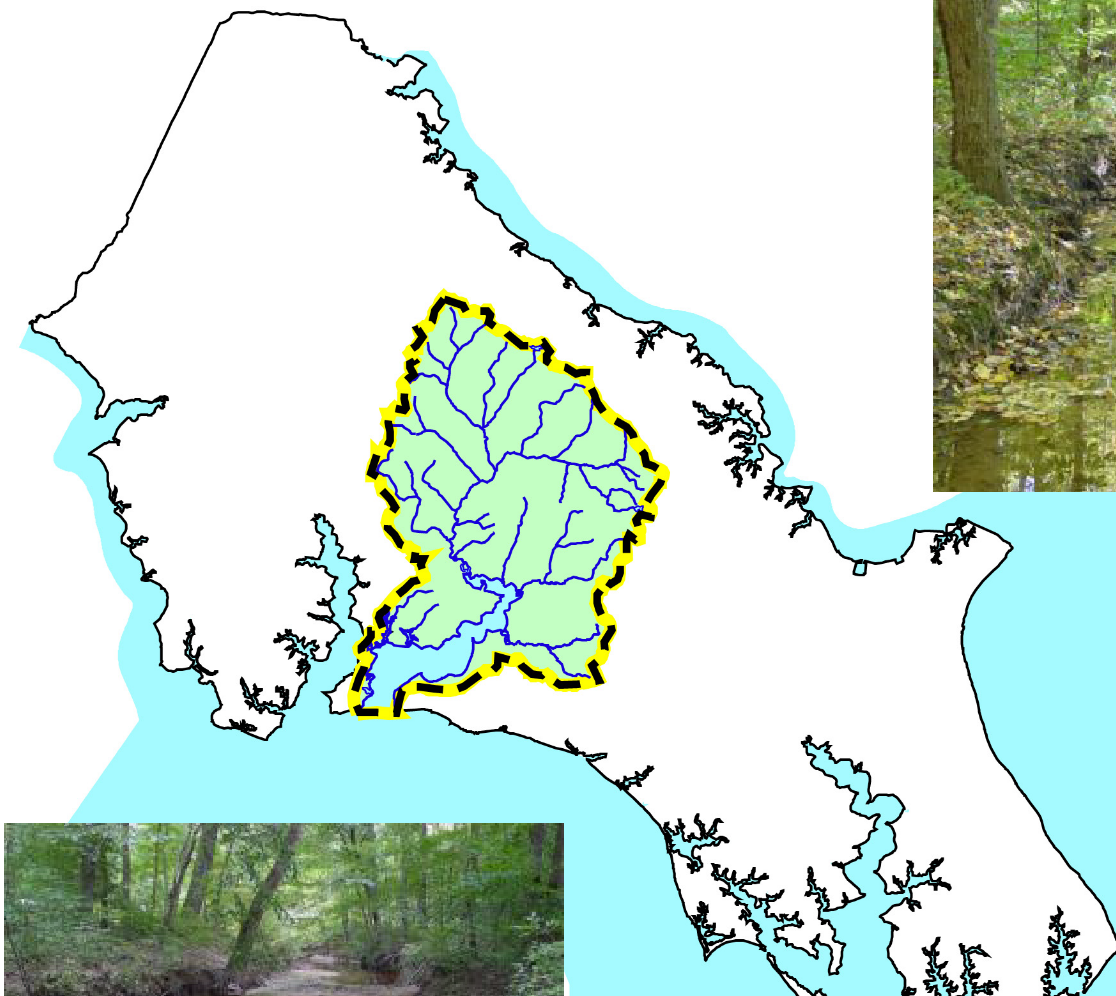
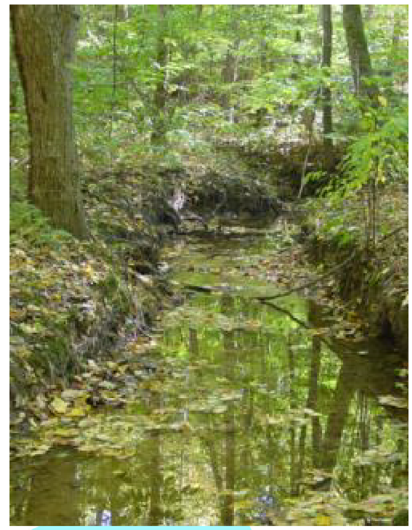
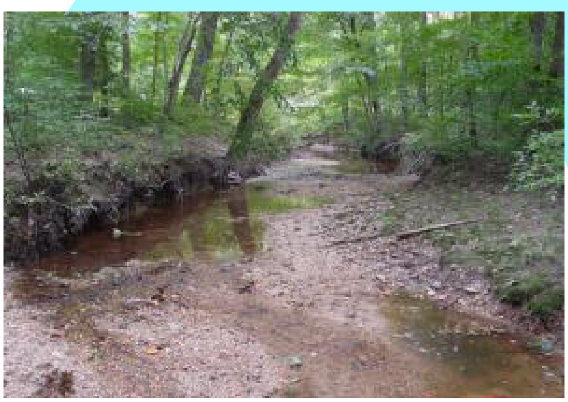
Breton Bay
Watershed Characterization

October 2002







Product of the
Maryland Department of Natural Resources
Chesapeake and Coastal Watershed Service
In partnership with St. Mary's County
and the Town of Leonardtown

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Cover Photographs

- Upper right: Town Run (by Bob Lewis)
- Left: Moll Dyers Run (by Bob Lewis)
- Lower right: Spartina grasses (by Peter Bergstrom)

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Watershed Characterization

October, 2002

In support of St. Mary's County's
Watershed Restoration Action Strategy
for the
Breton Bay Watershed

Product of the
Maryland Department of Natural Resources
Chesapeake and Coastal Watershed Service
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St. Mary's County and the Town of Leonardtown

Parris N. Glendening
Governor

Kathleen Kennedy Townsend
Lt. Governor

A message to Maryland's citizens

The Maryland Department of Natural Resources (DNR) seeks to preserve, protect and enhance the living resources of the state. Working in partnership with the citizens of Maryland, this worthwhile goal will become a reality. This publication provides information that will increase your understanding of how DNR strives to reach that goal through its many diverse programs.

J. Charles Fox
Secretary

Karen M. White
Deputy Secretary

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EXECUTIVE SUMMARY
For the Breton Bay Watershed Characterization

St. Mary's County, Maryland is receiving Federal grant funding to prepare a Watershed Restoration Action Strategy (WRAS) for the Breton Bay watershed. The WRAS project area encompasses about 38,500, acres including about 3,260 acres of open water.

As part of WRAS project, the Maryland Department of Natural Resources (DNR) is providing technical assistance, including preparation of a Watershed Characterization–a compilation of available water quality and natural reources information and identification of issues–and two surveys of on-the-ground conditions, which may be used as the County generates its Watershed Restoration Action Strategy.

Water Quality

The Breton Bay watershed does not support the uses designated for it in state regulation (water contact recreation and shellfish harvesting) due to problems with fecal coliform bacteria, nutrients and sediment. High bacteria counts have required closure of northern Breton Bay to shellfish harvesting. A large portion of central Breton Bay has conditional approval for shellfish harvesting, which limits harvesting activity. No other human health issues relating to water quality are identified in the watershed.

Excess nutrient loads have contributed to algae blooms and low dissolved oxygen. High algae populations and areas that occasionally fail to meet the 5.0 mg/l dissolved oxygen standard tend to appear in upper Breton Bay in late summer.

High sediment deposition has led to reports of expanding sand bars near the mouth of Town Creek. In colonial times, Leonardtown was a sea port, but it has been many years since upper Breton Bay was navigable by large vessels.

Steps to improve water quality are underway. The Leonardtown Wastewater Treatment Plant, the only significant point source contributing nutrients to Breton Bay, is undergoing an upgrade which will lead to a nutrient load reduction. Collection of water quality data began in 2002 to support calculation of Total Maximum Daily Loads (TMDLs) that will determine the pollutant load reductions for all sources that are considered necessary in order for Breton Bay to meet its designated uses.

The Landscape

Land in St. Mary's County / Breton watershed is nearly 60% forested, slightly more than 25% agriculture and nearly 14% developed land. Large blocks of forest that meet Maryland's criteria for high quality forest interior habitat cover about 42% of the land in the watershed. The most significant of these forest blocks from a habitat perspective, the McIntosh Run Forest Block, covers about 80% of the McIntosh Run subwatershed (as delineated by The Nature Conservancy.) This extensive forest cover suggests that nonpoint sources of nutrients in the watershed probably arise from a relatively small land area.

Only about 1% of the Breton Bay watershed has some form of protection from development. About 14% of the watershed is categorized as a Priority Funding Area where State funding may be available to improve infrastructure associated with new development.

Slightly over 6200 acres (18%) of the watershed is wetlands, most of which are forested. About 16% of the watershed has hydric soil and about 18% has highly erodible soil.

Living Resources and Habitat

In tidal waters of Breton Bay, available data show that problems exist for some important species. Submerged aquatic vegetation (SAV) acreage has been very sparse in recent years compared to historic acreage. US Fish & Wildlife Service findings suggest that water quality is limiting SAV but some opportunities for restoration may be identified. DNR data on oysters indicate that small populations are surviving in Breton Bay but a very high incidence of disease will likely inhibit restoration efforts in the foreseeable future. Relatively little information is available on fisheries, however, no fish consumption advisories apply to fish caught in Breton Bay.

In nontidal waters, a Federally endangered fresh water mussel is an important local living resource needing protection. Assessment of available benthic macroinvertebrate information shows a few areas with communities rated as good while most communities are rated as fair or poor.

As described above, much of the Breton Bay watershed is covered with intact forest, providing habitat for many forest interior dwelling species. Fourteen of the 19 forest interior dwelling bird species found in Maryland are found in the Tall Timbers breeding Bird survey, which includes a portion of the Breton Bay watershed.

Restoration Targeting Tools

Consultants working for St. Mary’s County in 1998 identified several potential sites for stream buffer restoration and wetland restoration.

Additionally, a stream corridor assessment completed in 2002 will identify the status of stream buffers, stream bank erosion, etc. This information will augment information in the watershed characterization to help target potential restoration areas or projects.

Computerized mapping was also used to demonstrate concepts for restoration targeting and to help identify areas for additional site investigation for restoration of stream buffers and wetlands. Based on this GIS analysis, numerous restoration opportunities may be available for site assessment subject to identifying land owner/cooperators.

CONTRIBUTORS TO THE WATERSHED CHARACTERIZATION

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INTRODUCTION

Background

In 1998, Maryland completed a Unified Watershed Assessment of all 134 of the state's watersheds in order to identify high priorities for restoration action based on impaired waters and high priorities for conservation action based on high or unique natural resource value. The assessment was conducted by the Maryland Department of Natural Resources (DNR) under the direction of the US Environmental Protection Agency's Clean Water Action Plan initiative with assistance from the Maryland Departments of Environment, Agriculture and Planning and the University of Maryland. It moved beyond consideration of water quality in the streams in the state, which had been assessed regularly since the early 1970's, to a larger consideration of living resources in the streams and the landscape conditions which could impact both water quality and living resources.[1,2]

As part of the State's response to the findings of the Unified Watershed Assessment, DNR is offering technical and financial assistance to local governments who are willing to work cooperatively to develop and implement Watershed Restoration Action Strategies (WRAS) addressing needs for restoration and conservation in priority watersheds. One of these is the Breton Bay watershed in St. Mary's County, in which the County, the Town of Leonardtown, DNR and other local cooperators, both public and private, are engaged in the second round of the strategy development program.

Location

The Breton Bay watershed is located within the Potomac River basin as shown in Map 1 Regional Context. The Breton Bay watershed's geographic location entirely within St. Mary's County is highlighted in Map 2 WRAS Project Area. This area is the focus of the Watershed Restoration Action Strategy and this Watershed Characterization. As shown in Map 3 Streams and Subwatersheds, DNR subdivides the Breton Bay watershed into five "12-digit" subwatersheds for analytical purposes. To assist in restoration planning, St. Mary's County has further divided the watershed into additional subwatersheds as shown in Map 4 County Subwatersheds and described in the County Subwatersheds Table.

Breton Bay Watershed
Acreage Summary
MDP 2000 Land Use/Land Cover

Land	Water	Total
35,193	3,256	38,449

Purpose of the Characterization

One of the earliest steps in devising a Watershed Restoration Action Strategy is to characterize the watershed using immediately available information. This Watershed Characterization is intended to meet several objectives:

– briefly summarize the most important or relevant information and issues
– provide preliminary findings based on this information
– identify sources for more information or analysis
– suggest opportunities for additional characterization and restoration work.
– provide a common base of knowledge about the Breton Bay watershed for local governments, citizens, businesses and other organizations

Additional Characterization Work

The Watershed Characterization is intended to be one starting point that can be updated as needed. It is part of a framework for a more thorough assessment involving an array of additional inputs:

– self-investigation by St. Mary's County
– targeted technical assistance and assessment by partner agencies or contractors
– input from local citizens
– completion of a Stream Corridor Assessment, in which DNR personnel physically walk the streams and catalogue important issues.
– completion of a synoptic water quality survey, i.e. a program of water sample analysis, that can be used to focus on local issues like nutrient hot spots, point source discharges or other selected issues. This is also part of the technical assistance offered by DNR. Findings of the 2002 synoptic survey of the streams in the Breton Bay watershed are reported in Appendix D.

Identifying Gaps in Information

It is important to identify gaps in available watershed knowledge and gauge the importance of these gaps. In assessing data gaps, we have found it helpful to review information in four categories:

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

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

Subwatersheds Selected By St. Mary's County For The Breton Bay Watershed WRAS Project					
12-Digit Subwatersheds		County Subwatersheds			
Number	Name	Letter	Area in Acres		Description
			With Water	Land Only	
02140104 -7020	Direct Drainage Breton Bay	A	6,801	4,044	Shoreline Drainage Area
		B	2,268	1,806	Combs Cr and Cherry Cove Cr
		C	1,507	1,507	Town Run
		D	2,907	2,907	Moll Dyers Run
02140104 -7021	Lower McIntosh Run	A	2,258	2,257	Bottom Land Drainage
		B	2,030	2,030	Nelson Run
		C	596	596	Greenhill Run
		D	2,080	2,080	Milski Run
02140104 -7022	Glebe Run	--	3,769	3,769	Glebe Run and Gravely Run
02140104 -7023	Headwaters McIntosh & Brooks Run	A	610	610	Bottomland Drainage
		B	1,677	1,677	McIntosh Run Headwaters
		C	5,560	5,539	Brooks Run
02140104 -7024	Burnt Mill Creek	A	380	380	Bottomland Drainage
		B	3,440	3,440	Headwaters Burnt Mill Creek
		C	2,565	2,551	Tom Swamp Run & Rich Neck Cr.
02140104	**Breton Bay Watershed**		**38,449**	**35,193**	

WATER QUALITY

Water quality is in many respects the driving condition in the health of Maryland's streams. Historically, the emphasis has been on chemical water quality. More recently, interest has focused on the biological conditions in streams and estuaries; active consideration of the physical parameters is even more recent. This developmental path is reflected in the ways in which streams have been monitored, the types of data gathered, and the regulatory approach taken.

Water Quality Standards and Designated Uses

All streams and other water bodies in Maryland are assigned a "designated use" in regulation, COMAR 26.08.02.08, which is associated with a set of water quality criteria necessary to support that use. The Breton Bay watershed is assigned two uses:

- Use I, Water Contact Recreation and Protection of Aquatic Life: All surface waters not designated as Use II.
- Use II, Shellfish Harvesting Waters: All estuarine areas.

Map 5 Designated Uses and Use Restrictions depicts the distribution of surface waters in each category. (COMAR or MDE should be consulted for official regulatory information.) [3,5]

Shellfish Harvesting Restrictions

As shown in Map 5 Designated Uses and Use Restrictions, portions of Breton Bay are affected by shellfish harvesting restrictions. Tidal waters closest to Leonardtown are "restricted" which "means that no harvesting of oysters and clams is allowed at any time." The central area of Breton Bay contains "conditionally approved waters" which "means that oysters and clams can normally be harvested except for the three days following a rainfall of an inch or greater in 24-hours."

These restrictions are applied by the Maryland Dept. of the Environment (MDE) to protect public health because elevated fecal coliform counts are commonly found in the upper Breton Bay. The elevated counts suggest the presence of contamination by animal or human waste. Restrictions are necessary because oysters and clams are filter feeders that readily absorb pathogens in animal or human waste.

Water Quality Indicators–Setting Priority for Restoration and Protection

The Clean Water Action Plan's 1998 *Unified Watershed Assessment* established priorities for watersheds in the State for restoration and protection. In the Plan, the Breton Bay watershed was included in two categories for priority action: highest priority for restoration, and priority for protecting valued resources.

As the basis for the prioritization, indicators of water quality, landscape and living resources were developed for all watersheds in Maryland. Other approaches to assessing water quality have been in use for several years and are further described below. In general they do not look comparatively at watersheds as the Unified Assessment did in an effort to set priorities. The Unified Assessment also considered a range of living resource and landscape indicators described a little later.

The Unified Assessment looked at five water quality indicators in comparing the State's 134 watersheds; for two of these (a water quality habitat index and a eutrophication index) there were insufficient data to characterize Breton Bay. The remaining three were used to place Breton Bay in the rankings of the 134 watersheds.

1. Nutrients

Two of the most important pollutants in the Chesapeake Bay system are the nutrients nitrogen and phosphorus, deemed this because of their contribution to excessive growth of algae, speeding the processes of eutrophication. Computer models are used to calculate how much of each of these nutrients reaches the streams and how much of each is ultimately delivered to the Bay. To arrive at the indicators for Modeled Total Nitrogen (TN) and Modeled Total Phosphorus (TP) reported in the Unified Assessment, the models calculate the amounts of these nutrients contributed by 1) nonpoint sources, based on land use and estimates of certain land management practices, 2) estimates of such factors as deposition from the air, plus 3) actual discharges from point sources. The modeling results placed Breton Bay in the better 50% of watersheds statewide for both TN and TP; although nutrients are a concern in Breton Bay, they are not the reason for the watershed's being given priority for restoration.

The most recent data from the models (2002) show Breton Bay annual loadings of 5.71 pounds per acre of nitrogen and 0.35 pounds per acre of phosphorus, even lower than the calculations used in the *Unified Watershed Assessment*. And the results of the Spring, 2002 synoptic survey (described later) bear out the low (better) ranking of Breton Bay in comparison with other watersheds in the state.

The third water quality indicator, which is responsible for the watershed's being a priority for restoration, is its being included on the list of impaired waters (the "303(d) list") –waters not supporting their designated uses.

2. State 303(d) Impairment–Not Supporting Designated Use.

A periodic of assessment of water quality statewide is required under Section 303(d) of the Federal Clean Water Act. As part of the assessment, Maryland tracks waterways that do not support their designated use in a list of "impaired waters" and in a prioritized list of "Water Quality Limited Basin Segments" also known as the 303(d) priority list. Information considered in setting the 303(d) list priorities includes the severity of the problem, threat to human health and high value resources, extent of understanding of problem causes and remedies.[5]

The Breton Bay watershed is identified as "impaired" in the *Draft Maryland's 2002 303(d) List*. (Satisfactory completion of a public comment period and approval by US EPA is required before the list can be finalized later in 2002.) There were, at the time the Unified Assessment was compiled, seven factors considered in determining that waters were impaired: nutrients, sediment, bacteria, pH (an indicator of acidity), temperature, metals and organics. New listings will also include biological impairments. Reasons for Breton Bay's being considered impaired are fecal coliform bacteria, nutrients and sediments, all estimated to come from a combination of nonpoint, or diffuse, sources, including natural sources.

Each impairment identified in the 303(d) List is assigned a priority which is intended to help communicate the need for correcting the impairment relative to all impairments listed Statewide. Waterways with impairments having the greatest potential impacts to human health, high value resources, etc. are ranked numerically 1 through 25. All other impairments that are not ranked in the top 25 are ranked high, medium or low.

Total Maximum Daily Loads

The Maryland Department of the Environment (MDE) uses the 303(d) priority list as the basis for determining Total Maximum Daily Loads (TMDLs) of stressors or impairments to listed water bodies. In general, TMDLs include several key parts:

1- Existing conditions for pollutant loads and pollutant sources.
2- Maximum pollutant load that the water can accept while still allowing the water body to meet its intended use.
3- Allocation of the maximum pollutant load to specific pollutant sources.

Based on a voluntary schedule submitted to the U.S. Environmental Protection Agency (EPA) in 1999, MDE has set several target years for establishing Breton Bay TMDLs. (Note: work load scheduling is subject to change):

- 2004, nutrients TMDL
- 2007, fecal coliforms TMDL
- 2008, suspended sediment TMDL

To collect the data necessary for TMDL work, MDE began water quality monitoring in Breton Bay in 2001.[8] MDE staff have offered to share findings from the monitoring data when its analysis is complete.

Why Are Local Waters Impaired?

Nutrients. In Maryland, most water bodies naturally have low levels of the nutrients nitrogen and phosphorus. These nutrients enter waterways from all types of land and from the atmosphere. Nutrient pollution or over-enrichment problems may arise from numerous sources. Residential land can be an important contributor of nutrients depending on fertilizer use, extent of lawn and the status of septic systems. Farmers apply nutrients using different approaches, so nutrients entering waterways from crop land vary greatly depending on management techniques. Typically, smaller amounts of nutrients reach surface waters from an acre of forest land than from an acre of other types of land. The atmosphere can contribute various forms of nitrogen produced by burning fossil fuels in power plants and other industries, and from automobiles. Some of what the atmosphere deposits originates far from the Breton Bay watershed. And a good deal of the excess of nutrients in Breton Bay itself likely originate from the Potomac River rather than the watershed.

Suspended Sediment. Most unpolluted streams and tidal waters naturally have limited amounts of sediment moving "suspended" in the water. Excessive amounts of suspended sediment in waterways are considered pollution because they can inhibit light penetration, prevent plant growth, smother fish eggs, clog fish gills, etc. Sediment in streams tends to arise from stream bed and bank erosion and from land that is poorly vegetated or disturbed. Suspended sediment pollution may arise from construction sites, crop land, bare ground and exposed soil generally. The amount of sediment contributed varies greatly site to site depending upon stream stability, hydrology, management controls and other factors.

Fecal Coliforms. One class of bacteria typically found in the digestive tract of warm-blooded animals, including humans, is known as fecal coliforms. Fecal coliform bacteria are always found in animal waste and human sewage (unless it is treated to kill them). In unpolluted streams and tidal waters, it is common for water samples to contain very few of these bacteria. Water samples exhibiting significantly larger fecal coliform bacteria populations are "indicators" of contamination by animal, including human, waste. Depending on local conditions, sources of fecal contamination may include any combination of the following: inadequately treated sewage, failing septic systems, wild or domestic animals, urban stormwater carrying pet waste and similar sources.

National Academy Press, Clean Coastal Waters (2000)
What Are the Effects of Nutrient Over-Enrichment? [6]

The productivity of many [lake, estuary and] coastal marine systems is limited by nutrient availability, and the input of additional nutrients to these systems increases primary productivity [microscopic organisms including algae]. In moderation in some systems, nutrient enrichment can have beneficial impacts such as increasing fish production; however, more generally the consequences of nutrient enrichment for [lake, estuarine and] coastal marine ecosystems are detrimental. Many of these detrimental consequences are associated with eutrophication.

The increased productivity from eutrophication increases oxygen consumption in the system and can lead to low-oxygen (hypoxia) or oxygen-free (anoxic) water bodies. This can lead to fish kills as well as more subtle changes in ecological structure and functioning, such as lowered biotic diversity and lowered recruitment of fish populations.

Eutrophication can also have deleterious consequences on estuaries even when low-oxygen events do not occur. These changes include loss of biotic diversity, and changes in the ecological structure of both planktonic and benthic communities, some of which may be deleterious to fisheries. Seagrass beds are particularly vulnerable to damage from eutrophication and nutrient over-enrichment.

Harmful algal blooms (HABs) harm fish, shellfish, and marine mammals and pose a direct public health threat to humans. The factors that cause HABs remain poorly known, and some events are entirely natural. However, nutrient over-enrichment of coastal waters leads to blooms of some organisms that are both longer in duration and of more frequent occurrence.

Although difficult to quantify, the social and economic consequences of nutrient over-enrichment include aesthetic, health, and livelihood impacts

Tributary Team Characterization

To assist work of the Lower Potomac Tributary Team, DNR analyzed data from long term water quality monitoring stations to characterize water quality status and trends. However, Breton Bay could not be assessed because no long term monitoring stations are located here. However, monitoring stations in the Potomac River mainstem, upstream and downstream of Breton Bay, may suggest water quality influences arising from the Potomac River. In the summary table below, the status for each parameter in the table is a relative ranking at three levels: good, fair and poor. For example, poor means this area's ranking is poor relative to comparable Chesapeake Bay tributaries with comparable salinity. This information is from DNR's Internet site http://www.dnr.state.md.us/bay/tribstrat/locator.html which includes maps of the Lower Potomac River showing the status and trends. These maps allow qualitative comparison of regional conditions. [1, 9]

Potomac River Parameter	**Status 1997 -99 data**		**Trend 1985 through 1999**	
	Upstream	Downstream	Upstream	Downstream
Nitrogen: total	Poor	Fair	Improving	No Trend
Phosphorus: total	Poor	Good	Improving	Improving
Algae: Abundance	Fair	Fair	Degrading	No Trend
Dissolved Oxygen (summer, bottom waters)	Fair	Poor	Improving	No Trend
Water Clarity: secchi depth	Poor	Fair	Degrading	No Trend
Suspended Solids: total	Fair	Good	Degrading	No Trend

Water Quality Monitoring

Only one multi-year monitoring program is active in Breton Bay. It is the fecal coliform monitoring conducted to support MDE's Shellfish Certification Program. Its findings of elevated fecal coliform counts have led to the long-standing shellfish harvesting restrictions in Breton Bay. Several short term or special purpose monitoring efforts recently began collecting water quality data. Available information on station locations is shown on Map 6 Monitoring By Programs..

1. US Fish and Wildlife Service 2001 Water Quality Monitoring

US Fish and Wildlife Service (USFWS) sampling by Dr. Peter Bergstrom during 2001 was conducted in tidal waters near the shoreline. Initial water quality findings are summarized here. Additional data will be collected in 2002. See Map 6 Monitoring By Programs, for locations where samples were taken.

The purpose of the USFWS monitoring was to gauge the likelihood that submerged aquatic vegetation (SAV) would survive local conditions. Therefore, water quality findings were measured in relation to benchmarks for SAV survival. The 2001 USFWS data suggest that water quality in the upper Breton Bay may be too poor to support SAV while the quality in lower Breton Bay may be good enough. Additional sampling is needed to increase confidence in these initial conclusions.

– Water clarity as measured by secchi disk depth was frequently poor (less than one meter) at stations BB1 and BB2. However, stations BB3 and BB4 tended to have secchi depths around one meter or a slightly better.

– High algae populations as measured by chlorophyll *a* where identified in late spring. Station BB1 tended to have the highest chlorophyll *a* concentrations.

– Dissolved oxygen bottom concentrations close to Leonardtown (station BB1) failed to meet the State standard of 5.0 mg/l in spring and late summer 2001. All other stations consistently surpassed the standard but dipped close to 5.0 mg/l in late summer.

– High total suspended solids concentrations were greater than 15 mg/l at all stations in spring 2001 but dropped below that level in summer except for station BB1.

– Dissolved inorganic phosphorus was frequently greater than 0.01 mg/l at station BB1.

2. Other 2001 Water Quality Monitoring

MDE initiated monitoring in 2001 to support work on TMDLs for Breton Bay. Stations are located to gauge water quality conditions in Breton Bay and pollutant inputs into the Bay. MDE will make its findings available when analysis of the 2001 monitoring data is complete.

St. Mary's County Technical Center (Dr. Forrest Career and Technology Center) students under the direction of Instructor Christi Daley, assessed nontidal stream sites for biological and physical habitat parameters in 2000 and 2001. Their findings are summarized in the Benthic Macroinvertebrates section. Additional monitoring may be anticipated.

3. 2002 Water Quality Monitoring

Three different groups collected water quality information during 2002 as summarized here. At the time this characterization was compiled, results of this work were not yet available.

DNR's Watershed Restoration Division conducted a Synoptic Survey of water quality in selected nontidal streams in 2002 (see Restoration Targeting Tools and Appendix D).

DNR's Maryland Biological Stream Survey (MBSS) targeted Breton Bay's nontidal tributaries for monitoring in 2002. Water quality and biological data are typically collected concurrently.

Stream Waders, a project of MBSS initiated in 2000, in which citizen volunteers are trained and conduct benthic macroinvertebrate sampling, expanded monitoring to selected streams in the Breton Bay watershed in Spring 2002. Map 7 Monitoring By Volunteers shows the locations of their monitoring. Results of their work are unavailable for the Watershed Characterization but they may be available to assist in preparation of the St. Mary's County Watershed Strategy. The initiative behind this effort is part of the Potomac River Association's Breton Bay project. The Association hired consultant Richard Klein of Community and Environmental Defense Services who identified and organized the volunteers to receive training and to conduct the monitoring.

Summing Up. Based on the available water quality information, Upper Breton Bay tends to have the greatest populations of algae and fecal coliforms. These conditions probably relate to the hydrology of the Bay and its watershed. Compared to other parts of Breton Bay, the upper estuary appears to be where circulation and flushing rates are likely to be slowest. The upper estuary is also likely to be where nutrients from much of the land in the watershed initially become available for primary production, i.e. algae growth.

Sources of Pollution

Since European settlement of North America there has been an explosive growth in human population, supported by more intensive agriculture and the growth of industry. The entire continent has been cris-crossed and made mutually interdependent by vast transportation systems. All of this contributes to the decline in quality of our water and other natural resources.

1. Point Sources

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

The Breton Bay watershed has few permitted point source discharges, based on information from the Maryland Department of the Environment (MDE) permit data base. Summary information is presented in the MDE Permits Summary Table and on Map 8 MDE Permits:

– The Leonardtown Wastewater Treatment Plant is the only permitted surface water discharge contributing nutrients to Breton Bay. The average daily discharge from the facility is 450,000 gallons. The facility is being upgraded by the Town of Leonardtown to include Biological Nutrient Removal (BNR) which will reduce both nitrogen and phosphorus entering Breton Bay.[7]

– The two groundwater discharges for treated sewage effluent are not known to affect Breton Bay water quality. However, no assessment of groundwater entering the Bay from these areas has been conducted.

– Discharges from the other permitted facilities will not significantly affect water quality if permit requirements and good operational practices are followed. If accidents or operational problems occur, sediment and/or petroleum wastes could cause localized water quality problems.

Characteristics of the these permitted discharges (volume, temperature, pollutants, etc.) are tracked by MDE through the permit system. Most of this information is accessible to the public and can be obtained from MDE.

MDE Permits Summary Table – Breton Bay Watershed (9/2001 data) Page 1 of 2				
Type / MDE Category	**Facility**		**MD Permit / NPDES Permit**	**Receiving Stream / Watershed Street Location / Description**
	Map #	**Name**		
Surface Water / Municipal	1	Leonardtown	94DP0434 MD0024767	Breton Bay / Van Wert Lane Wastewater Treatment Plant
Groundwater / Municipal	2	Forrest Farm	99DP3280	Gravely Run subwatershed Brown Road Wastewater Treatment Plant
	3	St. Clements Shores	96DP1587A	Cherry Grove Creek subwatershed Commerce Ave. Wastewater Treatment Plant
Gen. Industrial Stormwater Permit	4	SHA Shop Loveville	97SW1334	Nelson Run Point Lookout Road
General Permits	5	AAA Materials	95MM0506 MDG490506	Glebe Run / Gravely Run St. Andrews Church Road sand & gravel mine
	6	Burch Oil Co. Inc.	98OCT3998 MDG343998	Greenhill Run / Point Lookout Road bulk petroleum
	7	Chaney Enterprises	95MM9813 MDG499813	Miski Run / Route 5 Loveville sand & gravel mine
	8	Leonardtown Utilities	00HT9569 MDG679569	Town Run Greenbriar Road water supply system
	9	McIntosh Pit	00MM9844 MDG499844	Between Miski Run and Burnt Mill Creek / Burnt Mill Road sand & gravel mine
	10	R. Sloan Zimmerman Mine 2	00MM9806 MDG499806A	Burnt Mill Creek / Friendship School & Maypole Roads sand & gravel mine

MDE Permits Summary Table – Breton Bay Watershed (9/2001 data) Page 2 of 2				
Type / MDE Category	**Facility**			**Permit Number**
	Map #	**Common Name**	**Applicant Name**	
Surface Mines*	11	Bishop Road Pit #1	Sloan, Randal H.	00SP0572
	12	Burch Pit	Bob's Excavating	98SP0536B
	13	Clark-Green Acres	Maryland Rock	77SP0119F
	14	Joe Dean Pit	Maxine, Inc.	86SP0241-2
	15	Louise Grand Pit	J&W Construction	80SP0220A
	16	Loveville Surface Mine	Chaney Enterprises	93SP0453B
	17	Martin Pit	Sloan, Randal H.	94SP0463
	18	McIntosh Pit	Woodburn, Raymond	90SP0348
	19	Medley's Neck Tract	Maryland Rock	83SP0147
	20	Oliver Guyther Pit #2	Woodburn, Raymond	95SP0486
	21	Pit #5	Chaney Enterprises	92SP0415
	22	Zimmerman Mine #2	Sloan, Randal H.	88SP0276C
	23	Zimmerman Mine #3	Sloan, Randal H.	99SP0548A

* In the Breton Bay watershed, all surface mine permits are for sand and gravel. The MDE permits listed under this heading address the mining activity. The surface mine information was compiled by two independent sources Richard Klein of Community & Environmental Defense Services and Bruce Young of the St. Mary's Soil Conservation District.

2. Diffuse or Nonpoint Sources

Nonpoint sources are also significant contributors of pollutants, particularly nutrients and sediment. These diffuse sources include rain water that runs off roofs, streets and parking lots (sometimes via storm drains) into nearby surface waters, as well as run-off from farm fields and, to a much lesser extent, forests. Also included in nonpoint source pollution is deposition from the atmosphere and contributions from ground water, where septic systems are a factor.

A. Nutrients

The role of nonpoint source nutrients relative to point source nutrients in Breton Bay's 303(d) listing for nutrients is not spelled out. Problems with depressed dissolved oxygen concentrations in some areas, local conditions supporting algae blooms and USFWS 2001 data point to a nutrient problem without identifying its source.

The modeled nutrient loads used to estimate Breton Bay's nonpoint source contributions for the watershed indicators reported earlier in this chapter were intended to support a statewide comparison of watersheds. These estimates cannot be confidently used to gauge nonpoint sources within the watershed.

However, in the near future nonpoint source nutrient loads will be assessed in greater detail. During 2002, synoptic water quality monitoring will be used to generate estimates of base flow nutrient loads in various Breton Bay tributaries. Also during 2002, work by the Center for Watershed Protection may also include estimates for nonpoint source nutrient loads within the Breton Bay watershed. Then, MDE modeling for the TMDL will partition nutrient load between nonpoint sources and point sources.

Given the current understanding of nutrient loads and related problems in Breton Bay, it is reasonable for WRAS partners to prioritize projects with the intention of reducing nutrient loads for several reasons:

– Anticipated TMDL nutrient load limits may require reduction of nonpoint source nutrients if the upgrade of the Leonardtown Wastewater Treatment Plant (WWTP) does not eliminate nutrient-related water quality problems in Breton Bay.
– Even if the Leonardtown WWTP upgrade would be sufficient to single-handedly meet TMDL nutrient load limits in the near term, growth in the Leonardtown sewer service area will tend to increase point source nutrient loads. It is reasonable to project that WRAS projects in the Breton Bay watershed could provide relatively cost-effective nonpoint source nutrient load reductions compared to additional costly treatment plant upgrades.

B. Sediment

Nonpoint source sediment loads have not been estimated for the Breton Bay watershed. However, several current sources of information identify sediment as a problem:

– In recent years, local residents report that sedimentation in upper Breton Bay near Leonardtown is a visible problem. They observe that the sand bar near the mouth of Town Run has grown significantly larger based on their recollection. Sediment transport from Town Run and perhaps other tributary streams is believed to be the cause.
– Stream assessments conducted in 2001 by the Potomac River Association, Inc. and its consultant, Community and Environmental Defense Services, identified stream segments that appeared to have abnormal amounts of sediment movement. Additional investigation and findings by the 2002 Stream Corridor Assessment will help identify areas of stream bank erosion that could be targeted for restoration projects.
– The Soil Erodibility Indicator discussed in the Land Use section suggests that erosion and sediment transport will be a continuing management issue in the Breton Bay watershed. Erodible soils are a natural physical condition. Therefore, promoting action by local land owners and

managers to reduce erosion and sedimentation can be an effective WRAS program. Various practices could be promoted, such as maximizing vegetative ground cover, minimizing exposure of bare soil and soil disturbance, and using best management practices where soil disturbance is unavoidable.

Work by the Center for Watershed Protection will help identify local areas in the watershed that could be prioritized for restoration and retrofit projects aimed at reducing erosion and sediment movement.

C. Shoreline Erosion

Wherever land and open water meet, change in the form of erosion or accretion of land is the inevitable result of natural processes. Human activity in these areas often either inadvertently accentuates these natural processes or purposefully attempts to control movement of water and/or loss of land. Erosion of shorelines can contribute significant amounts of nutrients (mostly phosphorus) and sediment (water column turbidity, habitat loss.)

Countywide shoreline erosion is summarized in the following table. [9]

St. Mary's County Shore Erosion Rate Summary (Miles of Shoreline)				
Total Shoreline	Total Eroding Shoreline	Erosion Rate		
		0 to 2 feet / year	2 to 4 feet / year	4 or more feet / year
297	87 (29%)	61	9	17

Maps of historic shoreline change were produced in 1999 by the Maryland Geological Survey (MGS) in a cooperative effort between DNR and the National Oceanic and Atmospheric Administration (NOAA). These maps included digitized shorelines for several different years in St. Mary's County. The maps show that extensive changes have occurred adjacent to large bodies of open water. Copies of these 1:24000 scale maps are available from the MGS.

Currently, DNR is working to improve our ability to predict areas of high-rate shoreline erosion. In addition to considering historic erosion rates, contributory effects of land subsidence and sea level rise are being considered. To help generate predictive tools, two pilot areas have been selected: St. Mary's County and Dorchester County. Results from this work are not currently available but information will be shared with St. Mary's County and other interests when they become available.

Groundwater and Water Supply

Groundwater in the Breton Bay watershed is the source of nearly all water used for agriculture and business, and all potable water. In general, these water uses do not employ near-surface groundwater, which is subject to potential local pollution sources. Additionally, near surface groundwater is credited with carrying nutrients, particularly nitrogen, from land source to surface waters where nutrient over-enrichment is occurring.

All public water supply systems in the Breton Bay watershed are served by groundwater, as listed in the table below and on Map 9 Water Supply. The Aquia Aquifer, which is an important groundwater source, is relatively protected from local contamination because it is a confined aquifer. The outcrop of the Aquia Aquifer shown in Map 10 Aquia Aquifer intercepts the surface in a broad strip of land, sometimes several miles wide, that is on the southeast side of the fall line to the south and east of Washington DC.[20] MDE's wellhead protection strategy for public well systems using confined aquifers (like the Aquia Aquifer) does not address the recharge zones due to the extremely great travel times between the recharge areas and the public water supplies.

The Maryland Department of the Environment (MDE) has an ongoing project with the St. Mary's County Metropolitan Commission (METCOM) and the MGS to identify 10-year time of travel capture zones around METCOM's well heads. Within the 10-year zones, MDE recommends that the water supplier seek the assistance of the County Health Department to require that unused wells be abandoned and sealed.[15]

Community Water Supply Permits in the Breton Bay Watershed [15]			
Map Key	**Permittee Name**	**Permit Number(s)**	**Source Formation**
1	Breton Bay	SM690337, SM920537	Aquia
2	Leonardtown	SM670053, SM811397 SM813372	Aquia
3	St. Mary's Industrial Park	SM732385, SM732379 SM232067, SM812431 SM732066	Aquia
4	King-Kennedy	SM730699, SM920571	Aquia
5	Wilderness Run	[number unavailable]	Aquia
6	Mulberry South	SM813493, SM813494	Aquia
7	Holland Forest	SM920701, SM920699	Aquia
8	Christmas Tree Farm	SM690238	Nanjemoy

LANDSCAPE

Water quality, particularly in streams and rivers, is affected by the land in the riparian zone and by soils, vegetative cover and the land use throughout the watershed. In an effort to gauge the affects of land use on water quality, and to allow comparison between watersheds, DNR has developed a series of Landscape Indicators. These indicators can be used to portray landscape conditions on a watershed scale that tend to support good water quality or that tend to degrade water quality.

Landscape Indicators

The 1998 *Maryland Clean Water Action Plan* included a unified watershed assessment that used a number of landscape indicators to assess the State's 138 watersheds.[2] Most indicators are relative measures by which a watershed like Breton Bay can be compared with the other 137 watersheds of similar size that together cover the entire State of Maryland. The following sections identify the findings for the Breton Bay watershed, with the exception of the population density indicator, which is based on 2000 Census data not available when the *Unified Assessment* was done.

Landscape Indicator Summary

Indicator	Finding	Interpretation
Impervious Surface	4.3%	Breton Bay is ranked in the best (lowest percentage) half of watersheds statewide. It should be noted that this indicator varies significantly between subwatersheds.
Population Density	0.31 people/land acre	A comparison with other watersheds in the state has not been completed using the 2000 census data.
Historic Wetland Loss	17,931 acres	Breton Bay is in the top quarter of watersheds for this indicator–those with the greatest loss.
Unbuffered Streams	9 %	Breton Bay is among the lowest-percentage–best–quarter of the state's watersheds on this indicator.
Soil Erodibility	0.33 value/acre	Breton Bay is among the 34 watersheds (25% of the total) with the highest erodibility.

1. Impervious Surface

On average across the entire Breton Bay watershed, 4.3% of surface cover is impervious. This average imperviousness compares well with similar watersheds in Maryland.[2]

Roads, parking areas, roofs and other human constructions are collectively called impervious surface. Impervious surface blocks the natural seepage of rain into the ground. Unlike many natural surfaces, impervious surface typically concentrates stormwater runoff, accelerates flow rates and directs stormwater to the nearest stream. Watersheds with small amounts of impervious surface tend to have better water quality in local streams than watersheds with greater amounts of impervious surface. The Maryland Biological Stream Survey has related the percent of impervious surface in a watershed to the health of aquatic resources. For areas with less than 4% impervious cover, streams generally rate "Fair" to "Good" for both fish and instream invertebrates. Beyond about 12% impervious surface, streams generally rate "Poor" to "Fair" for both. Side-effects of impervious surfaces become increasingly significant and negative as the percentage of impervious area increases. Examples of related problems include reduction of groundwater infiltration, increased soil and stream bank erosion, sedimentation, destabilization or loss of aquatic habitat, and "flashy" stream flows (reduced flow between storms and excessive flows associated with storms.)

The impervious surface estimate used for this indicator was generated for the 1998 *Unified Watershed Assessment*. Each land use type in the 1994 Maryland State Planning land use data was assigned an estimated imperviousness taken from the TR-55 manual used by the former Soil Conservation Service.

2. Population Density

The population density in the Breton Bay watershed was 0.31 people per acre of land, using 2000 Census data, which differ from what is shown in the *Unified Watershed Assessment*. A comparison with other watersheds in the state has not been completed using the 2000 census data.[2]

While population density may be beyond the scope of a WRAS, directing growth is a potential WRAS component. As human population increases, the effects of human activity that degrades, displaces, or eliminates natural habitat also tend to increase. Watersheds with higher populations, assuming other factors are equal, tend to exhibit greater impacts on waterways and habitat. However, growth can be directed in ways to reduce negative impacts.

3. Historic Wetland Loss

The Breton Bay watershed is estimated to have lost nearly 18,000 acres of wetlands over the years. This is a relatively large loss of wetlands compared with other similar Maryland watersheds.[2]

This interpretation is based on the assumption that the hydric soils in the watershed were all, at one time, wetlands. Thoughtful selective restoration of historic wetland areas can be an effective WRAS component. In most of Maryland's watersheds, extensive wetland areas have been converted to other uses by draining and filling. This conversion unavoidably reduces or eliminates the natural functions that wetlands provide.

4. Unbuffered Streams

Approximately 9% of streams in the Breton Bay watershed were not buffered with trees, based on 1998 information. Corridors 100 feet wide (50 feet either side) along streams were combined with forest cover to develop this indicator. This estimate of streams lacking forested buffer was generated for the 1998 Maryland Clean Water Action Plan by using Maryland Department of State Planning GIS data for streams and for 1994 land use. The finding for Breton Bay compares well with other Maryland watersheds; this relatively low percentage of unforested riparian area limits the utility of one potential WRAS strategy, buffer reforestation, to address problems in Breton Bay.[2]

In most of Maryland, trees are key to healthy natural streams. They provide numerous essential habitat functions: shade to keep water temperatures down in warm months, leaf litter "food" for aquatic organisms, roots to stabilize stream banks, vegetative cover for wildlife, etc. In general, reduction or loss of riparian trees / stream buffers degrades stream habitat while replacement of trees / natural buffers enhances stream habitat. (For this indicator only "blue line streams" were included. Intermittent streams were not considered.)

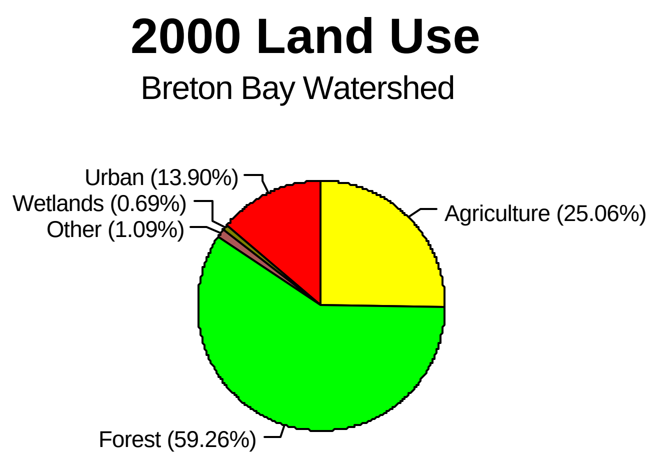
5. Soil Erodibility

Soil erodibility for the Breton Bay watershed is represented by what is known as the K factor, in this case estimated to be 0.33.[2] The K factor normally varies from approximately zero to about 0.6. A K value of 0.17 has a very low erosion potential, a value of 0.32 has a moderate erosion potential, a value of 0.37 has a high erosion potential, and a value of 0.43 has a very high erosion potential. Breton Bay's erodibility is moderate, although its ranking among all watersheds in the state was fairly high.

Watersheds with more highly erodible soils are naturally more susceptible to surface erosion, sedimentation, streambank erosion and other problems related to soil movement. These negative effects of soil erodibility on water quality can be minimized through careful management. The soil erodibility indicator accounts for natural soil conditions but not for management of the land. (Existing cropland management was not considered.) The naturally erodible soils in the watershed are addressed by techniques called Best Management Practices (BMPs) to prevent soil loss, practices that are typically in use on local farms. BMPs like no-till or reduced till cropping, planting cover crops, field strips, or retiring erodible soils from production can significantly reduce erosion and sediment movement. These BMPs can be seen in use in many places in the watershed.

Because soils can vary significantly within very small areas, a generalized erodibility indicator must be used with caution and supplemented with site-specific evaluation prior to implementing any management action.

Land Use



The following table and pie chart summarize 2000 land use / land cover for the Breton Bay Watershed as categorized by the Maryland Department of Planning.

Nearly 60% of the Breton Bay watershed is forest or brush. About one quarter of the land is in some form of agriculture and about 14% is covered with some type of developed or urban use. All other types of land together amount to less than 2% of the watershed.

Viewing these general land use categories as potential nonpoint sources of nutrients, agricultural lands are likely to contribute the greatest loads to local waterways. Urban lands may also contribute significant nutrient loads. Map 11 Generalized 2000 Land Use shows the distribution of these land use categories in the watershed.

2000 Land Use Summary Breton Bay Watershed in St. Mary's County		
Category	**Description**	**Acres**
Agriculture	Field, Pasture, farm buildings	8,800
Forest	All woodlands and brush	20,900
Urban	All developed areas	4,900
Wetlands	Tidal marsh, Emergent wetlands	200
Other	Extractive industry, bare ground (sand and gravel pits, etc.)	400
Watershed Total – excluding open water		**35,200**
Watershed Total – including open water		**38,449**

Lands With Significant Natural Resource Value and Large Area

Forest lands in the McIntosh Run watershed have been identified as important natural resource and habitat area by two different programs: DNR's Green Infrastructure model and The Nature

Conservancy's ecoregion-based planning process. These independent programs agree on emphasizing the ecological value of the watershed and the importance of maintaining its extensive, contiguous forest.

In general, actions taken to assure that forest cover will be maintained, to avoid fragmentation of forest, and to restore forest in areas that have been cleared will contribute significantly to improving the water quality in this watershed and to conserving the biodiversity of the State.

1. Green Infrastructure

DNR has mapped a network of ecologically important lands, comprised of hubs and linking corridors, using several of the GIS data layers used to develop other indicators. Hubs contain one or more of the following:

- areas containing sensitive plant or animal species;
- large blocks of contiguous interior forest (at least 250 contiguous acres, plus the 300 foot transition zone);
- wetland complexes with at least 250 acres of unmodified wetlands;
- streams or rivers with aquatic species of concern, rare coldwater or blackwater ecosystems, or important to anadromous fish, and their associated riparian forest and wetlands; and
- conservation areas already protected by public (primarily DNR or the federal government) and private organizations like The Nature Conservancy or Maryland Ornithological Society.

This "Green Infrastructure" provides the bulk of the state's natural support system. Ecosystem services, such as cleaning the air, filtering and cooling water, storing and cycling nutrients, conserving and generating soils, pollinating crops and other plants, regulating climate, protecting areas against storm and flood damage, and maintaining hydrologic function.

Protection of Green Infrastructure lands may be addressed through various existing programs including Rural Legacy, Program Open Space, conservation easements and others. The 2001 Maryland General Assembly approved $35 million for the GreenPrint program which is targeted primarily to protecting Green Infrastructure areas. GreenPrint is administered by Program Open Space.

Map 12 Green Infrastructure shows that, even from the statewide perspective that guided the analysis, there is a significant amount of Green Infrastructure in the Breton Bay watershed:

– The largest Green Infrastructure hub in the watershed encompasses significant portions of the McIntosh Run area. This hub ranks, ecologically, in the top 5% of Green Infrastructure hubs in the western Coastal Plain of Maryland. The Maryland Department of Planning projected that this hub may lose as much as 30% of its 1997 natural vegetative cover by 2020;

– Other watershed hubs include areas around the lower reaches and headwaters of Glebe Run; both Moll Dyers Run and Nelson Run have areas of hub and corridors, and a small portion of another hub covers part of the lower western shore of Breton Bay near the Potomac River.

2. McIntosh Run Forest Block Assessment By The Nature Conservancy

Nationwide, the private non-profit organization, The Nature Conservancy (TNC) has embarked on an ecoregion-based planning process in consultation with State Natural Heritage Programs to identify the most important sites for future conservation activities. The resulting ecoregional plans identify rare species habitat, as well as larger sites that by virtue of their size, condition and lack of fragmenting features, represent high-quality examples of common, widespread natural communities, and serve as coarse filters to identify areas important for the conservation of common native species. The Maryland/DC Chapter of The Nature Conservancy worked with staff of the Maryland, Delaware and Virginia Natural Heritage Programs to develop TNC's Chesapeake Bay Lowlands Ecoregional Plan which covers lands within the 16 Maryland Counties that border the Bay as well as portions of coastal Delaware and Virginia.

In this plan, the large expanse of relatively undeveloped, intact forest along McIntosh Run was identified as a conservation target. In comparison with the 13 blocks in this ecoregion in Maryland, the McIntosh Run block has several significant attributes based on statistics provided by the Maryland/DC Chapter of The Nature Conservancy:

– It is relatively small compared to the other blocks
– Forest cover exceeds 80%; only three blocks in Maryland have forest cover percentage this high.
– It possesses the lowest road density of all of the forest blocks in the ecoregion.
– It has a low percentage of developed land compared to other Maryland blocks.

Additional information and a map showing TNC's interpretation of the McIntosh Run forest area are presented in Appendix A.

3. Large Forest Blocks

Within large blocks of forest, habitat is available for species that are specialized for conditions with relatively little influence by species from open areas or humans. For example, forest interior dwelling birds require forest interior habitat for their survival and they cannot tolerate much human presence. Map 13 Forest Interior shows blocks of contiguous forest that are at least 50 acres in size with at least 10 acres of forest interior (forest edge is at least 300 feet away) that may be important locally within the Breton Bay watershed. This size threshold was chosen to help ensure that the forest interior is large enough to likely provide locally significant habitat for sensitive forest interior dwelling species. The assessment shown in Map 13 differs from the Green Infrastructure assessment which considered only large blocks of forest land cover at least 250 acres in size that are likely to have state or regional importance.

Protected Lands

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

For purposes of watershed restoration, a knowledge of existing protected lands can provide a starting point in prioritizing potential restoration activities. In some cases, protected lands may provide opportunities for restoration projects because owners of these lands may value natural resource protection or enhancement goals.

The following listing and Map 14 Protected Land and Smart Growth summarize the status of protected lands in the Breton Bay watershed.

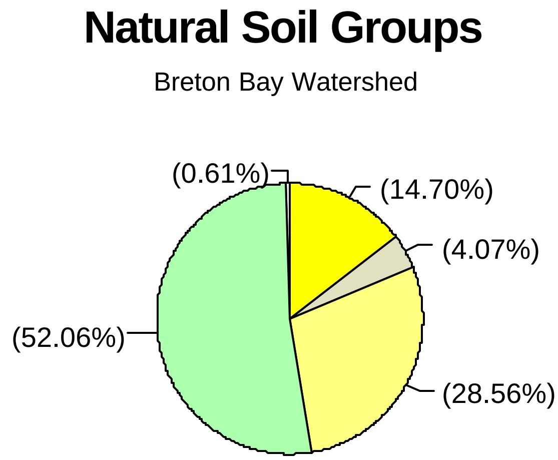
– Overall, about one percent of Breton Bay watershed has some form of protection.
– One County Park, Judge PH Dorsey Memorial Park, encompasses about 67 acres.
– Agricultural easements and agricultural districts together account for a few hundred acres of land in the Breton Bay watershed.
– No DNR land or Federal land is in Breton Bay watershed
– No easements by Maryland Environmental Trust or private conservation organizations have been identified in the watershed.
– The Town of Leonardtown owns a former SHA property located in the McIntosh Run floodplain. The Town has demolished abandoned buildings and removed debris from the site.[7] This land is not depicted on the map because its status regarding protection is not specified.

Existing protected lands could be assessed as potential contributors to WRAS implementation. Various types of opportunities could be explored:
– Potential sites for implementation projects and/or demonstration projects
– Opportunities for management enhancement or additional protection
– Opportunities for expanding protection from currently protected land to adjacent parcels.

Soils of the Breton Bay Watershed

1. Interpreting Local Conditions with Natural Soil Groups

Soil conditions like soil type and moisture conditions greatly affect how land may be used and the potential for vegetation and habitat on the land. Soil conditions are one determining factor for water quality in streams and rivers. Local soil conditions vary greatly from site to site as published information in the Soil Survey for St. Mary's County shows. This information has been summarized into Natural Soil Groups to help identify useful generalizations about groups of soils.



Map 15 Soils By Natural Soils Groups shows the distribution of natural soils groups in the Breton Bay watershed. The pie chart creates even broader categories from the natural soils groups (clockwise from 12 o'clock):

– Prime farmland soils cover slightly less than 15% of the watershed, mostly to the north.
– Sandy, excessively well drained soils cover slightly more than 4% of the watershed. Sandy soils tend to be in headwater areas of Breton Bay's tributary streams.
– Well drained soils cover over 28% of the watershed mostly in the north central and central areas of the watershed.
– Soils with wetness limitations (E2a, F2, F3, G2, G3) cover about 52% of the watershed, particularly along streams and in extensive areas in the middle and lower watershed.
– All other soil types (borrow pits, etc.) cover less than 1% of the watershed.

2. Soils and Watershed Planning

Local soil conditions can be a useful element in watershed planning and for targeting restoration projects. Soils with limitations like wetness or slope naturally inhibit active use for farming or development and may then be available as restoration project sites. By comparing Map 15 Soils By Natural Soils Groups with the three preceding maps listed below, it may be possible to discern how patterns of active or passive land use relate to soil conditions:

– Map 11 Generalized 2000 Land Use
– Map 12 Green Infrastructure

Natural Soils Groups and other soils assessments can be used to help identify potential areas for restoration projects or habitat protection. Hydric soils, for example, are more easily restored as wetlands than soils that were never saturated with water. St. Mary's County already has identified highly erodible or hydric soils as shown in Map 16 Hydric Soils And Highly Erodible Soils and the table Soils With Highly Erodible and Hydric Conditions. Once areas of interest are targeted and landowner interest is verified, additional detailed soil assessment is an essential step in identifying viable restoration project sites.

Soils With Highly Erodible Or Hydric Conditions For The Breton Bay Watershed WRAS Project						
Breton Bay Subwatershed		**Total Land Acreage**	**Highly Erodible**		**Hydric**	
Name	**Number**		**Acres**	**%**	**Acres**	**%**
Shoreline Drainage Area	02140104-7020 A	4,152	523	13	631	15
Combs Cr and Cherry Cove Cr	02140104-7020 B	1,775	169	10	791	45
Town Run	02140104-7020 C	1,507	477	32	165	11
Moll Dyers Run	02140104-7020 D	2,907	657	23	181	6
Bottom Land	02140104-7021 A	2,258	270	12	602	27
Nelson Run	02140104-7021 B	2,030	248	12	324	16
Greenhill Run	02140104-7021 C	596	158	27	71	12
Milski Run	02140104-7021 D	2,080	344	17	204	10
Glebe Run and Gravely Run	02140104-7022	3,769	713	19	576	15
Bottomland	02140104-7023 A	610	197	32	121	20
McIntosh Run Headwaters	02140104-7023 B	1,677	459	27	221	13
Brooks Run	02140104-7023 C	5,560	864	16	854	15
Bottomland	02140104-7024 A	380	112	29	191	50
Headwaters Burnt Mill Creek	02140104-7024 B	3,440	681	20	457	13
Tom Swamp Run & Rich Neck Cr.	02140104-7024 C	2,565	628	24	265	10
Breton Bay Watershed Total		**35,306**	**6,500**	**18**	**5,654**	**16**

Wetlands

1. Wetland Categories

The Coastal Plain Province likely has the highest diversity of emergent estuarine and palustrine (fresh water) wetland communities relative to other Maryland physiographic regions because both tidal and nontidal freshwater marshes occur here. Wetlands are most abundant in the Coastal Plain due to the low topographic relief and high ground water table characteristic of the region.

Estuarine Wetlands. Estuarine wetlands are abundant throughout the Coastal Plain. These systems consist of salt and brackish tidal waters and contiguous wetlands where ocean water is at least occasionally diluted by freshwater runoff from the land. These wetlands may extend far upstream in tidal rivers to freshwater areas. Differences in salinity and tidal flooding within estuaries have a significant effect on the distribution of these wetland systems. Salt marshes occur on the intertidal shores of tidal waters in areas of high salinity. Brackish marshes are the predominant estuarine wetland type in Maryland. They are found along the shores of Chesapeake Bay, mostly on the Eastern Shore, and for considerable distance upstream in coastal rivers. Estuarine shrub swamps are common along the Maryland coastal zone. Aquatic beds, comprised mostly of submerged aquatic vegetation (SAV), were historically abundant in shallow water zones of Maryland's estuaries, especially Chesapeake Bay and its tributaries.

Palustrine wetlands. These are freshwater wetlands that are not associated with streams or lakes. In general, palustrine wetlands are associated with freshwater, high water tables or intermittent ponding on land. Forested wetlands are the most abundant and widely distributed palustrine wetland type on the Coastal Plain. These wetlands are found on floodplains along the freshwater tidal and nontidal portions of rivers and streams, in upland depressions, and in broad flat areas between otherwise distinct watersheds. Tidal freshwater swamps occur along coastal rivers in areas subject to tidal influence. Scrub-shrub swamps are represented in the Breton Bay watershed. Emergent wetlands on the Coastal Plain are characterized by a wide range of vegetation, depending on water regime. (Adapted from *Wetlands of Maryland*, Tiner and Burke, 1995.)

2. Tracking Wetlands

Oversight of activities affecting wetlands involves several regulatory jurisdictions. The Maryland Department of the Environment (MDE) is the lead agency for the State and cooperates with DNR, the Army Corps of Engineers and other Federal and local agencies. As part of its responsibility, MDE tracks State permitting and the net gain or loss of wetlands over time.

As the table on the next page shows, the State regulatory program has measured a small net increase of wetland acreage in the Breton Bay watershed over the past 10 years. This slowing of wetland loss in the watershed contrasts significantly with the estimated historic18,000 acre wetland loss in the watershed as described in the Landscape Indicators section.

Tracking Nontidal Wetland Change By Watershed For The St. Mary's County Area In Acres 1/1/1991 through 12/31/2001 [14]						
Watershed	**Basin Code**	**Permanent Impacts**	**Permittee Mitigation**	**Programmatic Gains**	**Other Gains**	**Net**
Breton Bay	02140104	-1.28	2.59	0	0	1.31
St. Mary's River	02140103	-3.09	3.68	0	0	0.59
St. Clement Bay	02140105	-0.33	0	0	0	-0.33
Wicomico River	02140106	-0.65	0	0	0	-0.65
Gilbert Swamp	02140107	-0.58	0.78	0	0.21	0.41
Potomac River	02140101	-0.52	0	0	0	-0.52
Patuxent River	02131101	-7.89	4.55	0	0.39	-2.95

Notes: 1) Regulatory tracking for authorized nontidal wetland losses began in 1991. Comprehensive tracking of voluntary wetland gains began in 1998. Only nontidal wetland changes are shown; tidal wetland changes are excluded. Acreage presented for each watershed includes the entire watershed; it does not identify County and it is not normalized. For example, the listing for the Patuxent River includes both St. Mary's and Calvert Counties.
2) "Permanent Impacts" refers to acres altered (e.g., filled, drained) under permit from MDE.
3) "Permittee Mitigation" refers to acres restored by a permit holder as required by terms of the permit from MDE.
4) "Programmatic Gains" refers to acres restored by MDE using fees paid into a compensation fund by a permit holder in lieu of undertaking mitigation himself.
5) "Other Gains" refers to acres of wetlands restored when not required as mitigation for permitted losses.

3. Interpreting Wetland Distribution

Map 17 Wetlands and Wetland Acreage Summary Table summarize distribution and categories of wetlands in the Breton Bay watershed. Overall, two wetland categories account for 88% of the wetlands in the watershed:

– Estuarine wetlands on unconsolidated bottom are slightly over 52% of all watershed wetlands, and

– Palustrine wetlands account for nearly 36% of total watershed wetlands (fresh water not associated with lakes).

Wetland Acreage Summary Table
Breton Bay Watershed

Wetland Class		Acres
Estuarine	emergent	247
	scrub shrub	6
	unconsolidated bottom	3,263
	unconsolidated shore	1
Palustrine	emergent	120
	flooded semipermanently	12
	forested	2,213
	scrub shrub	103
	unconsolidated bottom	254
	unconsolidated shore	1
Total Wetlands (DNR mapped wetlands)		6,220

Wetlands of Special State Concern (WSSC)
127 acres of the wetlands in the table are subject to WSSC regulations. See the Sensitive Species Section.

In comparing the wetlands map to Map 11 Generalized 2000 Land Use, it can be seen that many of the nontidal wetland areas are depicted as forest on the land use map. And most of the estuarine wetlands are not identified on the land use map These differences are simply the result of two differing views of the landscape. For example, wooded nontidal wetlands can be viewed as “wetlands” from a habitat / regulatory perspective and they can be viewed as “forest” from a land use perspective. Similarly, most of the estuarine wetlands shown on the wetlands map are considered open water on the land use map.

In the Breton Bay watershed, differing perspectives on counting wetlands are significant for watershed management. From a land use perspective, 180 acres of wetlands are identified by the Maryland Department of Planning. From a habitat / regulatory perspective, there are at least 6,220 acres of wetlands in the watershed.

In the context of the Watershed Restoration Action Strategy (WRAS), wetlands serve valuable water quality and habitat functions that may not be provided by other land uses. Therefore, protection and enhancement of existing wetlands, and restoration of past wetland areas, can be a valuable element in the WRAS. (Also see the Wetland Restoration section.)

Floodplains

Flooding was identified as a local issue early in the WRAS project. Flooding of public roads crossing streams is a particular concern. Map 18 Floodplain and Sea Level Rise shows that the 100-year floodplain extends far up tributaries to Breton Bay. The most extensive of these tributary floodplains is along McIntosh Run.

In recent years, stormwater management requirements have provided a means to limit impacts of new development and impervious area that would otherwise contribute to stream degradation and flooding. However, these new projects may not significantly improve water quality or quantity problems that are driven by systemic watershed factors.

For existing development and impervious area, retrofitting controls to enhance water quality and limit peaks in stormwater runoff may offer an additional way to protect waterways. However, consideration of retrofits must address at least two local issues:

- Potential negative effects on sensitive aquatic species, particularly the globally rare fresh water mussel, need to be avoided.
- Experience in the adjacent St. Mary's River watershed demonstrates that large regional waterway projects have been very controversial among local residents even though they successfully prevent flooding. (An example is a project that was initiated in the 1960s to protect Great Mills.)

Low Elevation Areas Subject to Sea Level Rise

Most areas of the Breton Bay watershed have sufficient elevation to be unaffected by any potential for sea level rise in the next 50 to 100 years. However, marshes and other low-lying wetlands are at risk for inundation.

As a gauge of the risk posed by potential sea level rise, a Maryland-wide assessment of land at an elevation of 1.5 meters or less was first published in 1998 and then repackaged in a 2000 State report.[10] One area of Breton Bay that was identified at this statewide scale is at the mouth of McIntosh Run as shown in Map 18 Floodplain and Sea Level Rise.

Currently, DNR is considering sea level rise as it works to improve prediction of shoreline erosion. St. Mary's is one of two counties for which erosion rate maps have been developed; unfortunately, erosion rate data for Breton Bay were missing when these maps were made. New information that may be generated by this effort will be shared with local jurisdictions as it becomes available.

LIVING RESOURCES AND HABITAT

Living resources, including all the animals, plants and other organisms that call the land and waters of the Breton Bay watershed home, are being affected by human activity. The information summarized here suggests that some of the significant stresses on living resources in the watershed are alteration and destruction of habitat, excessive movement of sediment and excessive availability of nutrients.

The living resource information summarized here should be considered a partial representation, because numerous areas of potential interest or concern could not be included due to lack of information, time, etc. For example, information on many forms of aquatic life, woodland communities, terrestrial habitats, etc. should be considered as watershed restoration decisions are being made. Therefore, it is recommended that stakeholders in the watershed identify important living resource issues or priorities so that additional effort can be focused where it is most needed. New information should be added or referenced as it becomes available.

Living Resource Indicators

Aquatic organisms are sensitive, in varying degrees, to changes in water quality and aquatic habitat. They are also sensitive to landscape changes. This association offers two perspectives that are important for watershed restoration. First, improvements for living resources offer potential goals, objectives and opportunities to gauge progress in watershed restoration. Second, the status of selected species can be used to gauge local conditions for water quality, habitat, etc. This second perspective is the basis for using living resources as an "indicator."

The *Maryland Clean Water Action Plan's Unified Watershed Assessment,* published in 1998, included a number of living resource indicators for the Breton Bay Watershed.[2] Several of these indicators rely on extrapolations from a limited number of sampling sites which were then generalized to represent entire watersheds. Some are indices comprising several conditions. Considering this limitation on field data, it would be beneficial to conduct additional assessments to provide a more complete understanding of local conditions.

1. SAV Abundance

For tidal areas of the Breton Bay watershed, the abundance of submerged aquatic vegetation (SAV) scored "1.0" for the Abundance Indicator, which means that SAV covered 10% or less of the potential SAV habitat. This indicator is designed to allow comparison of watersheds based on actual SAV acreage versus potential SAV acreage. To generate the score for this indicator, two measurements of SAV area were used: 1) area covered by SAV in the year 1996 was measured using aerial survey data, and 2) the potential SAV area was measured based on water depth (up to two meters deep), physical characteristics and historic occurrence of SAV.

The benchmark used in the *Unified Watershed Assessment* of the *Clean Water Action Plan* for the SAV Abundance indicator was 10%. If less than 10% of the potential SAV area in a watershed was covered by SAV in 1996, then the watershed was listed in the category "needs restoration". If more than 10% of the potential SAV area in a watershed was covered by SAV in 1996, then the watershed was listed in the category "needs preventative action" to protect or enhance SAV abundance. No watershed in the State scored higher than 2, reflecting a maximum observed coverage of 20%.

2. SAV Habitat Index

For tidal areas of the Breton Bay watershed, the abundance of submerged aquatic vegetation (SAV) scored "3.3" for the Habitat Index, which means that SAV habitat requirements were not met based on 1994-1996 data. This index is designed to allow comparison of watersheds based on several measurements of habitat conditions: water clarity as measured by secchi depth, dissolved inorganic nitrogen where applicable, dissolved inorganic phosphorus, abundance of algae as measured by Chlorophyll *a* and total suspended solids.

The benchmark used in the Unified Watershed Assessment for the SAV Habitat Index was 7. A score less than 7 means that the watershed's habitat conditions were not favorable for SAV and the watershed was listed as being in need of restoration (Category 1). A score of 7 or higher means that 1994 through 1996 data showed that habitat conditions for SAV in a watershed were sufficient and the watershed was listed in the category for "restoration needed". Breton Bay is among the lowest scoring half of watersheds statewide on this indicator.

3. Migratory Fish [21]

A number of the most valuable fish species found in the Chesapeake Bay must migrate up tributary streams to spawn. The migratory fish indicator rates watersheds based on the diversity of spawning habitat for seven species: American Shad, Hickory Shad, Alewife, Blueback Herring, White Perch, Striped Bass, and Yellow Perch. It deals with a highly valued function of non-tidal streams and for this reason can be considered an indicator of vulnerability to human-induced damage. It also reflects the condition of the resource. This indicator scores watersheds based on the number of migratory fish species from 0 - 7 that spawn within the watershed

Breton Bay, with a score of 2, ranked relatively low on this indicator, suggesting interventions that address fish passage may be appropriate.

4. Nontidal Benthic Index of Biotic Integrity (IBI) [21]

The Coastal Plain stream benthic IBI looks at the insects and other invertebrates, like crayfish, living on the bottoms of streams, considering the overall community composition, the number and diversity of species and the presence of sensitive species. To calculate the benthic IBI, for the *Unified Watershed Assessment*, reference conditions were established for minimally-impacted streams. IBI values are relative to conditions in these minimally-impacted streams.

Breton Bay ranked in the top quartile in the state on this indicator in the 1998 *Unified Watershed Assessment.*

5. Nontidal Fish Index of Biotic Integrity (IBI) [21]

As interest in whole ecosystems, and ecosystem health, has grown, Indexes of Biotic Integrity (IBIs) for fishes have been developed for small (first- to third-order) non-tidal streams. Several characteristics of the fish community are measured–numbers of native species, of benthic species and of tolerant individuals; the percent of tolerant species, of dominant species, and of generalists, omnivores and insectivores; the number of individuals per square meter; biomass in grams per square meter; percent of lithophilic spawners; and percent insectivores. These characteristics are scored and summed to calculate a fish IBI for each sampled stream. Scores for watersheds are reported as means for the sites within each watershed (one most degraded, 10 best condition).

With an IBI score of 8, the Breton Bay watershed ranked in the top quartile of watersheds statewide in the 1998 Assessment.

6. Headwater Streams in Interior Forest [21]

Small headwater streams are among the most likely areas for finding native riparian vegetation. Further, these areas provide important aquatic habitat, and retaining riparian vegetation improves water quality. Often these streams and their surrounding forest are lost during the process of developing land into urban uses. The lack of forest along first order streams leads to a marked decrease in the quality of downstream resources as a result of erosion, nutrient inputs, temperature, and other influences.

The Breton Bay watershed ranks in the top quartile, statewide, for this indicator.

7. High Quality Habitat for Forest Interior Dwelling Species (FIDS) [21]

Recent work by DNR for the Strategic Forest Lands Assessment has developed an indicator to compare watersheds on the basis of habitat for FIDs. High quality FIDS habitat is defined as a predominantly mature hardwood or mixed hardwood-pine forest tract, at least 100 acres in size, of which forest interior habitat comprises at least 25% of the total forest area. Intact forest, as suggested elsewhere, is a relatively scarce landscape feature and is vulnerable to destruction as land is converted to agricultural or, more common in recent decades, urban uses.

Breton Bay watershed ranks in the top quartile of watersheds, statewide, for this indicator.

Birds

Limited information is available on birds in the Breton Bay watershed based on data collected in the Tall Timbers breeding bird survey route. The Tall Timbers route meanders through south central St. Mary's County near the Potomac River including portions of the Breton Bay watershed. The survey results on breeding bird abundance averaged for the period 1966 through 2000 show that 14 of the 19 forest interior dwelling (FID) birds found in Maryland were also identified along the Tall Timbers route. This finding indicates that forest interior habitat supporting these species has been available in the Breton Bay watershed vicinity. (Also see Map 13 Forest Interior.) However, the available data has not been assessed to determine if loss of forest interior habitat from development, forestry and other causes is impacting FIDs abundance in the area. Additional details are available in Appendix B Breeding Bird Survey for Tall Timbers 1966-2000.

Additionally, DNR tracks eagle nest locations and colonial waterbird nesting areas. Available information indicates that eagle nests are uncommon in the Breton Bay watershed as shown in Map 20 Sensitive Species. There are several Least Tern colonies in St. Mary's County along the Potomac River but none are located in the Breton Bay watershed.

Fish and Crabs

1. Tidal Areas

Commercial fisheries harvest information is tracked by Maryland DNR Fisheries Service. In general, Breton Bay's data for several important commercial species is aggregated with several other tidal Potomac tributaries for reporting purposes, as listed below. Reporting for other commercially harvested species is for significantly larger geographic areas. In general, fisheries information is available on DNR's Internet site.

– Blue Crabs: In the reporting area for all Maryland Potomac tidal tributaries in St. Mary's and Charles County, the annual commercial harvest ranged from 995,000 to 1,950,000 pounds for 1995 to 1999. Breton Bay probably represents a small percentage of the reported harvest.

– Striped Bass: In the reporting area for all Maryland Potomac tidal tributaries in St. Mary's and Charles County except the St. Mary's River, the annual commercial harvest ranged from 67,000 to 110,000 pounds during the period 1996 to 1999. Breton Bay probably represents a small percentage of the reported harvest.

2. Nontidal Areas

Information on fish in nontidal streams is primarily gathered as part of the Maryland Biological Stream Survey. See MBSS Findings for summary information. Additional information on fish populations and related recreational activities will be incorporated as it becomes available.

3. Fish Consumption Advisory

In late 2001, MDE issued revised fish consumption advisories. While the advisory addressed fish caught in the Potomac River mainstem between Washington, DC and the Route 301 Bridge vicinity, no advisories were issued for Breton Bay or the Potomac River mainstem near Breton Bay. Also see the section on shellfish closure in the Water Quality chapter.

Benthic Macroinvertebrates [17, 18]

1. Benthos in Nontidal Streams

Several different benthic population and habitat sampling efforts have been conducted in the Breton Bay watershed at sites as shown in Map 6 Monitoring Stations.

The most recent data available on "bugs" living in streams (benthic macroinvertebrates or benthos) in Breton Bay streams was conducted in 2000 and 2001 by students at the Dr. Forrest Career and Technology Center. Their efforts focused on the lower portion of the watershed. As shown in the 2000-2001 Findings table, most benthic populations and habitat conditions tended to be poor. Notable exceptions were the good rating for the benthic population at station MD-01 in Moll Dyers Run, and the fair ratings at stations in McIntosh Run and Gravely Run.

Why Look at Benthos in Streams?

Benthos are sometimes called "stream bugs" though that name overly simplifies the diverse membership of this group. Unimpaired natural streams may support a great diversity of species ranging from bacteria and algae to invertebrates like crayfish and insects to fish, reptiles and mammals. Benthic macro-invertebrates, collectively called benthos, are an important component of a stream's ecosystem. This group includes mayflies, caddisflies, crayfish, etc., that inhabit the stream bottom, its sediments, organic debris and live on plant life (macrophytes) within the stream.

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

Benthos are a valuable tool for stream evaluation. This group of species has been extensively used in water quality assessment, in evaluating biological conditions of streams and in gauging influences on streams by surrounding lands. Benthos serve as good indicators of water resource integrity because they are fairly sedentary in nature and their diversity offers numerous ways to interpret conditions. They have different sensitivities to changing conditions. They have a wide range of functions in the stream. They use different life cycle strategies for survival.

Earlier assessments in 1995 were conducted by the Maryland Biological Stream Survey (MBSS) as summarized in the 1995 MBSS Findings Table. The results from two Burnt Mill Creek sites demonstrate that two segments of the same stream that are not very far apart can vary significantly in character – varying from good upstream to fair/poor further downstream.

2000-2001 Findings By Dr. Forrest Career and Technology Center Students
Breton Bay Watershed In St. Mary's County

Station #	Stream Location	Year	Benthos		Physical Habitat	
			Score	Condition	Score	Condition
NR-01	Nelson Run	2001	2.4	Poor	96	Very Poor
MR-01	McIntosh Run	2001	3.0	Fair	136	Fair
UTGR-01	Unnamed Trib to Glebe Run	2001	2.14	Poor	70	Very Poor
GR-01	Gravely Run	2000	2.7	Poor	120	Poor
		2001	3.28	Fair	124	Fair
MD-01	Moll Dyers Run	2001	4.14	Good	91	Very Poor
UTMD-01	Moll Dyers Run Unnamed Trib	2000	2.4	Poor	120	Poor
		2001	1.6	Poor	85	Very Poor
UTMD-02		2001			107	Poor

1995 MBSS Findings * Breton Bay Watershed In St. Mary's County							
Station # SM-...-95	Stream Location	Fish		Benthos		Physical Habitat	
		Score	Condition	Score	Condition	Score	Condition
S-040-128	Burnt Mill Creek	3.75	Fair	3.86	Fair	20.45	Poor
S-006-212	Burnt Mill Creek	4.0	Good	4.43	Good	94.59	Good

Index Used In 1995 MBSS	Description
Fish Index of Biotic Integrity	Ranges from 1.0 (worst) to 5.0 (best)
Benthic Index Biotic Integrity	Ranges from 1.0 (worst) to 5.0 (best)
Physical Habitat Index	Range from 0 (worst) to 100 (best)

* Additional details are available at www.dnr.state.md.us. At the DNR home page:
– Click on "Bays and Streams"
– Click on "Streams" (upper left corner of page)
– Click on "Small Streams (MBSS)" (upper left corner of page)
– Click on "Search Online Data" (button on left)
– Enter 02140104 in dialog box for "8 Digit watershed code" and click on search

Oysters

DNR surveys oyster bars in Maryland every autumn, including two bars in Breton Bay. Based on that information, it appears that oysters inhabiting Breton Bay are few in number and they are significantly impacted by disease. In recent years there appears to be a trend toward increasing observed mortality. In 2001, the observed mortality rates for the two oyster bars surveyed were 74% and 76%. Spat seeding projects in Breton Bay in the 1990s did produce measurable improvements, but it appears that disease overcame most of the seed oysters by 2000. Additional information is in Appendix C Fall Oyster Bar Survey Results for Breton Bay 1990-2001.[19]

Oyster bars are areas defined by law to protect and control oyster habitat and populations of oysters. Legally-defined oyster bars are depicted on charts maintained by DNR. In Breton Bay, charted oyster bars cover about 900 acres, which is nearly one third of the Bay as shown in Map 19 Oysters . The boundaries of the oyster bars shown in the map were delineated in 1983. They are larger than any oyster habitat or populations that they may contain. Regulations control activities in and around the oyster bars. For example, regulations prohibit digging for clams in areas labeled on the chart as oyster bars or within 150 feet of an oyster bar. Protection of oyster bars is considered in the review of proposed projects like dredging and marina construction or expansion before permits are issued.[19]

The current-day oyster lease areas in Breton Bay cover slightly over 52 acres of bay bottom. Lease areas do not include any natural oyster habitat or populations.

The map shows that current day Breton Bay legal oyster bars are located approximately where they were 90 years ago according to a survey of oyster beds by C.C. Yates conducted between 1906 and 1912.

Reporting of commercial oyster harvest for Lower Potomac River tributaries aggregates information for Breton Bay with St. Clements Bay and Wicomico River. For this aggregate area, the annual commercial oyster harvest ranged from 60,000 to 87,000 pounds during the period 1990 to 1996 but it declined to 7,000 pounds in 2000. Within this reporting area, a small percentage of the commercial oyster harvest is from Breton Bay. In recent years, activities of the Wicomico River Commission have served to help focus State attention on restoring or constructing oyster beds in the Wicomico River, but similar interests have not arisen for Breton Bay.

Sensitive Species

Sensitive species are most widely known in the form of Federally-listed Endangered or Threatened animals such as the bald eagle. In addition to these charismatic rare animals, both US EPA and Maryland DNR work through their respective Federal and State programs to protect numerous endangered, threatened, or rare species of plants and animals and the habitats that support those species.

For the purposes of watershed restoration, it is valuable to account for known locations of habitat for these species, which are often indicators, and sometimes important constituents, of the network of natural areas or "green infrastructure" that are the foundation for many essential natural watershed processes. Protecting these species and/or promoting expansion of their habitats can be an effective component for a watershed restoration program.

1. Habitat Protection Categories

DNR's Wildlife and Heritage Division uses three designations for areas providing habitat for sensitive species. These designations are described in the text box Maryland's Sensitive Species Protection Areas. As shown in Map 20 Sensitive Species, two of the three sensitive species designations are found in the Breton Bay watershed. The purpose of these designations is to help protect sensitive species and their habitat through the review of applications for State permits or approvals, and review of projects that involve State funds. For the types of potential projects described above, DNR makes recommendations and/or sets requirements to protect sensitive species and their habitat.

These categories do not place requirements on any activities that do not require a permit/approval or do not involve State funds. However, there are State and Federal restrictions that address "takings" of protected species, which apply more broadly. In addition, many counties have incorporated safeguards for these areas into their project and permit review processes. In all instances, property owners are encouraged to seek advice on protecting the sensitive species / habitat within their ownership. More details and guidance can be requested from DNR Natural Heritage staff.

2. Rare, Threatened and Endangered Species List

The following table lists the rare, threatened and endangered species found in the McIntosh Run watershed In general, these species are located within the SSPRA area on the Sensitive Species Map. A recent Statewide assessment of rare fish and mussels suggested that the Breton Bay watershed contains species and habitat of Statewide importance. Additional work on the assessment is being conducted and results are anticipated to be available next year.

Rare, Threatened and Endangered Species of the McIntosh Run Watershed [11]		
Common Name	**Scientific Name**	**Status (Maryland unless noted)**
Dwarf wedge mussel	Alasmidonta heterodon	Federal endangered
Purple cress	Cardamine douglassii	watch list
Cat-tail sedge	Carex typhina	highly rare
Red turtlehead	Chelone obliqua	threatened
Deciduous holly	Ilex Decidua	threatened
Large-seeded forget-me-not	Myosotis macrosperma	threatened
Climbing dogbane	Trachelospermum difforme	endangered

Sensitive Species Protection Areas In the Breton Bay Watershed

Sensitive Species Project Review Area (SSPRA)

At least four SSPRAs are identified in the Breton Bay watershed. Each SSPRA contains one or more sensitive species habitats. However, the entire SSPRA is not considered sensitive habitat. The SSPRA is an envelope identified for review purposes to help ensure that applications for permit or approval in or near sensitive areas receive adequate attention and safeguards for the sensitive species / habitat they contain. Also see Map 20 Sensitive Species.

Natural Heritage Area (NHA)

No NHAs are located in the Breton Bay watershed. NHAs are rare ecological communities that encompass sensitive species habitat. They are designated in State regulation (COMAR 08.03.08.10). For any proposed project that requires a State permit or approval that may affect an NHA, recommendations and/or requirements are placed in the permit or approval that are specifically aimed at protecting the NHA.. To help ensure that proposed projects that may affect an NHA are adequately reviewed, an SSPRA is always designated to encompass each NHA and the area surrounding it.

Wetlands of Special State Concern (WSSC)

Two WSSCs, totaling about 125 acres, are designated in the Breton Bay watershed as shown on Map 20 Sensitive Species: One is located along Miski Run and one along lower McIntosh Run. Both were designated to protect habitat for rare wetland plant species. For any proposed project that requires a wetland permit, these selected wetlands have additional regulatory requirements beyond the permitting requirements that apply to wetlands generally. To help ensure that proposed projects that may affect a WSSC are adequately reviewed, an SSPRA is always designated to encompass each WSSC and the area surrounding it. For a listing of designated sites see COMAR 26.23.06.01 at www.dsd.state.md.us

Submerged Aquatic Vegetation

The well-defined link between water quality and submerged aquatic vegetation (SAV) distribution/abundance make SAV communities good barometers of the health of estuarine ecosystems.

SAV is not only important as an indicator of water quality, but it is also a critical nursery habitat for many estuarine species. For example, blue crab "post-larvae" are up to 30 times more abundant in SAV beds than in adjacent unvegetated areas. Additionally, several species of waterfowl depend on SAV for food when they over-winter in the Chesapeake region.

1. SAV Status

In 2000 and 2001, SAV was found in Breton Bay in only five small areas as shown in Map 21 SAV. As also shown on the map, limited areas of SAV have intermittently appeared in Breton Bay adjacent to the shoreline over the past several decades. These SAV areas have consistently been downstream of Lovers Point / Pawpaw Point.[12] Also see Additional Water Quality Data Collection During 2002 and SAV Abundance and SAV Habitat Index.

The reasons for the very limited presence of SAV in Breton Bay are not understood. Similar habitat conditions appear to be present in nearby St. Clements Bay where significantly greater SAV acreage is typically present.[13]

2. SAV Restoration Potential [13]

Breton Bay is included in a study currently underway by the US Fish and Wildlife Service to help improve understanding of the factors that are inhibiting SAV growth. Water quality data collected during 2001 is too limited to confidently project the potential for SAV restoration but several preliminary findings are available:

– Water quality in upper Breton Bay may be too poor to support SAV.
– Conditions in lower Breton Bay might support SAV restoration but more data is necessary to better quantify that at least minimum conditions necessary for SAV habitat are present.

The Potomac River Association, Inc. is sponsoring a submerged aquatic vegetation (SAV) project that involves volunteers from the region. The first step was to partner with Dr. Peter Bergstrom of the U. S. Fish and Wildlife Service, who conducted an SAV identification and hunting technique workshop which was held in nearby St. Clement's Bay on June 15, 2002. Continuing on into the summer and fall of 2002, twelve participants are tasked with ground-truthing and hunting/identifying SAV throughout the Breton Bay tidal watershed. Data collected will be incorporated into regional databases and assessments of water quality, overall health, and suitability for additional growth will facilitate plantings of SAV shoots in fall 2002, spring 2003, and fall of 2004. SAV planting projects are already funded through the Chesapeake Bay Trust. Additional funding could expand this project.

RESTORATION AND CONSERVATION TARGETING

There are a number of programs and tools available to assist in implementing goals for protection of valued watershed resources and for targeting restoration of those that have become degraded or otherwise function less than optimally.

2002 Stream Corridor Assessment

Using the Stream Corridor Assessment Methodology (SCAM) developed and applied by the DNR Watershed Restoration Division, valuable information can be compiled to assist in targeting restoration activities. In partnership with St. Mary's County, DNR is conducting a Stream Corridor Assessment in the Breton Bay watershed during 2002. In this effort, trained teams from the Maryland Conservation Corps walk along streams to identify and document potential problems and restoration opportunities such as the items listed below:

Stream Corridor Assessment Data Collection Categories	
Pipe Outfalls	Fish Blockages
Pond Sites	Exposed Pipe
Tree Blockages	Unusual Conditions
Inadequate Buffers	Trash Dumping
Erosion	In- or Near-Stream Construction

A stream corridor assessment report will be generated, including maps and photographs, to support targeting decisions for restoration projects. Draft data summaries are expected to be available in late 2002. The results of the stream corridor assessment will provide a valuable foundation for development of the Watershed Restoration Action Strategy.

2002 Synoptic Survey and Aquatic Community Assessment

During 2002 DNR staff collected water quality samples in nontidal streams to supplement knowledge of local conditions. The water quality findings included in the report on this work can help identify problem areas and relative conditions among local streams based on measurements of dissolved oxygen, pH, nutrients (phosphorus and nitrogen), conductivity and flow. The findings (see Appendix D) include nutrient loads at each sampling site and allow the ranking of subwatersheds based on the nutrient load estimates.

For some of these nontidal stream sampling sites, DNR staff has also assessed fish and benthic organism populations. These assessments provide additional perspectives to gauge local water quality and habitat conditions. DNR's Watershed Restoration Division completed this work in September, 2002.

Agricultural Conservation Programs

Many farmers in St. Mary's County willingly implement management systems that address nutrient runoff and infiltration, erosion and sediment control, and animal waste utilization. St. Mary's Soil Conservation District (SCD) records for the Breton Bay watershed indicate that there are 178 agricultural units totaling 18,326 acres. Of that number, 55 have current soil conservation and water quality plans covering 4346 acres. The remaining agricultural units either have never had a plan, or their plans are over ten years old and have expired.

Some of the conservation practices in plans include grassed waterways, riparian herbaceous and riparian forested buffers, conservation cover, cover crops, shallow water wildlife areas and grade stabilization structures. The Maryland Agricultural Cost-Share program (MACS), the Conservation Reserve Program (CRP and CREP) and the Environmental Quality Incentive Program (EQIP) are some of the state and federal programs promoted and administered by the St. Mary's SCD and Natural Resource Conservation Service (NRCS). [28]

As part of the WRAS project, farmers in the watershed who are already using good management practices that benefit water quality could provide examples to promote adoption of similar practices by other farmers.

Smart Growth

In Maryland's Smart Growth program, there are two targeting programs that should be considered when potential watershed restoration projects are considered. In Rural Legacy Areas, protection of land from future development through purchase of easements (or in fee simple) is promoted. In Priority Funding Areas (PFAs), State funding for infrastructure may be available to support development and redevelopment. Both are shown in Map 14 Protected Land and Smart Growth:

- Rural Legacy Areas in the St. Mary's County are located outside of the Breton Bay watershed, mostly in the Patuxent River drainage area.

- Priority Funding Areas cover about 12% of the Breton Bay watershed. These PFAs are concentrated in two areas: Leonardtown and Rt 235. Two very small parts of other PFAs are also in the Breton Bay watershed.

Marina Programs

Discharges of sewage from boats are a concern for water quality because they contribute nutrients, biochemical oxygen demand, pathogens, etc. These discharges are preventable if a sufficient number of pumpout facilities are locally available and boat operators take advantage of these services. Boat maintenance and operation also can contribute petroleum and other noxious materials to the aquatic environment.

There are few marinas in Breton Bay identified in DNR's Marina database. The sites are shown in Map 22 Clean Marinas. Two of these marinas offer pumpout facilities. None of the marinas is currently participating in Maryland's Clean Marina Program.

The Clean Marinas Program is a way for marina owners to gain certification and public recognition for voluntarily undertaking a number of actions related to marina design, operation, and maintenance intended to properly manage all kinds of marine products and activities, and to reduce and properly manage waste. Information is available at DNR's website, www.dnr.state.md.us/boating.

DNR also funds installation and maintenance of marine pumpout facilities, including those at certified Clean Marinas. Information may be obtained from the Waterway and Greenways Division at DNR.

One potential element of a Watershed Restoration Action Strategy (WRAS) is to encourage and/or support adding marina pumpout facilities serving the local area and increasing participation in the Clean Marina Program.

Fish Blockage Removal

Many fish species need to move from one stream segment to the next in order to maintain healthy, resilient populations. This is particularly true for anadromous fish species because they spawn and hatch from eggs in free flowing streams but live most of their lives in estuarine or ocean waters. Blockages in streams can inhibit or prevent many fish species from moving upstream to otherwise viable habitat.

To help prioritize stream blockages for mitigation or removal, the DNR Fish Passage Program maintains a database of significant blockages to fish movement. However, the database has no information listed for the Breton Bay watershed. The 2002 Stream Corridor Assessment will confirm if any blockages to fish movement exist in the watershed.

Stream Buffer Restoration

1. Benefits and General Recommendations

Natural vegetation in stream riparian zones, particularly forest, provides numerous valuable environmental benefits:

– Reducing surface runoff
– Preventing erosion and sediment movement
– Using nutrients for vegetative growth and moderating nutrient entry into the stream
– Moderating temperature, particularly reducing warm season water temperature
– Providing organic material (decomposing leaves) that are the foundation of natural food webs in stream systems
– Providing overhead and in-stream cover and habitat
– Promoting high quality aquatic habitat and diverse populations of aquatic species.

To realize these environmental benefits, DNR generally recommends that forested stream buffers be at least 100 feet wide , i.e. natural vegetation 50 feet wide on either side of the stream. Therefore, DNR is promoting this type of stream buffer for local jurisdictions and land owners who are willing to go beyond the minimum buffer standards. The DNR Watershed Restoration Division and other programs like Conservation Reserve Enhancement Program (CREP), managed by the DNR Forest Service, are available to assist land owners who volunteer to explore these opportunities.

2. Using GIS

Identifying the areas that need buffer restoration and prioritizing them for action can be a time-consuming, expensive project. Fortunately, use of a computerized Geographic Information System (GIS) to manipulate remotely sensed data can help save limited time and funds. To assist in this technical endeavor, DNR Watershed Management and Analysis Division is offering assistance, including GIS work, to help target restoration of naturally vegetated stream buffers, wetlands and other watershed management projects that may be identified locally. With these tools, information generated by a Stream Corridor Assessment and additional on-the-ground verification or "ground-truthing," local government may more efficiently and confidently consider stream buffer restoration as part of a local Watershed Restoration Action Strategy.

Several scenarios are presented here to help consider potential areas for stream buffer and wetland restoration. These scenarios can be used alone or in combination as models for targeting potential restoration sites for field verification. These maps are intended to demonstrate a methodology that can be used to locate sites having a high probability of optimizing certain ecological benefits of stream buffers. The resolution of the data used to generate these maps is not sufficient for an accurate site assessment, but can be used to identify candidate sites for more detailed investigation. The streams presented in the maps are perennial (blue line) streams as generally shown on US Geological Survey Quadrangle Maps. Intermittent streams were not considered in the stream buffer scenario maps.

3. Headwater Stream Buffers

Headwater streams are also called first order streams. For many watersheds, first order streams drain the majority of the land within the entire watershed. Therefore, stream buffers restored along headwater streams (First Order) tend to have greater potential to intercept nutrients and sediments than stream buffers placed elsewhere. In targeting stream buffer restoration projects, giving higher priority to headwater streams is one approach to optimizing nutrient and sediment retention.

Restoring headwater stream buffers can also provide habitat benefits that can extend downstream of the project area. Forested headwater streams provide important organic material, like decomposing leaves, that "feed" the stream's food web. They also introduce woody debris which enhances in-stream physical habitat. The potential for riparian forest buffers to significantly influence stream temperature is greatest in headwater regions. These factors, in addition to positive water quality effects, are key to improving aquatic habitat.

Since the Breton Bay watershed has a substantial percentage of its headwater streams in interior forests, protection of these forests against impacts from development may be an important part of WRAS strategies, along with reforestation where necessary.

4. Land Use and Stream Buffers

One factor that affects the ability of stream buffers to intercept nonpoint source pollutants is adjacent land use. Nutrient and sediment loads from different land uses can vary significantly. The loading rates shown in the table here were calculated for the Lower Potomac River Tributary Basin from the Chesapeake Bay Watershed Model.

Annual Nonpoint Source Pollution Load Rates By Land Use Chesapeake Bay Watershed Model (2000)

Land Use	Nitrogen (lbs/ac)	Phosphorus (lbs/ac)	Sediment (tons/ac)
Crop land	17.11	1.21	0.74
Urban	7.5	0.7	0.09
Pasture	8.40	1.15	0.30
Forest	1.42	0.00	0.03

In general, restoration of stream buffers has been an agricultural Best Management Practice (BMP), with less applicability in urban areas. By identifying land uses in riparian areas with inadequate stream buffers, like crop land adjacent to streams, the potential to reduce nutrient and sediment loads can be improved. To assist in finding areas with crop land adjacent to streams, the same land use data shown in Map 11 Generalized 2000 Land Use can be filtered using GIS.
The new scenario shown in Map 23 Stream Buffer Land Use Scenario focuses on the land use within 50 feet of a stream. The map shows that naturally vegetated stream buffers are extensive but significant stream segments are unbuffered. This scenario, supplemented with the land use pollution loading rates,

suggests potential buffer restoration opportunities that could minimize nutrient and sediment loads. (Note: DNR is encouraging stream buffers at least 50 feet wide on each side of the stream, which is significantly greater than minimum buffer requirement, to enhance nutrient and habitat benefits beyond minimum buffer requirements. Also, the enlargement shows that more detailed GIS data, like the County's stream data, has greater capability to identify potential restoration opportunities along a selected stream segment)

5. Nutrient Uptake from Hydric Soils in Stream Buffers

In general, the nutrient nitrogen moves from the land into streams in surface water runoff and in groundwater. In watersheds like the Breton Bay drainage, a significant percentage of nitrogen enters streams in groundwater. Stream buffers can be used to capture nitrogen moving in groundwater if buffer restoration projects have several key attributes:

– Plants with roots deep enough to intercept groundwater as it moves toward the stream
– Plants with high nitrogen uptake capability, and
– Targeting buffer restoration projects to maximize groundwater interception by buffer plants.

Hydric soils in stream riparian areas can be used as one factor to help select stream buffer restoration sites. Siting buffer restoration on hydric soils would offer several benefits:

– Plant roots are more likely to be in contact with groundwater for longer periods of time
– Hydric soils tend to be marginal for many agricultural and urban land uses
– Natural vegetation in wet areas often offers greater potential for habitat.

Map 24 Stream Buffer Hydric Soil On Open Land Scenario identifies lands that are adjacent to streams, that are composed of hydric soil, that are cropland or barren land and also lack naturally vegetated stream buffers. To generate the watershed-wide map, hydric soils (Natural Soils Group of Maryland, MDP) were grouped into two classes and rated in terms of their potential to maximize groundwater/root zone interaction: poorly drained hydric soils (high nutrient retention efficiency), and moderately well drained hydric soils (moderately high nutrient retention efficiency). To generate the enlarged map of Brooks Run, detailed stream and hydric soil data supplied by St. Mary's County was used to identify potential opportunities. An important next step in using this information is verification of field conditions. Care must be taken during field validation to evaluate any hydrologic modification of these soils, such as ditching or draining activities, which would serve to decrease potential benefits.

6. Optimizing Water Quality Benefits by Combining Priorities

Strategic targeting of stream buffer restoration projects may provide many different benefits. To maximize multiple benefits, site selection and project design need to incorporate numerous factors. For example, finding a site with a mix of attributes like those in the following list could result in the greatest control of nonpoint source pollution and enhancement to living resources:

– land owner willingness / incentives
– marginal land use in the riparian zone
– headwater stream
– hydric soils
– selecting appropriate woody/grass species
– adjacent to existing wetlands / habitat

Additionally, selecting restoration projects that are likely to produce measurable success is an important consideration in prioritizing projects for implementation. In the early stages of a watershed restoration program, measurable water quality improvement can be one of the strongest ways to demonstrate project success.

In general, targeting restoration projects to one or a few selected tributaries or small watersheds will tend to offer the greatest probability of producing measurable water quality improvement in the short term. By selecting small areas like a small first order stream for restoration, there is greater likelihood that water quality problems arise locally and that they can be corrected by limited investment in carefully selected local restoration projects. In addition, water quality improvements achieved in the tributary will also inevitably contribute to improving Breton Bay even if improvements in the Bay are not immediately measurable.

Wetland Restoration

Wetlands serve important environmental functions such as providing habitat and nursery areas for many organisms, facilitating nutrient uptake and recycling, providing erosion control. However, most watersheds in Maryland have significantly fewer wetland acres today than in the past. This loss due to draining, filling, etc., has led to habitat loss and negative water quality impacts in streams and in the Chesapeake Bay. Reversing this historic trend is an important goal of wetland restoration. One approach to identifying candidate wetland restoration sites involves identifying "historic" wetland areas based on the presence of hydric soils. This process can be accelerated by using GIS to manipulate soils information with other data like land use. The GIS products can then assist in initiating the candidate site search process, targeting site investigations and helping to identify land owners. To promote wetland restoration, DNR Watershed Management and Analysis Division has developed GIS capability for these purposes.

For the Breton Bay watershed, GIS was used to map and prioritize areas of hydric soil for potential wetland restoration. The steps and priorities used to generate the map are listed below:

– Data used: Hydric soils (St. Mary's County Data), existing wetlands (DNR Wetlands), land use (Maryland Dept. of Planning, 1997).
– Identify candidate hydric soil areas based on land use. Hydric soils on open land (agricultural fields, bare ground, etc.) are retained while those underlying natural vegetation and developed lands are excluded.
– Explore hydric soils based on land use / land cover and proximity to existing wetlands or streams.

Two of many possible scenarios for finding potential wetland restoration sites are presented on the accompanying maps:

– Map 25 Wetland Restoration Opportunities and the table Wetland Acreage and Wetland Restoration Potential show that the potential for wetland restoration based on identifying open land on hydric soil varies significantly among the subwatersheds in the Breton Bay watershed.

– Map 24 Stream Buffer Hydric Soil On Open Land Scenario indicates that opportunities to restore or create new wetlands may vary in their ability to intercept nutrients. Additionally, the number of potential opportunities increases significantly by using St. Mary's County's better soils data.

The potential wetland restoration sites suggested in these scenarios can be filtered further by using more accurate wetlands and soil information, considering land ownership, etc. Additional steps would be beneficial in applying this information such as considering additional criteria like habitat enhancement opportunities, sensitive species protection, targeting specific streams or subwatersheds for intensive restoration, and using Conservation Reserve Enhancement Program (CREP) information.

Wetland Acreage and Wetland Restoration Potential Breton Bay Watershed					
Subwatersheds			Existing Wetlands	Wetland Restoration Potential On Open Land w/ Hydric Soil	
12-Digit	Letter / Name			Within 300 ft of Wetlands	More Than 300 ft From Wetlands
Direct Drainage Breton Bay 02140104-7020	A	6800 total acres	630	216	414
	B	Combes/Cherry Cove Creeks	139	80	59
	C	Town Run	44	5	39
	D	Moll Dyers Run	137	1	136
Lower McIntosh Run 02140104-7021	A		357	101	256
	B	Nelson Run	105	35	70
	C	Greenhill Run	34	4	30
	D	Miski Run	120	14	106
Glebe Run 02140104-7022	--	Glebe and Gravely Runs	230	8	222
Headwaters McIntosh & Brooks Run 02140104-7023	A		112	4	108
	B		96	4	92
	C	Brooks Run	409	29	380
Burnt Mill Creek 02140104-7024	A		129	12	117
	B		247	42	205
	C		166	22	144
Total For Breton Bay Watershed			2955	577	2378

PROJECTS RELATED TO THE WRAS PROCESS

There are numerous projects and programs that have the potential to contribute to successful development and implementation of a Watershed Restoration Action Strategy (WRAS). The listing included here suggests opportunities for cooperation and coordination that can improve the likelihood of success for the WRAS. This listing is not all-inclusive. It is recommended that this list be augmented as new information becomes available and that follow-up should continue to promote the WRAS process with these and other projects and programs.

319(h)-Funded Projects

The Federal funding source generally known as "319" has not been awarded to projects in the Breton Bay watershed during the 1999 through 2002 time frame.

Other Projects/Programs

This section summarizes projects and programs that have the potential to contribute to development and implementation of the Watershed Restoration Action Strategy that have not been addressed elsewhere in the watershed characterization.

1. Center for Watershed Protection

As part of WRAS project, St. Mary's County has enlisted the assistance of the Center for Watershed Protection to perform several planning and project targeting functions for the Breton Bay watershed at the subwatershed scale:

- estimate existing impervious cover based on land use data
- verify imperviousness estimates based on Stream Corridor Assessment results and additional field investigation.
- project future impervious cover based on zoning
- conduct a stakeholder involvement process to address findings and goal setting
- perform a subwatershed retrofit inventory and priority for the Town Run subwatershed

St. Mary's County will employ the experience and information from this process to support production of the County's watershed strategy.

2. Watershed Evaluation for St. Mary's River and McIntosh Run Watersheds

In 1998, St. Mary's County Department of Planning and Zoning received a report from its consultants that in part assessed the McIntosh Run watershed. It identified areas that were unsuitable for development and areas showing potential as forest and wetland mitigation sites. Map 26 Potential Mitigation Sites shows the areas identified in the assessment.

The study was funded by DNR's Coastal Zone Management Program pursuant to National Oceanic and Atmospheric Administration Award No. NA67OZ0302.

3. Potomac River Association Breton Bay Campaign

The Potomac River Association, Inc. (PRA) is a non-profit environmental group working throughout Southern Maryland. Since its formation in 1967, PRA has been working to preserve and enhance the county's waterways including Breton Bay and its tributaries. PRA's latest efforts on behalf of Breton Bay began in May 2001 with a $10,000 Small Watershed Grant from the National Fish & Wildlife Foundation and matching $5,000 from PRA's membership dues. With assistance from the consulting firm Community and Environmental Defense Services (CEDS), a survey of the watershed, including water quality sampling, was conducted.

In July 2001, the PRA released a 28-page report titled *Opportunities to Enhance the Quality of Breton Bay* which is available online in pdf format at http://www.p-r-a.org/pub/bretonbay.pdf This report contains a review of available information regarding the unique importance of Breton Bay and presents a number of methods for improving the quality of the Breton Bay system.

PRA then began pursuing corrective action for the most serious threats to Breton Bay that it had identified: excessive erosion in the Town Run watershed, inadequate stormwater management serving some commercial areas on Route 5, and the possibility of a massive development project along McIntosh Run - the principal tributary to Breton Bay.

In October 2001 the Saint Mary's County Commissioners initiated the Breton Bay Watershed Restoration Action Strategy project. PRA has been an active participant since the project started.

On November 15, 2001, PRA held a public meeting at the Olde Breton Inn to release the results of it's July 2001 report and to offer watershed residents an opportunity to take a more active role in the restoration effort. More than 70 people attended the meeting and many of the meeting attendees volunteered to help the Association identify and pursue opportunities to enhance Breton Bay.

In February 2002, a dozen of the volunteers identified in November 2001 attended a DNR training session for the Stream Waders program. The volunteers learned how to collect samples of aquatic insects, crustaceans, and other stream-dwelling creatures. In March and April 2002 the volunteers sampled Breton Bay tributaries at 25 points. The samples were delivered to DNR biologists who will identify the organisms and develop an assessment of stream conditions at each sampling point. PRA will then ask the volunteers to return to those points that show signs of degradation in order to conduct further sampling pin-pointing the cause(s).

In May 2002, the Association offered recommendations to the St. Mary's County Commissioners on how the draft sediment control and stormwater ordinances could be modified to gain more of the benefits of development with fewer adverse water quality impacts. The Association will be monitoring projects approved through the new ordinances to ensure that these benefits are achieved.

Also in May, PRA received a $5,916 grant from the Chesapeake Bay Trust to plant 4000 submerged aquatic vegetation plants (SAV). (PRA is providing a $5,916 in-kind match) A similar matching grant has been requested from the Mirant Corporation.

On June 15, PRA held the first SAV identification and searching technique workshop in preparation for the fall 2002 and spring 2003 plantings. Dr. Peter Bergstrom from the US Fish and Wildlife Service led a field training session providing valuable information on recognition of appropriate planting sites and fostering stewardship of our waterway resources.

PRA's Breton Bay project is expected to extend well into the summer of 2004 with continuing SAV plantings, stream monitoring and sampling, riparian buffer restoration, and lobbying local and State government for adequate protective regulations for future development.

4. Yellow Perch Restoration In McIntosh Run[16]

On May 11, 2002, members of the Southern Maryland chapter of the Coastal Conservation Association (CCA) and other volunteers restocked 15,000 yellow perch into McIntosh Run in a project to re-establish native breeding populations in this Breton Bay tributary. This project is a cooperative effort between the CCA, the Maryland DNR Fisheries Service and Mirant Mid-Atlantic LLC.

During the annual spring spawning run, eggs are collected at Allens Fresh at the headwaters of the Wicomico River and taken to DNR’s Manning Hatchery in Cedarville for incubation. The fry are marked with oxitetracycline for future identification and then raised for several weeks before being released. In McIntosh Run, the fry were released next to the Rt. 5 bridge over McIntosh Run in the Port of Leonardtown Park.

During the summer, the stream will be monitored for surviving yellow perch fingerlings and to collect environmental data. Any perch collected will be analyzed at the hatchery to detect the tell-tale oxitetracycline identifying them as part of the restocking project. Native fish caught in the survey will not have the unique chemical mark. If the project is successful, the surviving perch should return to spawn in this stream in three to five years.

Currently, yellow perch are relatively rare in many streams around the Chesapeake Bay where they were once plentiful. Spawning takes place in fresh water where the long gelatinous strips of eggs get caught on submerged structures in the free-flowing stream. Two to three weeks later, the perch larvae hatch. The young perch mature in salt water and return after three to five years to spawn where they hatched. Their predictable spawning habits make them vulnerable to fishing exploitation as they congregate in narrow streams each spring. Sedimentation of their spawning sites probably reduces the hatching success rate, and low dissolved oxygen has been blamed for poor survival of juveniles and adults during the warm summer weather. Stream blockages sometimes force the perch to spawn where the salinity is too high for the larvae to survive, and extreme tides or storm events can strand the eggs high and dry where they die after the water level drops. No single factor seems solely responsible for their reduced population levels.

CCA has been involved in restocking selected streams for the past two years. For example, several thousand fry are also being raised at the Academy of Natural Sciences Estuarine Research Center in St. Leonard for restocking into St. Leonard Creek in Calvert County.

POTENTIAL BENCHMARKS FOR WRAS GOAL SETTING

Several programs designed to manage water quality and/or living resources have existing or proposed goals that are relevant to setting goals for the Breton Bay Watershed Restoration Action Strategy (WRAS). The goals from these other programs tend to overlap and run parallel to potential interests for developing WRAS goals. Therefore, to assist in WRAS development, selected goals from other programs are included here as points of reference.

Coastal Zone Management

– The Watershed Restoration Action Strategy (WRAS) Initiative is a component of the Cumulative and Secondary Impacts section of the *Maryland Coastal Zone Management Program Section 309 Strategy (2000-2005)*. Watershed strategies are defined as comprehensive plans that will identify areas of concern, monitoring strategies, gaps in information, mitigation options, and restoration and protection opportunities.

– WRAS projects funded under Coastal Zone Management must be in Maryland's Coastal Zone and must include a local program change as part of the effort. This could include incorporation into the County Comprehensive Plan, adoption of local implementing tools like zoning ordinances and environmental codes, modification of sensitive areas elements or alterations to Smart Growth Priority Funding Areas.

Chesapeake 2000 Agreement

The Chesapeake 2000 Agreement (C2K) includes several significant commitments pertaining to local watershed management planning and implementation. The goal in the C2K Agreement that is directly related to the development of watershed management plans and action strategies is "By 2010, work with local governments, community watershed groups and watershed organizations to develop and implement locally supported watershed management plans in two-thirds of the Bay watershed covered by this Agreement. These plans would address the protection, conservation and restoration of stream corridors, riparian buffers and wetlands for the purposes of improving habitat and water quality, with the collateral benefits for optimizing flow and water supply."

Four common elements of watershed management planning were adopted by the Chesapeake Bay Program member jurisdictions to be applied Bay-wide. Those elements support the WRAS components which were also identified as common Bay-wide criteria for watershed management planning. The four approved C2K watershed planning elements are as follows:

1. Does the plan "address the protection, conservation and restoration of stream corridors, riparian forest buffers and wetlands?" Each watershed management plan needs to be based on an assessment of natural resources within the watershed. At a minimum, the assessment will evaluate the condition of stream corridors, riparian buffers and wetlands within the watershed.

2. Does the plan reflect the goals and objectives of "improving habitat and water quality?" The plan should reflect the issues that the stakeholders feel are important, and, at a minimum, exhibit a benefit to habitat and water quality within the watershed.
The goals should be based on priority issues identified by the watershed assessment.

3. Chesapeake 2000 Watershed Commitments Criterion #3-- Does the plan identify implementation mechanisms?
Capacity to implement the plan will be demonstrated by identifying:
- What are the specific management actions?
- What are the resources necessary for implementation?
- Who will implement the plan?
- And when will the actions will be implemented?
The implementation mechanisms should also incorporate a periodic re-evaluation to ensure the plan is "living" and flexible to the changes in the watershed.

4. Does the plan have demonstrated local support? Every effort should be made to demonstrate a diversity of local support. At a minimum, local governments, community groups and watershed organizations should be encouraged to participate in developing and implementing the watershed management plan.

Goals from the *Clean Water Action Plan* [2]

– Clean Water Goals - Maryland watersheds should meet water quality standards, including numerical criteria as well as narrative standards and designated uses.
– Watersheds should achieve healthy conditions as indicated by natural resource indicators related to the condition of the water itself (e.g. water chemistry), aquatic living resources, and physical habitat, as well as landscape factors (e.g. buffered streams and wetland restoration).

Water Quality Improvement Act of 1998

- The most significant feature is requiring nutrient management plans for virtually all Maryland farms. The requirement is being phased in over a several year period.
- Nitrogen-based plan implementation will be required on all farms beginning December 31, 2001.
- Phosphorus-based plan implementation will be required on farms using chemical fertilizer beginning December 31,2002 and on farms using manure or biosolids by July 1, 2005.
- Up to 87.5% cost share is available for development of nutrient management plans and up to $20 per ton contribution toward the costs of manure transportation is available. Implementation of projects assisted by this funding has the potential to move nutrients to sites where they are needed.

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GLOSSARY

303(d)	A section of the federal Clean Water Act requiring the states to report which waters of the state are considered impaired for the uses for which they have been designated, and the reasons for the impairment. Waters included in the "303(d) list" are candidates for having TMDLs developed for them.
319	A section of the federal Clean Water Act dealing with non-point sources of pollution. The number is often used alone as either a noun or an adjective to refer to some aspect of that section of the law, such as grants.
8-digit watershed	Maryland has divided the state into 138 watersheds, each comprising an average of about 75 square miles, that are known as 8-digit watersheds because there are 8 numbers in the identification number each has been given. These nest into the 21 larger 6-digit watersheds in Maryland which are also called Tributary Basins or River Basins. Within the Chesapeake Bay drainage, 8-digit watersheds also nest into 10 Tributary Team Basins.
Anadromous fish	Fish that live most of their lives in salt water but migrate upstream into fresh water to spawn.
Benthic	Living on the bottom of a body of water.
CBIG	Chesapeake Bay Implementation Grant Program, a DNR-administered program that awards grants from the Chesapeake Bay Program to reduce and prevent pollution and to improve the living resources in the Chesapeake Bay.
CBNERR	The Chesapeake Bay National Estuarine Research Reserve in a federal, state and local partnership to protect valuable estuarine habitats for research, monitoring and education. The Maryland Reserve has three components: Jug Bay on the Patuxent River in Anne Arundel and Prince Georges' Counties, Otter Point Creek in Harford County and Monie Bay in Somerset County.
CCWS	Chesapeake and Coastal Watershed Service, the unit in DNR that works with local governments and other interested parties to develop restoration strategies and projects.

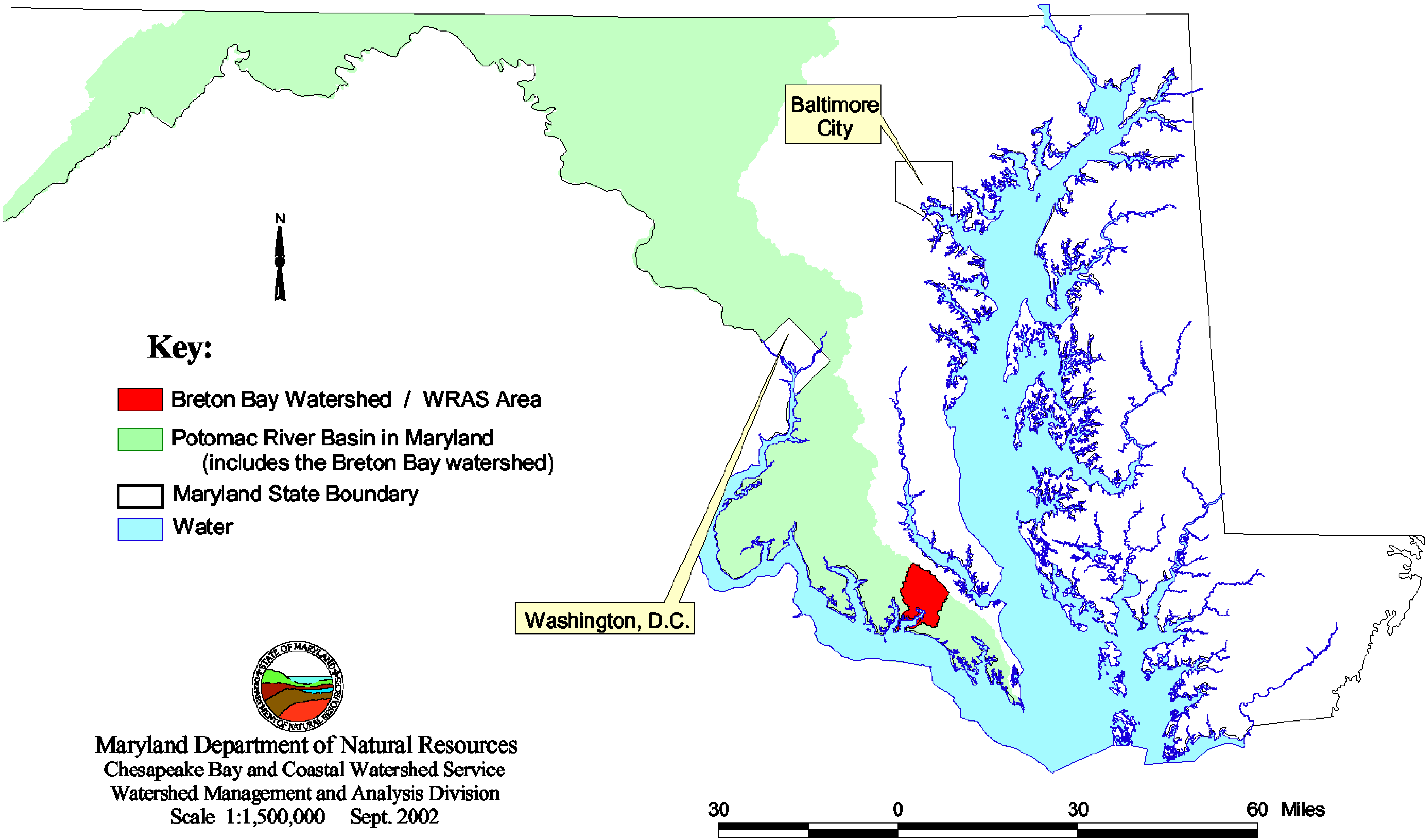
COMAR	Code Of Maryland Regulations (Maryland State regulations)
CREP	Conservation Reserve Enhancement Program, a program of MDA. CREP is a federal/state and private partnership which reimburses farmers at above normal rental rates for establishing riparian forest or grass buffers, planting permanent cover on sensitive agricultural lands and restoring wetlands for the health of the Chesapeake Bay.
CRP	Conservation Reserve Program, a program of Farm Service Agency in cooperation with local Soil Conservation Districts. CRP encourages farmers to take highly erodible and other environmentally-sensitive farm land out of production for ten to fifteen years.
CWAP	Clean Water Action Plan, promulgated by EPA in 1998. It mandates a statewide assessment of watershed conditions and provides for development of Watershed Restoration Action Strategies (WRASs) for priority watersheds deemed in need of restoration
CWiC	Chesapeake 2000 Agreement watershed commitments. CWiC is a shorthand phrase used in the Chesapeake Bay Program.
CZARA	The Coastal Zone Reauthorization Amendments of 1990, intended to address coastal non-point source pollution. Section 6217 of CZARA established that each state with an approved Coastal Zone Management program must develop and submit a Coastal Non-Point Source program for joint EPA/NOAA approval in order to "develop and implement management measures for NPS pollution to restore and protect coastal waters".
CZMA	Coastal Zone Management Act of 1972, establishing a program for states and territories to voluntarily develop comprehensive programs to protect and manage coastal resources (including the Great Lakes). Federal funding is available to states with approved programs.
Conservation Easement	A legal document recorded in the local land records office that specifies conditions and/or restrictions on the use of and title to a parcel of land. Conservation easements run with the title of the land and typically restrict development and protect natural attributes of the parcel. Easements may stay in effect for a specified period of time, or they may run into perpetuity.

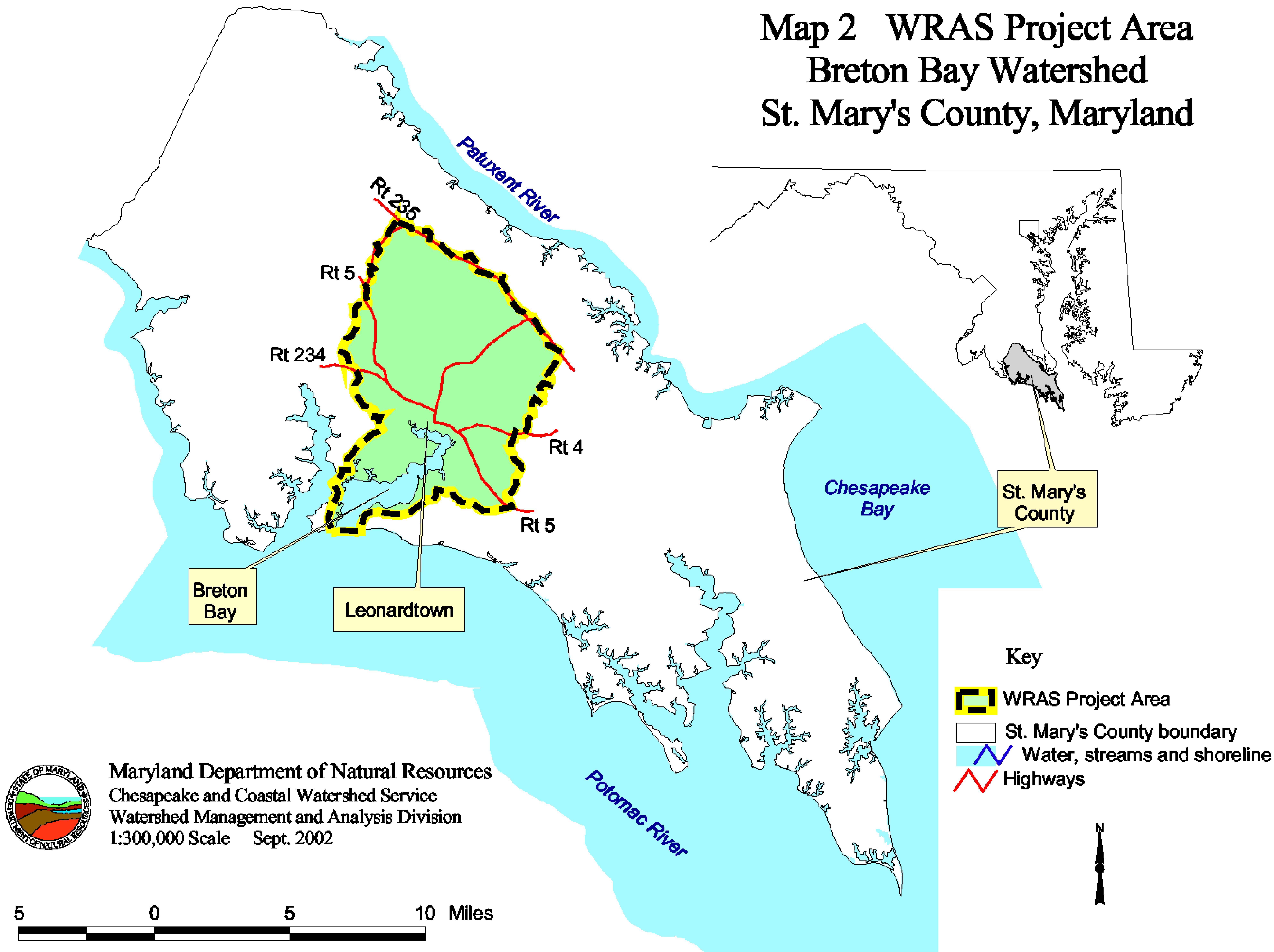
DNR	Department of Natural Resources (Maryland State)
EPA	Environmental Protection Agency (United States)
Fish blockage	An impediment, usually man-made, to the migration of fish in a stream, such as a dam or weir, or a culvert or other structure in the stream
GIS	Geographic Information System, a computerized method of capturing, storing, analyzing, manipulating and presenting geographical data.
MBSS	Maryland Biological Stream Survey, a program in DNR that samples small streams throughout the state to assess the condition of their living resources.
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
MET	Maryland Environmental Trust, an organization that holds conservation easements on private lands and assists local land trusts to do similar land protection work.
MGS	Maryland Geological Survey, a division in DNR.
NHA	Natural Heritage Area, a particular type of DNR land holding, designated in COMAR.
NOAA	National Oceanic and Atmospheric Administration, an agency of the US Department of Commerce that, among other things, supports the Coastal Zone Management program, a source of funding for some local environmental activities, including restoration work.
NPS	Non-Point Source, pollution that originates in the landscape that is not collected and discharged through an identifiable outlet.
NRCS	Natural Resources Conservation Service, formerly the Soil Conservation Service, an agency of the US Department of Agriculture that, through local Soil Conservation Districts, provides technical assistance to help farmers develop conservation systems suited to their

	land. NRCS participates as a partner in other community-based resource protection and restoration efforts.
PDA	Public Drainage Association
Palustrine Wetlands	Fresh water wetlands, including bogs, marshes and shallow ponds.
RAS	Resource Assessment Service, a unit of DNR that carries out a range of monitoring and assessment activities affecting the aquatic environment.
Riparian Area	1. Land adjacent to a stream. 2. Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e. a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines. (National Research Council, *Riparian Areas: Functions and Strategies for Management*. Executive Summary page 3. 2002)
SAV	Submerged Aquatic Vegetation, important shallow-water sea grasses that serve as a source of food and shelter for many species of fin- and shell-fish.
SCA[M]	Stream Corridor Assessment is an activity carried out by CCWS in support of WRAS development and other management needs, in which trained personnel walk up stream channels noting important physical features and possible sources of problems.
SCD	Soil Conservation District is a county-based, self-governing body whose purpose is to provide technical assistance and advice to farmers and landowners on the installation of soil conservation practices and the management of farmland to prevent erosion.
SSPRA	Sensitive Species Protection Review Area, an imprecisely defined area in which DNR has identified the occurrence of rare, threatened and/or endangered species of plants or animals, or of other important natural resources such as rookeries and waterfowl staging areas.

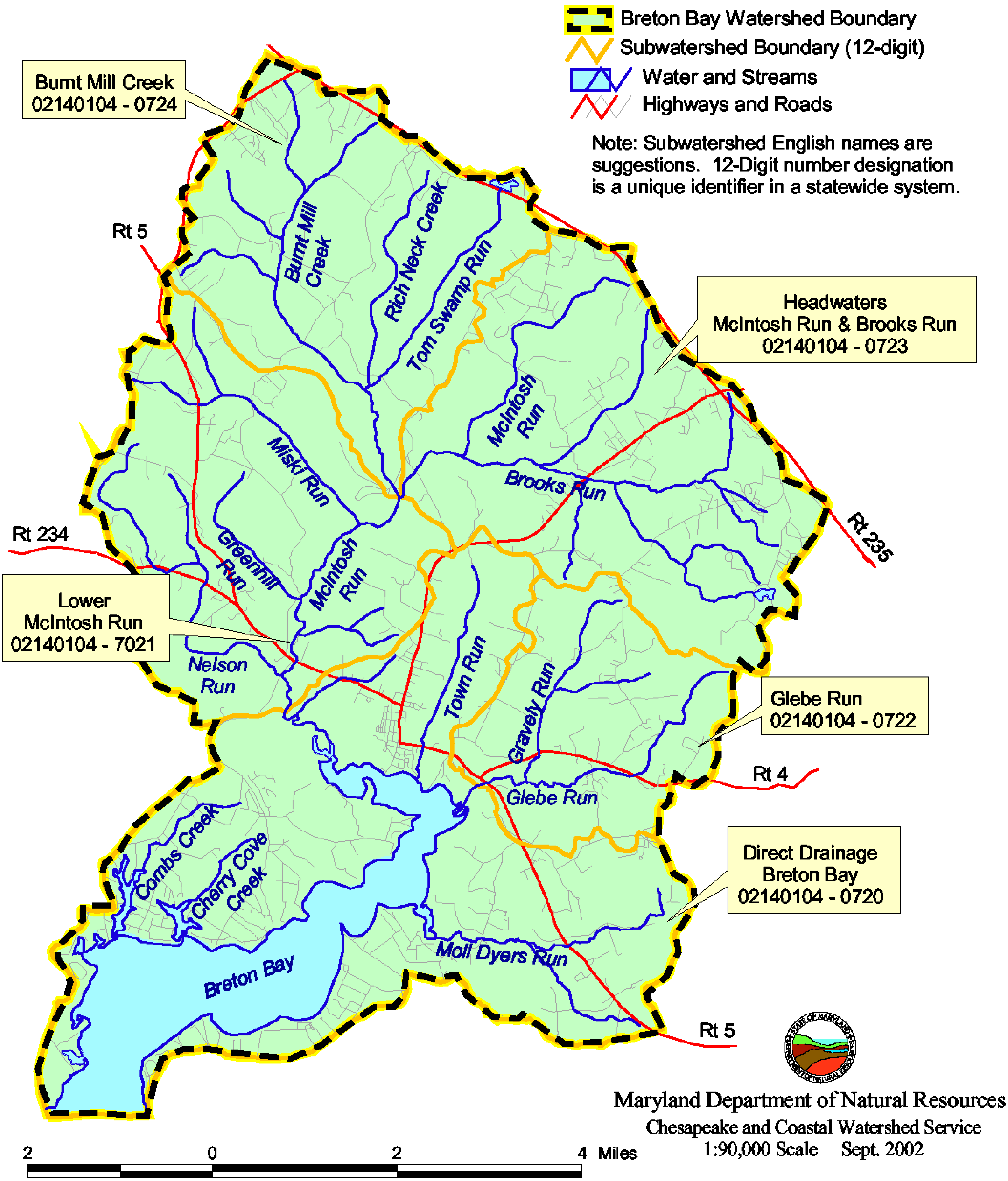
Synoptic survey	A short term sampling of water quality and analysis of those samples to measure selected water quality parameters. A synoptic survey as performed by DNR in support of watershed planning may be expanded to include additional types of assessment like benthic macroinvertebrate sampling or physical habitat assessment.
TMDL	Total Maximum Daily Load, a determination by MDE of the upper limit of one or more pollutants that can be added to a particular body of water beyond which water quality would be deemed impaired.
Tributary Teams	Geographically-focused groups, appointed by the Governor, oriented to each of the 10 major Chesapeake Bay tributary basins found in Maryland. The teams focus on policy, legislation, hands-on implementation of projects, and public education. Each basin has a plan, or Tributary Strategy.
USFWS	United States Fish and Wildlife Service, an agency of the Department of Interior.
USGS	United States Geological Survey
Water Quality Standard	Surface water quality standards consist of two parts: (a) designated uses of each water body; and (b) water quality criteria necessary to support the designated uses. Designated uses of for all surface waters in Maryland (like shell fish harvesting or public water supply) are defined in regulation. Water quality criteria may be qualitative (like “no objectionable odors”) or quantitative (toxic limitations or dissolved oxygen requirements).
Watershed	All the land that drains to an identified body of water or point on a stream.
WRAS	Watershed Restoration Action Strategy, a document outlining the condition of a designated watershed, identifying problems and commiting to solutions of prioritized problems.
WSSC	Wetland of Special State Concern, a designation by MDE in COMAR.

Map 1 Regional Context
Breton Bay Watershed In St. Mary's County
Watershed Restoration Action Strategy (WRAS) Area

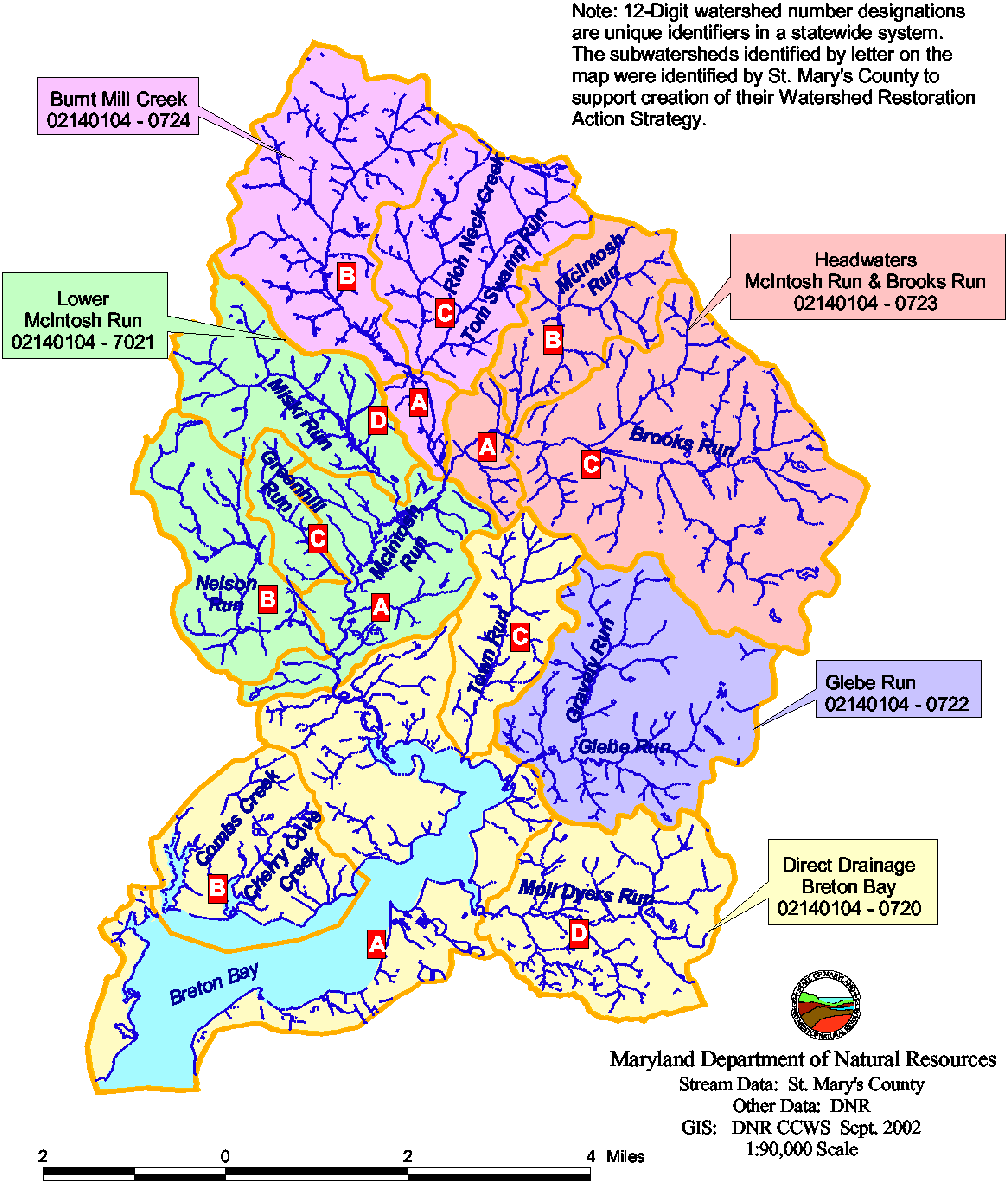



Map 2 WRAS Project Area
Breton Bay Watershed
St. Mary's County, Maryland
Patuxent River
Rt 235
Rt 5
Rt 234
Rt 4
Rt 5
Chesapeake Bay
St. Mary's County
Breton Bay
Leonardtown
Potomac River
Key
WRAS Project Area
St. Mary's County boundary
Water, streams and shoreline
Highways
N
Maryland Department of Natural Resources
Chesapeake and Coastal Watershed Service
Watershed Management and Analysis Division
1:300,000 Scale Sept. 2002
5 0 5 10 Miles

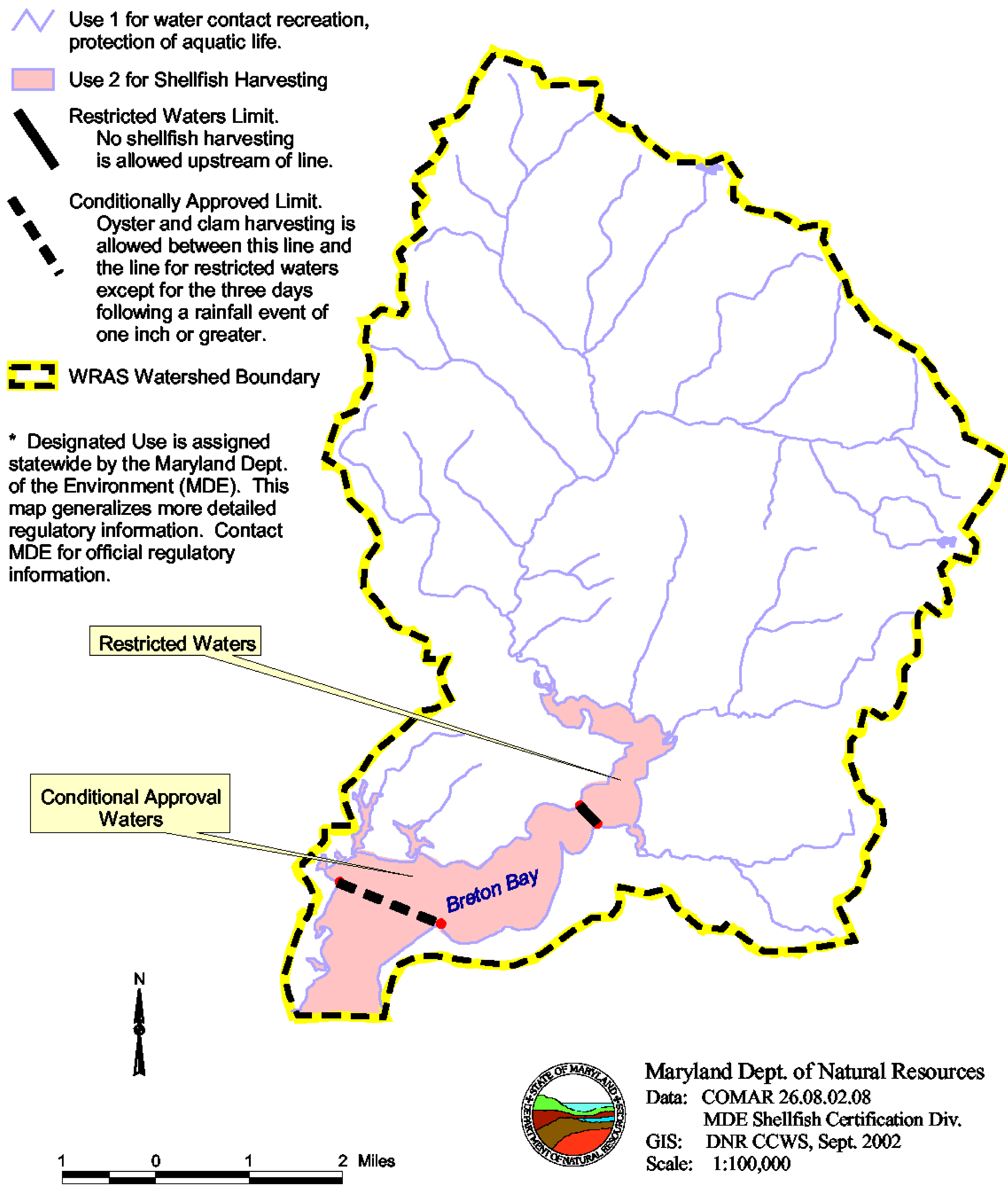
Map 3 Streams and DNR Subwatersheds
Breton Bay Watershed 02140104



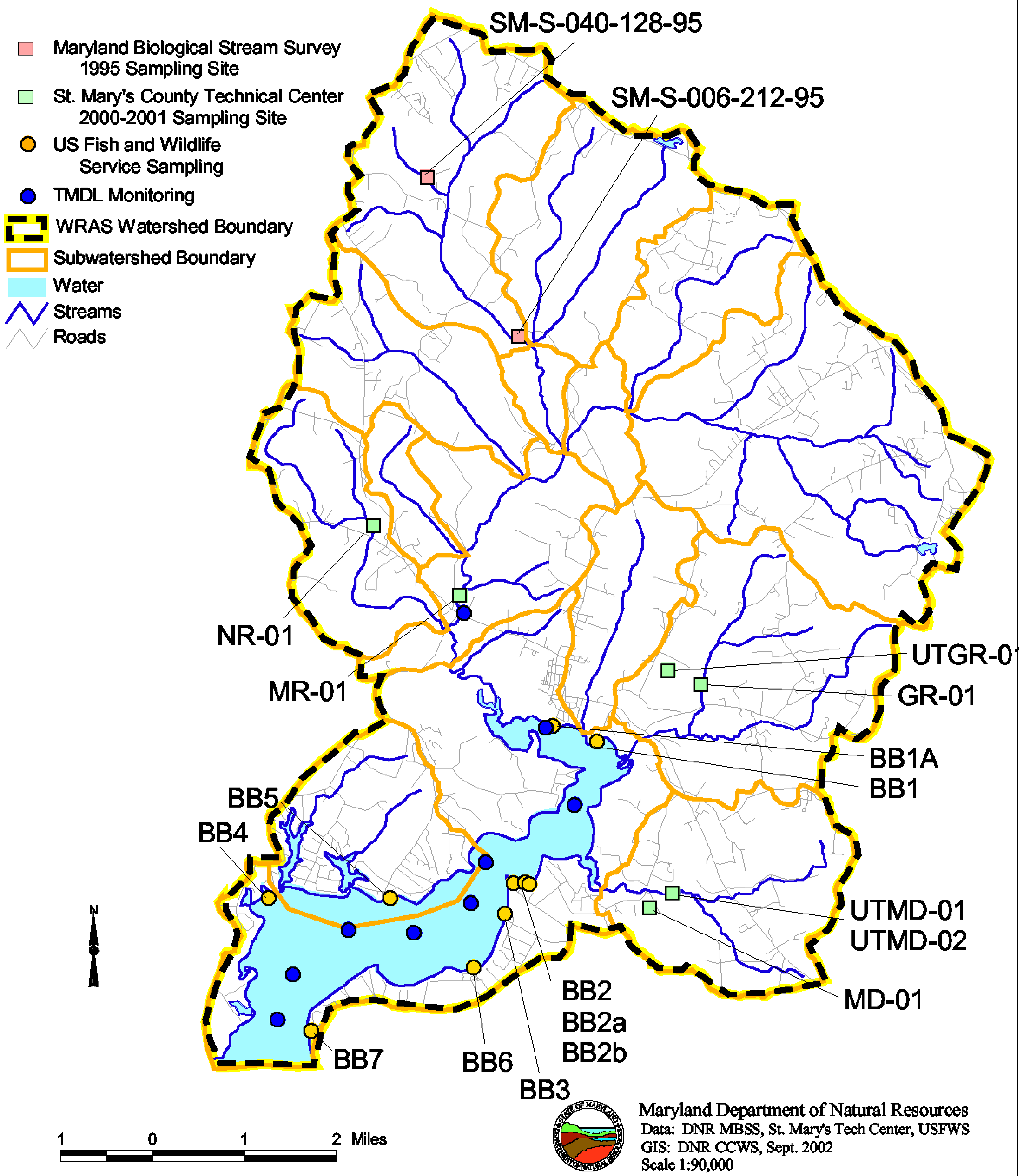
Map 4 County Subwatersheds
Breton Bay Watershed



Map 5 Designated Uses and Use Restrictions
Breton Bay Watershed

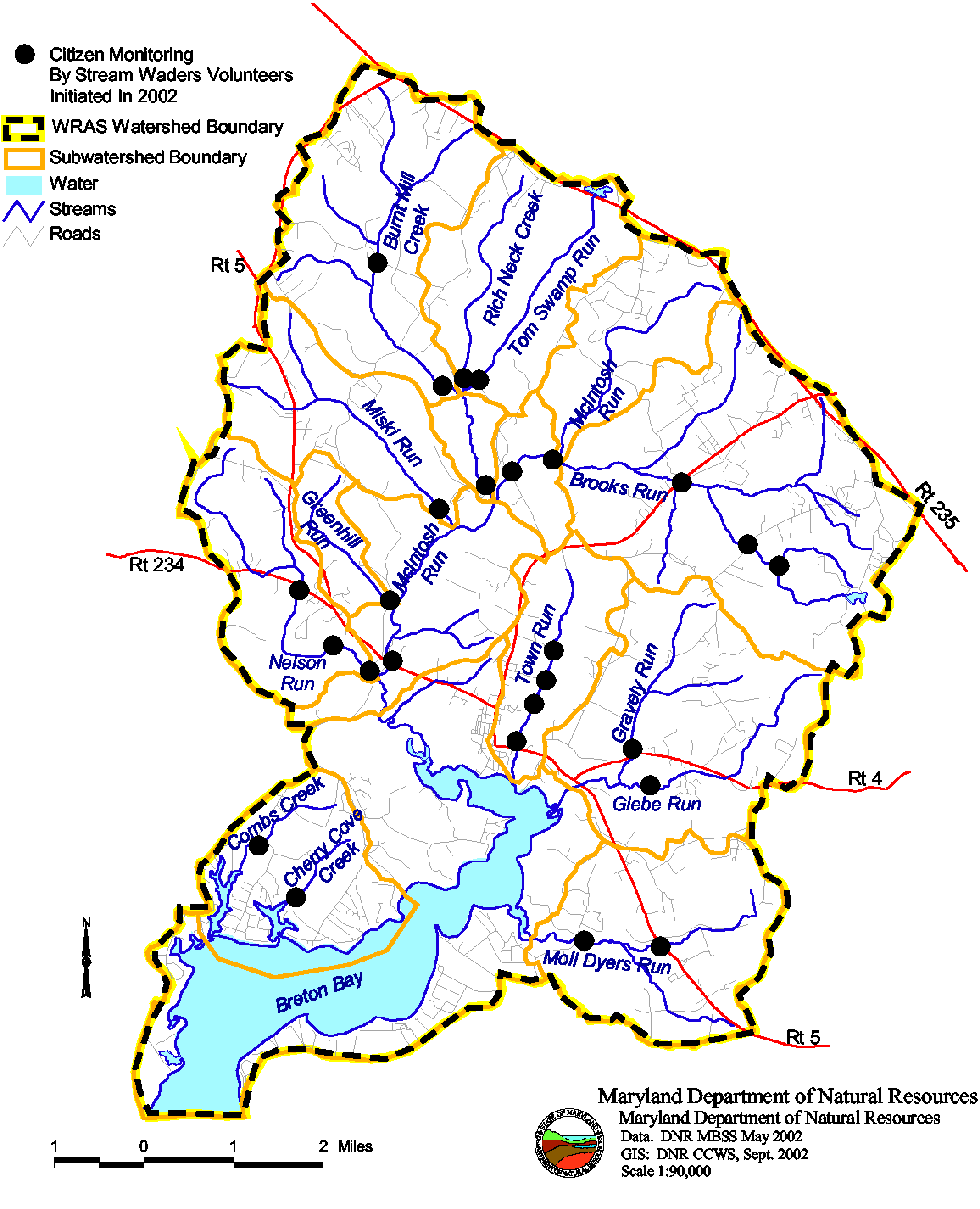


Map 6 Monitoring By Programs
Breton Bay Watershed

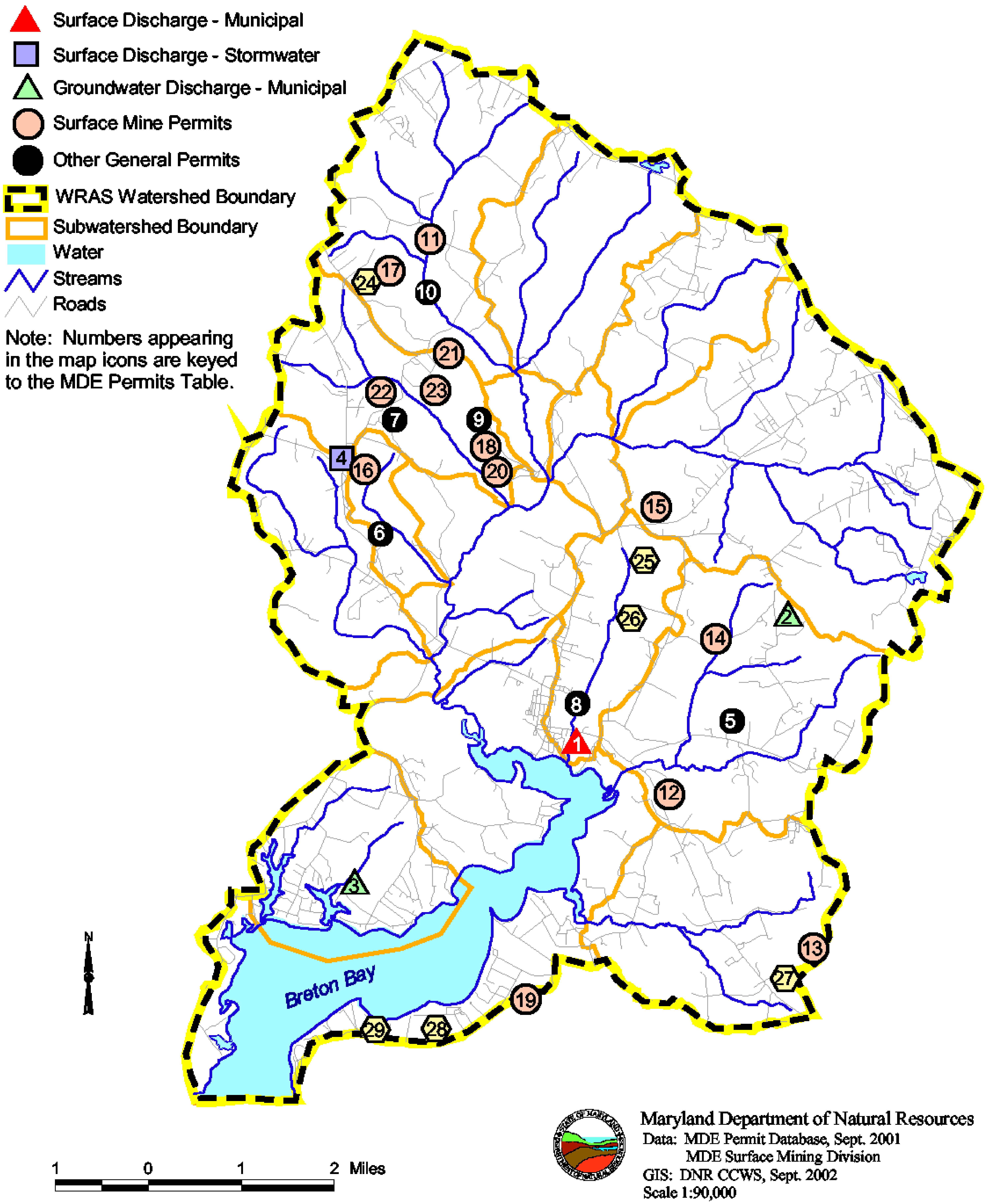


Maryland Department of Natural Resources
Data: DNR MBSS, St. Mary's Tech Center, USFWS
GIS: DNR CCWS, Sept. 2002
Scale 1:90,000

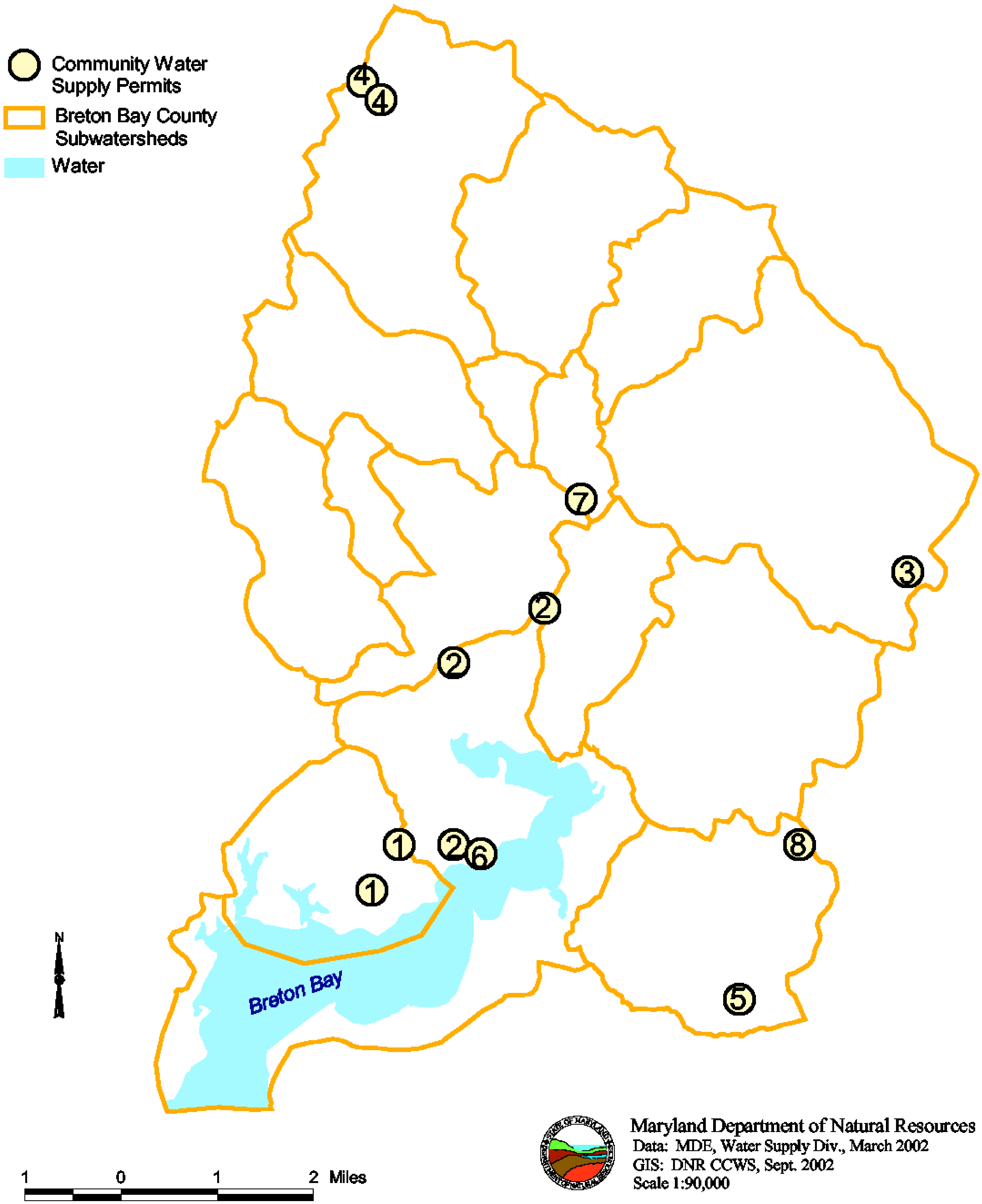
Map 7 Monitoring By Volunteers
Breton Bay Watershed



Map 8 MDE Permits
Breton Bay Watershed



Map 9 Water Supply
Breton Bay Watershed

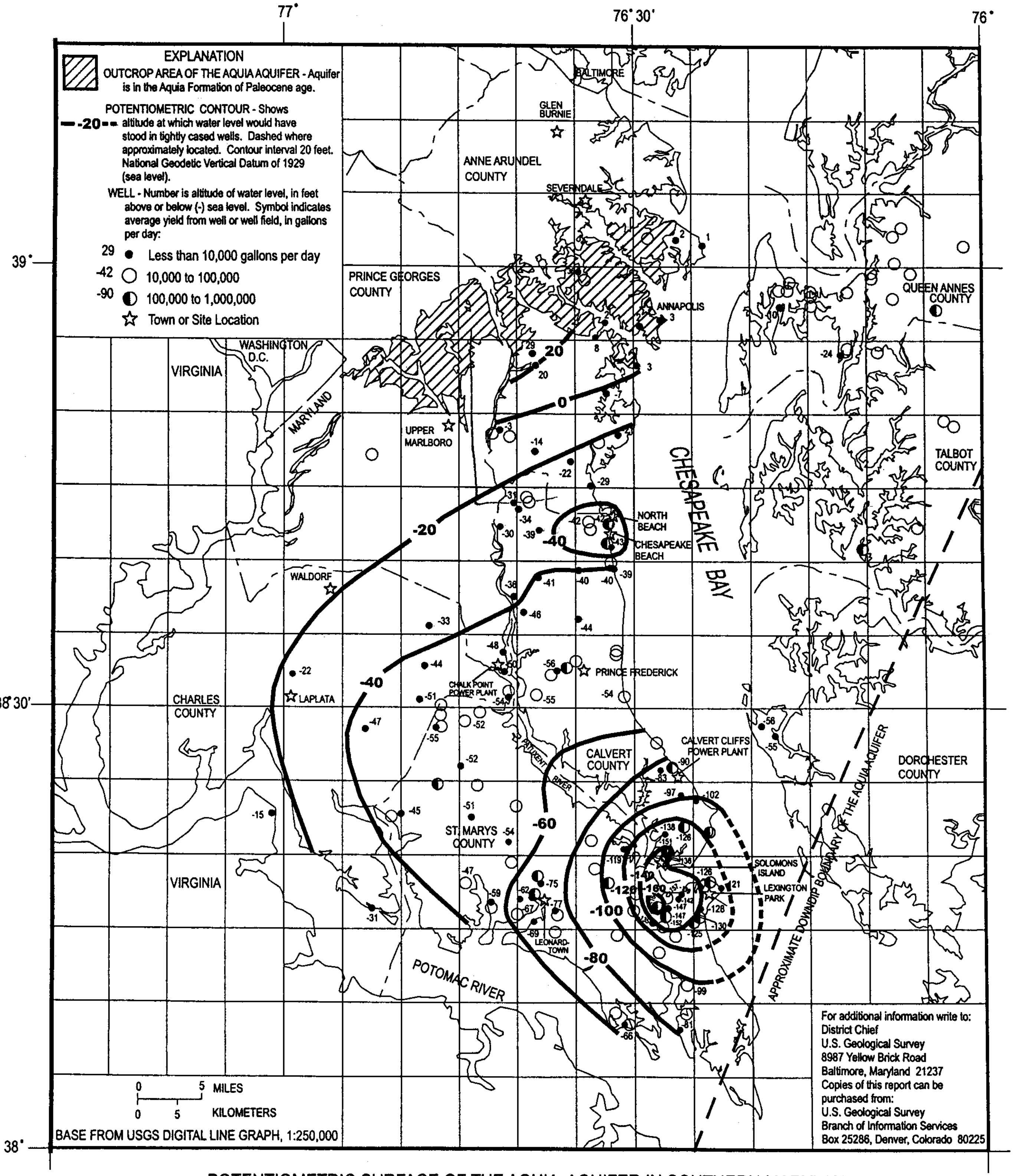


Map 10 Aquia Aquifer

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
MARYLAND GEOLOGICAL SURVEY
AND
POWER PLANT ASSESSMENT PROGRAM,
MARYLAND DEPARTMENT OF NATURAL RESOURCES

OPEN-FILE REPORT
01- 204

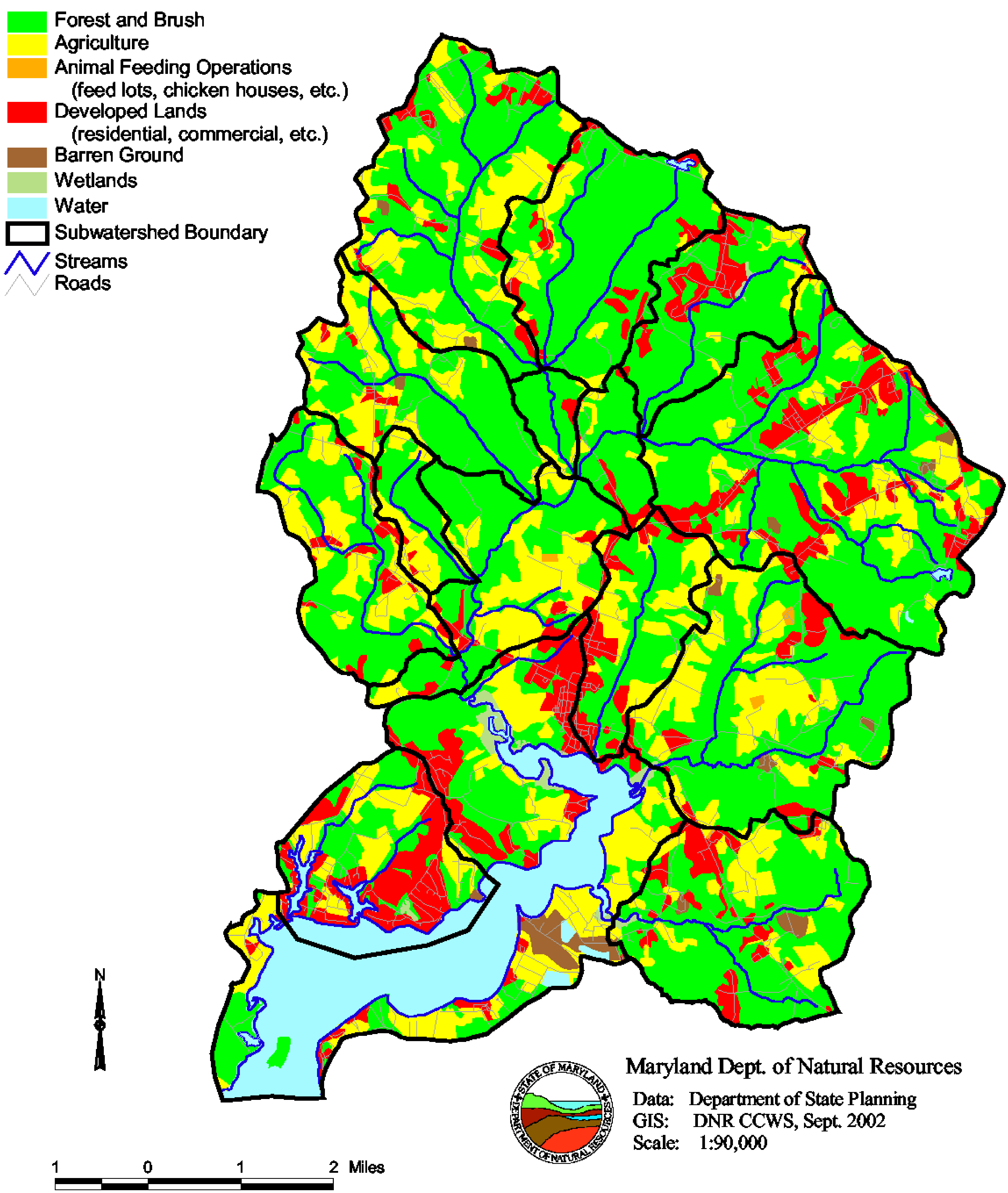


POTENTIOMETRIC SURFACE OF THE AQUIA AQUIFER IN SOUTHERN MARYLAND,

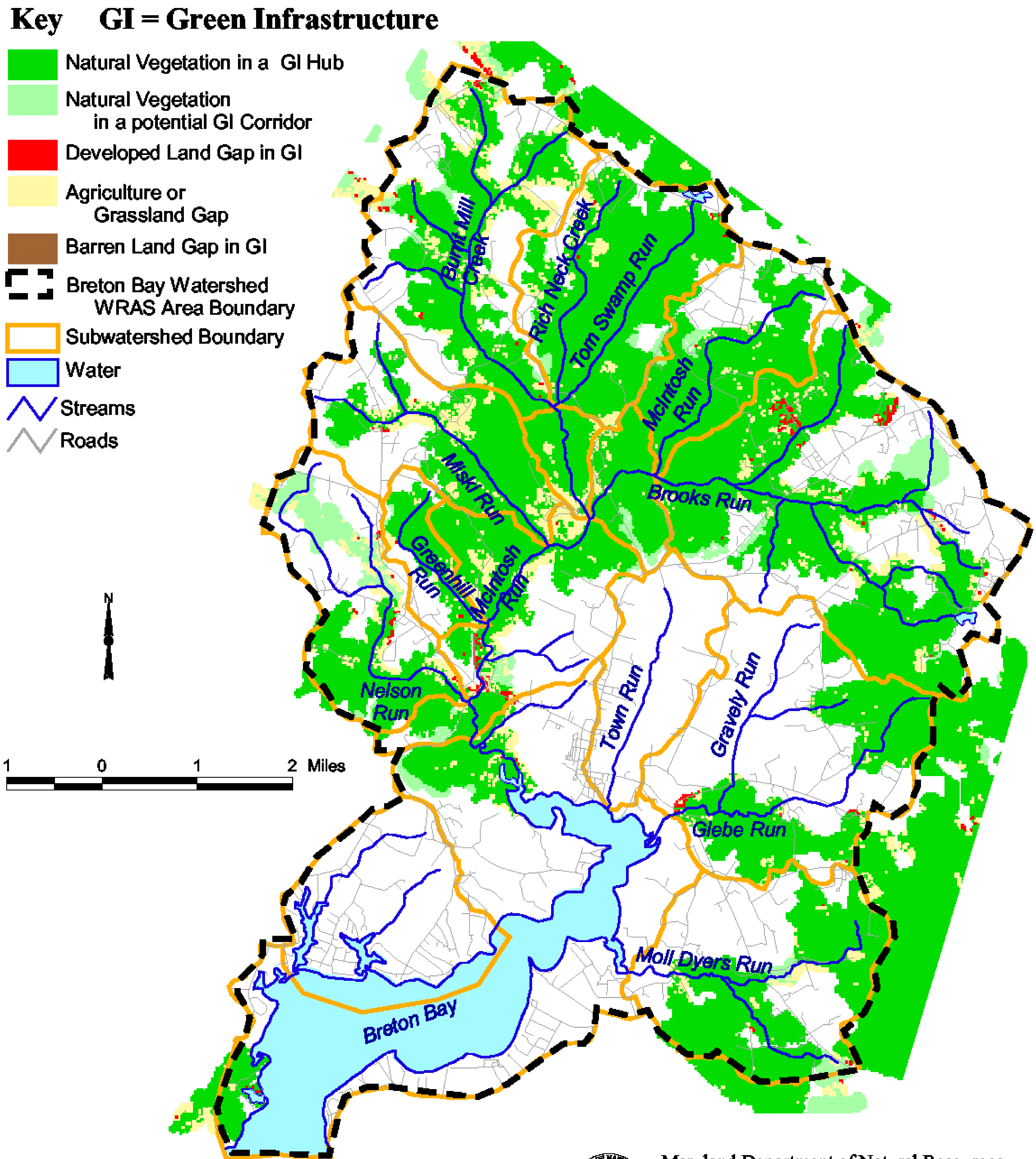
SEPTEMBER 1999

Stephen E. Curtin, David C. Andreasen, and Judith C. Wheeler

Map 11 Generalized 2000 Land Use
Breton Bay Watershed

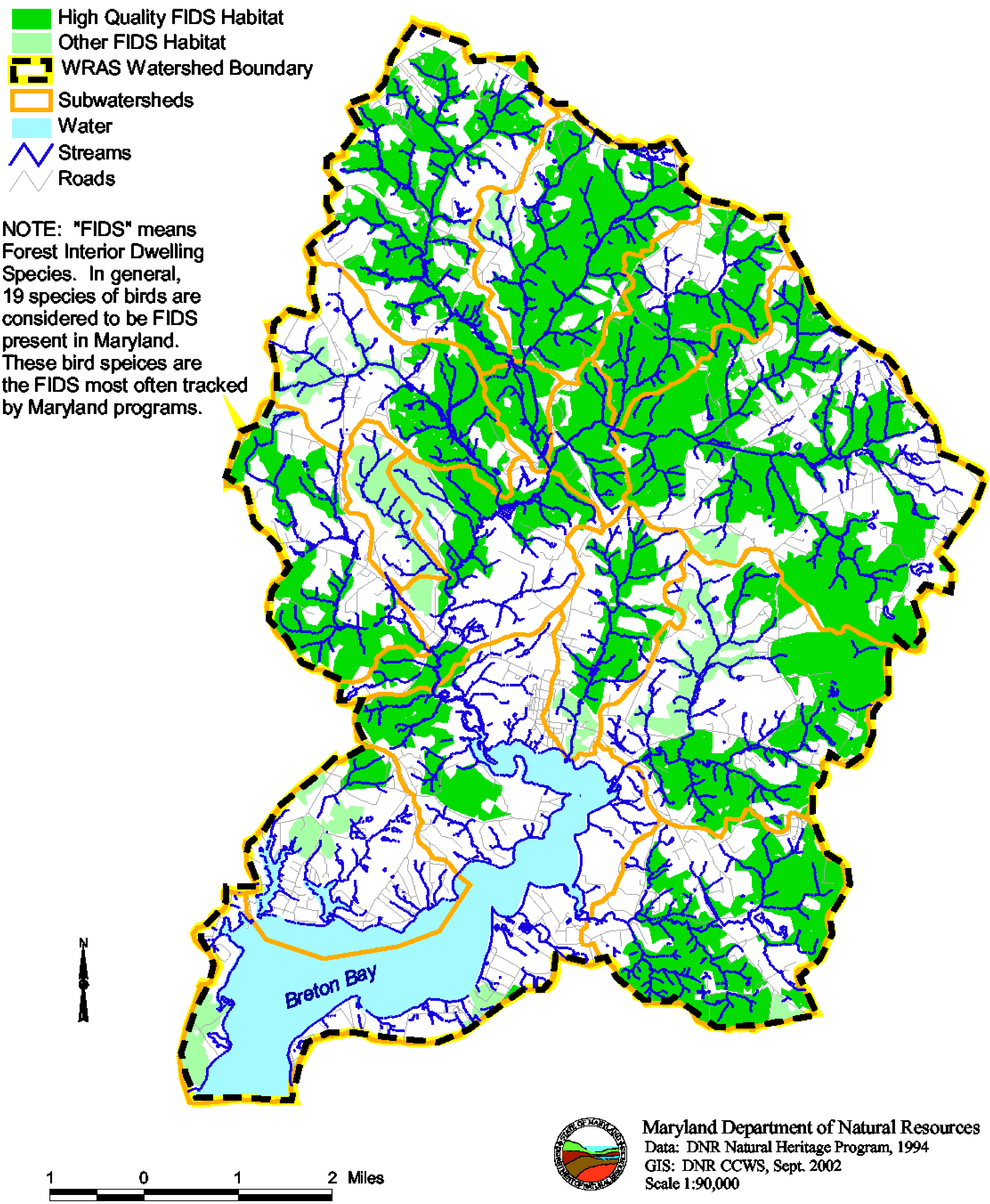


Map 12 Green Infrastructure
Breton Bay Watershed

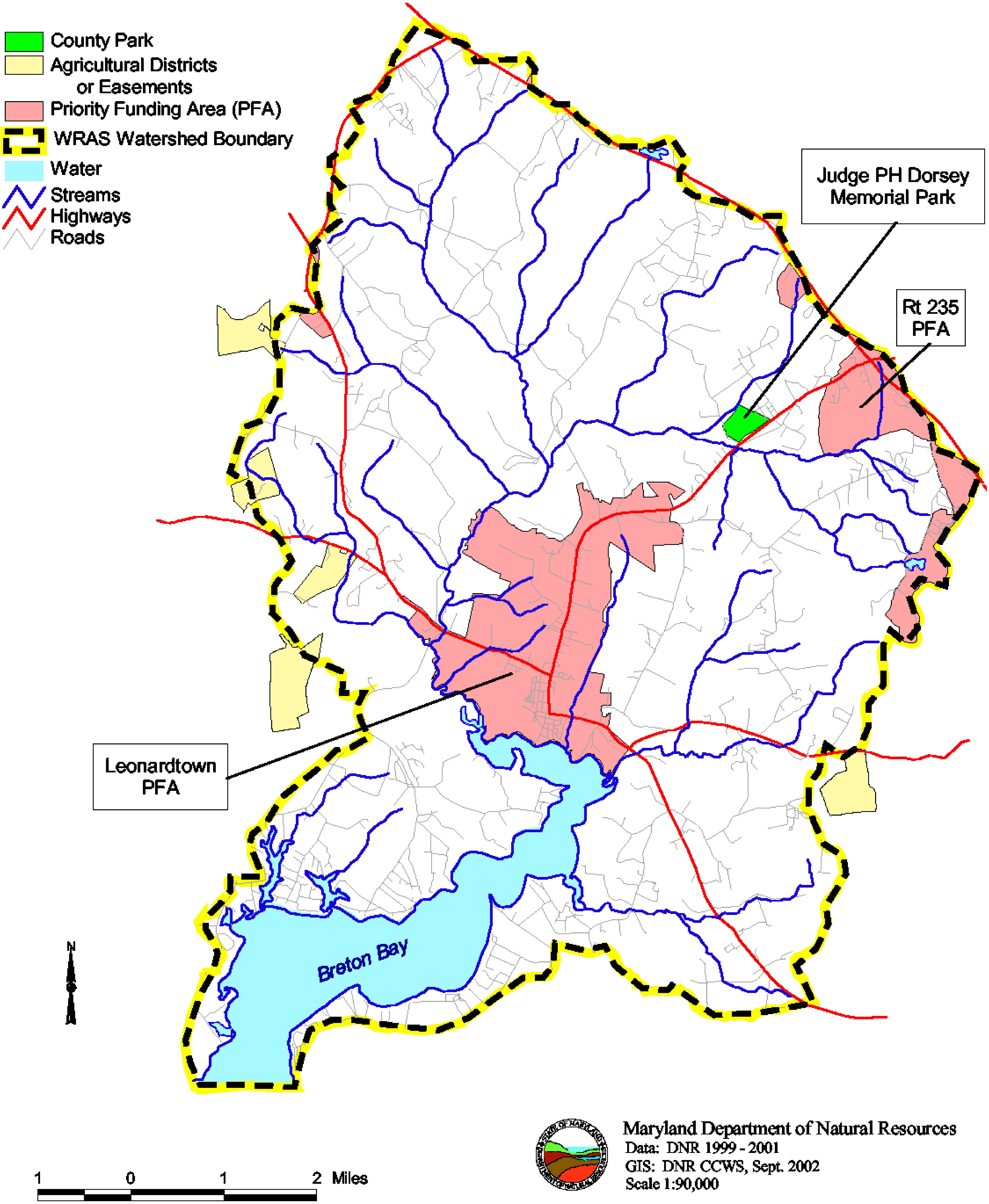


Maryland Department of Natural Resources
Data: DNR CCWS, 1999
GIS: DNR CCWS, Sept. 2002
Scale 1:90,000

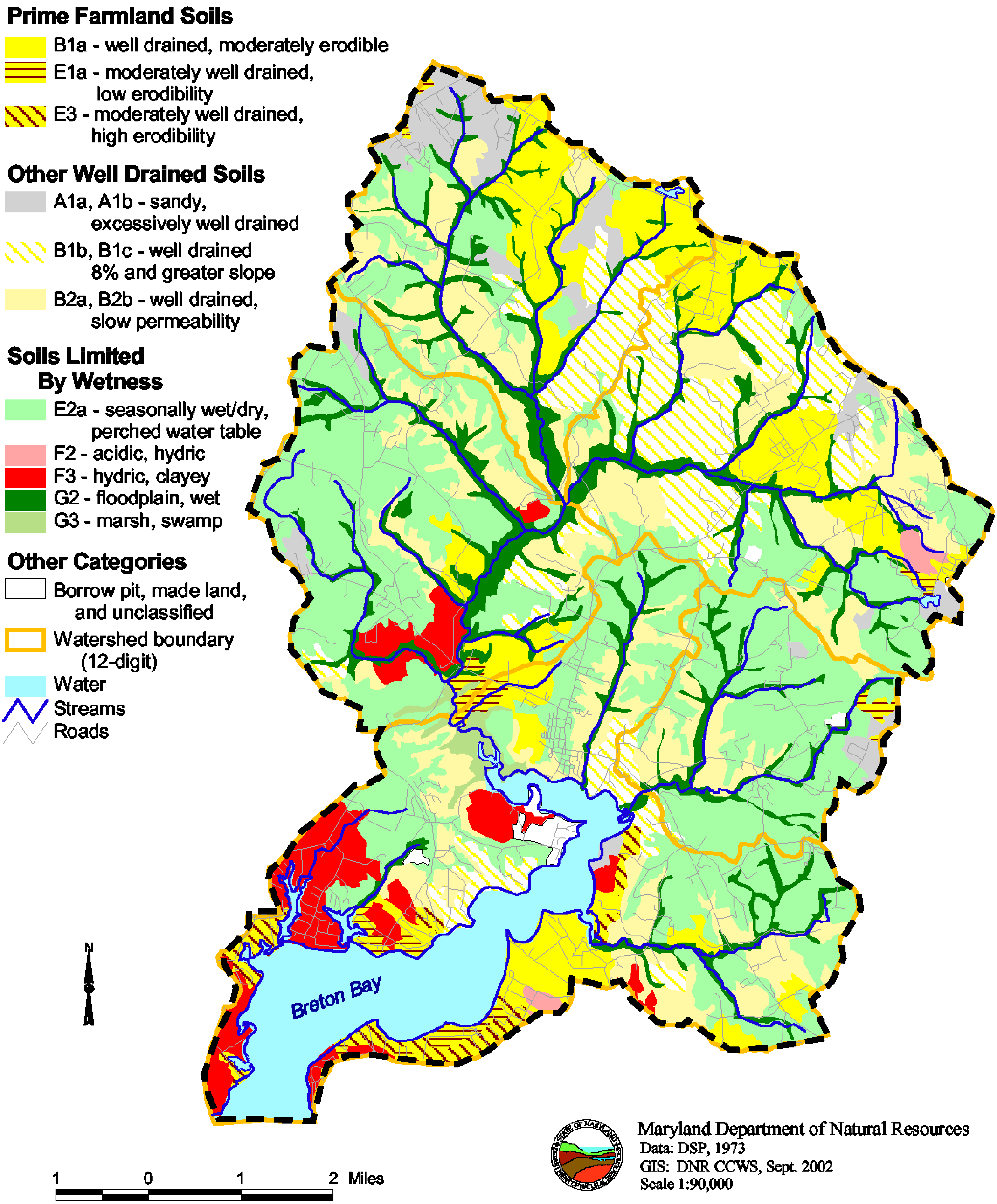
Map 13 Forest Interior
Breton Bay Watershed



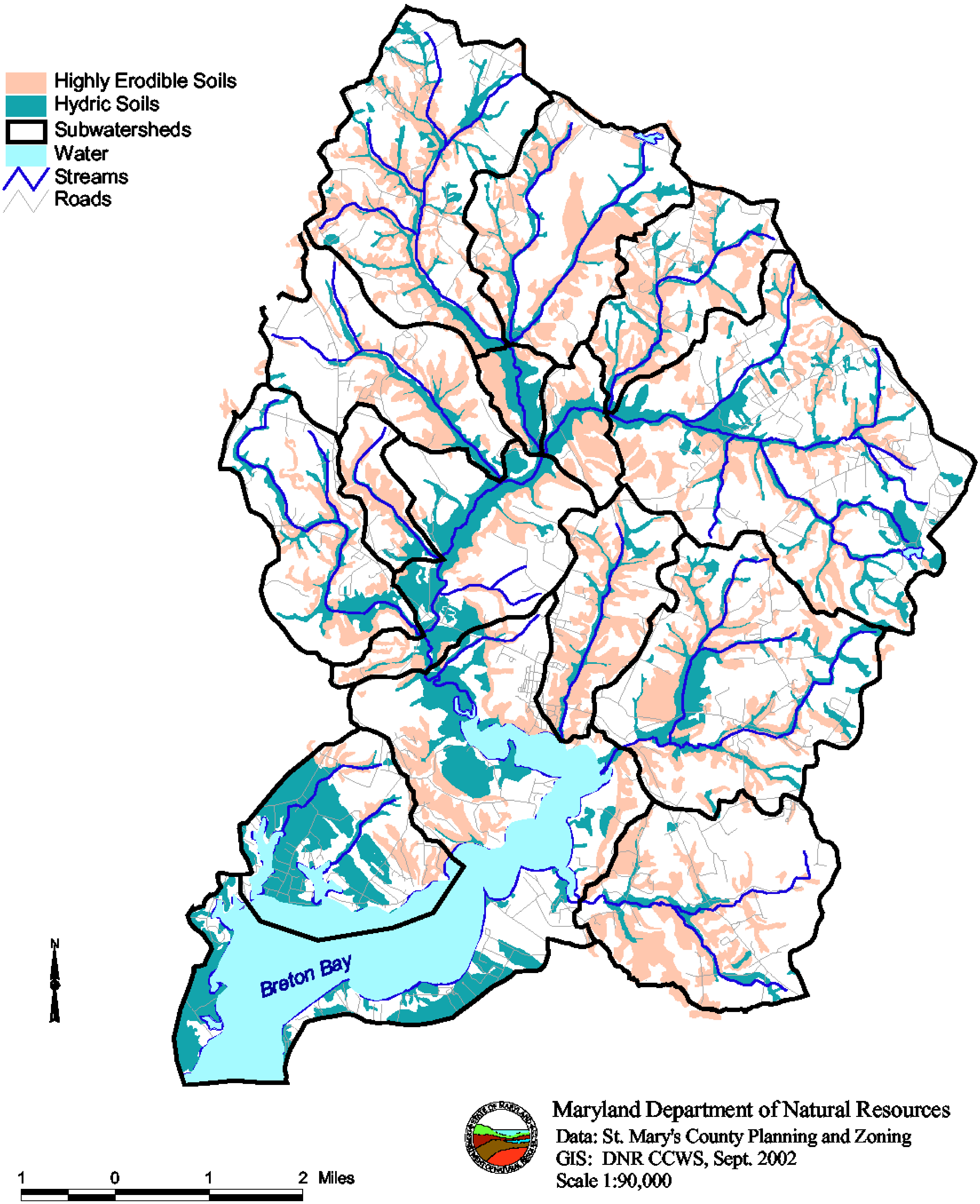
Map 14 Protected Lands and Smart Growth
Breton Bay Watershed



Map 15 Soils by Natural Soils Groups
Breton Bay Watershed

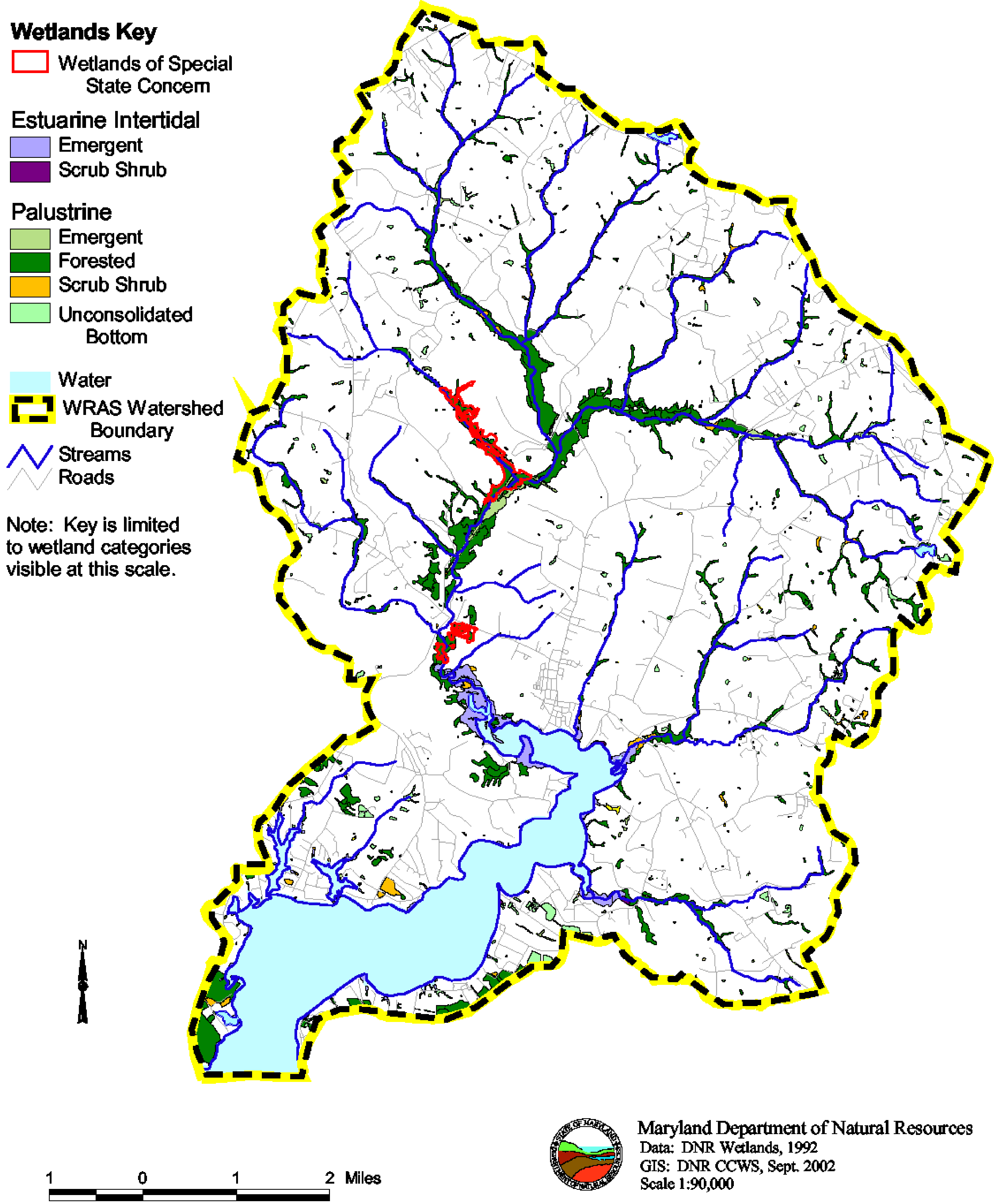


Map 16 Hydric Soils And Highly Erodible Soils
Breton Bay Watershed

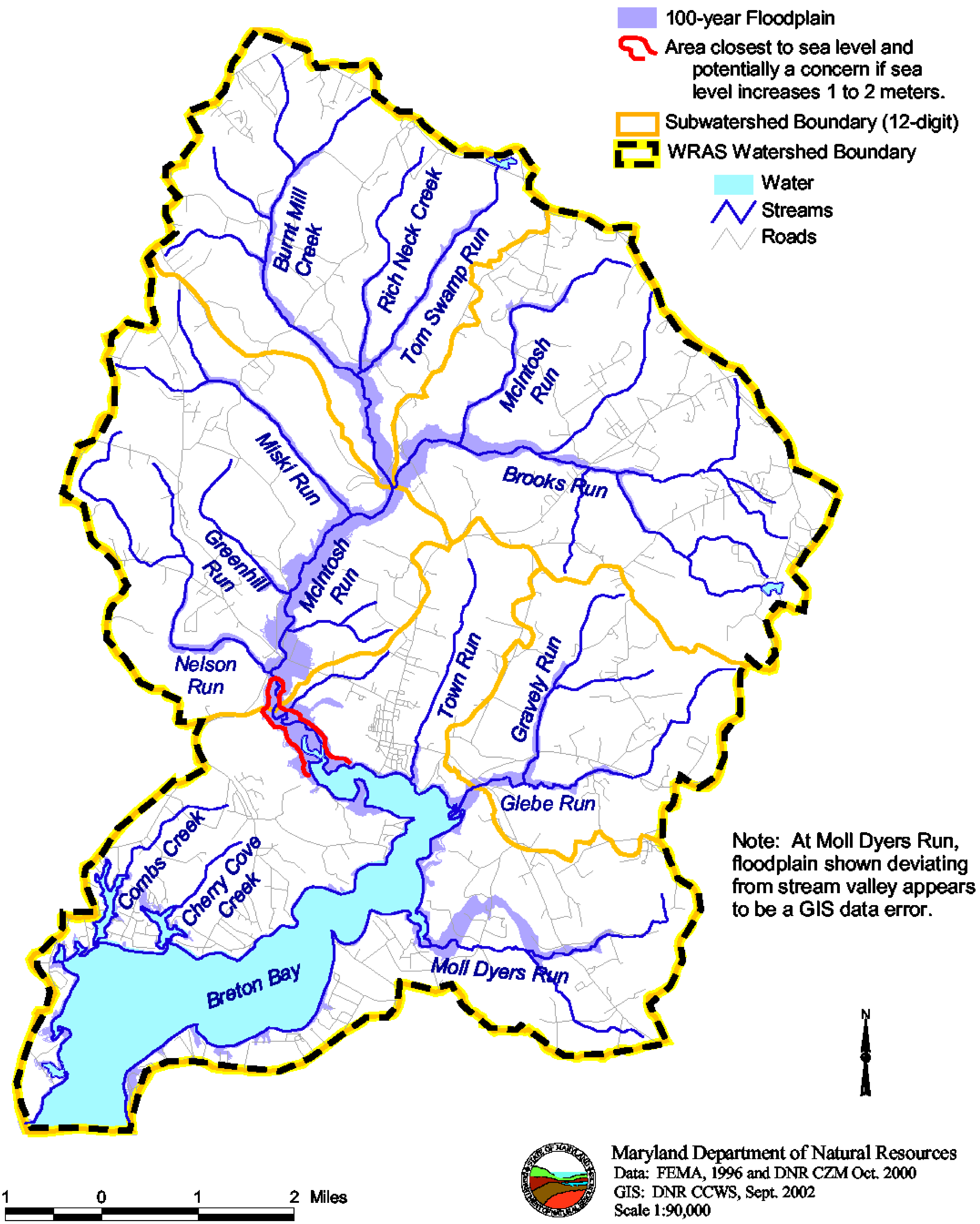


Maryland Department of Natural Resources
Data: St. Mary's County Planning and Zoning
GIS: DNR CCWS, Sept. 2002
Scale 1:90,000

Map 17 Wetlands
Breton Bay Watershed



Map 18 Floodplain and Sea Level Rise
Breton Bay Watershed



Note: At Moll Dyers Run, floodplain shown deviating from stream valley appears to be a GIS data error.

Maryland Department of Natural Resources
Data: FEMA, 1996 and DNR CZM Oct. 2000
GIS: DNR CCWS, Sept. 2002
Scale 1:90,000

Map 19 Oysters In Breton Bay

KEY: Current Conditions

Oyster Leases: areas leased for private control of oysters such as cultivation. Leases do not cover natural oyster bars.

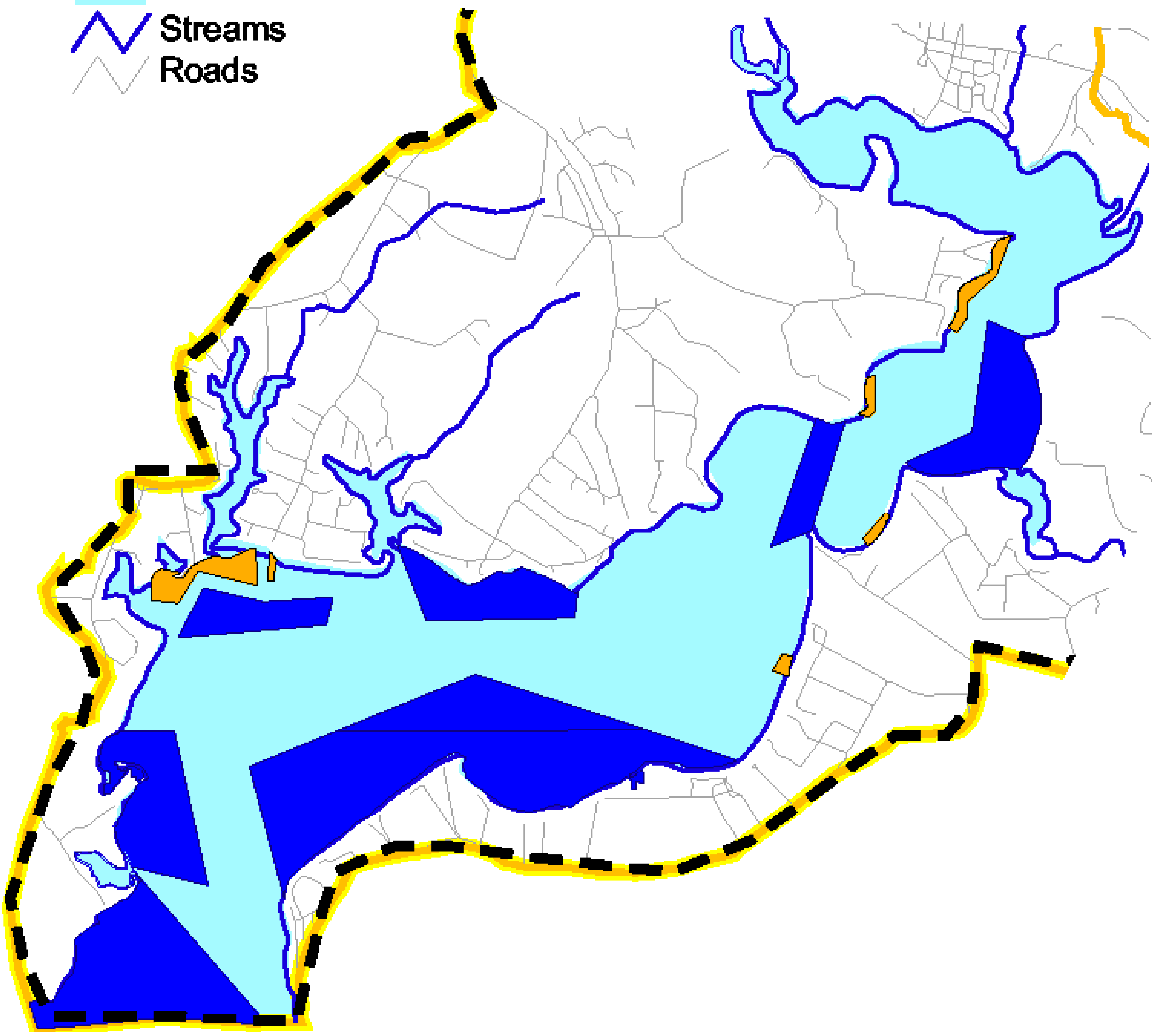
Oyster Bars: areas delineated to protect and manage oysters and their habitat including natural oyster bars. Maps were last updated in 1983. Oyster bar boundaries are always larger than any oyster habitat or population that they may contain.

WRAS Area Boundary

Water

Streams

Roads



KEY: Historic Conditions

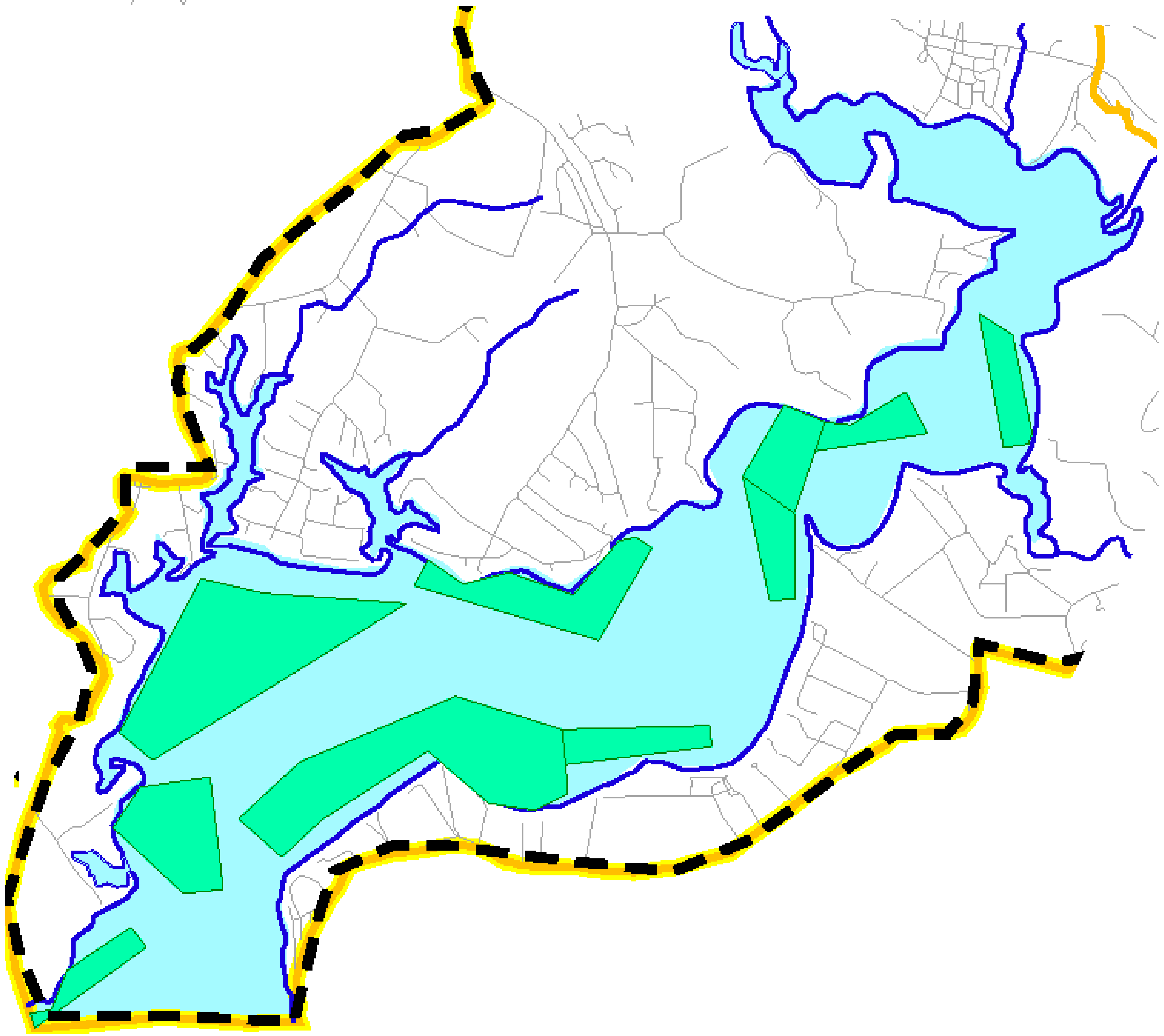
Oyster Bars (CC Yates Survey 1906 - 1912)
These bars show the extent of oyster habitat/populations identified by physically probing the bottom either visually or with poles, chains or other implements.

WRAS Area Boundary

Water

Streams

Roads

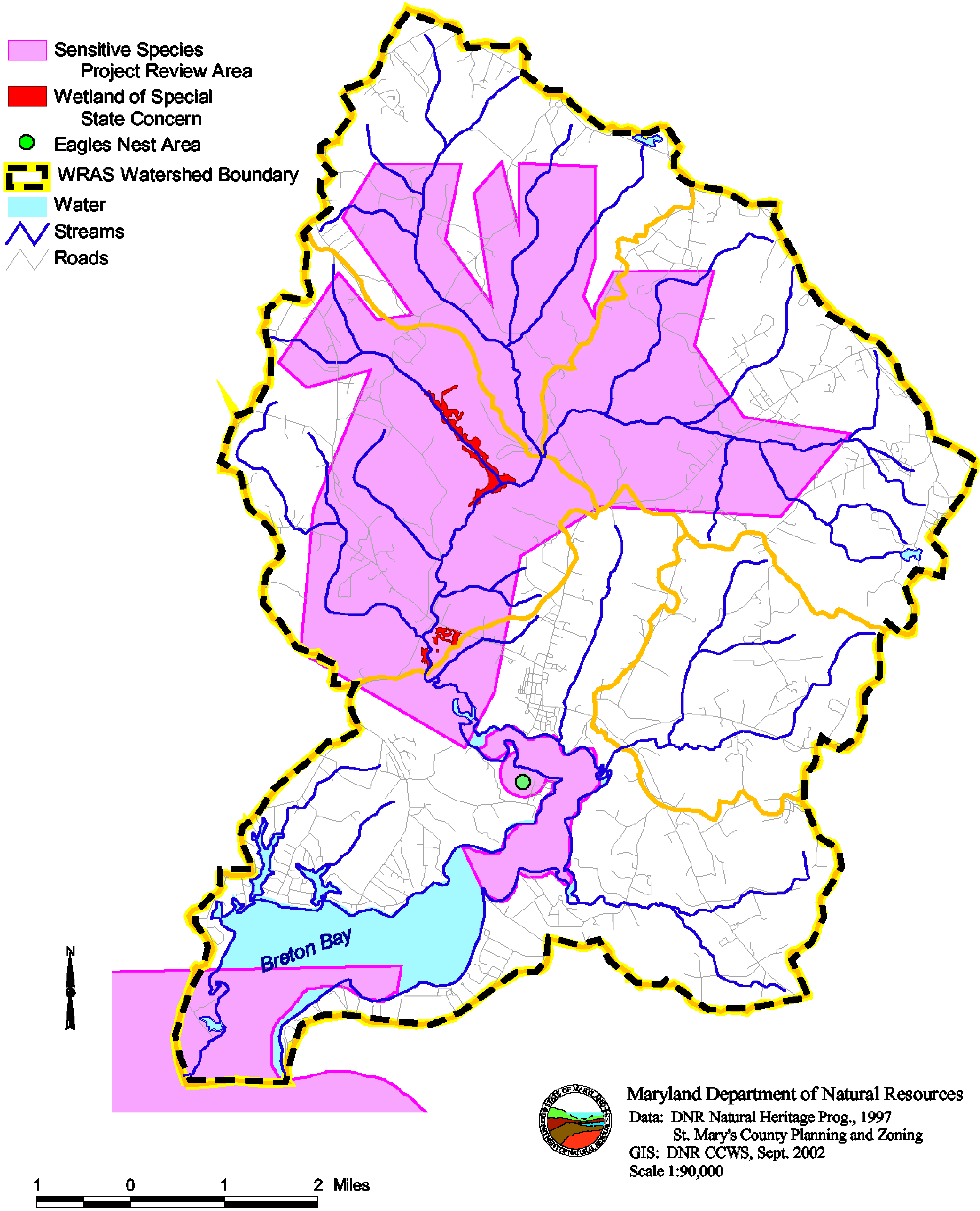


1 0 1 2 Miles

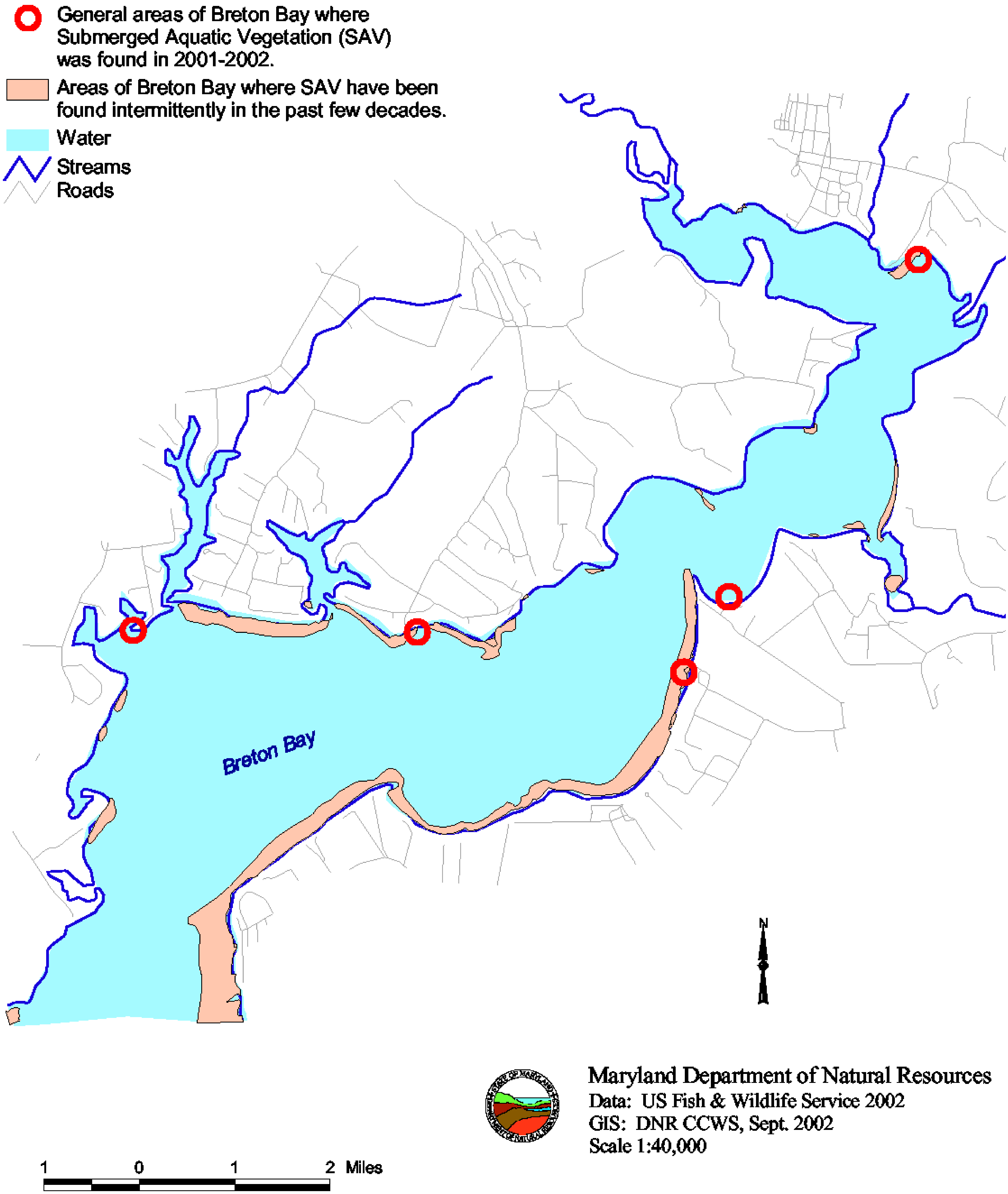
N

Maryland Dept. of Natural Resources
Data: DNR Fisheries Service, 1993-2000
GIS: DNR CCWS, Sept. 2002
Scale 1:60,000

Map 20 Sensitive Species
Breton Bay Watershed

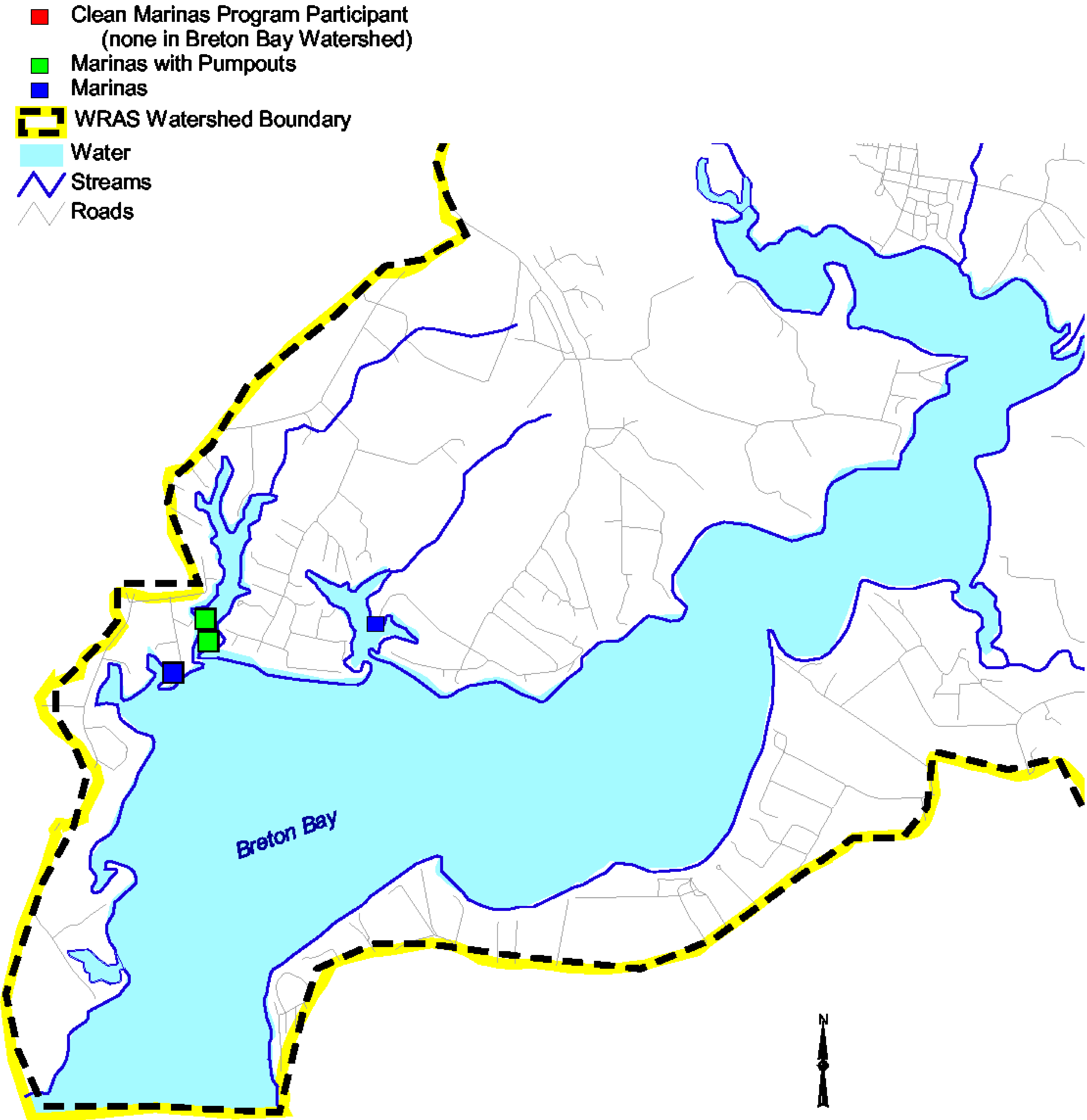


Map 21 Submerged Aquatic Vegetation
Breton Bay Watershed



Maryland Department of Natural Resources
Data: US Fish & Wildlife Service 2002
GIS: DNR CCWS, Sept. 2002
Scale 1:40,000

Map 22 Clean Marinas
Breton Bay Watershed



1 0 1 2 Miles

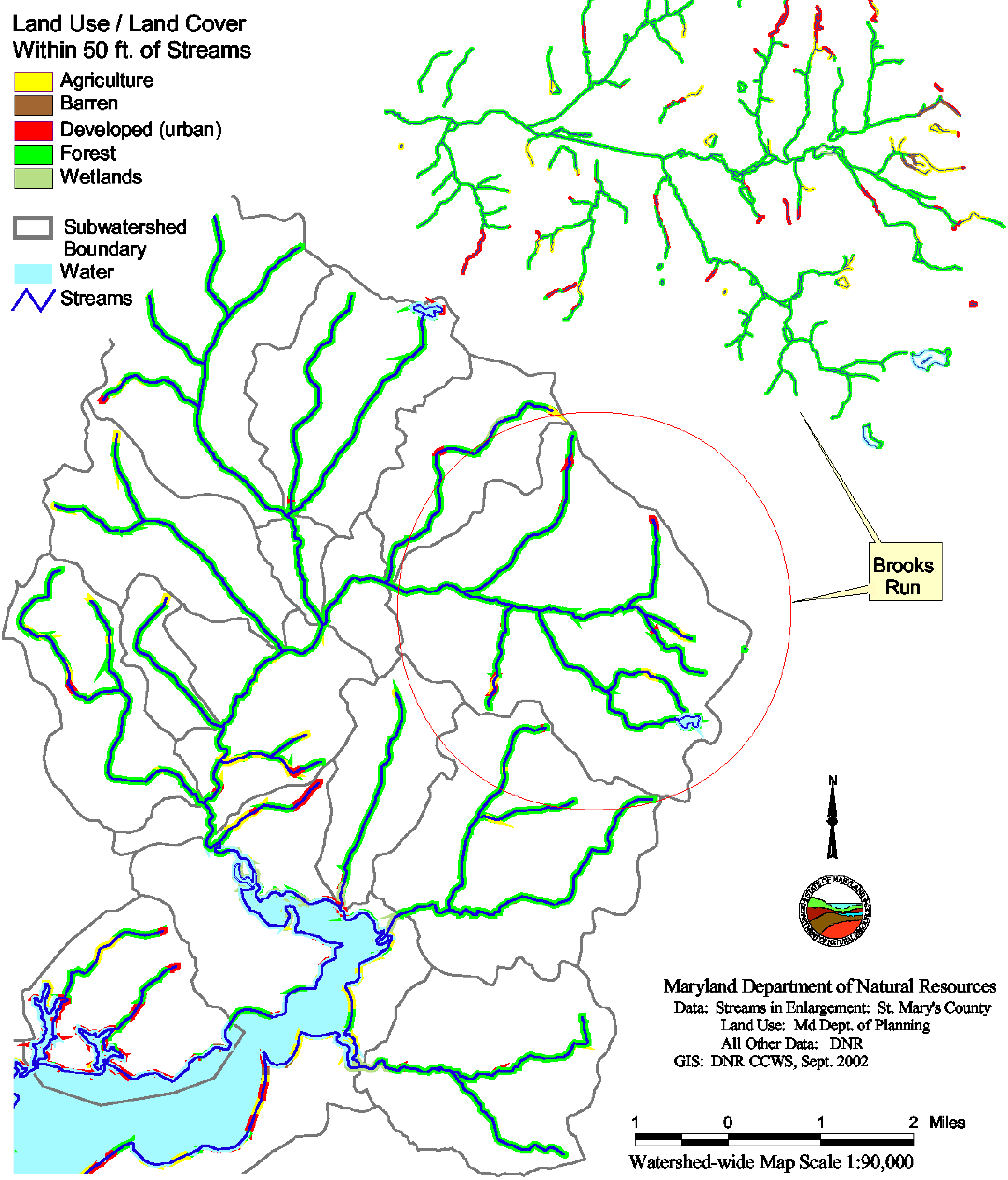
Maryland Department of Natural Resources

Data: DNR Clean Marinas Prog., 2000
Local Citizen Input, May 2002

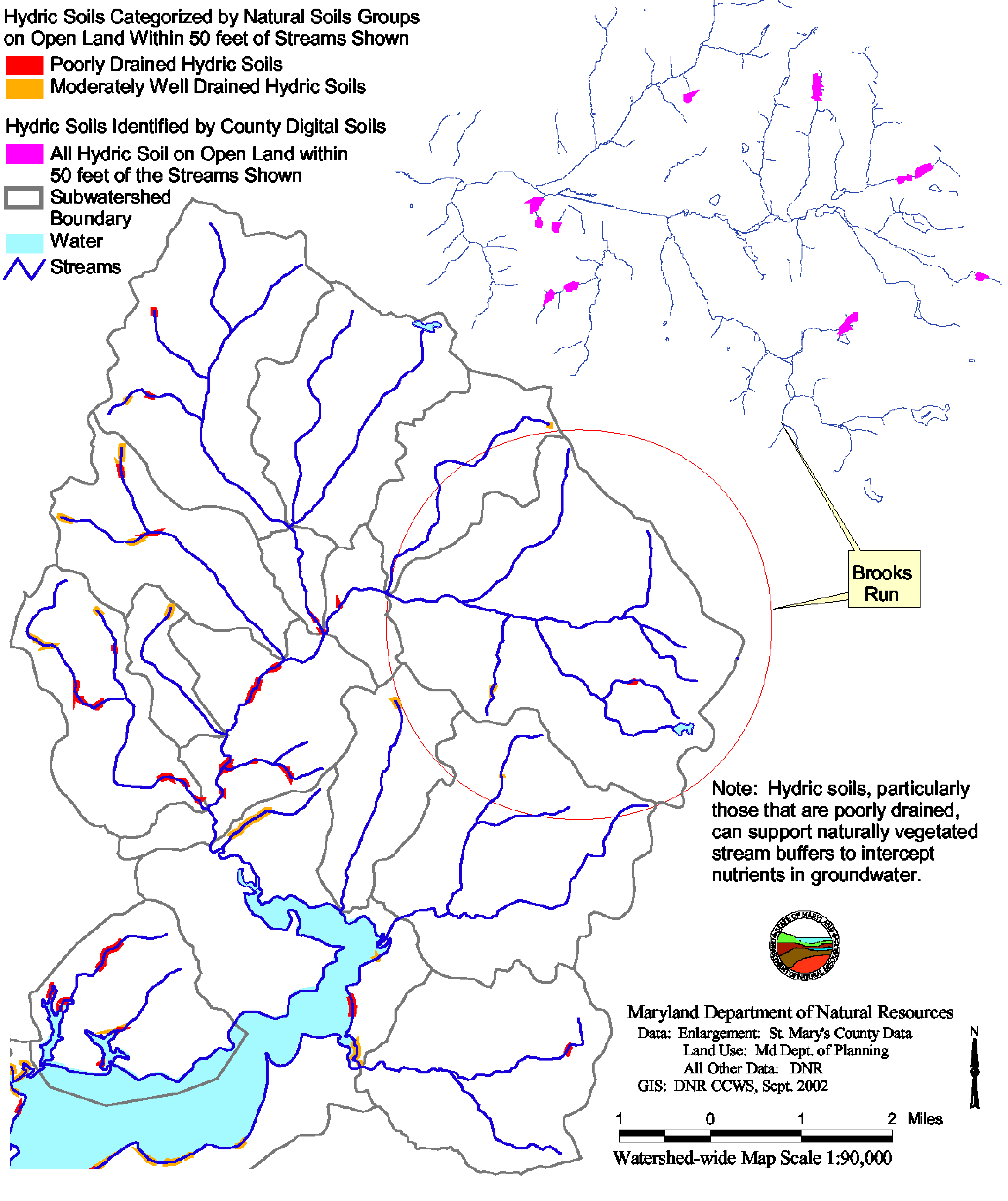
GIS: DNR CCWS, Sept. 2002

Scale 1:40,000

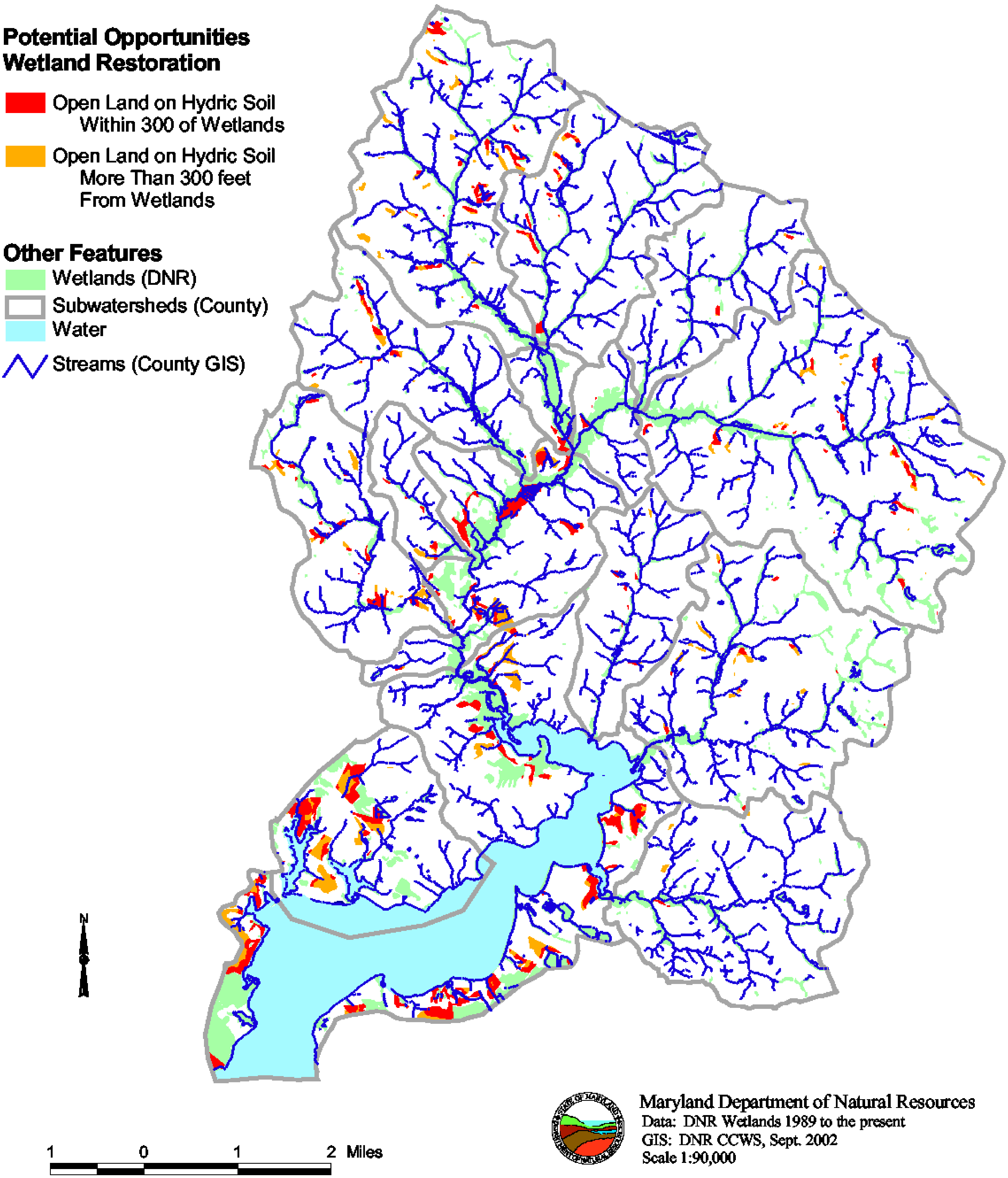
Map 23 Stream Buffer Land Use Scenario Breton Bay Watershed



Map 24 Stream Buffer
Hydric Soil On Open Land Scenario
Breton Bay Watershed

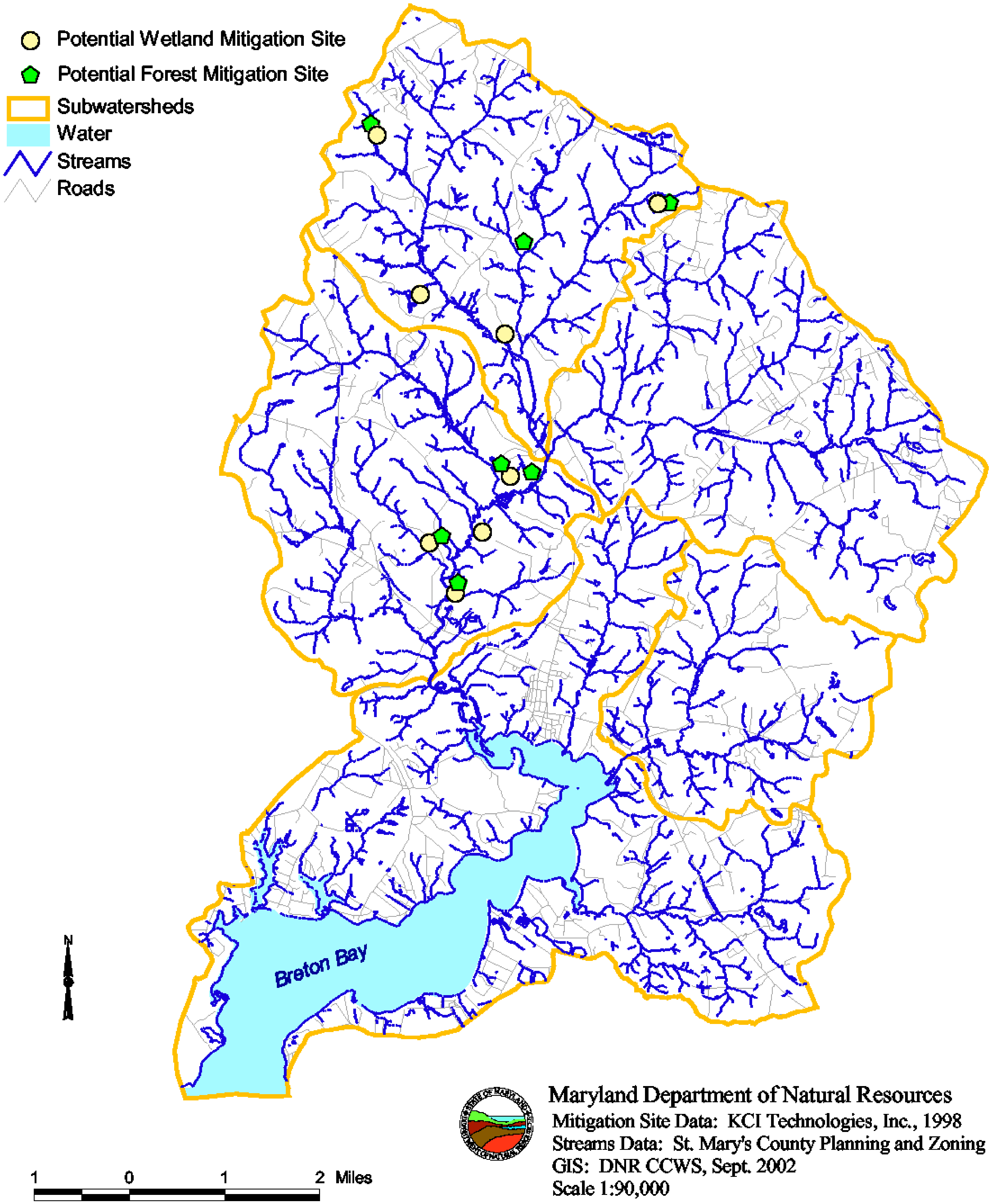


Map 25 Wetland Restoration Scenario
Breton Bay Watershed



Maryland Department of Natural Resources
Data: DNR Wetlands 1989 to the present
GIS: DNR CCWS, Sept. 2002
Scale 1:90,000

Map 26 Potential Mitigation Sites
Breton Bay Watershed



Appendix A McIntosh Matrix Forest Block Report

Appendix B
Breeding Bird Survey for Tall Timbers 1966-2000

Information supplied by Peter Bergstrom and Daniel Murphy
US Fish & Wildlife Service, Chesapeake Bay Field Office
http://www.mbr-pwrc.usgs.gov/cgi-bin/rtena.pl?46027

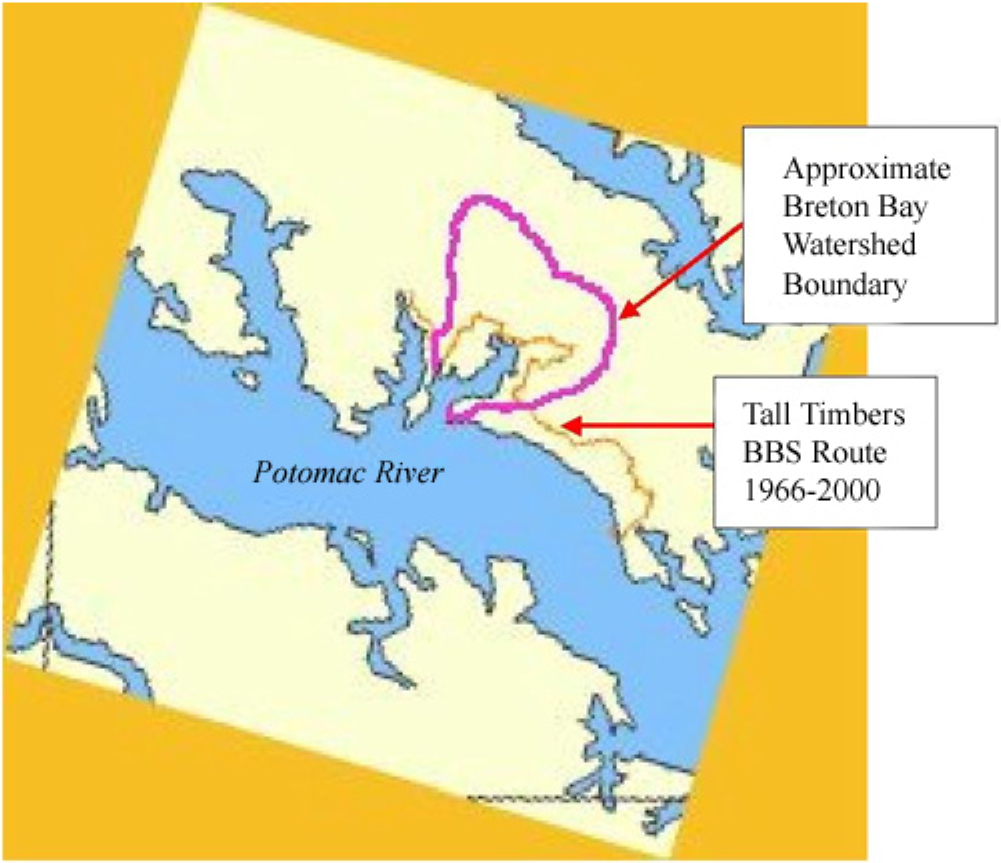
1) The maps (last page) shows that the Tall Timbers Breeding Bird Survey route covers south central St. Mary's County including portions of the Breton Bay watershed.
2) Forest interior dwelling bird species: highlighted in green and common named are underlined.

Common Name	Scientific name	Birds/route
Great Blue Heron	*Ardea herodias*	2.89
Cattle Egret	*Bubulcus ibis*	0.67
Green Heron	*Butorides virescens*	0.11
Turkey Vulture	*Cathartes aura*	2.11
Canada Goose	*Branta canadensis*	0.44
Wood Duck	*Aix sponsa*	0.11
American Black Duck	*Anas rubripes*	0.22
Mallard	*Anas platyrhynchos*	0.67
Osprey	*Pandion haliaetus*	1.33
Cooper's Hawk	*Accipiter cooperii*	0.22
Red-shouldered Hawk	*Buteo lineatus*	0.89
Red-tailed Hawk	*Buteo jamaicensis*	0.33
American Kestrel	*Falco sparverius*	0.11
Ring-necked Pheasant	*Phasianus colchicus*	0.22
Wild Turkey	*Meleagris gallopavo*	0.22
Northern Bobwhite	*Colinus virginianus*	6.56
Killdeer	*Charadrius vociferus*	1.56
Laughing Gull	*Larus atricilla*	1.78
Royal Tern	*Sterna maxima*	0.11
Rock Dove	*Columba livia*	2.33
Mourning Dove	*Zenaida macroura*	28.67
Yellow-billed Cuckoo	*Coccyzus americanus*	5.22
Great Horned Owl	*Bubo virginianus*	0.33
Chuck-will's-widow	*Caprimulgus carolinensis*	0.67
Chimney Swift	*Chaetura pelagica*	4.89
Ruby-thr. Hummingbird	*Archilochus colubris*	0.44
Belted Kingfisher	*Ceryle alcyon*	0.11
Red-bellied Woodpecker	*Melanerpes carolinus*	11.67
Downy Woodpecker	*Picoides pubescens*	1.00

Common Name	**Scientific name**	**Birds/route**
Hairy Woodpecker	*Picoides villosus*	1.00
Yellow-shafted Flicker	*Colaptes auratus*	2.89
Pileated Woodpecker	*Dryocopus pileatus*	1.00
Eastern Wood-Pewee	*Contopus virens*	10.33
Acadian Flycatcher	*Empidonax virescens*	8.22
Eastern Phoebe	*Sayornis phoebe*	2.22
Grt. Crested Flycatcher	*Myiarchus crinitus*	2.33
Eastern Kingbird	*Tyrannus tyrannus*	0.78
White-eyed Vireo	*Vireo griseus*	4.44
Yellow-throated Vireo	*Vireo flavifrons*	0.89
Red-eyed Vireo	*Vireo olivaceus*	33.44
Blue Jay	*Cyanocitta cristata*	17.89
American Crow	*Corvus brachyrhynchos*	44.89
Fish Crow	*Corvus ossifragus*	0.89
Horned Lark	*Eremophila alpestris*	0.22
Purple Martin	*Progne subis*	10.89
Tree Swallow	*Tachycineta bicolor*	0.11
Barn Swallow	*Hirundo rustica*	8.11
Carolina Chickadee	*Poecile carolinensis*	8.11
Tufted Titmouse	*Baeolophus bicolor*	31.78
Carolina Wren	*Thryothorus ludovicianus*	17.89
Blue-gray Gnatcatcher	*Polioptila caerulea*	1.33
Eastern Bluebird	*Sialia sialis*	7.78
Wood Thrush	*Hylocichla mustelina*	24.22
American Robin	*Turdus migratorius*	32.89
Gray Catbird	*Dumetella carolinensis*	0.89
Northern Mockingbird	*Mimus polyglottos*	20.33
Brown Thrasher	*Toxostoma rufum*	3.89
European Starling	*Sturnus vulgaris*	43.11
Cedar Waxwing	*Bombycilla cedrorum*	0.44
Northern Parula	*Parula americana*	2.33
Yellow Warbler	*Dendroica petechia*	0.11
Yellow-throated Warbler	*Dendroica dominica*	0.11
Pine Warbler	*Dendroica pinus*	7.56
Prairie Warbler	*Dendroica discolor*	0.78
Black-and-white Warbler	*Mniotilta varia*	0.44
Worm-eating Warbler	*Helmitheros vermivorus*	0.33
Ovenbird	*Seiurus aurocapillus*	6.22

Common Name	Scientific name	Birds/route
Louisiana Waterthrush	*Seiurus motacilla*	0.33
Kentucky Warbler	*Oporornis formosus*	3.00
Common Yellowthroat	*Geothlypis trichas*	4.22
Hooded Warbler	*Wilsonia citrina*	0.22
Yellow-breasted Chat	*Icteria virens*	3.56
Summer Tanager	*Piranga rubra*	3.22
Scarlet Tanager	*Piranga olivacea*	8.22
Eastern Towhee	*Pipilo erythrophthalmus*	3.44
Chipping Sparrow	*Spizella passerina*	21.56
Field Sparrow	*Spizella pusilla*	4.33
Grasshopper Sparrow	*Ammodramus savannarum*	2.22
Song Sparrow	*Melospiza melodia*	3.33
Northern Cardinal	*Cardinalis cardinalis*	26.11
Blue Grosbeak	*Guiraca caerulea*	4.89
Indigo Bunting	*Passerina cyanea*	26.89
Red-winged Blackbird	*Agelaius phoeniceus*	11.56
Eastern Meadowlark	*Sturnella magna*	4.33
Common Grackle	*Quiscalus quiscula*	44.33
Brown-headed Cowbird	*Molothrus ater*	5.89
Orchard Oriole	*Icterus spurius*	0.89
House Finch	*Carpodacus mexicanus*	9.11
American Goldfinch	*Carduelis tristis*	8.67
House Sparrow	*Passer domesticus*	24.33

Breeding Bird Survey Map
Breton Bay Watershed Relative to Tall Timber BBS Route



Map Source: US Fish & Wildlife Service, May 2002

Appendix C   Fall Oyster Bar Survey Results for Breton Bay 1990-2001

Chris Judy
Shellfish Division, Fisheries Service
Maryland Department of Natural Resources
May 2002

Fall Oyster Bar Survey Results for Breton Bay Oyster Bar Sample Sites from 1990 thru 2001

May 15, 2002

Sample Date	Bar Name	Bar Type	Plantings Year/Material	Bushels	Source	Temp °C	Sal. ppt	Live Oysters per Bushel: Market #	Market Avg size	Small #	Small Avg size	Spat #	Spat Avg size	Dead Oysters per Bushel: Market Old	Market Rec.	Small Old	Small Rec.	Spat Old	Spat Rec.	Observed Mortaliy %: Markets	Smalls	Total
10/30/90	Black Walnut	Natural				14.0	9.0	64	3 5/8	4	2 3/4	1	1	7	2	0	0	0	0	12	0	12
11/06/91	Black Walnut	Natural				12.0	16.0	33	3 5/8	5	2 1/2	6	5/8	40	6	2	0	0	0	58	29	56
11/03/92	Black Walnut	Natural				14.0	15.0	11	3 1/2	11	2	0		34	2	2	0	0	0	77	15	63
11/08/93	Black Walnut	Natural				11.0	13.0	13	3 3/8	36	2 1/2	1	7/8	6	0	2	0	0	0	32	5	14
11/07/94	Black Walnut	Natural				15.0	12.5	18	3 1/4	26	2 3/4	0		6	0	9	0	0	0	25	26	25
11/13/95	Black Walnut	Natural				10.0	13.0	41	3 1/4	12	2 5/8	1	1 5/8	28	1	13	1	0	0	41	54	45
11/07/96	Black Walnut	Natural				14.5	6.0	34	3 1/4	16	2	0		8	0	3	2	0	0	19	24	21
11/05/97	Black Walnut	Natural				14.0	15.0	40	3 1/2	4	2 3/8	2	1	5	0	3	0	0	0	11	43	15
11/07/96	Black Walnut	Natural +	1996 Seed	1,311	GR	14.5	6.0	36	3 1/2	96	2 3/8	0		4	0	0	0	0	0	10	0	3
11/07/96		DISEASE SAMPLE				REC DER- 57.0				REC DERS- 2.2			PCT OVER 4- 3.0			LABSZAV- 68						
11/05/97	Black Walnut	Natural +	1996 Seed	1,311	GR	14.0	15.0	32	3 1/2	70	2 1/2	0		10	0	14	0	0	0	24	17	19
11/05/97		DISEASE SAMPLE				REC DER- 63.0				REC DERS- 3.6			PCT OVER 4- 13.0			LABSZAV- 79						
11/11/98	Black Walnut	Natural +	1996 Seed	1,311	GR	13.0	16.0	30	3 1/2	22	2 5/8	0		13	0	15	1	0	0	30	42	36
11/11/98		DISEASE SAMPLE				REC DER- 73.0				REC DERS- 2.6			PCT OVER 4- 13.0			LABSZAV- 84						
11/04/99	Black Walnut	Natural +	1996 Seed	1,311	GR	14.3	15.0	40	3 5/8	44	2 5/8	3	7/8	14	3	28	2	0	0	30	41	36
11/01/00	Black Walnut	Natural +	1996 Seed	1,311	GR	15.2	14.9	37	3 1/2	9	2 3/8	0		32	1	25	1	0	0	47	74	56
10/16/01	Black Walnut	Natural +	1996 Seed	1,311	GR	19.3	15.1	4	3 1/4	1	2 5/8	1	1	12	0	4	0	0	0	75	80	76
10/30/90	Blue Sow	Natural+	1988 Seed	4,820	GR	14.3	10.5	34	3 1/2	13	2 3/4	1	3/4	18	6	5	0	0	0	41	28	38
			1984 DSH	103,318																		
11/06/91	Blue Sow	Natural+	1988 Seed	4,820	GR	12.0	15.0	30	3 5/8	12	2 3/8	22	3/4	30	4	2	0	0	0	53	14	46
			1984 DSH	103,318																		
11/03/92	Blue Sow	Natural+	old plantings			14.0	15.0	17	3 1/4	63	2	0		16	0	5	1	0	0	48	9	22
11/08/93	Blue Sow	Natural+	old plantings			11.5	13.0	24	3 3/8	64	2 3/4	1	5/8	2	0	3	1	0	1	8	6	6
11/07/94	Blue Sow	Natural+	old plantings			15.0	12.5	73	3 3/8	25	2 3/4	0		4	0	9	0	0	0	5	26	12
11/13/95	Blue Sow	Natural+	old plantings			10.5	13.0	38	3 3/8	4	2 5/8	7	1	10	1	0	0	0	0	22	0	21
11/07/96	Blue Sow	Natural+	old plantings			14.5	6.0	43	3 1/2	7	2	0		10	0	1	0	0	0	19	13	18
11/05/97	Blue Sow	Natural+	old plantings			14.0	15.0	25	3 5/8	10	2 1/2	3	1 3/8	7	0	0	0	0	0	22	0	17
11/11/98	Blue Sow	Natural+	old plantings			13.0	15.5	49	4	12	2 1/2	0		20	0	1	0	0	0	29	8	26
11/04/99	Blue Sow	Natural+	old plantings			13.9	14.5	31	3 5/8	5	2 5/8	11	4/9	33	1	9	0	0	0	52	64	54
11/01/00	Blue Sow	Natural+	old plantings			15.7	15.6	10	3 7/8	19	1 3/4	0		25	1	0	0	0	1	72	0	47
10/16/01	Blue Sow	Natural+	old plantings			19.1	15.1	11	3 3/8	11	2 1/2	2	3/4	10	0	12	0	0	0	48	52	50
11/13/95	Blue Sow	Natural+	1995 Seed	2,143	FPA	10.5	13.0	32	3 3/8	38	2 3/8	2	1 1/8	14	2	20	2	0	0	33	37	35
11/07/96	Blue Sow	Natural+	1995 Seed	2,143	FPA	14.5	6.0	24	3 3/4	38	2 1/2	0		16	0	18	0	0	0	40	32	35
11/05/97	Blue Sow	Natural+	1995 Seed	2,143	FPA	14.0	15.0	38	3 1/2	16	2 1/2	0		10	0	4	2	0	0	21	27	23
11/11/98	Blue Sow	Natural+	1998 Seed	1,400	WCT	13.0	15.5	18	3 3/8	262	2 1/4	0		2	0	26	0	0	0	10	9	9
11/04/99	Blue Sow	Natural+	1998 Seed	1,400	WCT	13.9	14.5	46	3 1/2	100	2 5/8	0		18	0	60	6	0	0	28	40	37
11/01/00	Blue Sow	Natural+	1998 Seed	1,400	WCT	15.7	15.6	40	3 5/8	20	2 1/2	0		82	4	94	2	0	0	68	83	75
10/16/01	Blue Sow	Natural+	1998 Seed	1,400	WCT	19.1	15.1	26	3 1/4	12	2 5/8	0		34	2	70	0	0	0	58	85	74

MATERIAL

DSH - Dredge oyster shells retained on a 1" X 1" shaker screen.

SOURCE

FPA - Fog Point #A
GR - Gravelly Run
WCT - Wild Cherry Tree

DISEASE ANALYSIS

(As diagnosed by the Chesapeake Bay Research and Monitoring Division of the Cooperative Oxford Laboratory)
REC DER - Percent of oysters in lab sample with Dermo (Perkinus marinus) found in rectal tissue.
REC DERS - Average sizzle or intensity of Dermo, in infected oysters, on a scale of 0 - 7, with over 4 being terminal.
PCT OVER 4 - Percent of oysters, in entire lab sample, with Dermo sizzle over 4.
LABSZAV - Average size, in millimeters, of oysters in lab sample.

Appendix D Breton Bay Synoptic Survey Report