



PATUXENT RIVER COMMISSION

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Patuxent River Policy Plan:

An Update For 1984 to 1997

November 1997

Patuxent River Policy Plan Update Document

Executive Summary

November 1997

Acknowledgments

The Addendum workgroup developed this document by consensus among its members to represent the variety and effects of the many changes that have occurred in the Patuxent River and its watershed since 1984. It was adopted by the Patuxent River Commission at its November 1997 meeting.

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We would also like to acknowledge the many local government and state agency staff who provided workgroup members with the background data and analysis included in this document.

Executive Summary

During 1984, resource management agencies and elected and appointed officials met, discussed, and agreed to 20 goals (Attachment B.) that were used as the basis of the Patuxent River Policy Plan (the Policy Plan), a land management strategy to protect the river and its watershed. The goals provided a broad vision to restore and maintain water quality, habitat, groundwater and surface water supplies, and a high quality of life along the Patuxent River and its tributaries.

The Policy Plan included ten recommendations (based on the goals) to control nonpoint source (NPS) pollution. NPS pollution originates from multiple sources, carried in runoff across lawns, farm fields, parking lots and roads, and cannot be controlled from one site, unlike point source pollution from industrial or wastewater treatment plants (WWTPs).

The recommendations are:

- ▼ establish a primary management area to protect environmentally sensitive areas;
- ▼ implement best management practices and vegetative buffers to control stormwater impacts;
- ▼ identify and address major nonpoint source pollution sites;
- ▼ retrofit existing development;
- ▼ accommodate future development;
- ▼ increase recreation and open space;
- ▼ protect forest cover;
- ▼ preserve agricultural land;
- ▼ manage sand and gravel extraction;
- and
- ▼ adopt an annual action program.

Over the past 13 years, state and local agencies have made significant strides in successfully implementing these ten recommendations and bringing about measurable water quality improvements in the tidal Patuxent River. By the mid-1990's, the nitrogen and phosphorus reductions began to be accompanied by increases in submerged aquatic vegetation and juvenile fish. More recent analyses seem to indicate that the bottom dwelling communities are also beginning to show positive responses.

During this time, the State has provided approximately \$109 million through grants and loans to local jurisdictions for urban and suburban projects and approximately \$1.04 million for agricultural cost-share projects in the Patuxent watershed. This assistance has included \$68.7 million in federal grants, \$20.5 million for state grants, and \$20.1 million for state loans. The bulk of this funding has been used to upgrade WWTPs, but local governments have also used these funds in their stormwater management programs for innovative approaches in wetland creation, retrofitting existing sites, stream restoration, water quality monitoring, and public outreach.

Despite these investments and the resulting dramatic nutrient reductions, nutrient concentrations remain elevated in the upper and middle reaches of the tidal river. The freshwater streams continue to show signs of degradation from uncontrolled stormwater runoff in eroded streambanks and channels filled with silt.

By the year 2020, the watershed population is projected to increase by about 54% while number of households is projected to increase by 74%. Forested lands will decrease from 44% to about 33% and agricultural lands will decrease from 27% to 20%, so that developed land will become the major land use category (43%) in the watershed by the year 2020. Existing and even enhanced levels of management activities will not be able to maintain the Patuxent's 40% nutrient reduction goal into and beyond the year 2010.

The Policy Plan's ten recommendations to protect the river are as important now as when they were first proposed and supported 13 years ago. Continued dedication to the Policy Plan recommendations will enable the Commission to meet the three key continuing challenges of growth management, personal stewardship, and financing to protect the watershed and its resources. The following lists findings that outline how to address these challenges in the Patuxent. Attachment A. identifies specific objectives and potential actions for the findings.

I. Implement a comprehensive watershed management approach to control all sources of pollution and resource degradation. The Patuxent watershed has an advantage over the other tributary basins due to the established history of interjurisdictional and interagency cooperation of the Patuxent River Commission in achieving common objectives.

II. Continue to restore, improve, and protect the habitat function of aquatic and terrestrial living resource. Healthy habitats that support fish and wildlife also ensure a variety of other functions: filtering pollutants, controlling stormwater runoff, and providing recreational opportunities.

III. Concentrate new development in and around existing developed areas and population centers while protecting rural lands and the associated agricultural economy. Maintaining undeveloped rural areas reduces infrastructure costs and supports economically desirable land uses such as agriculture and forestry.

IV. Enhance the environmental quality and community design in new and existing communities. Innovative approaches are needed to assure that new and existing communities are attractive places to live.

V. Develop a sense of stewardship for the Patuxent River and its watershed through increased public education and participation programs. A well-educated and highly motivated public is necessary for long term resource protection.

VI. Provide sufficient funding and staff to support continued programs, policies, and projects to meet the ten recommendations of the Plan. Without funding, it will not be possible to implement agreed upon strategies nor will it be possible to conduct routine tracking and regular reporting. State and local management agencies need to be able to identify existing and potential problems and issues and must be aware of both successes and failures to effectively focus resources on meeting the challenges facing the watershed.

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Patuxent Policy Plan Update Document

November 1997

I. INTRODUCTION

The deplorable condition of water quality in many of the nation's most visible waterways, including the Potomac River around the Nation's capital, provided a direct impetus for the passage of the 1972 Clean Water Act (CWA) and substantial federal funding for wastewater treatment plant (WWTP) upgrades to improve water quality. Similar concerns about WWTP impacts on the tidal portion of the Patuxent River and recognition of a need for a long term management strategy resulted in the establishment of the Patuxent River Commission (the Commission) in 1981 and the development of the Patuxent River Policy Plan (the Policy Plan) in 1984.

State and local management agencies and elected and planning officials met, discussed, and agreed to 20 goals (Attachment B.) that were used as the basis of the Policy Plan. These goals provide a broad vision to restore and maintain water quality, habitat, groundwater and surface water supplies, and a high quality of life along the Patuxent River and its tributaries.

The Policy Plan included ten recommendations for a land management strategy to control nonpoint source (NPS) pollution. NPS pollution originates from multiple sources, carried in runoff across lawns, farm fields, parking lots and roads, and cannot be controlled from one site, unlike point source pollution from industrial or municipal treatment plants.

The recommendations are:

- ▼ *establish a primary management area to protect environmentally sensitive areas;*
- ▼ *implement best management practices and vegetative buffers to control stormwater impacts;*
- ▼ *identify and address major nonpoint source pollution sites;*
- ▼ *retrofit existing development;*
- ▼ *accommodate future development;*
- ▼ *increase recreation and open space;*
- ▼ *protect forest cover;*
- ▼ *preserve agricultural land;*
- ▼ *manage sand and gravel extraction;*
and
- ▼ *adopt an annual action program.*

Over the past 13 years, state and local agencies have made significant strides in successfully implementing these 10 recommendations and bringing about measurable water quality improvements in the tidal portion of the Patuxent River. By the mid-1990's, these water quality improvements began to be reflected by increases in submerged aquatic vegetation and juvenile fish. More recent analyses seem to indicate that the bottom dwelling communities are also beginning to show positive responses.

This document provides highlights of accomplishments since the Policy Plan's adoption and the challenges which must be overcome in pursuing the long term protection of the Patuxent watershed and its resources. These achievements in watershed planning and land management have been facilitated through the interjurisdictional cooperation of the Commission. In 1995, the Commission's role was amended to include oversight of the development and implementation of the Patuxent basin's strategy to meet the Chesapeake Bay 40% nutrient reduction goal.

As shown in Table 1, the population in the watershed has more than doubled since 1970. By 1990, there were nearly half a million people in the watershed, with a total projected increase of more than 54% to 756,929 residents by the year 2020. This increase roughly equals the current population of the three most southern counties in the watershed--Calvert, Charles, and St. Mary's. At the same time, the number of households has increased faster than population because the average number of people per household has decreased. There is an expected increase of 74% in the number of households by the year 2020.

YEAR	POPULATION		HOUSEHOLDS	
	Number	% increase for the ten-year period	Number	% increase for the ten-year period
1970	261,907	-----	87,302	-----
1980	352,860	35	118,808	36
1990	490,915	39	161,100	42
2000	601,800	23	217,200	28
2010	695,200	16	262,200	20
2020	756,929	9	293,900	13

Source: Maryland Office of State Planning

The middle portion of the watershed, bounded by Interstate 95 and State Route #214, was that most heavily developed since 1970. This area includes Laurel, Jessup, Savage, Bowie, and Upper Marlboro, most of which have developed since 1985.

Current demographic and land use changes indicate that these new households tend to be accommodated in increased suburban development in previously rural areas with a corresponding decrease in rural land uses such as agriculture and forest. During the 1980's, there was a 15% loss in forested lands and a 21% loss in agricultural lands, while there was a 92% increase in acres being developed. Despite these changes, "Forested Land" remains the major land use category in the watershed at 44%.

Table 2 shows that between 1990 and 2020, developed land is projected to increase by 77% from 144,197 to 255,945 acres, while agricultural land is projected to decrease by 28% from 159,882 to 115,411 acres and forested land to decrease by 26% from 256,909 to 189,632 acres. By the year 2020, developed land (43%) will become the major land use category in the watershed.

YEAR	Developed Land		Agricultural Land		Forested Land	
	Acres	% of total	Acres	% of total	Acres	% of total
1981	75,400	13	195,300	34	303,000	52
1990	144,197	25	159,882	27	256,909	44
2000	187,439	33	142,155	25	231,394	41
2020	255,945	43	115,411	20	189,632	33

Source: Maryland Office of State Planning

Resource Investments

The Patuxent watershed has been the target of a wide array of resource investments from Federal, State, and local agencies, as well as from private entities. As shown in Table 3, these efforts have included substantial land and easement acquisitions. State and local data indicate that total protected land represents about 92,321 acres, about 16% of the watershed.

There have also been major capital investments in the urban and suburban areas of the Patuxent watershed. These have included cost share programs for Stormwater Pollution Control, Small Creeks and Estuaries, and Construction grants and Biological Nutrient Removal funds for WWTP upgrades, as well as the Supplemental Assistance program and the State Water Quality Loan Fund for sewerage and other infrastructure needs. From July 1984 to August 1997, the State has provided approximately \$109 million for financial assistance through grants and loans to local jurisdictions for projects in the Patuxent watershed. This includes \$68.7 million in Federal grants, \$20.5 million for State grants, and \$20.1 million for State loans. Local governments have used this funding in upgrading WWTPs and in their stormwater management programs for innovative approaches in wetland creation, retrofitting existing sites, stream restoration, water quality monitoring, and public outreach.

On the agricultural side, the Maryland Department of Agriculture (MDA) has invested about \$1.04 million in 229 cost-share best management projects in the Patuxent watershed since 1984. These projects, funded through the Maryland Agricultural Cost Share (MACS) Program, have included best management practices for cropland, pasture, and feedlots. Of the agricultural land in the watershed, about 90% are in cropland. Conservation plans have been developed for 50% of the agricultural land in the watershed. About 30% of total agricultural land is under conservation tillage to reduce soil loss and 2% has nutrient management plans to minimize nutrient inputs. Federal expenditures for agriculture in the watershed were not available. They are expected to be between \$1 and \$2 million.

Since 1984, the Federal government has provided direct financial support to two major basin-wide management and project planning initiatives: the Patuxent Watershed Demonstration Project (Demonstration Project) and the U.S. Army Corps of Engineers (COE) Patuxent River Water Resources Reconnaissance Study (COE Reconnaissance Study). Approximately \$6 million in total federal funding is being provided over six years to support multi-disciplinary, multi-institution research on the effects of multiple environmental stressors on the Patuxent River Estuary and on integrating ecological economic values and

**Table 3.
PROTECTED LANDS IN THE
PATUXENT WATERSHED**

<i>Category</i>	<i>Acres held</i>
Federal Lands	26,523
County Parklands	25,372 ^a
Agricultural Easements	17,131 ^b
State Lands	16,835 ^c
Regional Agencies	4,400 ^d
Maryland Environmental Trust	1,485
Private Conservation	575
TOTAL	92,321

^a Held as parks, natural heritage areas, and open areas.

^b Acreage in the State program only

^c The Maryland Department of Natural Resources holds about 16,800 acres of Program Open Space Land, designated Wildlands, and parklands.

^d Owned and managed by the Washington Suburban Sanitary Commission as a buffer around the Triadelphia

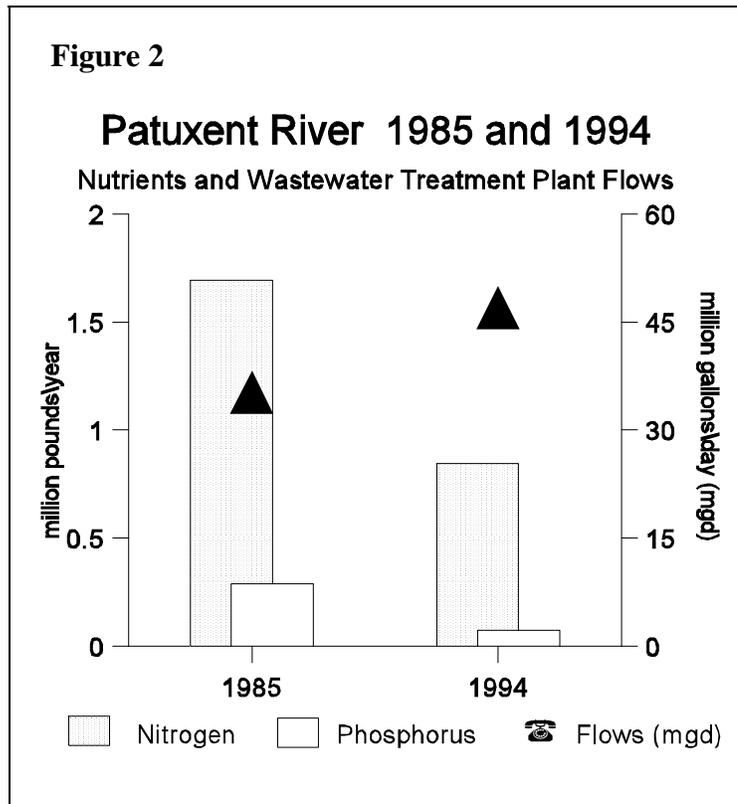
alternative resource management strategies into a predictive modeling tool.

In 1991, the U.S. Environmental Protection Agency (US EPA) awarded the State \$3.5 million for the Demonstration Project, with \$1.75 million cost-share funding from participating State and local jurisdictions and agencies. The Patuxent River estuary was selected partly because it could be used as a model for the Chesapeake Bay and because point source pollution controls had been successfully imposed. Nonpoint source pollution and growth management continued to be major factors affecting the river and its resources. In 1994, Congress authorized \$750,000 for the COE Reconnaissance Study to identify problems, needs, and opportunities for water and related land resource management in the Patuxent River watershed. The resulting report is a comprehensive listing of the status of environmental resources in the watershed and includes approximately 100 projects that could be implemented for impact mitigation or restoration of wetlands, riparian buffers, and aquatic habitat.

III. PROGRESS SINCE 1984

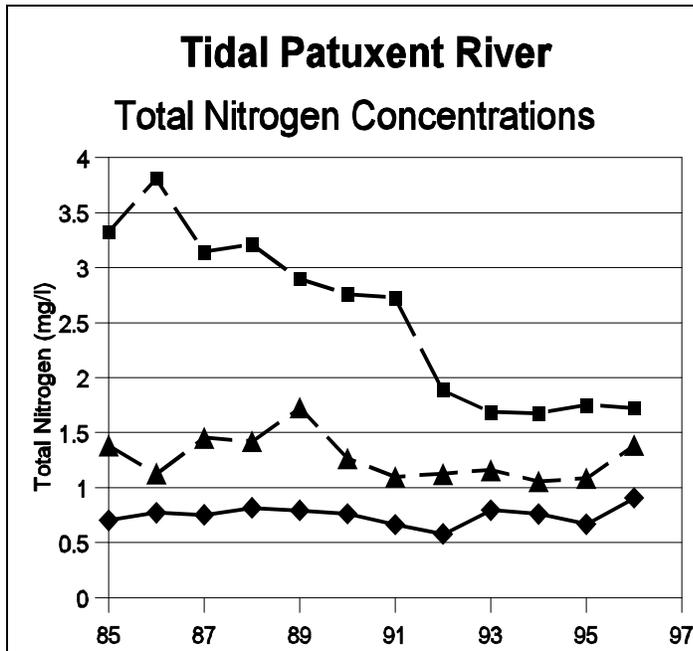
Point Source Pollution Control

One impressive result of these major capital investments is that all nine major WWTPs in the Patuxent watershed have implemented advanced nutrient removal. As shown in Figure 2, by 1994, point source nitrogen loads were reduced by 50% and phosphorus loads by 76%. These nutrient load reductions occurred while there was a 25% increase in WWTP flows. The 1994 phosphorus loads were lower than the 40% loading cap developed through the Tributary Strategy efforts, but the nitrogen loads still exceeded the loading cap by about 10%.

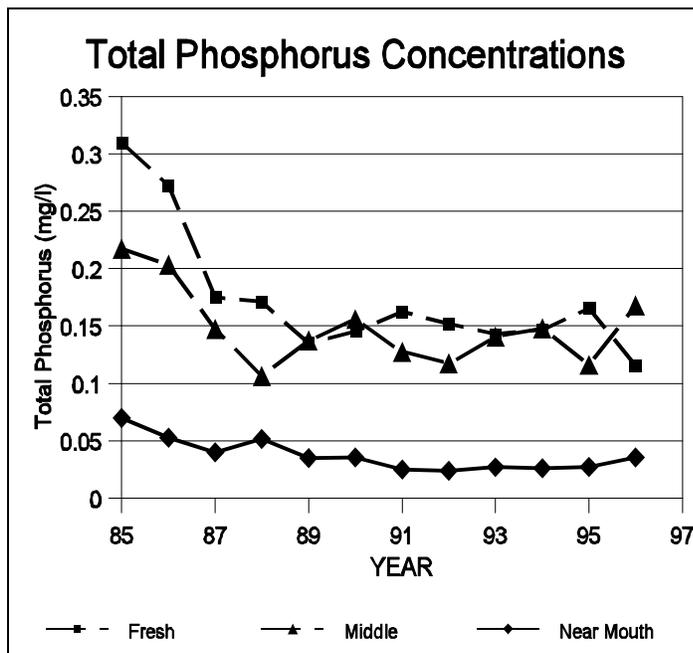


Source: MDE, 1997

Figure 3



The aquatic plant community responds directly to the concentrations of these nutrients in the water column, particularly that available in the surface waters. Figure 3 shows the annual surface median concentrations at three stations representing the tidal fresh, middle, and near the mouth of the Patuxent River from 1985 to 1996. There was a steady decline in total nitrogen concentrations in the tidal fresh segment from 1985 to 1991, as the upgraded WWTPs began operating.



Source: DNR, 1997. These represent annual median concentrations for surface samples only.

In contrast, the total phosphorus concentrations shown in Figure 2 showed a sharp decline from 1985 to 1987. This decrease directly reflects the enactment of a statewide phosphate detergent ban in 1985. The decline was particularly noticeable in the tidal fresh reaches where total phosphorus concentrations had been more than four times higher than in the lower Patuxent River prior to the phosphate ban.

Legislative and Regulatory Initiatives

There have been a variety of state and federal initiatives since 1984 that have provided legislative and regulatory support for implementing the Policy Plan recommendations. These have included land management, stormwater management and resource protection strategies. The most relevant are summarized in Table 4.

Table 4. State, Regional, and Federal Initiatives Implemented Since 1984	
<i>Initiative (Year passed)</i>	<i>Description</i>
Chesapeake Bay Critical Area Management Act (1984)	Provides for land use management within 1,000 feet (approximately 1/4 mile) of the average high tide of tidal waters that drain to the Chesapeake Bay. This program was partially based on the 1984 Patuxent River Policy Plan regarding the designated area (1/4 mile from the shoreline), and has different protection standards for different land uses within each of three management categories.
Stormwater Management Program (1984)	Requires that stormwater from urban land is treated using best management practices. In 1988, enhanced stormwater quality began to be required. Many local governments have been delegated authority, including Anne Arundel, Howard, Montgomery, and Prince George's counties in the Patuxent watershed.
State Nontidal Wetlands Act (1989)	Requires a minimum 25' buffer around nontidal wetlands greater than 5,000 square feet.
State Forest Conservation Act (1991)	Requires protection, and in some cases, restoration of forested areas during development. The threshold for protection is dependent upon type of land use.
State Economic Growth, Resource Protection, and Planning Act of 1992. <i>See Page 15 for information on Smart Growth.</i>	Requires that local governments incorporate the Act's seven visions into their comprehensive plans. A Sensitive Areas Element must be included to protect the four types of sensitive areas identified by the Act.
State Phosphate Ban (1985)	Banned the use of phosphate in most detergents and led to measurable reductions in phosphorus concentrations throughout Maryland's rivers and the Chesapeake Bay.
Chesapeake Bay Agreement amendments of 1987 and 1992. <i>See Page 16 for Tributary Strategy information.</i>	The Governors of Maryland, Virginia, and Pennsylvania; the Mayor of Washington, D.C.; and the Administrator of the U.S. EPA agreed to specific management actions to restore the Bay. The most notable provision was for a 40% nitrogen and phosphorus loading reduction between 1985 and 2000. This is very similar to the nutrient reduction agreement that resulted from the 1981 Patuxent River Charrette.
National Pollutant Discharge Elimination System Permits for Municipal Separate Storm Sewer Systems (1990)	Resulting from 1987 amendments to the Clean Water Act, local jurisdictions with populations greater than 100,000 are required to inventory, monitor, and assess their stormwater management programs. Public education is a required component. In many cases, this federal program has led to comprehensive watershed management initiatives at the local level.

Primary Management Area--*A Cornerstone of the Patuxent Policy Plan*

The Policy Plan recommended that “a primary management area, delineating the area along the river and its tributaries, will be established to identify and manage land from which pollution is most likely to be transported into the river.” The State initiatives for protecting Critical Areas and Sensitive Areas provided for minimum criteria throughout the basin. Within the Patuxent, portions of Anne Arundel, Calvert, Charles, Prince George’s, and St. Mary’s Counties fall within the area protected under the Critical Areas legislation.

There have been many local initiatives to establish and maintain management areas to protect the Patuxent River and its watershed. For example, Prince George’s County has established the Patuxent River Primary Management Area (PMA) Preservation Area with criteria for stream and wetland buffers within the Patuxent watershed and includes the PMA in County Master Plans. Montgomery County has adopted the Functional Master Plan for the Patuxent River Watershed with guidelines for the protection of steep slopes, wetlands, reservoirs, and other sensitive areas in the Patuxent River watershed.

In February 1997, St. Mary’s County acquired 192 acres of river-front land for use as a park through a creative partnership involving the federal and state government and the Trust for Public Land, a national nonprofit group. The land had been owned by a developer who went bankrupt, with the land eventually ending up in federal hands for disposal. After complicated negotiations, the Trust for Public Land purchased the property on behalf of St. Mary’s County, using state government funds of \$1.35 million along with \$400,000 in state open space monies designated for St. Mary’s County.

Local environmental management initiatives have been recognized by the Chesapeake Bay Partner Communities program for protecting local natural resources, the Bay, and its rivers. In 1997, Calvert County and the City of Bowie were two of four Bay jurisdictions winning GOLD awards as Chesapeake Bay Partner Communities. Calvert County won for its innovative growth management and watershed planning efforts which include mandatory clustering, extensive use of transfer of development rights, and extended buffers to protect steep slopes adjacent to streams and other sensitive resources throughout the County. The County is currently working directly with a stakeholder’s group to complete the development of a comprehensive management plan for Hunting Creek in the Patuxent watershed. The City of Bowie documented the better part of two decades of environmentally sensitive efforts and programs while providing municipal services, highlighting their Biological Nutrient Removal (BNR) program which demonstrated that simultaneous biological nitrogen and phosphorus removal could be obtained through operational changes alone.

A variety of local management programs are outlined in Attachment A, originally developed as part of the Demonstration Project and updated during 1997 through the Patuxent River Commission’s efforts.

Agricultural Preservation

Many local jurisdictions have also implemented agricultural preservation programs that complement the State’s program and which also help to meet the Policy Plan recommendation to preserve agriculture in the watershed. One example is Howard County’s Agricultural Land Preservation Program (the County Program) which purchases development rights from agricultural landowners and holds them in perpetuity. A farmer whose land meets size and soil criteria may offer to sell an easement to the County while holding fee simple title to the land and continuing to farm.

The County Program also accepts easements on qualifying preservation parcels created through the cluster development process and sending parcels created through the density exchange option of the development process. As of May 1997, the County holds easements on approximately 17,192 acres, including 3,960 acres in the Maryland Agricultural Land Preservation Program. About 75% of this easement acreage is within the Patuxent River watershed. To help ensure the viability of agriculture in the County and thereby protect its investment in the agricultural land base, the County and the Howard County Economic Development Authority launched an Agricultural Marketing Program in July 1996 which offers marketing and promotional assistance to county farms and agricultural businesses.

Sand and Gravel Extraction

One of the ten Plan recommendations was to provide for resource extraction while minimizing long term impacts to the environment. Unfortunately, abandoned sand and gravel mining operations often remained as derelict land, turning into illegal dump sites and dirt bike and four-wheel vehicle drive tracks which produced complaints from nearby residents for action by local agencies. An innovative partnership between Anne Arundel County Recreation and Parks and the State Highway Administration has turned a 138-acre abandoned gravel mine into 71 acres of forested nontidal and 3 acres of tidal emergent wetlands along the banks of the middle part of the Patuxent River. The wetlands were created on County-owned land in this \$2.1 million project as mitigation for wetlands affected during construction of Route 50 and 10 other highway projects. This was the largest such wetland mitigation project in history and one of the largest contiguous wetlands mitigation projects on the entire East Coast. The project restores valuable wetlands that can serve as both pollutant filters and wildlife habitat, as well as providing aesthetic benefits to the area.

Environmental Indicators

The Policy Plan recognized the importance of controlling pollution and habitat loss to protect the living resources of the river and its watershed. In February 1997, the Maryland Department of the Environment (MDE) and Department of Natural Resources (DNR) published a discussion draft report presenting the status of Maryland's key public and ecological resource health parameters. The parameters were identified for use in working with the US EPA to provide a results-based approach for tracking environmental issues. Many of the living resources indicators included in that report are already being used to document the successes of the Chesapeake Bay Restoration Program (Bay Program) effort. The Bay Program has established quantitative goals for restoring submerged aquatic vegetation, for bottom dwelling communities, and for protecting riparian areas. The status of these living resource indicators in the Patuxent Basin reflects successes to celebrate as well as reminders that improvements are still needed.

Designated Uses

Water quality in Maryland's waterways has traditionally been tracked statewide through the Maryland Water Quality Inventory required by the federal Clean Water Act. The inventory emphasizes state program data and compliance with existing designated use criteria for temperature, pH, dissolved oxygen, turbidity, fecal coliform bacteria, and a number of toxic compounds. The Patuxent basin includes a diversity of designated uses--drinking water supply reservoirs, shellfish areas, and trout streams. The Patuxent includes free-flowing freshwater, tidal fresh, and estuarine (brackish) waters from its origin in Frederick County to its mouth at Solomons Island.

Based on the Maryland Water Quality Inventory for 1993-1995 (December 1996), the tidal fresh and estuarine reaches are partially supporting of their designated uses. The estuarine reaches do not support their designated use as shellfish areas due to high bacterial levels. Water quality in the basin has been judged as being from Good to Fair, with the estuarine portion still suffering from seasonal algae blooms and low dissolved oxygen levels. The freshwater as well as estuarine stretches show elevated nutrients, bacterial, and suspended sediment levels from agricultural and urban runoff.

Much emphasis has been placed on limiting nitrogen and phosphorus loadings to the tidal portion of the Patuxent to control these seasonal occurrences of adverse water quality. Despite these capital project investments and other nutrient control strategies, the living resources in the tidal Patuxent are not yet showing widespread improvements in abundance and diversity. This lag may indicate that more time is needed for the communities to rebound from the long history of adverse water quality impacts or that factors other than nutrients are limiting their restoration.

Submerged Aquatic Vegetation Distribution

Submerged aquatic vegetation (SAV) provides food and habitat for a variety of aquatic life and is adversely affected by algae blooms and sediment which prevent sunlight from penetrating through the water column. SAV represents one category of living resources for which the Bay Program has established specific numerical goals for restoration and habitat requirements needed to allow an increase to meet those goals. Based on recent DNR photo interpretation of historical photos, there were an estimated 700

hectares (about 1,729 acres) of submerged aquatic vegetation in the nontidal and tidal reaches of the Patuxent in 1952. In 1996, there were only 90 hectares (222 acres) of SAV in the Patuxent watershed.

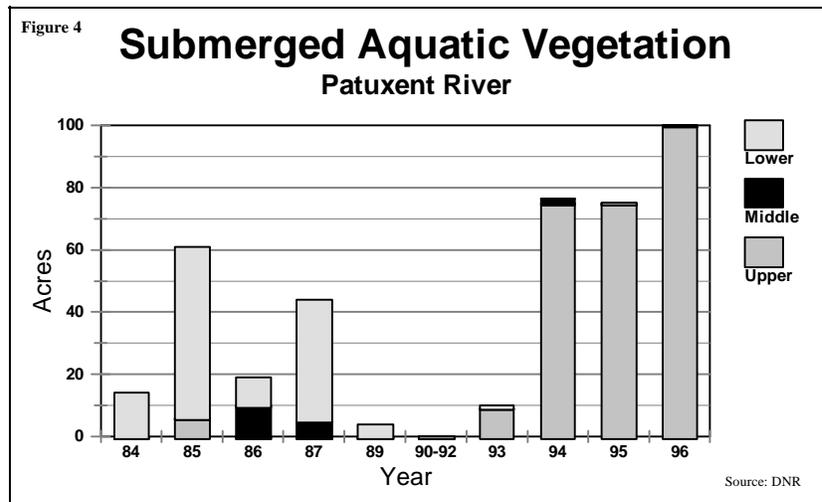


Figure 4 shows the very low levels of SAV from 1984 (< 20 hectares) to none identified during 1990-92. There was a dramatic SAV increase in the upper, tidal fresh reaches beginning in 1994. This occurred coincidentally after completion of upstream WWTP upgrades in 1990-91. Nitrogen loads continue to exceed the Bay Program 40% reduction goal, although nitrogen concentrations for the lower Patuxent now meet Bay program SAV habitat requirements (DNR, 1996). The middle and lower Patuxent reaches have not shown signs of SAV recovery, despite the dramatic upstream decreases in both phosphorus and nitrogen concentrations since 1984. The DNR is currently investigating the differences in SAV recovery and has theorized that it is a lack of seed populations that is preventing SAV reestablishment in the estuarine Patuxent.

Indices of Biotic Integrity

The DNR has also initiated a series of monitoring and analysis efforts to develop numerical indices to convey the status of Maryland's biological resources. An Index of Biotic Integrity (IBI) is a number which reflects the health of a biological community. The IBI integrates an array of measures that individually provide information on several biological attributes that describe the community's structure and function for an overall indication of biological condition. For example, biodiversity is an attribute included in many IBIs, and in general, the greater the diversity, the healthier the community.

Evaluating the biological community's structure and function can be used not only to identify impaired or degrading stream reaches, but also to provide insights into the causes of impairment. The community responds over time in specific ways to specific impairments, so that more nutrient tolerant species will become dominant where nutrients are a problem and only pollution tolerant species will be present if dissolved oxygen levels or pH levels become too low.

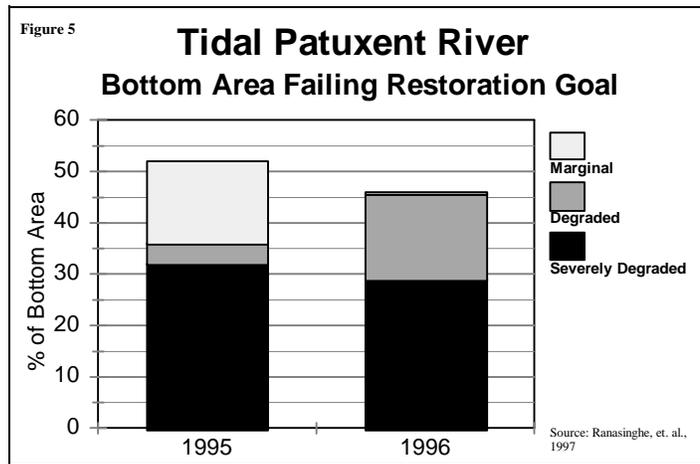
Estuarine Benthic Communities

Benthic communities include those organisms, known as *benthic macro invertebrates*, that live or are associated with the bottoms of rivers and streams. In estuarine systems, these organisms include mainly worms and mollusks. The State is conducting *status* monitoring at randomly selected stations to estimate the spatial extent of water quality problems and *trends* monitoring at fixed stations to evaluate changes over time.

Status monitoring was first conducted during 1994 to estimate the extent of bottom area where the benthic community met the Chesapeake Bay Benthic Community Restoration Goals. These Goals are the first national estuarine bio-criteria and provide a threshold for assessing the conditions of the benthic community (Ranasinghe, et al., 1997). The thresholds are still undergoing development, however, so these results are considered preliminary.

Results for the Patuxent are shown in Figure 5. The bottom area not meeting Bay Program goals decreased from 52.0% in 1995 to 45.8% in 1996. In 1996, 29.2% of the bottom area was classified as "severely degraded," while 16.0% was classified as "degraded." Throughout the Bay, however, the benthic IBIs for status stations seemed to indicate that these degraded areas will show improvements as nutrient reduction efforts continue and water quality improves.

To track changes over time, three trend stations located in the middle part of the tidal Patuxent have been monitored every summer since 1984. The two most upstream stations met Bay Program restoration goals during 1984-1986 (initial conditions) but showed declines during 1994-1996 (current conditions). The third, the most downstream, station did not meet restoration goals during either period. The two upstream stations are located in areas not subject to seasonal low dissolved oxygen



conditions, while the third station is near Broome's Island and is probably exposed to low dissolved oxygen concentration stress. All three stations are located where nutrient concentrations have not changed substantially over the past 13 years. The declines at the upstream stations are manifested in the biological community as excess abundance and/or biomass, shown in increases in the abundance of pollution tolerant organisms (Ranasinghe, et al., 1997).

Estuarine Fish Community

Fish monitoring data from 1989-1995 have been used in developing average IBI scores for the estuarine portions in each of 13 Maryland tributaries, including the Patuxent. The Patuxent was among eight of these sampled tributaries with estuarine fish community IBIs below reference standards. However, fish young of year (YOY) indices have increased in the Patuxent since 1983 as shown in Table 5. YOY refer to fish that have hatched out during that year, with high numbers predicting higher landings of adults in future years. The indices represent the mean number of that species of that life stage caught per netting attempt.

The YOY increases in the Patuxent have been observed for five fish species with a variety of life cycle requirements. Striped bass, American shad, alewife, blueback herring, and hickory shad are anadromous species, marine species which migrate to freshwater to spawn. White perch is a semi-anadromous species in the Chesapeake Bay and its tributaries, found in low to moderate salinities but also migrating into freshwater to spawn. Yellow perch and channel catfish are freshwater species, although yellow perch are also often found in low salinities in the Bay.

Striped bass produced dominant year-classes in 1993 and 1996, with record numbers of YOY produced in the Patuxent River in 1996. White perch YOY have had five successive dominant year-classes in the Patuxent from 1992 through 1996. Likewise, YOY recruitment of yellow perch and channel catfish was better in 1996 than in any year since 1983 when YOY were first enumerated.

The observed increased recruitment in many of these species can be attributed to both successful fisheries management and improved water quality in the Patuxent River and its freshwater tributaries. For example, striped bass were severely over fished and a fishing moratorium was imposed from 1985-1989. The striped bass moratorium and continued effective fisheries management have resulted in recent record numbers of striped bass in the Patuxent River and Chesapeake Bay.

White perch is a species favorably affected by striped bass management activities and which has been very abundant in the Patuxent in recent years. The prohibition of small mesh gill nets (used to target white perch) during striped bass spawning seasons has reduced commercial harvests of white perch. White perch have a longer spawning season, March through June, than striped bass. Female white perch do not release all their eggs at once, as do striped bass, and may continue to spawn over a period of 10 to 21 days. Thus chances are better that some batches of eggs will hatch in favorable environmental conditions.

Increased recruitment of yellow perch is probably also attributable to both effective fisheries management, through reducing creel limits and prohibiting yellow perch fishing in some areas during spawning season, and improved water quality. Yellow perch eggs and larvae are very sensitive to acidic stream conditions which can be worsened by acid rain.

YEAR	Striped Bass	American Shad	Alewife	Blueback Herring	Hickory Shad	White Perch	Yellow Perch	Channel Catfish
1957 ^a	1.00	0	0	0	0	0	0	0
1958 ^b	11.50	1.50	0	25.00	0	0	0	0
1959 ^b	0	0	0.50	5.50	0	0	0	0
1960 ^b	8.00	7.00	0.50	37.50	0	0	0	0
1983	0.06	0	0	0	0	0.17	0	0.39
1984	0.61	0	0.11	0.50	0	0.67	0	0.11
1985	3.17	0	0.17	2.33	0.06	12.72	0.22	1.28
1986	2.44	0	0.67	0	0	4.67	0.11	0.78
1987 ^c	2.94	0	0.35	0	0	7.65	0.18	1.76
1988 ^c	0.59	0	0	0	0	4.47	0.24	0.47
1989	1.39	0	1.27	6.67	0	33.67	0.17	0.16
1990	0.28	0	0.11	0	0	4.61	0	0.11
1991	0.94	0	0.44	0	0	11.72	0.11	0.11
1992	9.50	0	0.39	0.17	0	43.00	0.06	0.06
1993	104.33	0	0.06	0.11	0	96.11	0.11	0.89
1994	4.06	0	0.56	0.17	0	57.56	1.28	0.61
1995	7.28	4.22	0.22	0.72	0	71.72	0.11	0.17
1996	420.39	3.72	0.94	0.83	0.22	406.17	4.94	8.94

^a Only one sample collected

^b Mean of two samples

^c Mean of 17 samples

NOTE: Both YOY and older fish are caught during beach seines. YOY indices are the arithmetic mean of catches of young of year fish from six stations sampled during July, August and September, with a 100-foot beach seine (4 feet deep with 1/4 inch mesh). Total number of samples per year is 18 unless otherwise indicated. Stations sampled extend from the tidal fresh to lower estuarine and include Shelby Landing (Jug Bay), Nottingham, Mill Town Landing, Eagle Harbor, Sheridan Point, and Peterson Point (Jefferson Patterson Park). White perch, yellow perch and channel catfish were counted but were not enumerated separately as YOY from 1957 through 1960.

Populations of alewife (not to be confused with Atlantic menhaden, a marine spawner often used for fish bait and chum and referred to as "alewife" by many local fishermen) and blueback herring, collectively known as river herring, remain at historically low levels. Both these species, as well as hickory shad and American shad, are subject to coastal intercept commercial fisheries. Improvements in water quality in spawning areas and removal of physical barriers to the upstream spawning migrations certainly have helped in the slow recovery of both shad and river herring.

Freshwater Communities

The DNR Maryland Biological Stream Survey (MBSS) is completing statewide biological and stream physical assessments and is developing IBIs for both freshwater fish and benthic communities in nontidal reaches. In freshwater systems, the benthic community is dominated by aquatic larval stages of insects. The larval stage is the immature, non-reproductive phase in the insect's life cycle. Benthic community IBIs will be developed for the Patuxent after basin-wide monitoring is completed during 1997.

As part of its countywide stream resource monitoring program, Montgomery County Department of Environmental Protection (DEP) has conducted fish, benthic organisms, and physical stream assessments in its portion of the Patuxent since 1994. The County program uses protocols and analysis techniques comparable to those used by the DNR-MBSS and has developed County IBIs. Based on this monitoring and analysis, many of the County's highest quality streams are found in its portion of the Patuxent watershed.

The DEP monitoring has not identified any stream reaches in the Patuxent watershed with impairments from nutrients or toxins. Most impaired stream reaches clearly show the physical impacts from stormflow volumes and sediment loads from uncontrolled runoff from agricultural and residential land uses. Many streams in urban areas also show disturbances in baseflow characteristics, either because of channel widening and a resulting decrease in stream depth, or baseflow reductions due to the paving over of recharge areas. Flow and sediment problems are well-documented throughout the nontidal tributaries of the Chesapeake Bay and must be addressed in local protection and restoration strategies in order to enhance the overall Bay restoration program.

Stream Miles Open to Migratory Fish

Habitat quality as well as water quality must be improved to assure long term resource protection and restoration. For migratory fish such as American shad, this means providing access to spawning areas in many of the Bay's tributary streams. Much of this access has been lost due to man-made blockages such as dams and road crossings. The DNR has identified at least 133 blockages in the Patuxent Basin and established priorities for removal of these blockages (Larry Leasner, pers. comm).

The dams to the Rocky Gorge and Triadelphia Reservoirs are obvious major blockages on the upper mainstem of the Patuxent River and DNR has no current plans to evaluate the areas above these dams for usable spawning habitat. Only a handful of the other blockages represent significant watershed areas. In 1992, a major blockage on the Little Patuxent was removed at Fort Meade, restoring access to the Little Patuxent and its tributaries in an 11 sq. mi. area. Another major blockage was removed at Horsepen Branch Dam in 1995, opening up 10 miles of fish passage. At the Croom Station Road Culvert on Charles Branch in Prince George's County, project design is completed and construction scheduled for 1998 to open 10.6 miles of stream.

In addition to providing spawning access for migratory fish, some of these constructed fishways have been used by non-migratory (*resident*) fish species. These species include white sucker, smallmouth bass, and brown trout. Local jurisdictions, such as Montgomery County, have identified blockages on many smaller tributaries and have developed road crossing design policies to provide “bio-sensitive” stream crossings to prevent the construction of additional blockages to resident fish species and to provide access during reconstruction projects.

Adequacy of Riparian Forest Buffers

Forest buffers to streams provide both water quality and habitat functions that are vital to maintaining both the aquatic and terrestrial biological communities. Based on the Environmental Indicators report, streams in Maryland lacked 50-60% of their forest buffers. This analysis is based on evaluating the extent of 100-ft. buffer on both sides of streams from satellite imagery used for the 1993 Forest Resource Inventory. In the Patuxent watershed, less than 35% of the streams had adequate buffers. This was among the lowest percentages among the 10 tributary basins. The Choptank and Youghiogheny Rivers watersheds had the highest percentages (about 45%) of forest buffers to streams.

The State has developed a target to establish 600 miles of forest buffers over the next 14 years. For the Patuxent, there is a Tributary Strategy target to establish 66 acres of forest buffers from 1994 to 2000.

IV. TRENDS

Management Initiatives

State Programs

The projected population and land use changes in the watershed increase the importance of managing future growth to continue successful restoration and protection efforts. The State has taken a strong step to manage future growth in ways that will preserve existing communities and save rural lands from development with the Smart Growth initiatives passed in 1997. The Priority Funding Areas Program will direct State funding to support economic development and new growth in existing developed areas and other areas designated by the State and local governments. The Rural Legacy Program will fund local government and land trust efforts to purchase land, easements and development rights in designated rural areas. Three additional initiatives include an incentive program to redevelop brownfield sites, a job creation tax credit for businesses that create jobs in priority funding areas and an incentive program to encourage employees to live near their places of employment.

Federal Programs

Continuing efforts are also needed to meet the requirements of existing federal regulatory programs. Jurisdictions with National Pollutant Discharge Elimination System (NPDES) permits are required to characterize the quality and quantity of storm water discharges to their storm drain systems and develop management programs to decrease pollutants entering these systems. These reductions can occur through efforts such as public outreach and education, new stormwater management facilities and retrofits of existing stormwater management facilities. Anne Arundel, Charles, Howard, Montgomery, and Prince George’s County have all obtained and must comply with these new NPDES municipal stormwater permits.

Recent changes to the Safe Drinking Water Act require that managers of drinking water supply systems must conduct source water assessments which include: delineating the watersheds for the drinking water supply source; identifying contaminant sources within these watersheds; and assessing the susceptibility of these waters to contamination. These assessments will be further designed to promote local, voluntary protection programs for these water supply sources, including the reservoirs and drinking water supply wells in the Patuxent watershed.

In response to recent court rulings, states may be required to enact stricter enforcement of Total Maximum Daily Loads (TMDLs), a requirement of the Clean Water Act. TMDLs specify the maximum amount of a pollutant that a water body can assimilate before exceeding water quality standards for the water body use classification. The State is in the process of developing TMDLs for 130 segments with identified impairments, with each of the 10 tributary basins, including the Patuxent, listed as impaired by nutrients. TMDLs could have significant implications for land use planning as allowable pollutant loads may be apportioned based on point and nonpoint source loads to a waterbody.

The Tributary Streams and the Reservoirs

The 1984 Patuxent Policy Plan identified the importance of addressing both point and nonpoint sources of pollution to protect the river: *If we would improve the water, and the vitality of life depending on it, we must better manage our land.* Since then, however, the major funding allocations have been targeted to control those pollutants with primary impacts to the tidal portion of the river--nutrients. Throughout the Patuxent basin, there are nearly 1,250 miles of nontidal streams and rivers and associated riparian areas that need protection to maintain valuable terrestrial and aquatic habitat, for their recreational value, and for their water quality benefits.

Maryland's Tributary Strategies for Nutrient Reduction: A Statewide Summary recognized the need to focus on the tributaries in order to control all major impacts to the nation's largest estuary, the Chesapeake Bay, including excess nutrients, sediment runoff, and possibly elevated levels of toxins. To accomplish this, there will need to be a comprehensive approach to watershed management, with an opportunity to integrate nutrient reductions, habitat restoration, growth management, and resource protection for a healthy environment and livable communities. The Demonstration Project identified the need to include local and regional water resource issues for successful watershed management and meeting the Bay restoration goals.

The Patuxent River Tributary Team Annual Report 1995-1996 includes the recommendation to develop methods to track the utility of and need for resource protection and growth management tools. Many local programs are implementing management tools to protect local streams, but these tools do not easily fall into categories that are being tracked or credited for nutrient reduction under the tributary strategy. While the effectiveness of individual policies in reducing nutrients may be difficult to quantify, these programs do provide water quality and habitat protection for local streams which ultimately benefits the Patuxent River and the Bay.

One example of an ongoing regional effort is focused on the upper Patuxent River watershed. The Triadelphia and T. Howard Duckett (Rocky Gorge) Reservoirs are located on the mainstem of the upper Patuxent and provide drinking water to residents in the Washington metropolitan area. In 1996, recognizing the importance of this resource, Howard County, Montgomery County, Prince George's County, the Howard Soil Conservation District, the Montgomery Soil Conservation District, the Maryland- National Capital Park and Planning Commission and the Washington Suburban Sanitary Commission signed the

Patuxent Reservoirs Watershed Protection Agreement. These jurisdictions and agencies are now working cooperatively with federal and State agencies to protect the long-term biological, physical and chemical integrity of the Patuxent reservoir watersheds. This regional watershed management approach will facilitate the basin wide efforts to protect the Patuxent River and its resources.

Public Outreach and Stewardship

The 1984 Policy Plan included the recommendation that “[A] community education program will be an integral part of the [Annual] action program.” There are numerous public outreach events in the watershed, including annual “Patuxent Discovery Day” and “Patuxent River Appreciation Days.” These events bring attention to the conditions and problems of the River and encourage the public to assist in improving the river.

Local streams must be protected and restored in order to assure long term protection of the Bay and its resources. To do this, local citizens must be informed of and understand water quality issues related to their neighborhood streams and must be motivated to become involved in environmental stewardship activities. The public must understand how everyday activities contribute to a cumulative impact on aquatic resources and that small changes in behavior or lifestyles that reduce pollutants will help to counterbalance these cumulative adverse effects.

Since 1984, there has been an increased recognition by all levels of government and the private sector of the importance of outreach and stewardship to accomplish common goals. Federal, state, and local programs now routinely require opportunities for public input during the development and implementation of policies and projects that have environmental as well as social and economic impacts.

Many of the local efforts funded through the Demonstration Project included public outreach components. For example, the Kettering Environmental Enhancement Project, conducted by the Prince George’s County Department of Environmental Resources, occurred in a 500-acre mixed use drainage area, where development had taken place without any stormwater management controls. The comprehensive project integrated water quality management with flood management, habitat development, wetland enhancement, and community education and participation. Based on the results of surveys conducted before and after outreach efforts and project construction, public attitudes and awareness of practices concerning residential sources of pollution increased 50%.

The Patuxent River Commission’s Annual Report 1995-1996 recognized that there seemed to be many youth-oriented programs but a lack of comparable adult programs. Survey results like those in the Kettering Project show the need for outreach programs targeted to increase adult participation in environmental stewardship activities. In the Annual Report, the Commission noted the need to measure and track progress for environmental education and stewardship initiatives and to conduct a citizen attitude survey on water quality issues. The Commission has been awarded grant funds through the federal CWA Section 319 program to inventory and computerize ongoing public outreach efforts for the Patuxent watershed.

Shift in Funding Sources

Despite recent increases in Federal regulatory requirements for State programs to protect water quality, there has been a decrease in Federal monies for preparing or implementing water quality protection programs. During the 70s and 80s, the Federal government provided substantial grants for construction to improve water quality. Figure 6 shows that, for the State of Maryland, Federal funding for construction peaked at \$87.5 million in State Fiscal Year (FY) 1992 and have declined dramatically since then to about \$15 million in FY 1997. Future increases in Federal construction funding are highly unlikely. (Note: the State Fiscal Year runs from July 1 to June 30).

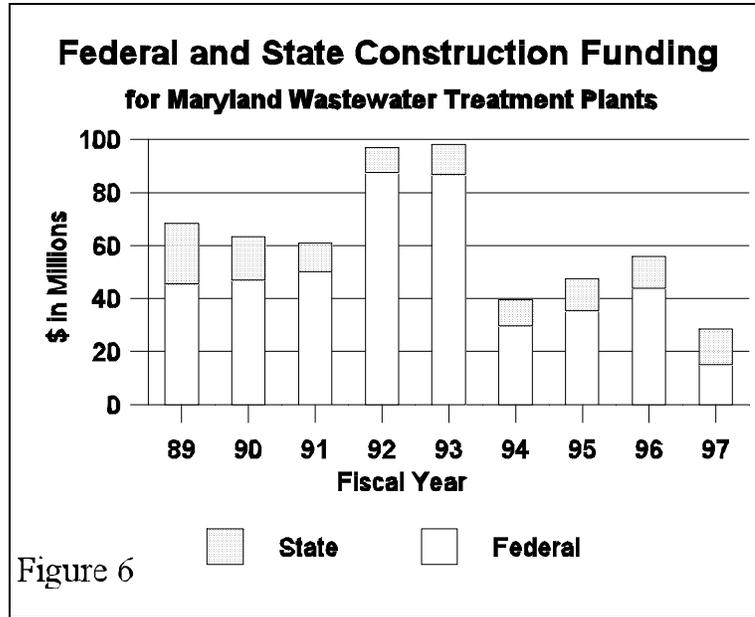


Figure 6

Local jurisdictions received direct benefits from the Federal Construction Grants in upgrading the major municipal WWTPs in the watershed. The federal construction grant program has been converted to one which contributes to the state revolving loan fund (SRF). The SRF provides low interest loans to municipalities, but with repayment obligations that were not required by the construction grants program.

The 1987 CWA amendments focused attention on NPS pollution. Section 319 of the CWA requires states to assess their NPS water quality problems, develop a management plan to control them, and to implement the management plan recommendations. Annual federal funding to support the 319 program is very limited, only about 10% of that which had been available for the construction program. Maryland has received federal 319 grant funding since Federal Fiscal Year (FFY) 1991, with a peak of \$1.76 million in FFY 1995. Most of these monies are used to directly support state agency programs and very little is available for local initiatives. Future federal 319 grant funding is anticipated to remain at the FFY '97 amount of \$1.3 million. (Note: the Federal Fiscal Year runs from October 1 to September 30).

The most straightforward controls and remediation techniques for point source pollution have already been implemented with resulting major water quality improvements since the 1970's. Restoring and maintaining current water quality conditions by continued emphasis on point source controls will require more complex and much more expensive technology, even as federal funding for research and construction of these technologies has been severely reduced. Maintenance and the per pound removal costs of point source technologies will provide additional impetus for the development and implementation of techniques to control nonpoint source contributions.

V. Goals, Challenges, and Enhancements

The Patuxent River and its watershed are valuable and necessary resources not only to our regional economy, but to our health and quality of life. People choose to live in this area not only because of the availability of jobs, but because here they have found a pleasing quality of life. This is in no small part due to the Patuxent River and its tributaries-their historic role in determining where important towns were established, what commerce would make these towns and people prosper, and which living resources would sustain them. These are among the many reasons why its citizens have chosen to preserve and protect the river and its watershed resources.

The Policy Plan's ten recommendations to protect the river are as important now as when they were first proposed and supported 13 years ago. Without successful implementation of these recommendations, there would have been no recognizable progress in cleaning up the river and its tributaries and improving the prospects for its living resources. With continued dedication to the Policy Plan recommendations, the three basic, continuing challenges of growth management, personal stewardship, and funding to protect the watershed and its resources can be met.

Accommodating Population Growth-The Greatest Challenge?

Accommodating the projected population increase in the Patuxent watershed may be the most difficult challenge faced by its residents. As the population grows, more and more homes are sought, farther and farther away from the infrastructure-supported urban core and commute times continue to increase. For example, in Calvert County, currently the fastest growing county in Maryland, the average commute time has increased to more than 35 minutes, the longest average in the state, while 20% of County residents commute an average of 90 minutes.

This growing population needs an increased water supply, new schools, new roads, and other infrastructure which in turn add new stresses to the Patuxent ecosystem. Vehicle emissions increase as the number of vehicles and miles traveled increase and then contribute to increased nitrogen loadings to the area's waterways. The groundwater resource suffers from lack of recharge as the impervious surfaces from roads, parking lots, and buildings increase. The breadth of living resources is reduced as forests and stream corridors become detached from each another.

The population of the Patuxent watershed will increase by 54% by the year 2020, with new residents seeking homes, schools, retail stores, roads and more, while at the same time demanding parks, open spaces and other recreational opportunities. Yet, if current trends continue, 26% of the remaining forests and 28% of the remaining agricultural land will be converted to other uses during that same period. How to accommodate growth and the accompanying changes in land uses, while striving to maintain and even reduce nutrients flowing from this growth into the Patuxent will require new thinking and innovative actions.

The Demonstration Project evaluated management measures focused on directing growth to areas with existing and planned infrastructure and preserving forested and agricultural lands. If the 125,000 projected new units were developed on two-acre lots, about 250,000 acres of additional land would be consumed; for comparison, Anne Arundel County is about 267,000 acres in size. Alternatively, the same number of new homes could be developed on quarter-acre lots, consuming 31,000 acres in development. In rural areas, clustering of new homes would minimize the amount of disturbed area during and after development.

As shown in Figure 7, the Demonstration Project analyses showed that directed growth options alone could provide a potential 26% reduction in total nitrogen loadings by the year 2010. However, full implementation of all management tools is needed to greatly reduce the future impacts of growth and to continue water quality and living resources improvements.

Personal Stewardship May Be our Greatest Tool

The sources of pollution to the Patuxent and its tributaries are as diffuse as the many inhabitants of the watershed. From septic systems to cropland and runoff from parking lots, this pollution results from the everyday activities of those who live, work, and play in the Patuxent watershed. The Demonstration Project analyses indicate that existing and even enhanced levels of land management activities will not maintain the Patuxent's 40% nutrient reduction goal into and beyond the year 2010. Even reaching the nutrient reduction goal does not guarantee that water quality conditions in the river will have improved enough to sustain its complex living resources community.

Fostering a sense of personal stewardship and commitment to reducing individual impacts is vital to the long term protection and enhancement of the river and its resources. There has been an explosion of information about conditions within the watershed, yet there is a lack of effective ways to engage the public so they feel responsible for and excited about positive outcomes. Only through successful public outreach to enhance local stewardship can the problems, progress, and plans be communicated to individual citizens and their elected and appointed officials.

Financial Challenge

To successfully overcome these continuing challenges, costs and sources of financing become important considerations. The cost of managing NPS pollution inevitably rests with the very people who live and work in the watershed: farmers, homeowners, recreational campers and fishermen, retail and industrial businesses, automobile and truck drivers, and others. Public recognition of individual responsibility is increasing as shown in a 1993 Chesapeake Bay Program survey. In that survey, business and industry were identified as a main cause of Bay pollution by 78% of Maryland residents responding, although there was an acknowledgment by 62% that "things individuals do" were a main cause. Without stewardship and support from everyone in the watershed, the challenge to preserve and protect the Patuxent watershed will be difficult to meet.

To effectively and equitably finance programs to meet the existing challenges, the public must acknowledge these problems and be willing to contribute to their resolution. An educated public forms an essential basis for successfully supporting the protection and preservation of the Patuxent watershed and its resources and all those who live, work or visit the Patuxent watershed must be involved in its restoration.

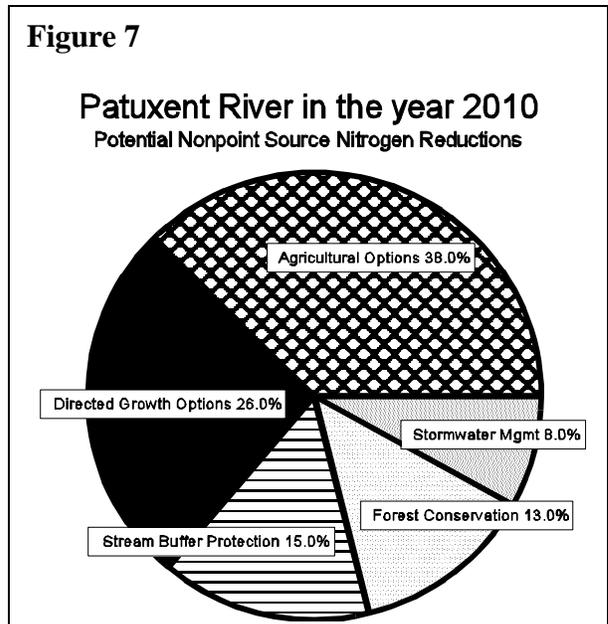
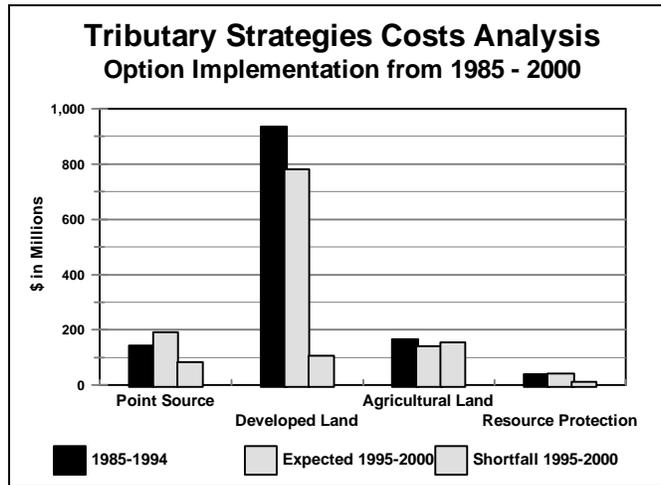


Figure 8

Financing sources depend on a dedicated, reliable source of repayment, sometimes in the form of special rates, fees, or taxes. These dedicated revenues represent acknowledgment on the part of those who live, work or visit the area, that their livelihood and quality of life are intertwined with the health of the river. It is acknowledgment that all stakeholders have a vested interest in maintaining this beautiful and bounteous region, which once boasted some of the largest catches of fish and shellfish in the region.

Most financing requires a dedicated source of repayment and therefore those being asked to repay the obligation must believe that there is a problem and believe that it is in their best interest to remedy that problem. This



necessitates a public committed to the 10 recommendations of the Policy Plan and to managing population growth and its associated water quality challenges. The Governor’s Blue Ribbon Panel Report (Blue Ribbon Report) on financing alternatives estimated that the cost for implementing nutrient reduction strategies was more than \$1.2 billion from 1985-1994. As shown in Figure 8, the Blue Ribbon Report estimated that there would be a \$300 million shortfall between total anticipated and projected costs to meet the reduction goals from 1995 to the year 2000. Attachment C. is a listing of financing mechanisms identified through the Blue Ribbon Report that could be employed to help pay for programs and projects to meet the nutrient reduction goals and provide long term resource protection.

Future Directions

The Demonstration Project, the COE Reconnaissance Study, and other studies have shown that additional efforts will be necessary to achieve and maintain the watershed goals of the Policy Plan. Management strategies may need to extend beyond the Patuxent watershed to address issues such as the links between air pollution control and water quality protection activities.

The Commission through efforts undertaken by the Demonstration Project identified six findings to enhance the implementation of the 10 Plan recommendations and to help meet the continuing challenges of population growth, land use changes, public stewardship needs, and decreasing public funding. Pursuing these six findings will help to preserve and protect the natural resources of the Patuxent River and her tributaries which are the very basis of our quality of life.

Cooperation among the basin's stakeholders is needed to successfully:

I. Implement a comprehensive watershed management approach to control all sources of pollution and resource degradation. The Patuxent watershed has an advantage over the other tributary basins due to the established history of interjurisdictional and interagency cooperation through the Commission in achieving common objectives.

II. Continue to restore, improve, and protect the habitat function of aquatic and terrestrial living resources. Healthy habitats that support fish and wildlife also ensure a variety of other functions: filtering pollutants, controlling stormwater runoff, and providing recreational opportunities.

III. Concentrate new development in and around existing developed areas and population centers while protecting rural lands and the associated agricultural economy. By directing growth, the cost of providing infrastructure and other public services is reduced while maintaining undeveloped rural areas that can better support healthy biological communities and economically desirable land uses such as agriculture and forestry.

IV. Enhance the environmental quality and community design in new and existing communities. Many existing communities were established before current environmental protection or community design regulations were in place. Consequently, many original resources were lost and little space may be available for new parks, stormwater facilities or retrofits, or environmental restoration. Innovative approaches are needed to assure that new and existing communities are attractive places to live.

V. Develop a sense of stewardship for the Patuxent River and its watershed through increased public education and participation programs. A well-educated and highly motivated public cooperating is necessary to control all sources of pollution and resource degradation.

VI. Provide sufficient funding and staff to support continued programs, policies, and projects to meet the 10 recommendations of the Policy Plan. Without funding, it will not be possible to implement agreed upon strategies nor will it be possible to conduct routine tracking and regular reporting. State and local management agencies need to be able to identify existing and potential problems and issues and must be aware of both successes and failures to effectively focus resources on meeting the challenges facing the watershed.

Attachment A. includes more detailed objectives and potential action items to address these needs. Many of the action items listed are currently being implemented in the watershed to some degree, but their use could be expanded or enhanced. *With the long history of cooperation and documented resource improvements in the Patuxent River, the Commission continues to provide a focus for innovative, flexible management approaches that can be used throughout the Patuxent River watershed.*

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Patuxent River Policy Plan Update Document

Attachment A.

Objectives and Action Items for the Findings

November, 1997

Vision to the Year 2000

The Patuxent Watershed is often viewed as the "proving ground" for Maryland's Chesapeake Bay Program and other resource protection activities. This watershed has a rich history of Federal, State, and local government commitment. Citizen commitment has also been strong. Many efforts to improve the watershed have occurred with the involvement of the Patuxent River Commission, which State legislation formed in 1980.

Our twenty-year vision for the watershed is that water quality and living resources will continue to improve. The watershed will have sustainable agriculture and economically viable communities. Forests, wetlands, and other sensitive areas will be protected. The environmental impacts from both agriculture and development will be minimized through cooperative efforts among the three levels of government, citizens, and the private sector. The watershed's citizens will be well informed on the conditions, trends, and challenges. In addition, they will participate in improving the watershed in a variety of ways.

The Patuxent River Commission will support and coordinate these activities through its focus on interjurisdictional cooperation and information exchange on implementing programs, policies, and projects that fulfill the 10 recommendations of the 1984 Policy Plan. The challenges in the watershed from population growth, land use changes, public stewardship, and financial support can be addressed through the pursuit of the following 6 broad programmatic guidelines.

I. IMPLEMENT A COMPREHENSIVE WATERSHED MANAGEMENT APPROACH TO CONTROL ALL SOURCES OF POLLUTION AND RESOURCE DEGRADATION

Many different management activities are currently in place in the watershed, with new ones planned. All three levels of government implement these various activities, and they need a method to coordinate them and to identify progress and future needs. In addition, non-governmental organizations and citizens also need to be involved in this process. The Patuxent Tributary Strategy will be an integral component of this activity. The Patuxent is additionally benefitted by: the Patuxent River Commission (in place since 1981 and now also the Patuxent Tributary Team), the 1984 Patuxent Policy Plan, the Patuxent Watershed Demonstration Project (1992 - 1996), the U.S. Army Corps of Engineers' Patuxent Study (1995 -1996), and the general history of watershed activities and inter-jurisdictional cooperation in the Patuxent Basin.

Objectives

- A. Obtain by the year 2000, and maintain thereafter, the Patuxent's 40% Nutrient Reduction Goal. This goal is part of the Chesapeake Bay Agreement and further articulated in the Patuxent Tributary Strategy.
- B. Continue to pursue environmentally sustainable and innovative technologies in the watershed to minimize point source pollution, which is primarily from wastewater treatment plants.
- C. Develop and implement a protection strategy for the reservoirs and their environmental resources in the upper watershed.
- D. Continue to develop, evaluate, recommend, and implement activities and programs that promote:
 - ▼ Good land use policy;
 - ▼ Terrestrial and aquatic habitat protection, restoration, and creation;
 - ▼ Viable communities;
 - ▼ Nonpoint source pollution reduction and management; and
 - ▼ Sound economic development.

Subsequent sections address these items in more detail.

II CONTINUE TO RESTORE, IMPROVE, AND PROTECT THE HABITAT FUNCTION OF AQUATIC AND TERRESTRIAL LIVING RESOURCES

Healthy ecosystems are "natural infrastructure" which support fish and wildlife populations. In addition, they provide other functions: filtering pollutants, reducing stormwater runoff, and providing aesthetic and recreational opportunities. Efforts to protect and restore critical habitat areas--such as tracts of contiguous forest, wetlands, streams and riparian areas--should be guided by an ecosystem approach.

Objectives

- A. Riparian Forests - Restore and protect riparian forest buffers to stabilize stream banks, shade waterways and improve riparian habitats to meet the State's goals established through its environmental indicators program.
- B. Stream Quality - Protect high quality streams and restore degraded streams to improve spawning ranges and habitats through a combination of SWM, retrofit projects, and stream and channel enhancements.
 - 1. Inventory and prioritize streams and riparian areas in the Patuxent River watershed

that need restoration.

2. Implement preferential land taxation policies, and other economic incentives currently done in some of the Basin's jurisdictions, to promote the preservation and restoration of riparian forest buffers, streams, and forest land.
3. Fully implement, inspect, and maintain existing urban and agricultural BMPs and other management techniques that protect stream quality and habitat.
4. Develop and implement more effective controls to reduce the problem of excessive sedimentation and the resulting loss of habitat for many aquatic species.
5. Participate in Maryland's commitment for 600 more miles of forested riparian buffers.

C. Wetlands - Protect and restore wetlands, which support high water quality downstream and provide valuable aquatic habitat.

1. Ensure the long-term viability of wetland ecosystems through comprehensive planning (e.g., Special Area Management Plans) and accurate inventories.
2. Encourage federal, state, and local purchases of conservation easements.
3. Promote using restoration projects to meet federal and state requirements for compensatory mitigation and creation.

D. Forest Land - Maintain and enhance contiguous tracts of forest. This will aid the habitat of migratory birds and other forest-dependent species (e.g., forest interior dwelling birds and neo-tropical migrant birds).

1. Expand existing state and federal landowner technical assistance programs for multiple benefits that include: water quality, food, and cover for birds and other species. (e.g., USDA Forest Legacy, Forest Stewardship program and the Stewardship Incentives program).
2. Identify and prioritize remaining tracts of contiguous forest in the Patuxent Watershed using aerial photography, GIS, or ground surveys and establish "habitat corridors" which are maintained and managed as unimproved lands
3. Develop programs that actively pursue the preservation and enhancement of priority woodlands, including techniques that identify potential riparian reforestation sites and encourage appropriate banking proposals.

E. Habitat Protection and Restoration - Protect and restore the habitat for ecologically

valuable species in the Patuxent Watershed, including rare, threatened, and endangered species.

1. Establish a Patuxent River coalition to identify, coordinate, and facilitate communication between existing conservancies, land trusts, and other easement holders and to operate as a regional coordinator of ecologically valuable lands in the basin under protection or in need of protection using easements of inclusion in land trusts.
2. Facilitate and coordinate existing conservation programs to facilitate priority setting among these programs
3. Develop and implement a consistent system of biological indicators (species or groups of species) to measure progress toward Patuxent River recovery, as recommended by the Chesapeake Bay Program Ecologically-Valuable Species Workgroup.

F. Submerged Aquatic Vegetation and Tidal Marsh - Increase the amount of submerged aquatic vegetation and tidal marsh.

1. Achieve, at a minimum, the submerged aquatic vegetation (SAV) recovery goals set by the Chesapeake Bay Program (Upper Patuxent - six hectares, Middle Patuxent - 40 acres and Lower Patuxent - 132 acres).

III. CONCENTRATE NEW DEVELOPMENT IN AND AROUND EXISTING DEVELOPED AREAS AND POPULATION CENTERS WHILE PROTECTING THE RURAL LANDSCAPE AND AGRICULTURAL ECONOMY

Concentrating new development in and around existing developed areas, if planned properly, can reduce the social, environmental, and economic costs of sprawl and provide many other benefits. When rural areas remain undeveloped, they are better able to support healthy ecosystems and act as a larger land base for economically desirable land uses such as agriculture and forestry. Protected rural areas also provide open space and scenic landscapes. By directing growth, the cost of providing and maintaining public services and facilities in existing developed areas may be reduced through greater efficiency and use of existing capital investments. The viability of existing communities can be enhanced through redevelopment, infill, and adaptive reuse.

Objectives

- A. Redevelopment - Encourage and provide incentives for redevelopment, adaptive reuses, and infill development in or adjacent to existing communities.
1. Develop and adopt appropriate incentives and disincentives that can include zoning to promote mixed uses, density bonuses, tax breaks and streamlined permitting when development includes environmental and community enhancements.
 2. Inventory and evaluate parcels within existing communities to determine which have potential for redevelopment, infill, and adaptive reuses.
- B. Concentrating Growth - Encourage growth in concentrated, targeted areas, preferably close to other existing developed areas.
1. Identify targeted growth areas (a.k.a. development districts) and structure development regulations so that these areas are the most attractive for development and redevelopment. Allow densities at an appropriate scale for these areas and coordinate infrastructure so that these areas, and not others are supplied with water, sewer, and other infrastructure.
 2. Provide incentives to make clustering and other creative measures more attractive to developers, and create disincentives for the disturbance of sensitive areas.
- C. Protecting Rural Character - Protect and enhance the rural character and function of areas not designated for growth.
1. Encourage participation in agricultural and rural preservation programs that allow for options such as purchase of land and easements or transfer or sale of development rights. Wherever possible, link these programs with other goals that designate growth areas, so that development rights can be transferred to the targeted areas.
 2. Encourage the continuation of rural industries through the implementation of rural economic development initiatives and other programs.
 3. Increase requirements for open space outside the development districts to help preserve rural character in rural areas, and serve as a possible additional disincentive for development outside the development districts.
 4. Limit the extension of services and infrastructure to rural areas at a scale designed to preserve rural character.

Most of these items can be measured in terms of the number of programs implemented or as acres saved, TDRs created/sold, or number of projects with coordinated greenway systems, and acres of open space.

IV. ENHANCE THE ENVIRONMENTAL QUALITY AND COMMUNITY DESIGN IN NEW AND EXISTING COMMUNITIES

A variety of current State and local development regulations require such measures as the provision of open space, forest conservation, stream and wetland protection, and stormwater management to mitigate impacts from development. When designed properly and integrated into a site, these measures can help protect the environment and enhance community design for the benefit of both wildlife and human populations. Many existing communities, however, grew before the enactment of these regulations. Consequently, many original resources were lost and there may be little land available for new parks, retrofit facilities, or environmental restoration. However, even small improvements to environmental quality such as tree planting and wildlife habitat plantings can make both new and existing communities more attractive for both wildlife and human populations. New infill development or redevelopment in existing communities can provide opportunities for enhancements such as the establishment of community open space, landscaping, stream restoration, etc.

Objectives and Action Items

- A. Innovative Approaches - Implement flexible zoning and other development regulations that promote innovative site design while creating additional open space or protected sensitive lands.
 - 1. Promote innovative site design by allowing greater flexibility in design parameters such as lot layout, building setbacks, parking, and street design requirements in exchange for enhancements such as additional open space or protected sensitive lands.
 - 2. Develop performance standards for site layout, signage, landscape design, and the provision of environmental and community enhancements.
 - 3. Incorporate flexible parking standards into overall development requirements.

- B. Coordination - Coordinate regulatory programs that affect land development to balance contradictory goals or permit requirements, speed reviews, and make these programs more environmentally sensitive.
 - 1. Enhance existing forums for federal, state and local governments to jointly review and evaluate regulatory programs for contradictory goals and permit requirements. This requires a review of all federal, state and local government regulatory programs that affect land development and a review of how each level of government regulation -- federal, state and local -- relates to the others.
 - 2. Bring federal, state and local government permitting schedules into closer alignment.

3. Enhance and expand existing forums to coordinate review of site specific projects.
 4. Seek mechanisms to pre-approve appropriate areas to streamline desirable development.
- C. Open Space - Maintain and increase open space and encourage connections such as greenways (corridors) between existing open space holdings to enhance aesthetic, habitat, and recreation values. Locate active recreation areas so that they do not compromise habitat areas.
1. Inventory existing open space areas to identify active recreational areas, natural areas and needs and opportunities for new acquisitions.
 2. Establish priorities for the acquisition of new areas to provide the greatest benefits for aesthetic, habitat, and recreation values. Specific goals can be expressed as additional acreage to be acquired, as a percent increase in existing acreage, or as acreage or length of connecting corridors to be created or enhanced.
- D. Stormwater Management - Design new stormwater management facilities and retrofit existing stormwater management facilities to be environmentally sound and aesthetically pleasing.
1. Include environmental and aesthetic enhancements plus more flexibility to test innovative approaches in stormwater management facility design standards.
 2. Enhance existing programs such as the NPDES permitting program that inventory and evaluate existing stormwater management facilities to determine retrofit priorities to maximize environmental benefits. Such measures as drainage area served, number of homes located within the drainage area served, percent impervious surface within the drainage area served, or severity of the environmental impact to be mitigated by the retrofit can be used to set definite goals.
 3. Emphasize and implement routine maintenance of stormwater management facilities.
- E. Pockets of Natural Land in Developed Areas - Promote tree planting and wildlife habitat planting programs that enhance the attractiveness of existing residential and business properties for wildlife and human populations.
1. Inventory existing conditions to identify and prioritize areas in greatest need of enhancement. To determine progress, acreage planted or quantity and type of stock planted in targeted areas can be used.
- V. **DEVELOP A SENSE OF STEWARDSHIP FOR THE PATUXENT RIVER AND**

ITS WATERSHED THROUGH INCREASED PUBLIC EDUCATION AND PARTICIPATION PROGRAMS.

A sense of stewardship for the Patuxent River and its watershed should be developed among all of its residents and resource users. Watershed residents and business need to recognize and understand the impact of human activities. Public outreach programs are crucial to building long-term support and environmental stewardship. They can provide low cost, easily implemented projects to improve water quality and protect aquatic resources. Outreach programs need to be as interactive as possible and targeted to reach the variety of audiences within the watershed, including urban, suburban, and rural stakeholders. These efforts should target children plus adults, because today's children are tomorrow's resource managers. The limited effectiveness of structural controls and the high cost of retrofitting existing development necessitates having a well-educated and highly motivated public cooperating to control all sources of pollution and resource degradation.

- A. Stakeholders - Identify the various stakeholders in the Patuxent River watershed and their roles in protecting the River and its resources. Also, customize outreach programs to increase awareness of their roles.
 - 1. Develop and track public surveys to identify resource protection, recreation, employment, and quality of life issues among the communities in the Patuxent watershed.
 - 2. Establish a subcommittee or workgroup to coordinate, expand, and track public outreach and volunteer environmental protection activities in the watershed

- B. Environmental Stewardship - Foster environmental stewardship among all residents and users of the Patuxent River and its resources by enlisting public participation in community service and environmental enhancement projects.
 - 1. Increase public outreach events such as the Patuxent River Appreciation Days and other festivals, forums, and community meetings throughout the watershed to update residents on ongoing activities and to generate support for these efforts.
 - 2. Identify and implement more effective mechanisms for advertising outreach events to encourage citizen participation.
 - 3. Develop and implement environmental education curricula to be used in the school systems and by environmental or other citizen-based groups.

- C. Effects of Everyday Activities - Document how modifications of everyday practices by watershed residents and resource users can bring about improvements in water quality and aquatic resources.

1. Encourage citizen monitoring and facilitate reporting the results from these monitoring activities to all the stakeholders in the watershed
 2. Develop and implement mechanisms for broad recognition of successful public participation and stewardship programs
 3. Use the tracking mechanisms required of local NPDES municipal storm sewer system permits to document water quality improvements from source control programs; include both the business and industry and residential programs required by this permit
- D. Targeted Outreach Programs - Implement targeted outreach programs for the various stakeholders to build long-term public support for protection, restoration, and enhancement policies and practices to assure sustainability of the resources of the Patuxent River.
1. Expand, enhance, and encourage public service/community service projects in both the public and private sector, including businesses, environmental organizations, and government agencies.
 2. Develop and track the results of pollution prevention programs for industrial and business owners in the watershed.
 3. Develop and track the results of residential outreach programs, including both urban and suburban components.
 4. Develop and track the results of programs targeted toward large-lot owners, including those involved in so-called "urban agricultural" land uses.
 5. Create a speakers' bureau for Patuxent River Commissioners and others to speak to various groups about management issues.
 7. Develop a newsletter for periodic distribution.
 8. Develop a program to enlist the cooperation of the editors of local newspapers and periodicals in the Patuxent River watershed for publishing articles addressing issues relevant to the Patuxent and the Commission. In addition, establish a mechanism for providing appropriate written material for this purpose.
 9. In a variety of forums, clearly communicate: Where are we?, Where are we going?, and Why?
 10. Consolidate data available from already existing studies, research, and monitoring programs and develop presentation techniques for easy understanding by the non-technical public.

- E. Promote Good Communities - Promote programs and policies that emphasize the aesthetic and economic benefits of living in well-designed communities that conserve land for open space, provide environmental protection, and minimize infrastructure costs.
 - 1. Develop information that explains the need for compact mixed use development to avoid citizen opposition to positive planning activities.

VI. PROVIDE SUFFICIENT FUNDING AND STAFF TO SUPPORT CONTINUED PROGRAMS, POLICIES, AND PRACTICES TO MEET THE 10 RECOMMENDATIONS OF THE PATUXENT POLICY PLAN

- A. Fund and implement urban and agricultural BMPs and the investigation of new, innovative, environmentally responsive, and cost effective BMP technologies.
- B. Initiate a bond initiative or other funding mechanism such as the Rural Legacy Program for acquiring and managing easements on ecologically-valuable lands in the Basin.
- C. Establish state funding for a comprehensive living resources monitoring program, particularly for ecologically-valuable species that may have little economic value but for which long-term data is needed to accurately assess ecological trends in the watershed.
- D. Fund expanded technical support and outreach for cost-share and other opportunities for source control from more traditional agricultural land uses.

Attachment B.

Goals of the Patuxent River Policy Plan

The following are twenty goals from the original Policy Plan. They are as important now as they were in 1984.

1. To restore water quality in the Patuxent River to acceptable pre-development levels as defined by dissolved oxygen content and turbidity;
2. To view the river as an integrated system from the headwaters to the Chesapeake Bay for management purposes;
3. To promote a continuous buffer along the river to protect water quality, prevent flood damage to human life and property, preserve wildlife habitats, and provide an open space and recreation resource;
4. To restore and improve the potential for recreational uses of the river including boating, sports fishing, crabbing, swimming, and aesthetic pleasure;
5. To restore the catch of desired species of fin and shellfish in the river;
6. To protect and enhance the use of the river for fish spawning;
7. To establish and maintain river flow volumes that support the multiple uses of the river;
8. To maintain research capability to identify the key environmental needs of important aquatic species;
9. To preserve and enhance important wildlife habitats throughout the watershed;
10. To protect and enhance the scenic quality of the river;
11. To protect and manage valuable natural resources within the watershed including prime agricultural and forest lands, aquifer recharge areas, and potential sand and gravel extraction sites;
12. To protect the economic and social needs of both upper and estuarine jurisdictions within the watershed;

13. To promote land use patterns and practices that will accommodate growth while protecting water quality goals;
14. To prohibit or regulate the use of hazardous and toxic materials and wastes to ensure that they will not harm the river;
15. To protect valuable cultural resources within the watershed including historic sites and areas that are architecturally unique or picturesque;
16. To determine State funding targets for research, Program Open Space, sewage facility construction, and rural and urban non-point source programs;
17. To assure that each county shall be responsible for the cost of mitigating or preventing environmental problems within its jurisdiction;
18. To promote coordinated planning for basin-wide issues requiring interjurisdictional action; and
19. To promote the protection of the environmental integrity of the areas surrounding the reservoirs to protect and enhance the water quality of the Rocky Gorge and Triadelphia Reservoirs.
20. To protect the environmental quality of aquifer recharge areas.

Summary of Funding Ideas by Type

FUNDING IDEAS	PAGE	TYPE						
		BOND	FEE	LOAN	PRIVATE INCENTIVE	PUBLIC/PRIVATE PARTNERSHIP	REDIRECTION OF EXISTING PROGRAM	SURCHARGE
 Point Source  Agricultural Land								
 Developed Land  Resource Protection								
 Pooling of communities' debt for credit enhancement/small community bond bank	27	◆						
 Extension of maturity of state revenue bonds to reduce annual debt payments	28	◆						
 Mini-bonds for stream restoration	52	◆						
 Special Assessment District	34	◆	◆					◆
 Stormwater Management Utility	32	◆	◆		◆			◆
 Grant processing or handling fee	29		◆					
 Annual user fee for the depletion/degradation of aquifer	37		◆					
 Full-Cost Pricing of Service Fees	37		◆					
 One-time septic system installation impact fee	39		◆					
 Environmental "check-off" for all agricultural products	45		◆					
 Create habitat stamps patterned after duck stamp program	56		◆					
 Extension of State Revolving Fund to the Private Sector   	26			◆				◆

FUNDING IDEAS	PAGE	TYPE						
		BOND	FEE	LOAN	PRIVATE INCENTIVE	PUBLIC/PRIVATE PARTNERSHIP	REDIRECTION OF EXISTING PROGRAM	SURCHARGE
 Allow individual property owners to receive loans for structural shore erosion control without being required to join a designated district	54			◆			◆	
 Conservation services incentive programs by major agricultural companies	47				◆			
 Issue credit card benefiting private environmental organization/fund	59				◆			
 Expand commemorative license plate program	55				◆			
 Establish forest mitigation banking systems at state and county levels	50				◆			
 Tree planting for carbon sequestration or other air quality credits	57				◆			
 Restore Buffer Incentive Program to \$500/acre payment to landowners	58				◆			
 Create incentives for Transferable Development Rights' (TDR) receiving areas	51				◆			
 Develop local agriculture cooperatives on a watershed basis to assist farmers in financing activities	42				◆			
 Public-private partnership for financing wastewater treatment plant upgrades	29					◆		
  Sale of municipal utility assets to private sector	28					◆		
 Purchase of environmental easements by the private sector	44					◆		
 Adopt-a-crab/Adopt-a-Bay creature	55					◆		
 Create endowment fund for environmental protection and restoration	58					◆		

FUNDING IDEAS	PAGE	TYPE						
		BOND	FEE	LOAN	PRIVATE INCENTIVE	PUBLIC/PRIVATE PARTNERSHIP	REDIRECTION OF EXISTING PROGRAM	SURCHARGE
  Apply Community Reinvestment Act requirements for local investment to environmental projects	40					◆		
 Statewide Purchase/Transferable Development Right Bank (PDR/TDR)	51					◆		
 Use of federal or state housing grants to finance public sewer extension to areas with failing septic systems	36						◆	
 Increase cost-share cap for livestock waste storage from \$35,000 to \$50,000 per system	46						◆	
 Expand tax deduction for conservation tillage and animal waste handling equipment to include other environmental equipment	43						◆	
 Require nutrient management plans on all Maryland Agricultural Land Preservation Foundation easements	43						◆	
 Tax Increment Financing (Value Capture)	35							◆
 Surcharge on prepared food and beverages	45							◆
 Lawn and Garden Fertilizer Surcharge	38							◆
  Environmental Trust Fund	52		◆	◆	◆	◆	◆	◆
 								

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