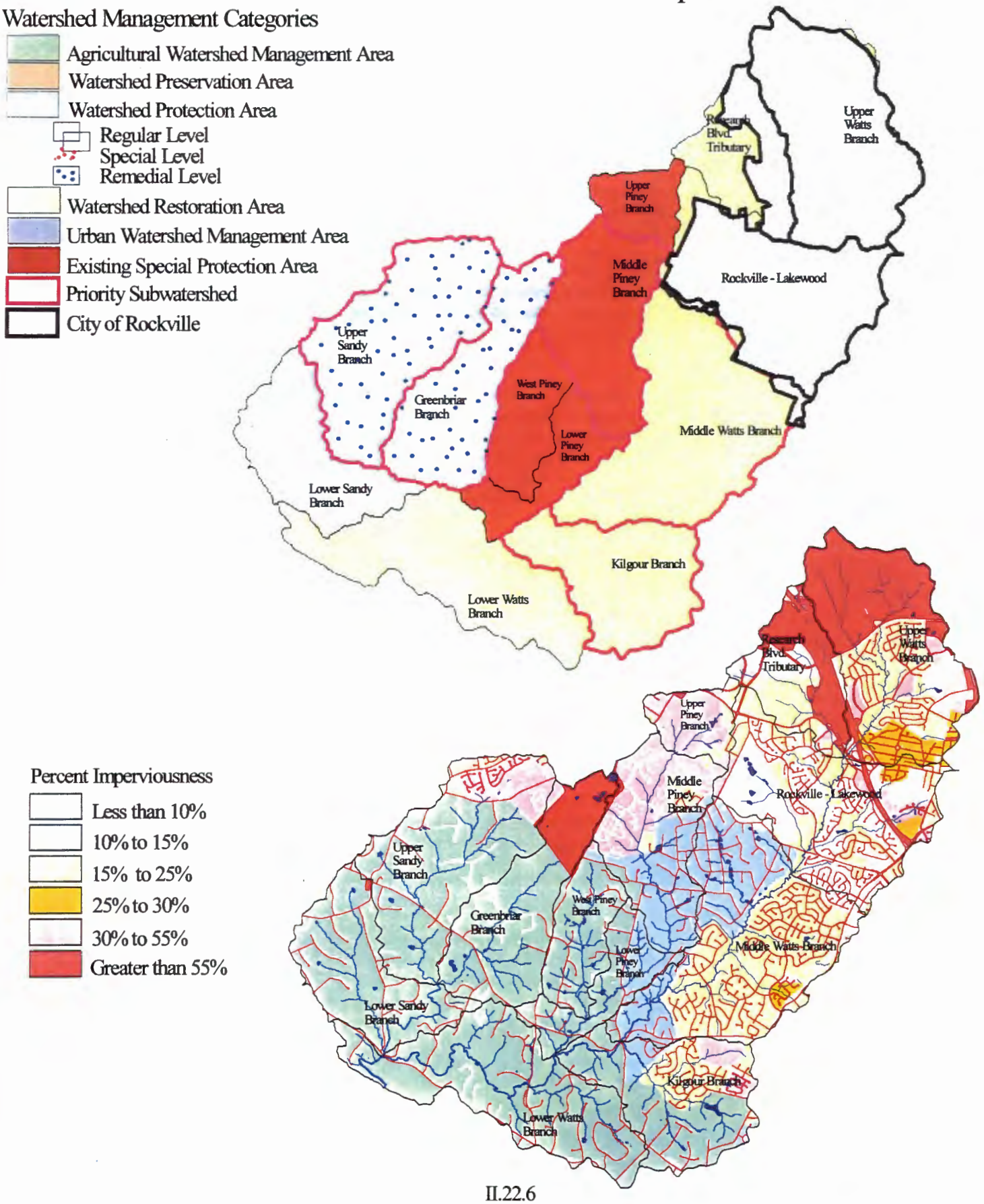
American eel
Rainbow trout (stocked)
Common carp
Golden shiner
Rosyside dace
Creek chub
Central stoneroller
Cutlips minnow
Blacknose dace
Longnose dace
Common shiner
Spotfin shiner
Satinfin shiner
Bluntnose minnow
Swallowtail shiner
Silverjaw shiner
White sucker
Northern hogsucker
Creek chubsucker
Yellow bullhead
Brown bullhead
Mottled sculpin
Potomac sculpin
Smallmouth bass
Largemouth bass
Green sunfish
Bluegill
Pumpkinseed
Redbreast sunfish
Black crappie
Tessellated darter
Greenside darter
Fantail darter

Watts Branch Stream Condition, Habitat Conditions and Management Category Designation

Subwatershed/ Stream Condition	Habitat Condition	Primary Factors Affecting Stream Condition	Unique Characteristics and Management Category
Upper Watts Branch - FAIR	FAIR Overall; sediment deposition and embeddedness high; bank condition poor	High imperviousness and uncontrolled stormwater runoff contribute to high sediment deposition and bank instability.	City of Rockville
Research Blvd. Trib. - FAIR (preliminary)			Watershed Restoration Area (outside City of Rockville)
Rockville - Lakewood FAIR			City of Rockville
Middle Watts Branch - FAIR	GOOD Overall; occurrence of riffles is infrequent	Uncontrolled runoff from older residential areas has affected stream system. Channels are entrenched in areas from accelerated stream downcutting, however, bottom contour still provides fish habitat.	Watershed Restoration Area
Kilgore Branch - FAIR	GOOD Overall	Problems with sediment deposition and bank stability were observed. Extreme downcutting of channel.	This stream is recovering from a water main break in the summer of 96 which temporarily delivered scouring velocities and chlorinated water to the system. Watershed Restoration Area
Lower Watts Branch - FAIR	FAIR Overall	Despite relatively low imperviousness, high levels of sediment deposition and embeddedness were observed. Stream substrate at sample area was unstable. Stream banks eroding with areas of entrenched channels.	Watershed Restoration Area
Upper Piney Branch - GOOD	GOOD	Headwaters have consistently rated good in all aspects.	Headwaters have numerous seeps and springs essential to this stream system. Existing Regulatory Special Protection Area
Piney Branch mainstem - FAIR	GOOD	Conditions have fluctuated due to weather (drought 1995, high flows 1996) and development related effects. Habitat has remained good, however, all other parameters have fluctuated from good to poor. Sediment deposition and bank erosion noted.	This area was examined for reclassification from a state Use I to Use III stream in 1991. Although water quality was high, a Use I classification was retained due to inadequate stream flow to support natural trout propagation. Existing Regulatory Special Protection Area
Piney Branch - Lower Main FAIR	GOOD		
West Piney Branch - GOOD	GOOD	Habitat conditions in this reach have resulted in consistent biological and habitat conditions for the most part. Marginal bank stability noted.	This stream reach has the potential to function as an important refugia for fish during times of stress on the Watts Branch mainstem. Existing Regulatory Special Protection Area
Greenbriar Branch - FAIR	GOOD	Sediment deposition problems were observed.	Watershed Protection Area - remedial
Upper Sandy Branch - FAIR	GOOD Overall	Upper reaches exhibit more habitat problems, (i.e. sediment deposition, embeddedness and poor bank stability). There is improvement in all these parameters in the lower reaches of the subwatershed.	Watershed Protection Area - remedial
Lower Sandy Branch - GOOD	GOOD Overall	Sediment deposition problems observed.	This stream reach also can serve as important refugia for fish during times of stress on the Watts Branch mainstem Watershed Protection Area - regular

Watts Branch Watershed Management Categories and Projected Development Levels

Map 4



Watts Branch Management Categories

The Potomac Subregion Master Plan Study is currently underway which will include an examination of land use and stream condition relationships. Watershed management approaches will be updated in the CSPS as necessary to respond to land use recommendations.

Watershed Protection Areas

This management category includes the western subwatersheds of Watts Branch. Three different protection levels are currently designated, in order to respond to different levels of stream protection needs.

Special level of protection - Existing Regulatory Special Protection Area

The Piney Branch tributary to Watts Branch was designated a Special Protection Area in 1995. SPA designation provides a higher level of protection to help mitigate impacts of planned development. Piney Branch contains much of the highest quality habitat and biological community remaining in the watershed. The current problems being seen in Piney Branch stem from prior agricultural uses, current development projects which were approved prior to the establishment of the Piney Branch Special Protection Area, and unusual flow conditions. To the extent that these impacts are temporary, future conditions in the watershed should return to the high quality conditions which led to the SPA designation. The existence of pockets of stable high quality resource, as in the upper reaches and West Piney Branch tributary, will facilitate the recovery of areas which have seen recent impacts.

Watershed Protection Strategy

- Continued implementation of the special protection area regulations.

Remedial level of protection

Within the context of Watershed Protection Areas, remedial efforts to address special problem areas that are influencing overall watershed conditions are needed to improve conditions from FAIR to GOOD in Upper Sandy Branch and Greenbriar Branch. In these areas, in-stream impoundments and impacts to the riparian buffer may be contributing to impairment. Targeting areas in need of remedial improvements can potentially halt the degradation which is occurring and forestall the need for more costly efforts in the future.

Watershed Management Strategy

- Targeted Public Education and Outreach, and cooperative efforts with private landowners to improve riparian areas.
- Further evaluate relationships between land use and stream conditions thorugh the Potomac Subregion Master Plan Study

Regular level of protection

This management category is designated for Lower Sandy Branch, where existing stream conditions are good and current environmental guidelines and regulations should continue to protect these areas, based on current land use.

Watershed Management Strategy

- Continued application of current environmental guidelines and regulations and other regular protection tools.

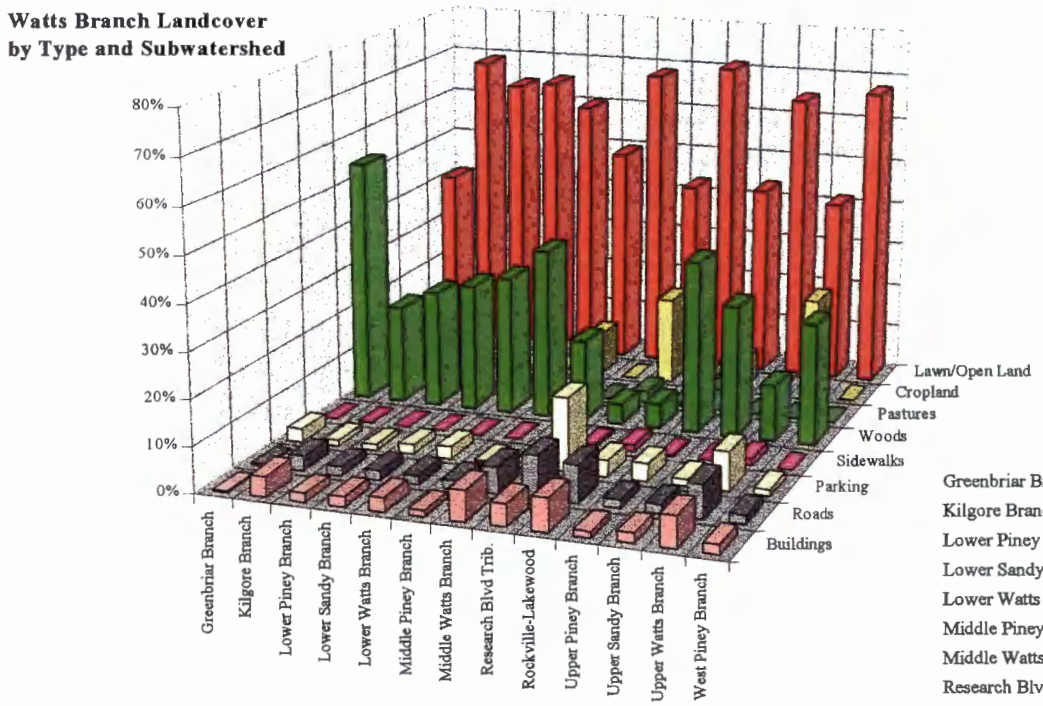
Watts Branch Watershed Management Categories (cont'd)

Watershed Restoration Areas

The Lower Watts Branch, and the mainstem and all tributaries above the confluence with Piney Branch are designated Watershed Restoration Areas. Some impervious areas within the high density commercial and R&D areas have stormwater controls. In the areas with no controls, or where the methods that were used have become outdated and more effective designs are possible, retrofits to improve performance of older structures as well as to provide new controls may be feasible to improve conditions and provide opportunities for downstream habitat improvement and stream restoration efforts. Residential areas of the watershed are also designated Watershed Restoration Areas, out of the need to address the effects of uncontrolled runoff from residential areas that developed without stormwater controls. The City of Rockville is currently undertaking watershed restoration efforts within its jurisdiction, and the County has scheduled watershed restoration planning efforts for Watts Branch to commence in 1999. An inventory of stream conditions has been conducted in preparation for restoration planning efforts.

Watershed Management Strategy

- Pursue comprehensive approach to watershed restoration through development of a watershed restoration action plan, to include study and implementation of potential stormwater retrofit projects, stream habitat improvements, and public education and volunteer projects.



	Acres	Stream miles
Greenbriar Branch	1084.7	5.1
Kilgore Branch	1084.6	6.4
Lower Piney Branch	468.3	3.3
Lower Sandy Branch	938.2	4.4
Lower Watts Branch	1461.5	6.5
Middle Piney Branch	1032.1	6.7
Middle Watts Branch	1941.3	8.3
Research Blvd Trib.	707.2	3.9
Rockville-Lakewood	1602.3	4.9
Upper Piney Branch	343.9	1.7
Upper Sandy Branch	1493.3	6.6
Upper Watts Branch	1608.1	7.0
West Piney Branch	525.2	5.0
Watershed Totals	14290.6	69.5

Appendix A

Example of a Stream Monitoring Data Summary Sheet

All Montgomery County stream monitoring data is organized with a summary sheet format. The summary sheet contains all data collected for the monitoring station at the time of monitoring. Chapter 2 provides more discussion of the monitoring methodology.

The kinds of information provided in a summary sheet are:

A Station location data, date of monitoring, and brief explanation of the number of taxa identified at the site.

B Measurements of the biological community (metrics) that respond in a predictable manner to cumulative impacts occurring in the County streams. Metric values are calculated, metric values are scored compared to those of the appropriate reference condition, and the scores are summed.

C Four kinds of summary information are provided here:

- The community trophic structure is summarized so that dominant feeding strategies can be understood. Different feeding strategies can indicate responses to different stream conditions.
- Physical/chemical data can indicate that the stream environment was either supportive or not supportive of a biological community. These parameters can also provide data that would indicate that a chemical water quality problem had occurred.
- The biological assessment score is summed and a narrative rating is provided. In this case, the narrative rating is "fair". A rating of "excellent" being highest, "good" being next highest, "fair" being next, and "poor" being lowest
- The rapid habitat assessment score and narrative value is also provided. These habitat data are used to determine if an observed stream condition is due to habitat impairment as opposed to a physical/chemical impairment.

D All identified organisms are listed by either scientific or common name. Included along with this list of observed taxa are the individual taxa's feeding group designation, pollution tolerance value, and total number of individuals found.

If you should want copies of any available summary data, please send a written request to: Department of Environmental Protection, Watershed Management Division, 250 Hungerford Drive, First Floor, Rockville, Md. 20815. Include the subwatershed(s) or watersheds) that you wish information for, and your name, telephone number and address so we can contact you with the cost (if any) for copying and mailing the summary sheets to you.

A

WATERSHED:	WATTS BRANCH	NUMBER OF TAXA:	10
STATION:	WBWB-204	NUMBER OF ORDERS:	5
LOCATION:	Greenplace Terrace	NUMBER OF FAMILIES:	8
DATE:	3/19/96	NUMBER OF GENERA:	7
LATITUDE:	39°04'36"		
LONGITUDE:	77°10'51"		
ADC GRID(94)	31-E-12		
FILE NAME:	G:\DATA\WATTS\1996\BENTHOS\BWB20496.SPR		

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INDEX OF BIOLOGICAL CRITERIA FOR BENTHIC MACROINVERTEBRATES

B

IBI METRIC	RESULTS	IBI SCORE
TAXA RICHNESS	10	1
BIOTIC INDEX	6.34	3
ABUNDANCE OF SCRAPERS/(SCRAPERS + FILTERING COLLECTORS)	41%	5
TOTAL # HYDROPSYCHE & CHEUMATOPSYCHE/EPT INDIVIDUALS	100%	1
% CONTRIB. OF DOMINANT TAXON	45%	3
# EPT TAXA	2	1
% EPT INDIVIDUALS	29%	3
ABUNDANCE OF SHREDDERS/TOTAL NUMBER OF INDIVIDUALS	0%	1
TOTAL IBI SCORE		18

TROPHIC GUILD STRUCTURE		PHYSICAL/CHEMICAL DATA	
PREDATOR (PRD):	2.0%	TIME:	10:45
SCRAPER (SCR):	20.0%	DO:	12.85 mg/L
SHREDDER (SHR):	0.0%	% SAT.:	108.3%
FILTERING COLLECTOR (FC):	29.0%	pH:	7.24
GATHERING COLLECTOR (CG):	49.0%	COND.:	579μS
TOTAL	100.0%	AIR TEMP.:	7.0°C
		H_2O TEMP.:	7.9°C

C

BIOLOGICAL ASSESSMENT SCORE:	18
BIOLOGICAL ASSESSMENT RATING:	Fair
RAPID HABITAT ASSESSMENT SCORE:	118
RAPID HABITAT ASSESSMENT VALUE:	Sub-Optimal

BENTHIC TAXA LIST

D

		# GRIDS SUBSAMPLED		20
		DATE COLLECTED		3/19/96
		# TAXA		10
		Total # individuals		172
FFG	T.V.	STATION I.D.		WBWB204
		TRICHOPTERA	65	
FC	6	HYDROPSYCHIDAE	66	
FC	5	Cheumatopsyche sp.	67	43
FC	4	Hydropsyche sp.	69	7
		MEGALOPTERA	106	
PRD	6	SIALIDAE	111	
PRD	4	Sialis sp.	112	2
		DIPTERA	113	
CG	8	CHIRONOMIDAE	114	78
SHR	4	TIPULIDAE	115	
CG	3	Antocha sp.	116	1
PRD	6	EMPIDIDAE	147	
PRD	6	Hemerodromia sp.	150	1
		COLEOPTERA	153	
SCR	4	ELMIDAE (L)	154	
CG		ELMIDAE (A)	155	1
SCR	4	Optioservus sp.	157	1
SCR	5	Stenelmis sp.	158	34
CG	10	OLIGOCHAETA	222	
CG	8	LUMBRICINA	223	4

NOTES