



**A Sustainable Strategy for  
Calvert's Aquifers and  
Watersheds**

***Guidance Document for the Preparation of  
the Water Resources Element  
of the Calvert County Comprehensive Plan***

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## **I. The Water Resources Element Law**

### **A. Statutory Requirements**

Section 1.03 (iii) of Article 66B of the Annotated Code of Maryland mandates that all Maryland counties and municipalities that exercise planning and zoning authority prepare and adopt a Water Resources Element (WRE) in their comprehensive plans. Local jurisdictions must:

- Identify drinking water and other water resources that will be adequate for the needs of existing and future development proposed in the land use element of the plan, considering available data provided by the Maryland Department of the Environment (MDE).
- Identify suitable receiving waters and land areas to meet the storm water management and wastewater treatment and disposal needs of existing and future development proposed in the land use element of the plan, considering available data provided by MDE.
- Adopt a WRE in the comprehensive plan on or before October 1, 2009, unless extensions are granted by Maryland Department of Planning (MDP) pursuant to law. Zoning classifications of a property may not be changed after October 1, 2009 (or as extended) if a jurisdiction has not adopted the WRE in its comprehensive plan.

### **What the Water Resources Element Means for State Agencies.**

The mandates of Maryland Departments of Planning (MDP) and the Maryland Department of the Environment (MDE) under this law are:

- MDE must review the WRE to determine whether the proposed plan is consistent with the programs and goals of the department as reflected in the general water resources program required under § 5-203 of the Environment Article.
- MDE shall provide technical assistance upon written request to a local government on the development of the WRE of the comprehensive plan.
- MDP and other state agencies must review the WRE as part of their review of all comprehensive plan components under the 60-day review requirement of the Planning Act.
- MDP may grant up to two six-month extensions to a local government upon written request by a local planning agency if that local government shows good cause for extending the time limit in order to be able to comply with the WRE implementation date.

### **B. General Discussion**

The Calvert County Comprehensive Plan is the county's official policy document. Being a component of the Comprehensive Plan, the WRE establishes policy for water resources in Calvert County. It highlights what will need to be done for provision of drinking water and for management of wastewater effluent and stormwater to support planned growth, given existing and future water resource limitations. These limitations include water supply beyond the planning horizon and the assimilative capacity of water bodies (i.e., the ability to accept treated wastewater and stormwater). Further, the Plan outlines changes to be made to the Calvert County Water and Sewerage Plan and county ordinances.

Information available from state, local and other sources has been used to describe the existing status of drinking water supplies and of the streams that receive treated wastewater effluent and nonpoint source runoff. Some information is not available to conduct ideal analyses of all water resources. This document outlines what we know, what we need to do, and what additional research is needed. It describes technical work and studies prepared for the WRE and the linkages developed within the Comprehensive Plan and its supporting plans and ordinances to implement the WRE.

### **C. Interjurisdictional Coordination and Cooperation**

Staffs from Calvert County and the Towns of Chesapeake Beach and North Beach participated in the state sponsored training sessions for preparation of the WRE. Following the training sessions, staff from all three jurisdictions met to discuss preparation of the WRE. Both towns arranged to have their planning consultants meet with County staff. The County provided GIS mapping information to both consultants and the County agreed to provide subwatershed land use and nutrient data to both municipalities for their Plans.

The jurisdictions share the same aquifers and the same regional sewerage treatment plant. It is logical that all three cooperate in a planning effort to protect and enhance water resources.

## **II. General Assessment Methodologies**

### **A. General Scope of the Water Resources Element (WRE)**

The WRE covers drinking water needs and wastewater and stormwater release in state waters. In several ways, preparation for the water needs portion began 12 years ago, when a new Comprehensive Plan was adopted and Tri-County Council for Southern Maryland contracted with the Maryland Geological Survey (MGS) to survey the regional aquifer levels. Based these initiatives, the county twice cut zoning densities.

The 1997 Comprehensive Plan called for the County to reduce residential buildout and the first MGS report concluded that the Aquia aquifer in the Southern end of the County would be below maintenance levels toward the end of the study period. Following the zoning density cuts, the second MGS report found that the aquifers should be adequate in Calvert through the study period (until 2030). The drinking water section in Section IV outlines the assessment methodologies that MGS used to evaluate the aquifers.

Effective wastewater system planning began 30 years ago when Southern Maryland counties sued the state and northern counties in the Patuxent River watershed over the impact of sewerage treatment plants on the Patuxent. As a result of the attention drawn to the problem, Calvert County pledged to give top preference for new sewerage treatment plants to be land application systems. All new systems constructed since then have been land application systems and the Prince Frederick system was converted to a land application system.

The greatest challenge in developing and implementing the WRE will be to meet state requirements and our own goals for reducing non-point source pollution from sources including stormwater management, lawn fertilization, and septic systems in Calvert's watersheds.

Watersheds are land areas that drain surface and groundwater to a downstream water body, such as a river, or bay. While the state law only requires the Water Resources Element to be prepared for the two major watersheds (Patuxent and Lower Western Shore), from a water quality and planning standpoint, it makes more sense to plan at a subwatershed level. The state has identified 22 subwatersheds in Calvert County which include many well known creeks such as Hunting Creek, Parkers Creek, Fishing Creek, St. Leonard Creek and Mill Creek. Each watershed has different attributes and water quality challenges. Therefore, the county has calculated land use impacts and conditions for each.

### **B. Work Item Sequence for the WRE**

Work began on the WRE in October, 2007 when the Board of County Commissioners directed staff to perform the following steps in preparing the plan update.

- Begin research on the status of the aquifers, wastewater, and non-point source pollution, including extensive mapping using Geographic Information Systems (GIS).
- Present information to citizens groups about the WRE from October, 2007 to April, 2008 (presentations were made to over 30 groups).
- Present research on two subwatersheds in April, 2008.
- Continue research on the remaining 20 subwatersheds from April, 2008 to October, 2008.
- Hold an open house on the data collected (held on October 2, 2008).
- Present the results of the research to the Board of County Commissioners in October, 2008 (presentation held on October 14, 2008)
- Present the results to the Planning Commission in November, 2008 (presented on November 19, 2008, so that the Planning Commission can begin its preparation of the WRE.
- Prepare this guidance document based on the WRE Analytical Framework that assesses current conditions plus future needs (based on buildout projections).
- Attend the Planning Commission presentation of the WRE in May, 2009.
- Hold a joint public hearing on the Plan in July, 2009.
- Prepare an amendment to the Water and Sewerage Plan for public hearing in September, 2009.
- Adopt the Plan amendment in October, 2009.
- Implement the actions called for in the WRE and assess the effectiveness of the results.

### **C. Defining Water Resource Limitations**

Published in 2008, the latest Maryland Geological Survey report determined that the aquifers serving Calvert County can provide adequate drinking water supply through the year 2030, so long as the water supplies remain potable. The MGS report is available on the MGS website at: <http://www.mgs.md.gov/esic/publications/download/RI76.pdf> . Issues with respect to reducing water consumption and protecting the water supplies are covered in Section IV of this report.

Likewise, Calvert's wastewater treatment systems meet or are on track to meet all state requirements for compliance with Chesapeake Bay Tributary Strategy point source caps. Details on the status of wastewater treatment systems are outlined in Section V of this report.

As to defining nonpoint sources of pollution, there has been an impressive amount of research conducted on the main stem of the Patuxent River. The state has conducted notable research on fresh water streams. More thorough stream assessments were conducted through the preparation of a Watershed Restoration Action Strategy (WRAS) for Hall's Creek, Island Creek and Mill Creek. This information covered in Section VI.

However, year-around scientific data do not exist for nitrogen and phosphorus in the subwatersheds, both freshwater and tidal water near the mouth of most creeks. Also, we do not know the effectiveness of many of the nutrient pollutant tools, such as those mentioned in Section VI, or how effective they will be in Calvert County. For this reason, additional research will be recommended as part of the action strategy.

### **D. Assessing Projected Capacity Needs over the Planning Period**

Calvert County has reasonably firm numbers on projected growth and acceptable ranges of capacity needs for drinking water and for wastewater system capacity over the next 20 years. Capacity needs will be used for the update of the Water and Sewerage Plan in the summer of 2009.

### **E. Assessing Development Impacts on Water Resources**

Using data from the Chesapeake Bay Model and the land use data prepared by MDP and by the Department of Planning and Zoning, the County has estimates of the development impacts of existing and

future growth on water resources, using two growth scenarios. The first assumes that 35% of all new residential development occurs in town centers. The second assumes that 45% of all new residential development occurs in town centers.

#### **F. Deciding on Whether to Limit Growth or Address Water Resource Limitations**

With the 1997 Comprehensive Plan, the Board of County Commissioners decided to limit growth to maintain quality of life, protect nature resources, and reduce the need for infrastructure. The zoning density reductions that followed in 1999 and 2003 have helped the County to avoid exceeding management levels the aquifers serving the County. Only a 20% increase in households (and 15% increase in population) is expected. However, since the state has already determined that nitrogen and phosphorus have exceeded the assimilative capacity of the waterways, the County will be pursuing techniques to reduce these nutrients. Those techniques are highlighted in Section VI.

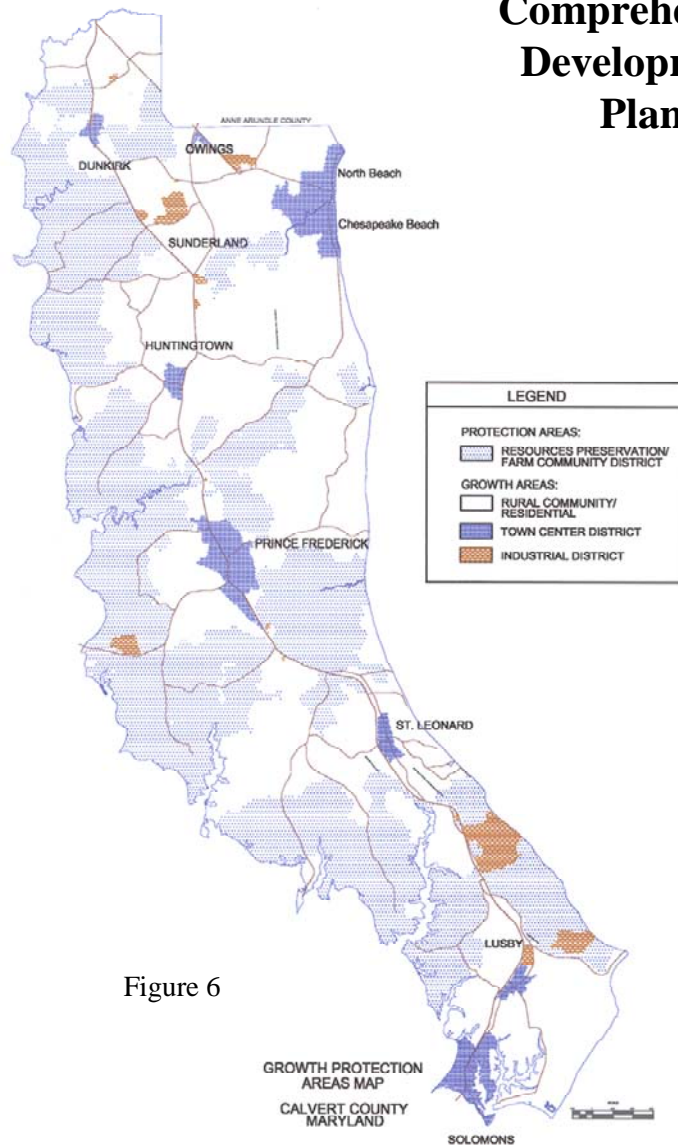
### **III. Links to Other Comprehensive Plan Elements and Other Plans**

#### **A. Linking the Water Resources Element and the Land Use Element**

The 2004 Comprehensive Plan set forth 10 visions for Calvert County. Benchmarks were adopted to measure success in achieving the visions. Population buildout is to be held to 37,000 residents. At least 40,000 acres of land is to be preserved via land preservation programs. New growth is to be directed away from Priority Preservation Areas and toward growth areas, such as infill development and the designated Priority Funding Areas.

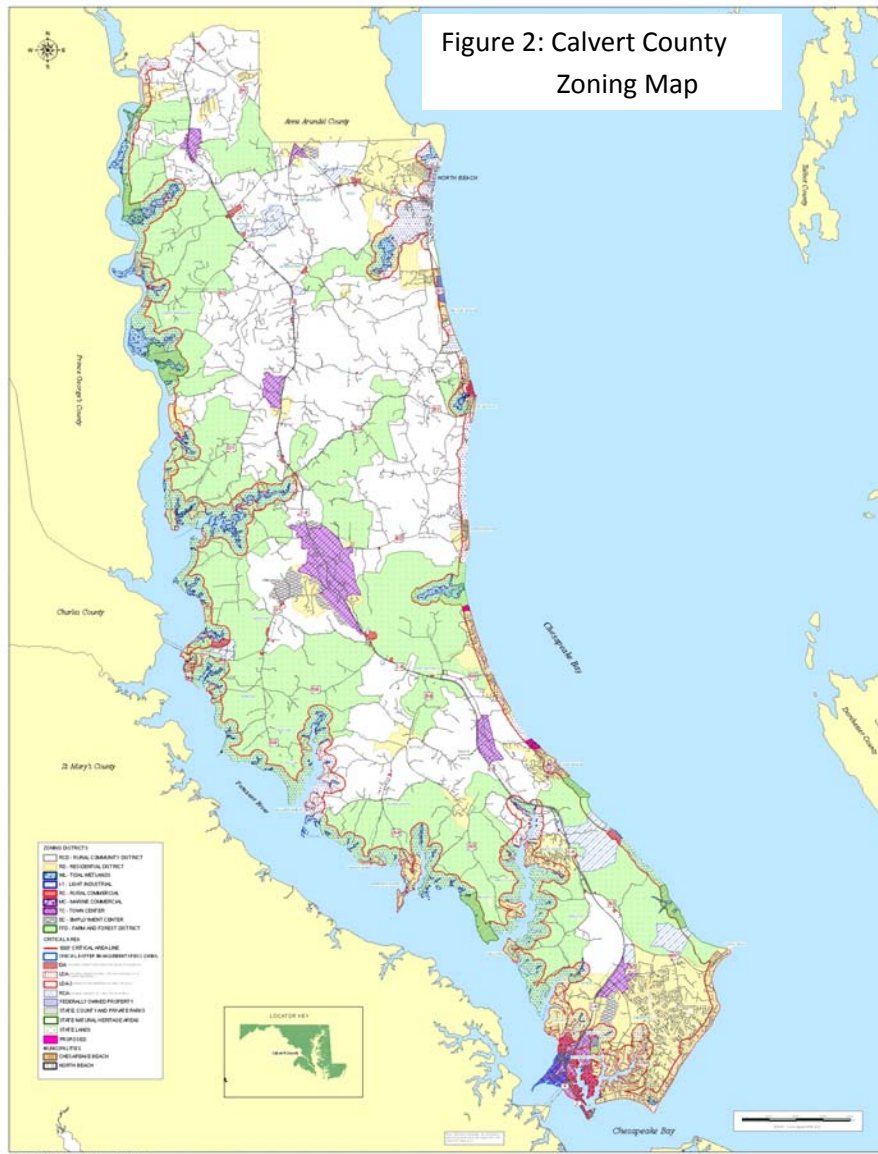
Using existing and future land use data we have used the Bay Model to estimate existing pollutant levels and project the impacts of future development on water quality. We can set watershed goals for nutrient levels, impervious surfaces, and forest cover. Then, using land use data, we can develop land use and development regulations which will achieve those water quality goals.

Figure 1  
**Comprehensive  
 Development  
 Plan**



**B. Linking Water Resources Element and the Land Use Implementation Element**

Following adoption of the 2004 Comprehensive Plan, the Calvert County Zoning Ordinance was amended to implement the Plan. The base zoning density in the Priority Preservation Areas was set at one house per 20 acres, with mandatory clustering. Transferable development rights regulations were amended to further facilitate land preservation in Priority Preservation Areas and encourage development in growth areas. These tools give land owners and land trusts the ability to protect lands in the Priority Preservation Areas. These tools and successes are highlighted in the 2006 Land Preservation, Parks and Recreation Plan. The Ordinance changes also give the Planning Commission the tools to protect sensitive lands and provide effective buffers during the development process.



Having these visions, benchmarks and revised regulations in place has simplified the planning process for the preparation of the WRE and the land use implementation actions in the Comprehensive Plan. The land use actions are being modified to reflect the steps needed to implement the WRE.

**C. Linking the Water Resources Element and the Community Facilities Element**

Community facilities are addressed in the Transportation, Waste Management, and Public Facilities and General Services Sections of the Comprehensive Plans. The Waste Management Section is being modified as part of the preparation of the WRE. The Transportation and Public Facilities and General Services Sections already reflect good planning principles and need no further changes at this time. An update to the Transportation Plan is due in 2010.

**D. Linking the Water Resources Element and the Municipal Growth Element**

Information collected for the WRE was submitted to the municipalities for their Municipal Growth Elements.

#### **E. Linking the Comprehensive Plan with the County Water and Sewerage Plan**

The 2008 Calvert County Water and Sewerage Plan was prepared and adopted to implement the 2004 Comprehensive Plan. Modifications are proposed to implement the WRE. Public hearings are expected in 2009.

#### **F. Linking the Water Resources Element with the County Land Preservation, Parks and Recreation Plan**

Calvert County's Priority Preservation Areas and sensitive areas are identified in the current Comprehensive Plan. The 2008 Calvert County Land Preservation, Parks, and Recreation Plan is designed to implement the 2004 Comprehensive Plan. In 2011, the Plan will be revised as required by the state. At that time, the Land Preservation, Parks and Recreation Plan will be modified to address issues related to the WRE.

#### **G. Sector and Subregional Comprehensive Plans**

Calvert County has seven town centers. Master plans are in place for all seven town centers. These are in the process of being modified to reflect the 2004 Comprehensive Plan. The Master Plan updates are being followed by amendments to all of the town center zoning ordinances. Changes needed to implement the WRE will be included.

### **IV. Drinking Water Assessment**

#### **A. Background**

The final report of the Advisory Committee on the Management and Protection of the State's Water Resources (also known as the Wolman Report), notes that Maryland does not have an accurate picture of the long-term viability of the State's water sources. "Wells have gone dry due to lowered water levels during droughts and studies have shown that in some areas of concentrated water demand, the current pattern of water use may already exceed the sustainable yield."<sup>1</sup>

Residential sprawl has contributed to concerns about the viability of water supplies. Many of the aquifer recharge areas are being developed into subdivisions and commercial areas. As the landscape is altered and impervious surfaces are created, there is concern that the water supply will decrease while demand increases.

Over the next 25 years, Southern Maryland is projected to have the highest percentage increase in water demand (40% over current needs) and Southern Maryland residents have already been complaining about their wells going dry. Calvert County is projected to be one of the slower growing counties (20% over the next 20 years), but it shares aquifers with other counties. The concern is that increased consumption and decreased recharge potential could adversely affect County residents and businesses.

The Tri-County Council for Southern Maryland contracted with MGS to study the five major aquifers: Piney Point, Aquia, Magothy, Upper Patapsco, and Lower Patapsco. Funding for this study was provided by the Board of County Commissioners of Calvert, Charles, and St. Mary's Counties; the Maryland

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<sup>1</sup>Advisory Committee on the Management and Protection of the State's Water Resources, "Water for Maryland's Future: What We Must Do Today" (2008) p. 3. The report is available at [www.mde.state.md.us](http://www.mde.state.md.us)

Department of Natural Resources; and the U.S. Department of the Interior, Geological Survey. Additional funding was provided by Chesapeake Ranch Estates.

#### **B. Assessment Approaches/Methodologies**

The MGS report<sup>2</sup> is the conclusion of a five-year study of the five major aquifers in Southern Maryland. The report includes the hydrogeology, population trends, and pumpage trends in Southern Maryland. The report builds off of previous investigations by MGS and others. Test wells were drilled in cooperation with the U.S. Geological Survey (USGS). The report identified current well locations and projected the increases anticipated by the counties. Eight scenarios for water pumpage were presented. Assessment approaches and methodologies were described the first five sections of the report, which can be reviewed at:

<http://www.mgs.md.gov/esic/publications/download/RI76.pdf>

#### **C. Linking Water Supply with the Land Use Element**

The report was prepared after Calvert County twice cut zoning densities, which yielded lower population projections for the study period. In the Discussion of Results, found on page 38, the MGS report concludes that “Results of future pumpage simulations indicate that drawdowns in Calvert and St. Mary’s Counties will not exceed the 80-percent management level under any of the scenarios considered in this study.” This includes the municipalities.

Since the aquifers are adequate during the planning horizon, the next step is to be sure that the infrastructure is in place to provide potable water where is it needed, consistent with the Land Use Element of the Comprehensive Plan. The Calvert County Water and Sewerage Plan is the implementation document that addresses water infrastructure. Data included in the Plan includes existing water supply, water quality, supply sources, and water quality protection strategies. Calvert’s Plan data is updated each year, before the Capital Improvement Program is prepared for the annual budget. Table 7 of the Plan identifies water supply problem areas. Solutions to the problems are considered for the CIP. The Plan can be viewed at [www.co.cal.md.us](http://www.co.cal.md.us) on the ‘Planning and Zoning’ page.

Water Supply Capacity Management Plan guidelines published by MDE provide a methodology for determining the net capacity of existing water supplies relative to water needs in developing areas. At this time, the Prince Frederick Water Treatment Plant is the only Plant exceeding 80% of its water appropriation permit. A Water Supply Management Plan is being prepared for this Plant. A Management Plan has been budgeted for the Solomons Water Plant in FY10. All remaining county owned systems will have Management Plans by FY12.

#### **D. Linking Water Supply with the Land Use Implementation Element**

The MGS report didn’t identify any impediments to implementing the Land Use Element of the Comprehensive Plan due to inadequate water supply. In effect, adequacy had already been established due to the actions taken to implement the Land Use Element in the 1997 Comprehensive Plan.

As required by the state, the County building code requires that all new or replacement plumbing fixtures be water conserving devices (see COMAR 26.03.01.07.) These standards are enforced by the Division of Inspections and Permits. No other Land Use implementation strategies are proposed at this time.

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<sup>2</sup> Drummond, D.D., “Water-supply Potential of the Coastal Plain aquifers in Calvert, Charles, and St. Mary’s Counties, Maryland, with the Emphasis on the Upper Patapsco and Lower Patapsco Aquifers: Maryland Geological Survey Water Resources Basis Data Report No. 76

## **E. Linking Water Supply, the Community Facilities Element and the County Water and Sewerage Plan with the WRE**

Despite a finding of sufficient water supply in the study, the Calvert County Water and Sewerage Plan cautions that the County needs to secure its water supply by:

1. Actively participating with state, federal and regional agencies in programs designed to monitor quality and quantity of ground water resources.
2. Maintaining an aggressive water conservation program to reduce overall water demands and expand to areas outside existing sanitary districts.
3. Developing a well head protection program that covers all municipal wells.
4. Developing a ground water protection plan.
5. Utilizing all available aquifers efficiently and effectively.<sup>3</sup>
6. Requiring all new multiuse water systems be conveyed to the County.

## **F. Review Criteria for Drinking Water**

State recommended criteria for drinking water are outlined in the Guidance Document for Water Supply Management Plans. As they are prepared, they will include county growth projects for each sanitary district.

## **V. Wastewater Assessment**

### **A. Background**

A peninsula with limited road access, Calvert County was a rural county at its establishment over 350 years ago and for 300 years that followed. Agriculture and forestry dominated the landscape. The seafood industry was present all around its shorelines. The villages and towns supported the two principal resource industries. Calvert County never developed a significant industrial economy. There was no railroad, no major airports, and no major roads. Geographic configuration allowed it to remain an isolated rural enclave and the county population remained about the same.

As residential sprawl began to creep out beyond the inner suburbs of Washington, D.C. and Baltimore in the early 1960s, Calvert was a likely target. The crime rate and property taxes were low. The rural character and access to the Bay and River attracted new residents. However, there was almost no sewer service in place. Therefore most development occurred on septic systems. In the last 30 years sewer systems in major town centers have developed/grown, but still only serve about 10% - 15% of the county population.

### **B. Assessment Approaches/Methodologies**

The 2008 Calvert County Water and Sewerage Plan provides a good basis for the assessment of the County's wastewater systems. Capacity and usage figures are current and the Water and Sewer Division is developing management analyses of each sewage treatment system. Updates to the Water and Sewerage Plan will be made in 2009 once population estimates and projections are updated as part of the WRE.

C. Linking Wastewater to the Land Use Element - Managing the amount and location of growth and development

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<sup>3</sup> 2008 Calvert County Water and Sewerage Plan, Chapter Three, Objectives 3-7

The Land use element of the 2004 Comprehensive Plan outlines Priority Funding Areas and Priority Preservation Areas in Calvert County. Community sewerage systems are permitted in all town centers (Priority Funding Areas), so long as criteria are met. The 2008 Water and Sewerage Plan prohibits new sewerage service areas from being designated in Priority Preservation Areas (zoned Farm and Forest District.) It also greatly limits new sewerage service areas from being designated in the Rural Community Districts. An exception is for dealing with septic failures in small residential communities.

The Water and Sewerage Plan encourages the use of nitrogen removing septic systems in the rural areas. In a number of cases, the Planning Commission or the Board of Appeals has required them for new development if the development is in the Critical Area or in sensitive areas. Currently, the County has a Bay Restoration Fund grant to install nitrogen-removing septic systems on residential properties.

#### **D. Linking Wastewater to the Land Use Implementation**

The 2008 Water and Sewerage Plan and the 2006 Zoning Ordinance implements the Land Use Element of the 2004 Comprehensive Plan. The 2004 Plan map and the 2008 Water and Sewerage Service Area Maps align. Zoning densities in the 2006 Zoning Ordinance discourage development outside the growth areas and the areas not to be served by community sewerage systems.

#### **E. Linking Wastewater to the Public Facilities and General Services Element and the County Water and Sewerage Plan**

The Public Facilities and General Services Chapter of the Comprehensive Plan calls for the county to “be proactive in the development of infrastructure in town centers as called for in town center master plans (IV-24).” The Water and Sewerage Plan calls for community water and sewerage systems in town centers consistent with the Public Facilities and General Services Chapter of the Plan and the Capital Improvement Program is used to implement the Water and Sewerage Plan.

As the WRE is developed the Board of County Commissioners should consider the following actions to be included in the County Water and Sewerage Plan:

1. Require new sewerage treatment systems to be land application systems and explore other beneficial ways of reusing wastewater.
2. Continue the policy of restricting new sewerage service areas for multiple users to Priority Funding Areas, except for connection to septic failure areas. In those cases, only connect to existing developed lots.
3. Develop and/or update wastewater capacity management plans for all county owned or operated community sewerage systems.
4. Estimate the approximate number of additional households and the associated commercial and industrial development and approximate quantity of additional wastewater capacity needed to support projected growth in the priority funding areas for the 2009 update to the County Water and Sewerage Plan.
5. Work with the Board of Education to upgrade the Northern High School Treatment Plant.

#### **F. Review Criteria for Wastewater**

The County is meeting the state’s criteria for wastewater effluent. Two of the three large systems are land application systems. The third is being upgraded to meet state standards. New wastewater treatment plants are already highly encouraged to develop as land application systems (see Chapter 4 page 54 of the current Water and Sewerage Plan.) The County will consider an amendment to require all new systems to be land application systems.

## VI. Stormwater Assessment

### A. Background

Calvert's topography and shape have had a great deal to do with the relationship its occupants have had with the water. When John Smith toured the peninsula four hundred years ago, he found steep wooded banks except for an occasional Indian village. Our first native Americans enjoyed oysters, crabs, fish, and clams from crystal clear waters. Calvert's shape provided ample water access and secure village sites.

As European settlers replaced the Indians in Southern Maryland, one of their principle occupations was production of the 'sot weed', tobacco. Approximately 85% of the Patuxent River watershed was being farmed in 1850 and over 57% of the watershed was in cropland as late as 1953 (see figure 3.) Much of the land was not suitable for intensive farming since most of the soils are highly erodible. In Calvert, only 28% of the land is suited to regular cultivation. Another 16% is suitable for limited farming, only when intensive conservation measures are practiced.<sup>4</sup> In Calvert, as much as 112,000 acres were farmed as recently as 1930.<sup>5</sup> At the turn of the 20<sup>th</sup> Century, only 30% of the County land was forested. By the end of that century, nearly 60% was forested, as land owners gave up the rough poor eroded soils to the forests.

Streams and creeks in the watershed suffered mightily from sedimentation over that period and Calvert's farmers weren't the only ones farming on marginal lands. It is estimated that the channel at Upper Marlboro filled in by up to forty feet from colonial times, to the point that it could no longer serve as a deep water port for commerce. To a lesser extent, Hunting Creek in Calvert County served as a conduit for shipments to Huntingtown, which used to be located where Plum Point Road now intersects MD 4. Sailing ships would float up with the tides and discharge their cargo in skiffs, which were rowed up to the small town. Eventually though, sediment filled the channel and it was no longer feasible to use Hunting Creek to ship cargo to the town.

Despite the sedimentation, Southern Maryland waterways remained productive for 350 years after European settlers began the mass clearing of forest land for farming. Fishing villages such as Solomons, Broomes Island, and Benedict were the centers of a vibrant seafood industry. Then two trends became the 'tipping point' for water quality around 1960. First, farmers began to use inexpensive chemical fertilizers to increase crop yields. Excess nitrogen and phosphorus would often make their way into the streams during spring and summer storms. Secondly, by 1960, residential development had spread from Washington D.C. into Howard, Prince George's and Anne Arundel Counties, and even as far as Calvert and Charles. Lawn fertilizers, septic effluent, and treatment plants added more nutrients into surface and shallow ground water.

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<sup>4</sup> Matthews, Earle, Soil Survey Calvert County, Maryland; United States Department of Agriculture Soil Conservation Service in cooperation with Maryland Agricultural Experiment Station; 1971; p. 1

<sup>5</sup> Wesler Kit Wesler, Dennis J. Pogue, Alvin H. Luckenbach, Gordon J. Fine, Patricia A. Sternheier, E. Glyn Furgurson, The M/DOT Archaeological Resources Survey, Volume 2: Western Shore, Maryland Historical Trust, Manuscript Series, Number 6, March 1981

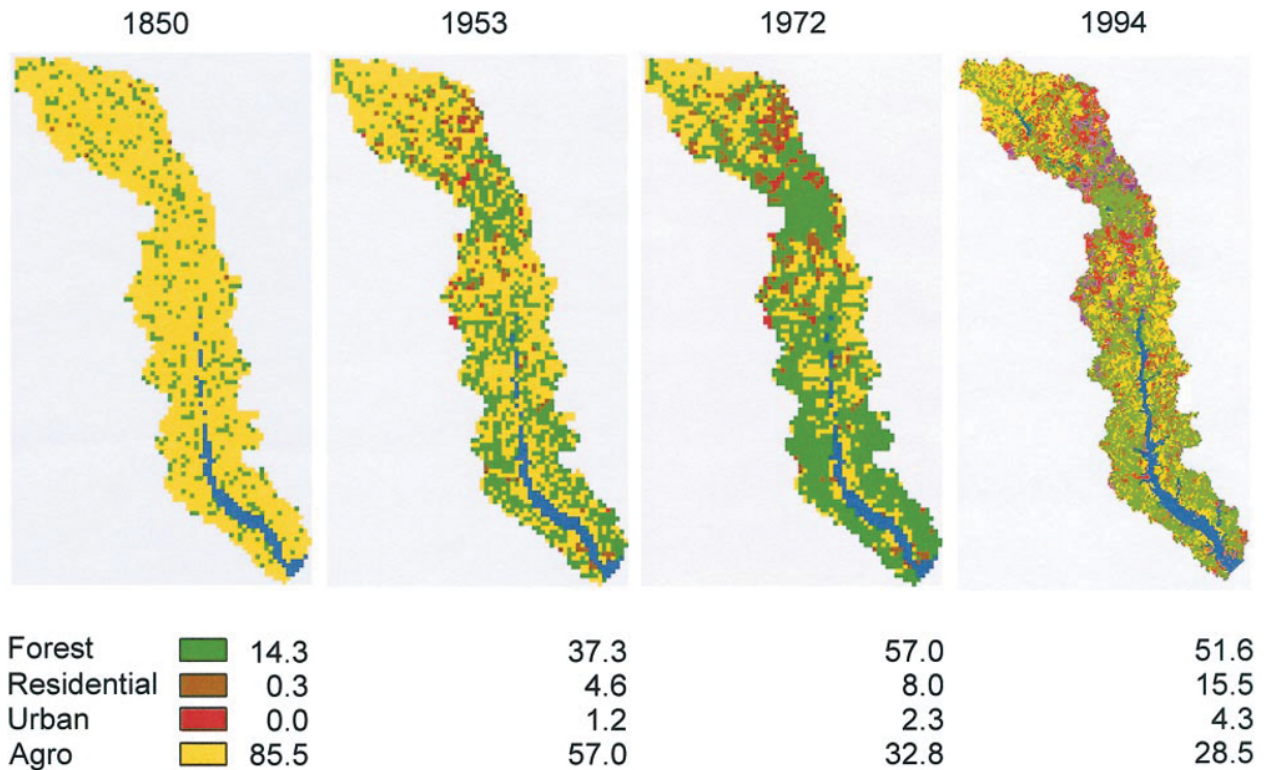


Fig. 3. A time series of land use maps for the Patuxent River basin (1850, 1953, 1972, 1994). Maps were adapted from Voinov (2001). Values are percents of total area. (source: A Watershed Perspective on Nutrient Enrichment, Science, and Policy in the Patuxent River, Maryland: 1960-2000. by Christopher F. D’Elia, Walter R. Boynton, and James G. Sanders)

In the first half of the twentieth century, the Patuxent River watershed was populated by as few as 25,000 residents<sup>6</sup>. It is now estimated to house over 600,000.

Between 1970 and 2000, Calvert County became a poster child for sprawl. Home buyers were drawn to the county for its rural character, good schools, low crime rate, and low taxes. Calvert County had very little public sewer capacity, but that didn’t deter developers. They developed one to three acre lots on septic systems. Out of concern for the loss of farmland and rapid growth, the Board of County Commissioners adopted a transferable development rights program in the 1970’s and adequate public facilities regulations in the 1980’s. Eventually, the Board adopted mandatory clustering in rural areas and a build-out goal of 37,000 households, reduced zoning density, and set a base zoning density in the Farm and Forest District and Rural Community District of one house per 20 acres. The growth rate slowed significantly and development is now effectively directed away from most resource and sensitive areas.

### B. State Stormwater Management Program

The state stormwater management law was enacted in 1982, requiring local governments to enact ordinances supporting stormwater management and approve stormwater management plans for new

<sup>6</sup> D’Elia, Christopher, Walter Boynton, and James Sanders, “A Watershed Perspective on Nutrient Enrichment, Science, and Policy in the Patuxent River, Maryland: 1960-2000”; *Estuaries*, Vol.26, No. 2a. p. 173; April 2003

development projects by July 1, 1984. The Calvert County Stormwater Management Ordinance became effective July 1, 1984. This Ordinance was based on providing water quantity for the 2, 10 and 100 year storms as well as quality management for the first flush. The first update to the Ordinance occurred in July 1996 and provided fee schedules for variances, review of waivers and review of stormwater management plans. The second update which was adopted in July 2001, was in response to the creation of The 2000 Maryland Stormwater Design Manual, by the Maryland Department of the Environment. This was a major overhaul of the design of best management practices to using sizing criteria for water quality, recharge, channel protection, overbank flood protection and extreme flood volumes. In addition, it also provided six credits for the use of non-structural practices.

The most recent Maryland stormwater management regulations encourage wise, environmentally sensitive site design techniques such as Low Impact Development (LID), that reduce the overall volume of runoff and the generation of runoff borne pollution. LID promotes infiltration using ground water recharge criteria from Natural Resources Conservation Service. The Maryland General Assembly enacted the Stormwater Management Act of 2007, which codified the requirements for implementation of Environmental Site Design (ESD) techniques, through the use of nonstructural best management practices and other better site design techniques, which must be implemented to the maximum extent practicable. Maryland's approach continues to require that appropriate volumes be controlled on site to protect stream stability (channel protection volume) and to handle large rainfall events (over bank and extreme flood protection).

Limiting the amount of impervious surfaces by implementing the most effective stormwater management practices, such as ESD, must be incorporated in every new development and redevelopment project. Stormwater utilities are effective and should be incorporated in local ordinances to ensure that dedicated financial resources are available to support the maintenance of stormwater controls. They should also provide the resources needed to address existing developed lands that do not yet have stormwater management. This stormwater management approach provides flexibility to localities and developers/designers by ensuring that innovative site design techniques are blended into local grading, building and development codes, while mandating a specific pollution reduction performance standard.

A stormwater management policy for redevelopment had been established in the July 2001 Ordinance that specified a 20% reduction in impervious surface area below existing conditions. Where site conditions prevent the reduction of impervious area, the stormwater management practices shall be implemented to provide qualitative control for at least 20 percent of the site's existing impervious area. When a combination of impervious area reduction and stormwater practice implementation is used, the combined area shall equal or exceed 20 percent of the site. Locally approved practical alternatives such as fees-in-lieu, off site implementation, watershed or stream restoration and retrofitting are allowed as well.

### **C. The WRE Role in Stormwater Management**

According to the Clean Water Act of 1972, when waterways fail to meet water quality standards, they are subject to the regulatory authority of the Environmental Protection Agency (EPA). In 2000, the EPA approved a plan by the Chesapeake Bay Program to improve water quality by 2010. The Chesapeake Bay and Patuxent River water quality goals will not be met by 2010.

We know this to be true, not just because of water samples, graphs and reports, but because watermen cannot find oysters to harvest, and are finding fewer fish and crabs to catch. River waders are finding much less shallow bay bottom area covered with submerged grasses. Waterfront property owners are dealing with fish kills caused by algal blooms or lack of oxygen in the water. Residents are ready to see change. They want to know what governments and residents must do to improve water quality.

Counties are now charged with doing that which hasn't been accomplished at the regional level.

As per the Clean Water Act, limited assimilative capacity of receiving waters can inhibit or stop planned development desired by counties. This is the case whether assimilative capacity is exceeded as a result of increased point source loads, as a result of nonpoint source loads from new development or as a result of a combination of the two. The National Pollutant Discharge Elimination System (NPDES) and State Stormwater Management programs do not directly regulate nonpoint source pollution loads from development or associated septic systems outside of areas served by water and sewer, which are typically also areas outside of Priority Funding Areas. For this reason, it is incumbent upon the WRE and land use management programs to properly manage and regulate development outside of PFAs. By doing so, local government can manage nonpoint source pollution loads, commensurate with the assimilative capacity of state waters. Failure to do so reduces assimilative capacity, and may hasten the time when constraints must be placed on planned development in a watershed through the NPDES program.

The implementation of the comprehensive plan's vision is realized through zoning and the site plan and subdivision regulations. Suitable stormwater treatment involves two key considerations:

- The stormwater management regulations and implementation and
- The assessment of potential impacts of proposed land use changes on nonpoint source loads to state waters.

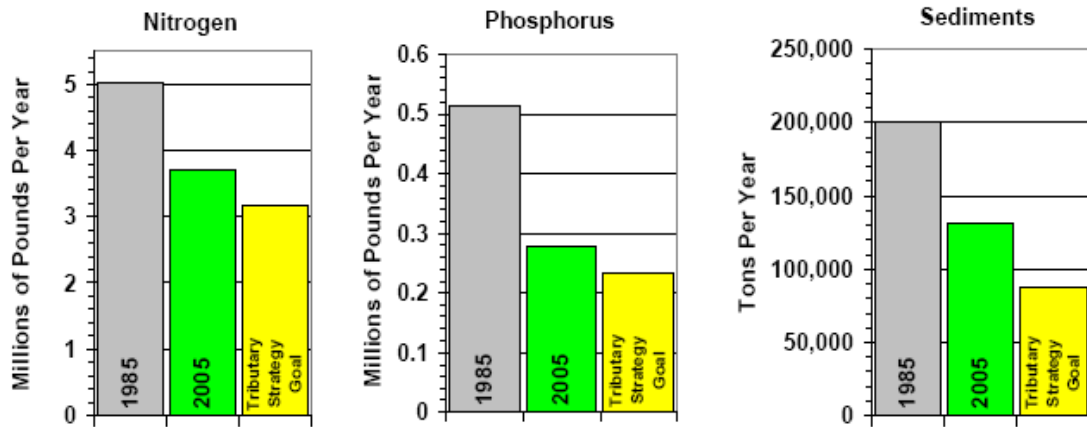
#### **D. Assessment Approaches/Methodologies**

Over the last two decades, the drought years have been the years with the best water quality. Heavy rains bring with them all the pollutants and loose soils along the way. Stormwater is a major source of pollutants.

##### **1. Sedimentation and Over-Nutrication in the Patuxent Watershed**

The three major culprits identified for cleanup in the Chesapeake Bay Agreement are nitrogen, phosphorus, and sediment and reduction goals were established by watershed.

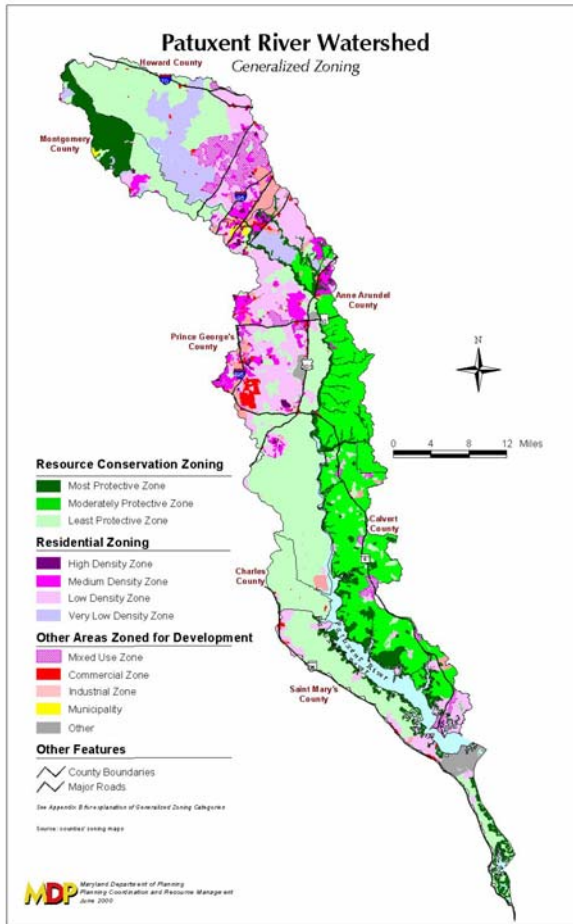
Before we can reduce pollutants, we must know their sources. The Patuxent River watershed includes land in seven Maryland counties. Roughly  $\frac{3}{4}$  of Calvert is in the Patuxent River watershed. Land Use models have been one of the principle tools used to set goals for reducing nutrients and sediments in the Bay. In 1992, the Bay Program Partners agreed to reduce controlled loads of nitrogen and phosphorus by 40% of 1985 levels by the year 2000. From this goal, the Bay Model was used to develop tributary nutrient load allocations for each of the nine major tributaries. The Patuxent goals are shown in figure 4.



**Figure 4: Patuxent River Tributary Goals**

**a. Nitrogen**

It has been well documented that three northern counties (Howard, Anne Arundel, and Prince George’s) have major community sewerage treatment plants that flow into the Patuxent. Only one small sewerage treatment plant flows from Calvert territory. Since our major sewerage treatment plants (Prince Frederick and Solomons) in the Patuxent River watershed use land-application technology, the Chesapeake Bay Model does not assess any nitrogen from these sources. According to zoning maps from the Maryland Department of Planning, most of Calvert’s lands enjoy ‘moderately protected’ status, whereas none of the other seven counties show lands with the same protected status (see figure 2.) In comparison, one would think that Calvert waters would be in the best condition. But that is not necessarily so.



**Figure 5: Generalized Zoning**

According to the Chesapeake Bay Model, Calvert County generates practically the same level of nitrogen pollution per acre as the rest of the watershed. The leading cause for nitrogen pollution, according to the model, is septic systems (see table 1.) Nitrogen is soluble and traditional septic systems do not remove nitrogen. Scientists estimate that 40% of the nitrogen leaving septic systems makes its way into surface water streams via groundwater. According to state estimates, sewerage treatment plants, with direct discharge, are 2 ½ to 5 times more effective at removing nitrogen than conventional septic systems, at least as long as they are not blown out in a storm which unfortunately is not a rare occurrence.

Cropland, according to the Bay Model, is Calvert’s second highest source of nitrogen pollution. Along the Patuxent River are Calvert’s best soils and over the last 30 years, Calvert has preserved over 28,000 acres of land, most of it

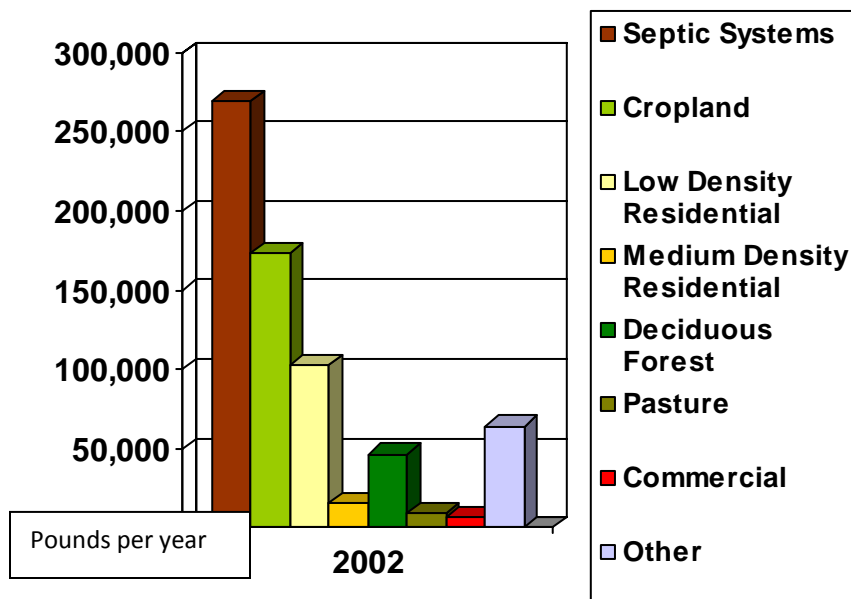
in the Patuxent River watershed. The Calvert County Comprehensive Plan calls for preserving farmland to ensure a sustainable future. Does this foretell a diminished future for water quality?

One hundred years ago, there was twice as much farmland and water quality was much better than it is now. The difference in the last 40 years has been abundant fertilizer and the introduction of many other sources of nitrogen. However, cropland does not have to generate excessive amounts of nitrogen runoff. In Maryland, farms are required to have nutrient management plans. In addition, most farms have soil conservation plans which require buffers and swales to control erosion and soak up extra nutrients. Other programs can reduce nitrogen runoff even more. These are outlined in the recommended actions.

Low density residential development rounds out the top three nitrogen sources, according to the Bay Model. In Calvert, there are nearly as many acres of land in the low density residential lots as cropland. Keeping lawns green can be a major source of nitrogen pollution. Unlike farm fertilizer, lawn fertilizer is not regulated and the Fish and Wildlife Service have notes that homeowners

spend more per acre to maintain their lawns than farmers and 10 times more chemical pesticides on their lawns than farmers place on crops.<sup>7</sup>

**Figure 6: Nitrogen Sources in the Patuxent Watershed according to the Bay Model**



How accurate are these estimates from the Chesapeake Bay Watershed Model? We don't know. Some of the model inputs are based on isolated studies and may not be applicable to Calvert's soils and groundwater hydrology. A study for the United States Geological Survey (USGS) by L. Joseph Bachman and David E. Krantz reported that soils in the middle and northern portions of Calvert may have the potential to denitrify ground water.<sup>8</sup> To date, there has not been a comprehensive study of nitrogen in county streams. Calvert's strategy needs to include a systematic study of stream water quality in its WRE strategy. Until that it complete, it is prudent for the Water Resources Element of the Comprehensive Plan to take steps to reduce nitrogen from new development, septic systems, farmland, and lawns.

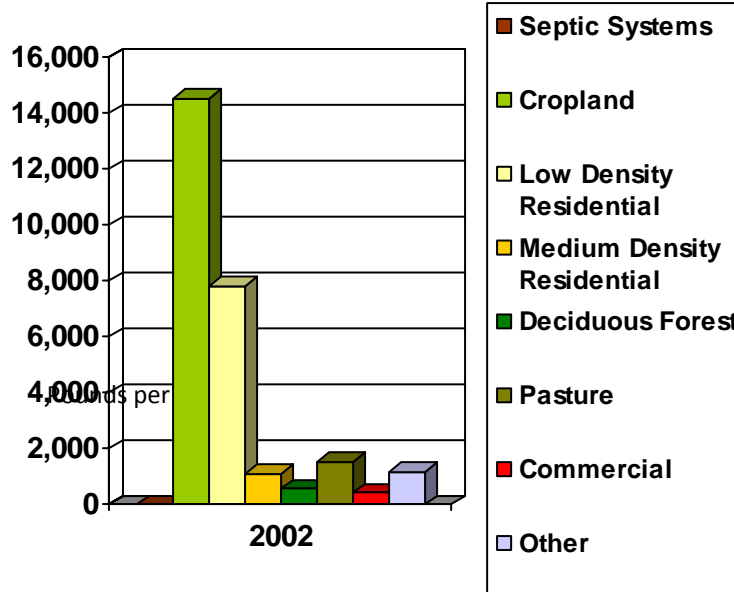
**b. Phosphorus**

Community sewerage systems can be a significant source of phosphorus, but this isn't a problem in Calvert's portion of the Patuxent River watershed due to the land application systems used. In addition, septic systems are not known as important source of phosphorus. However, there are three significant sources, cropland fertilizer, yard fertilizer, and erosion. According to the Chesapeake Bay Model, Calvert County generates approximately 15,000 pounds of phosphorus per year.

<sup>7</sup> Homeowner's Guide to Protecting Frogs – Lawn & Garden Care; U.S. Fish & Wildlife Service, Division of Environmental Contaminants; July 3, 2000.

<sup>8</sup> Bachman, L. Joseph and David E. Krantz; "The Potential for Denitrification of Ground Water by Coastal Plain Sediments in the Patuxent River Basin, Maryland; USGS Fact Sheet FS-053-00; 2000

**Figure 7: Phosphorus Sources in the Patuxent Watershed according to the Bay Model**



Perfect conditions for algal growth are when nitrogen and phosphorus are available in a ratio of 16:1. Solutions for over-fertilization are similar to the ones for nitrogen; daunting but not impossible. The tougher challenge is to reduce the phosphorus from sediment.

**c. Sediment**

A high percentage of Calvert’s soils are highly erodible. When John Smith toured the area, the highly erodible soils were held together by forestland. As previously mentioned, most of the forest was cleared by farming practices as far back as the 1800’s. The erosion from cropland filled wetlands and scoured streambanks and beds. Even today, the Bay Model estimates that the majority of sediment comes from farming practices. With no bedrock beneath them, coastal plain streams can erode well below the nutrient uptake and root-mat benefits of the surrounding vegetation.

Much of the sediment and sedimentation in the streams of Calvert County come from stream bank erosion caused by a lack of stormwater management. The Maryland Biological Stream Survey (MBSS, Maryland Department of Natural Resources) found that 44% of stream miles in the County had eroded banks. The study also estimated that 77% of stream miles in Calvert County had extensive or moderate development of in-stream sand bars. No streams were devoid of sand bars. There was no apparent geographic trend in bank erosion in the County (figure 8). This erosion causes downstream nutrient pollution and sedimentation that impacts fish, shellfish, benthic invertebrates and submerged aquatic vegetation. With eroded bands and bar formation, the physical habitat index for the benthic community is impaired.

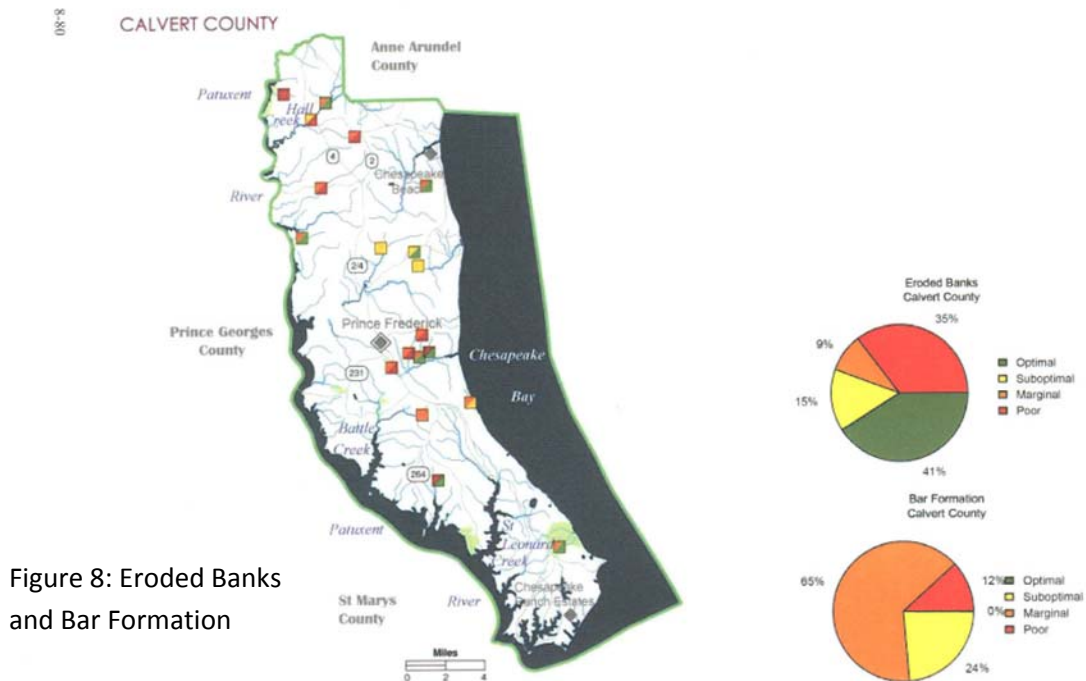


Figure 8-47. Pie charts and map of sites with eroded banks and instream bar formation for Calvert County streams sampled by the MBSS during 2000-2004

## 2. Sources of Pollutants in the Bay Side (Lower Western Shore Watershed)

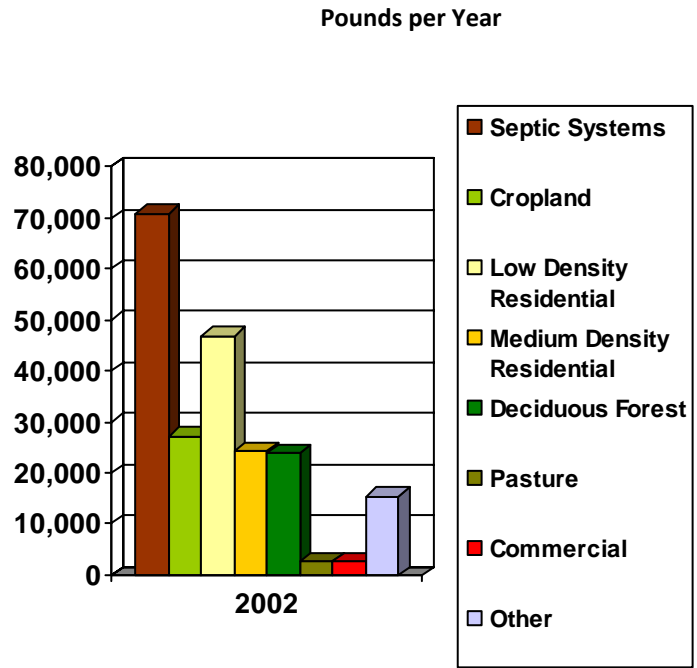
The Bay side of Calvert consists primarily of rugged land bounded by the famous Cliffs of Calvert. Before the adoption of zoning in 1967, dozens of weekend and vacation communities were recorded along the Bay, including Chesapeake Ranch Estates, Drum Point, Scientists Cliffs, Neelds Estates, Randalls Cliffs, etc. Most of the undeveloped land is forested. The old communities consist of small lots, septic systems, and no stormwater management plans or easements.

Fifty years ago, much of the land was farmed, but many of unproductive farms reverted to forestland.

### a. Nitrogen

On the Bay side, septic systems are once again the biggest source of nitrogen. The second highest source is low density residential and cropland, medium density residential and deciduous forests are nearly tied for the next major source.

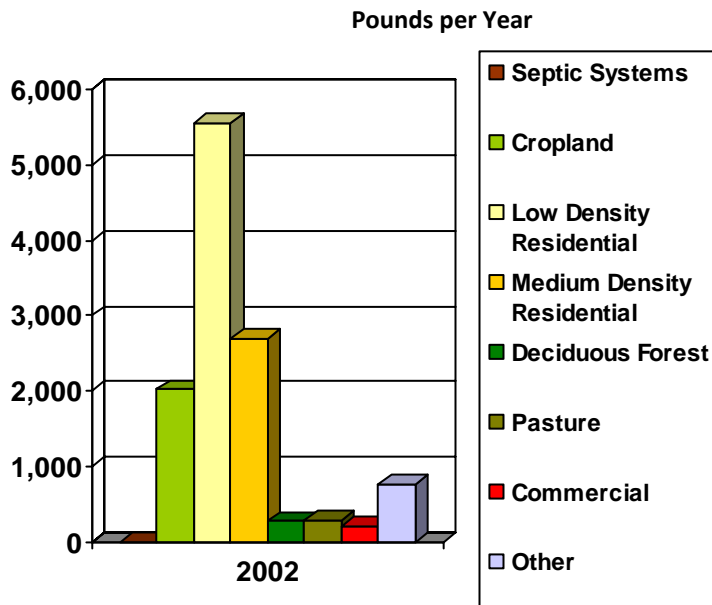
Figure 9: Nitrogen Sources on the Bay Side watershed according to the Bay Model



**b. Phosphorus**

Phosphorus is a key ingredient in the growth of plants. In nature it is a more stable nutrient than nitrogen, which is more soluble. It tends to attach itself to soil granules. It reaches surface water in two ways: the application of fertilizer on lawns and fields and sediment erosion into waterways.

Figure 10: Phosphorus Sources in the Bay Side watershed according to the Bay Model



### c. Sediment

The Lower Western Shore contains the most steep slopes in the County and a high percentage of highly erodible soils. This combination has led to excessive erosion at many development sites.

### 3. Watershed Planning

Each subwatershed has different attributes and water quality challenges. Therefore, the county has calculated land use impacts and conditions for each. Therefore, it is appropriate to evaluate the subwatersheds and set goals for each. Detailed information on the subwatersheds can be found in the Appendix ([under construction!](#))

### 4. Forest Cover and Impervious Surfaces

A number of studies have identified the strong correlation between good water quality and two conditions on the land: forest cover and impervious surfaces. Subwatersheds with the most forest cover and the least impervious surfaces are typically in the best condition. One benchmark for superior water quality is at least 60% forest cover and at most 10% impervious surfaces<sup>9</sup>.

Forests provide numerous benefits for water quality protection. Tree leaves, stems, and branches intercept rainfall, absorb water, filter out pollutants, provide shade over streams, and reduce temperatures on the ground and in the creeks. Roots store water, hold the soil and soak up nutrients. Leaf litter diffuses and reduces stormwater runoff. The shade from trees also reduces the ambient temperatures for inhabitants by an average of 3 to 10% F, which is particularly important in urban areas where heat islands are created by asphalt, roofs, and other impervious surfaces. In short, more forest the better, and at least 60% forest cover is a good standard for maintaining or improving water quality over the watersheds.

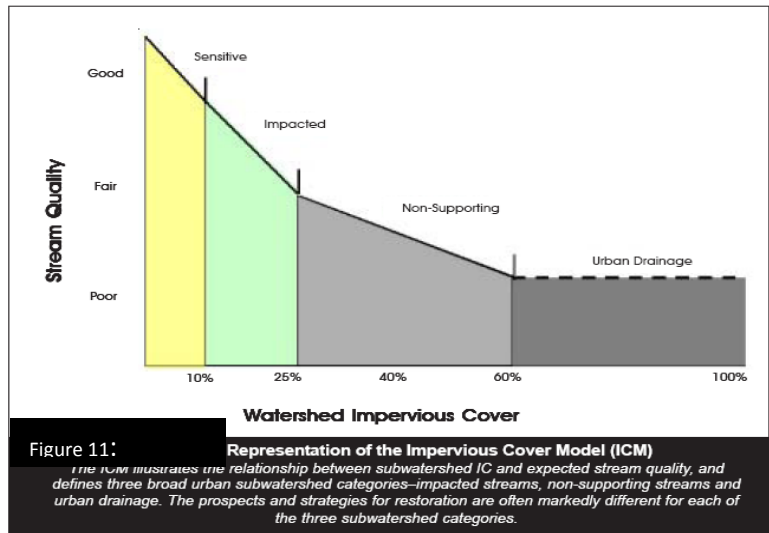
Within urban subwatersheds though, that standard is not achievable if one wishes to achieve smart growth and concentrate residential and commercial land uses. In urban subwatersheds, American Forests recommend an overall 40% urban canopy goal, 50% canopy in suburban residential areas, 25% canopy in urban residential areas, and 15% canopy in commercial areas (footnote Urban Tree Canopy). The overall tree canopy in Calvert County is 56%. prepared by American Forests. The pollutant reducing benefits of the trees in Calvert County according to the *City Green* model prepared by *American Forests* can be found by [clicking here \(connection under construction\)](#).

On the other hand, the more impervious surfaces in a watershed, the worse the water quality tends to be. The Center for Watershed Protection defines subwatersheds with less than 10% impervious surfaces as 'sensitive' and note that there is the opportunity for good water quality. Subwatersheds with 10% to 25% impervious surfaces are categorized as 'impacted' and these subwatersheds are characterized as 'urban.' Fair water quality is possible with this amount of impervious surfaces. However, in a rain event the amount of stormwater entering streams can be 1 ½ to 2 ½ times the amount of stormwater in sensitive

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<sup>9</sup> Goetz, Scott J. et al; IKONOS imagery for resource management: Tree cover, impervious surfaces, and riparian buffer analyses in the mid-Atlantic region; The Woods Hole Research Center; July 4, 2003; p. 1

subwatersheds. Therefore treatment of stormwater is key to prevent streams from becoming eroded and habitats from becoming degraded to the point that they don't support flora and fauna.



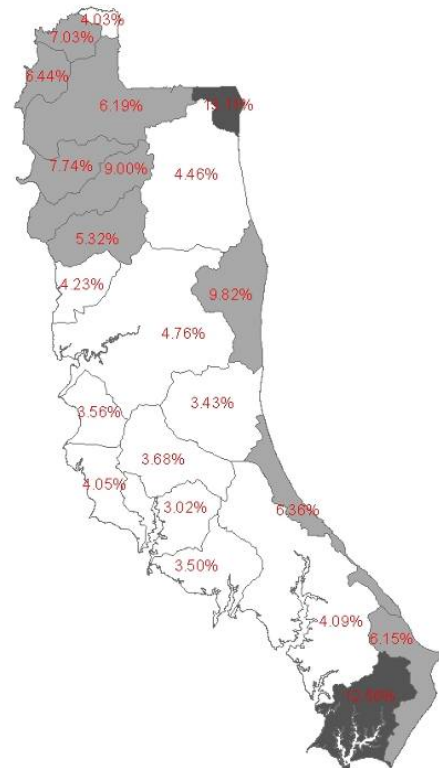
Urban Subwatershed Restoration Manual 1

In Calvert County, only two subwatersheds exceed 10% impervious surface—South Creek, within which is North Beach and part of Chesapeake Beach, and Mill Creek, within which is Solomons, most of Lusby, and portions of a number of residential communities. Of the remaining 20 subwatersheds, only two are approaching 10% (see figure 12.) With respect to stormwater, they should be treated the same way as urban subwatersheds to avoid the long term deleterious effects of stormwater. The remaining 18 subwatersheds are likely to remain below 10% impervious surfaces due to the zoning densities and land preservation efforts adopted by the Board of County Commissioners.

As mentioned earlier, the combination of high amounts of forest cover (>60%) and low impervious surfaces (<10%) can set the stage for good water quality. There are no guarantees. High pollutants loads can still exist, but at least these conditions can improve the chances for good water quality.

**Figure 12: Impervious Surfaces By Subwatershed**

(Source: Calvert County Dept. of Planning and Zoning)



# Tree Coverage and Impervious Surface Map

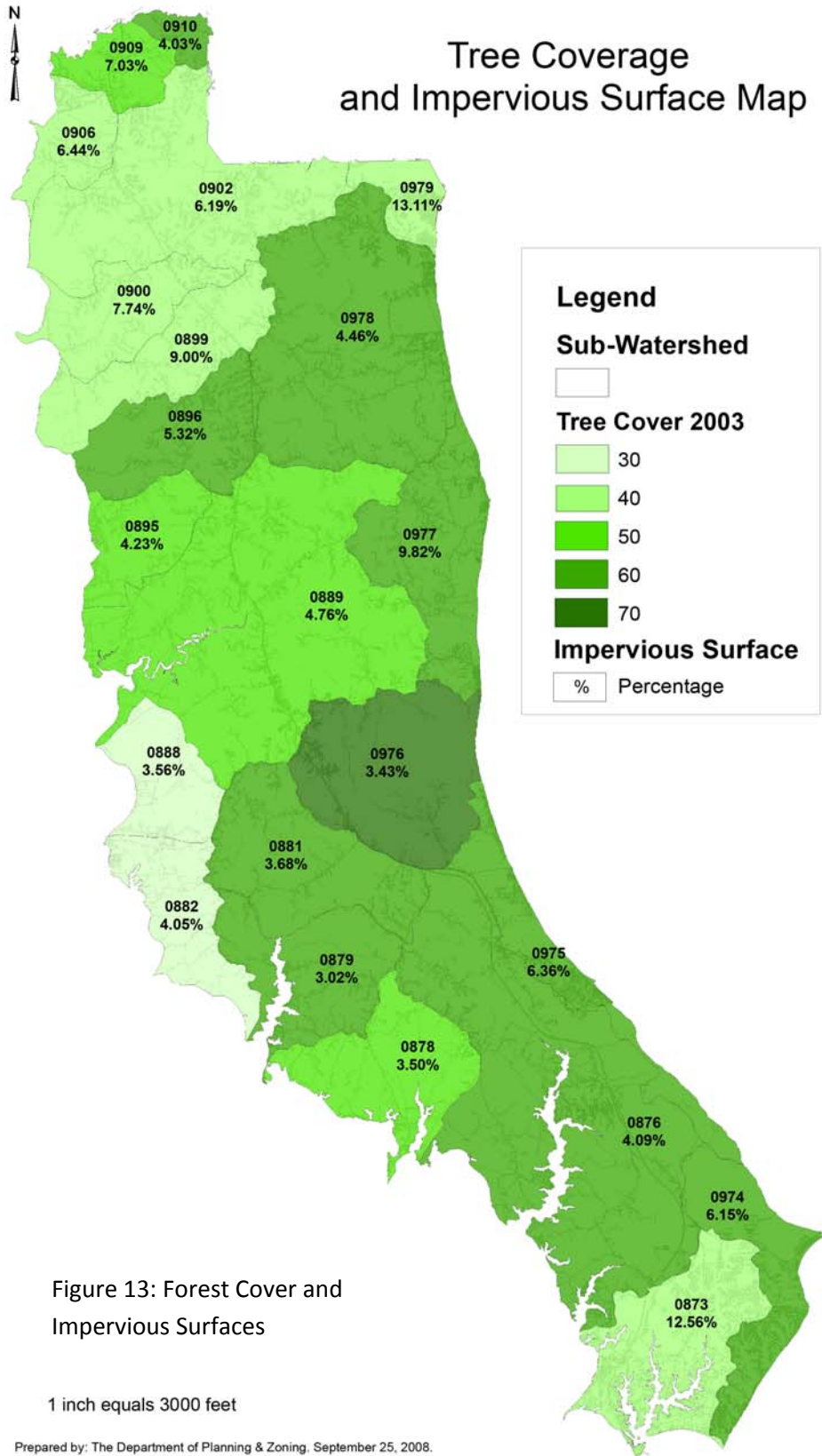


Figure 13: Forest Cover and Impervious Surfaces

1 inch equals 3000 feet

Prepared by: The Department of Planning & Zoning, September 25, 2008.

## 5. Integrating Stormwater Management and Smart Growth

Maryland has adopted smart growth policies that are geared toward concentrating development where it currently exists, thereby reducing suburban sprawl and impervious surface. To achieve overall watershed goals and promote smart growth, urban subwatersheds should not be held to the same standards or goals as rural subwatersheds. According to Manual 1 of the Center for Watershed Protection entitled “An Integrated Framework To Restore Small Urban Watersheds,” urban subwatersheds with between 10% to 25% impervious surfaces can achieve certain goals like ‘swimmable/ fishable’ but not necessarily others, such as ‘keep shellfish beds open’.<sup>10</sup> On the other hand, the manual notes that subwatersheds which exceed 25% impervious surfaces can not achieve many of the water quality goals. None of the urban subwatersheds in Calvert County should be allowed to exceed 25% impervious surfaces and nutrient loads should be held to levels that will preclude algal blooms.

On the other hand, steps should be taken to enhance water quality in rural subwatersheds so that they can achieve full ecological benefits of a sensitive subwatershed.

The following goals should be established in the WRE to recognize the roles of both rural and urban subwatersheds:

- Identify urban and rural watersheds and set water quality goals for both types of watersheds.
- Limit urban subwatersheds to less than 25% impervious surfaces and establish a goal of at least a 40% tree canopy for urban subwatersheds.
- Direct green offsets, such as wetland mitigation and forest conservation mitigation to rural watersheds.
- Establish forest cover goals and impervious surface limits for rural subwatersheds after studying the conditions of the streams.
- Maintain/establish conditions for rural subwatersheds to allow them to be anadromous fish spawning streams.

### E. Linking Stormwater Management to the Land Use Element

The results of the assessments outlined in D. above reinforce the County’s approach of establishing the Priority Preservation Areas and the twenty acre base zoning density. Doing so means that there will be fewer septic systems in subwatersheds that may already be exceeding nutrient loads. This approach has been reinforced by the County’s very active land preservation program which includes transferable development rights, two county purchase of development rights programs, and state land preservation programs.

However, the results also raise concerns about allowing transfer zones (with a density of one house per four acres) in the Rural Community District. Either the County may need to reduce the use of TDRs in this district or require nitrogen removing septic systems for all new developments. Before either approach is considered we need to determine if the actual loads to the streams are as high as those estimated by the Chesapeake Bay Model.

To have an effective strategy for watershed protection, the WRE must be adopted with goals and actions to protect/improve water quality, the actions must be implemented, and studies must be conducted to

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<sup>10</sup> See figure 26 of the manual, found on page 53.

see if the water quality is maintained or improved. The results of those studies are then the basis for amending the land use element.

**F. Linking Stormwater Management to the Land Use Implementation Element**

It is possible to accommodate growth in the county AND lower pollutant loads. Table 1 outlines the possible solutions that have been identified during the preparation of the plan. These are the tools that will be needed as we look at each subwatershed and prepare specific goals and action strategies for each.

**Table 1: Sources of Nonpoint Pollution and Possible Solutions**

Source	Pollutant	Solutions
<b>Septic systems</b>	Nitrogen	Continuing to proactively pursue state grants for installing nitrogen removing septic systems or reactive barriers, connecting to community systems, and directing new growth to community systems
<b>Farms</b>	Sediment, nitrogen, phosphorus	Working with the state to help farmers to plant cover crops, maintaining Soil Conservation District farm plans, promoting wetland creation in farming areas, and implementation of best management practices
<b>Old residential and commercial dev.</b>	Storm water, nitrogen and phosphorus	Promoting rain gardens, rain barrels, reactive barriers, pervious concrete for driveways, and providing education on land fertilization, etc.
<b>Stream bank erosion</b>	Sediment and phosphorus	Reducing stormwater entering streams and retrofitting impacted streams and using grants when available
<b>Roads</b>	Oils, sediment	Installing coastal plain outfalls and requiring open sections roads, encouraging the use of pervious pavement and non-structural stormwater management
<b>New Urban development</b>	Sediment, nitrogen phosphorus	Establishing tree canopy goals, and requiring non-structural storm-water management (bio-retention, grass swales, sand filters, green roofs, etc.)
<b>Tidal waters</b>	Nitrogen, phosphorus and sediment	Promoting oyster projects, living shorelines, planting SAVs and tidal marshes

### **Storm Water Recommendations:**

1. Establish the following goals for all waters in Calvert County.
  - Goals for fresh water:
    - <0.71 milligrams of nitrogen per liter
    - <0.031 milligrams of phosphorus per liter
    - <10 TNUs of turbidity
  - Goals for tidal water:
    - Chlorophyll <10 micrograms per liter of water
    - Secchi Depth measurements > 1 meter
    - Oxygen levels: 4 mg/l for deep waters and 6 mg/l for surface waters.
2. Establish the following additional goals for urban watersheds (>10 percent impervious surfaces):
  - Maintain fishable/swimmable status
  - Improve water clarity
  - Improve aquatic diversity in freshwater streams
3. Within the rural subwatersheds (<10 percent impervious surfaces), achieve the goals above, plus the following:
  - Maintain or create anadromous fish spawning streams
  - Develop and maintain shellfish beds, with the goal of making them open to harvesting.
4. Prepare watershed plans for all subwatersheds, using the tools suggested in Table 1 to help reduce pollutants. Once prepared, the subwatershed plans will be included in this guidance document and added to or referenced in the WRE. The actions will also be included in the subsequent amendment to the Water and Sewerage Plan and submitted to the Planning Commission for consideration in actions on subdivision and site plan cases.
5. Continue to monitor water quality:
  - a. Promote River keeper Stream Testing and those of other citizen groups.
  - b. Expand baseline studies of freshwater and tidal creeks.
  - c. Monitor effectiveness of wetland mitigation, rain gardens, rain barrels, nitrogen removing septic systems, nitrogen barriers.
  - d. Evaluate water quality goals as progress is made.
6. Include tree ordinances, with tree canopy goals in all town center ordinances.
7. Update the Stormwater Management Ordinance, using the latest model ordinance recommended by the state.
  - a. In communities developed without stormwater management regulations, require roof-top disconnects and rain gardens or other non-structural techniques in addition to payment of fees-in-lieu.
  - b. Consider using the fees-in-lieu to grant funding assistance for homeowners who voluntarily wish to retrofit their development by installing rain barrels or rain gardens.
8. Require open road design outside Priority Funding Areas.