

Chapter Four

NATURAL RESOURCES

INTRODUCTION

Balancing the protection of natural resources with the demands for development is becoming increasingly more contentious. In the 60's, little thought was given to the effects of land disturbing activities. Erosion and sedimentation went unabated. Wetlands were filled to accommodate new development and pesticide and fertilizers were applied to croplands with little consideration for runoff. However, over the last two decades, as the adverse impacts of development on the environment have become evident, and citizens, farmers, developers, and public officials have become more informed, increased efforts have been made to ensure the compatibility of land uses with the environment.

Recently, the trend has again turned as property rights advocates have argued, successfully on some occasions, that the public good does not always take precedence over the property rights of individual owners. This has forced local, state and federal agencies to evaluate their policies and regulations to ensure that they are reasonable and defensible against court challenges.

Caroline County is fortunate to have an abundance of natural resources in its agricultural and forestal lands, unspoiled watersheds, good water quality, scenic areas, wetlands, and other environmentally sensitive areas. The objective of this plan is to preserve and protect our environmental resources while accommodating development.

The purpose of this chapter is to provide an overall view of the County's natural resources and issues related thereto. This chapter further provides a series of goals, objectives and strategies for environmental protection with an emphasis on ensuring that development and environmental protection complement each other.

GEOGRAPHIC SETTING

Caroline County is located in the northeastern portion of the State on Interstate 95 (Figure 4-1). It is bounded on the north by the Rappahannock River and the counties of King George and Stafford. It is bounded to the east by the counties of King and Queen and Essex. It is

bordered to the south by King William and Hanover Counties as well as the North Anna and Pamunkey Rivers. Spotsylvania County borders to the west.

There are two incorporated towns within Caroline County. The Town of Bowling Green is located approximately in the center of the County and serves as the County Seat. The Town of Port Royal is located in the northeastern part of the County along the Rappahannock River. Caroline County is located within the Coastal Plain and Piedmont Physiographic Provinces.

NATURAL RESOURCES

AGRICULTURAL AND FORESTAL RESOURCES

As with most rural localities, Caroline County's economy is tied closely to the abundance of natural resources. As such, the wise use and protection of those resources is critical. These resources not only contribute to the economy but contribute to the rural character and quality of life as well. Caroline County's agricultural and forestal resources have been and continue to be important to the County. The preservation of agricultural and timberlands and retention of the County's rural character while accommodating development have always been goals espoused in the Comprehensive Plan.

The total amount of acreage available for agricultural or forestry uses is 313,306 acres or approximately 91% of the total acreage in the County. However, development policies that encourage rural development and discouraging resource preservation can lead to significant losses of this resource. County land use policies and decisions should encourage balancing the need for development with resource preservation.

Agriculture

Agriculture is a small but important aspect of the economy and the quality of life in Caroline County. It is both an industry as well as a part of the rural character of the County. However, land development and agriculture can be and often are incompatible. By permitting the development of prime agricultural lands, useful land is taken out of production. Rural subdivisions often create interface problems with agriculture such as dust and noise from the cultivation of fields or the raising of livestock. Planning efforts must be directed towards balancing the needs for future

development while maintaining the County's rural character and agricultural activities.

Agricultural Trends

Between 1987 and 1992, there was a net loss of 19 farms in the County, from 200 farms to 181 farms. At the same time, the amount of acreage farmed also decreased from 59,527 to 51,604 or approximately a 13.3% reduction. These trends reflect a continuation that was noted as far back as the 1977 Comprehensive Plan (Table 4-1).

**Table 4-1
Farm Statistics**

Year	Number of Farms	Change
1977	272	
1982	265	-7
1987	200	-65
1992	181	-19
1997	179	-2

Year	Acreage in Farms	Change
1977	73,916	
1982	73,802	-114
1987	59,527	-14,275
1992	51,604	-7,923
1997	55,403	+3,799

Year	Average Farm Site	% of County in	
		Farms	
1977	272	21.3	
1982	278	21.5	
1987	298	17.4	
1992	285	14.9	
1997	310		

Source 1978, 1987 & 1992 Census of Agriculture

The total acreage devoted to cropland declined slightly between 1987 and 1992. However, the total acreage harvested actually increased (Table 4-2).

**Table 4-2
Cropland - 1987 - 1992**

	1987	1992	Change	% Change
Total	35,740	35,707	- 83	- 2%
Harvested	28,026	29,631	+1503	+5.7%
% Harvested	78.3%	83%	---	---

Source: 1987 & 1992 U.S. Census of Agriculture

Table 4-3 shows the net cash return from farm sales in Caroline for 1987 and 1992.

**Table 4-3
Net Cash Return from Agricultural Sales
1987 & 1992**

	1992	1987
Farms	200	181
\$1,000	277	1,530
Average per farm in dollars	1,384	8,455
Farms with net gain	60	82
\$1,000	904	2,028
Average farm dollars	15,062	24,734
Farms with net loss	140	99
\$1,000	627	498
Average per farm in dollars	4,478	5,029

Source: U.S. Census of Agriculture - 1987 & 1992

As is evident from Table 4-3, 1992 was obviously a much better year for farms than 1987. The 181 farms in Caroline County "netted" \$1,530,000 in agricultural sales, for an average net sales of \$8,455 per farm. These sales and average sales figures for Caroline County showed significant increases over 1987. However, it is important to note that of the 181 farms in Caroline, 82 farms operated with net gains, while 99 farms still operated at net losses in 1992. The 82 farms were operating at relatively high gains to offset those farms operating at net losses. This indicates that the viable farming operations are concentrated on slightly less than half of the farms in the County.

Another indicator of agricultural viability is the value of the machinery, equipment and real property. Table 4-4 identifies real property and marketing value for 1987 and 1992. As is evident from this table, the value of both machinery/equipment and real property increased substantially between 1987 and 1992. Given the fact that there were fewer farms in 1992 than 1987, it appears that there were significant and important capital expenditures to upgrade agricultural operations.

Table 4-4

	1987	1992	Change	% Change
Machinery and Equipment	5,872,000	6,808,000	+936,000	+16%
Land and Buildings	594,525	713,479	+118,950	+20%

Thus, while the trend towards a reduction in the number of farms has continued, it appears that agricultural

operations have improved since 1987 and that agriculture will continue to be viable.

Total 261,702 acres

Source: 1991 Forest Survey of Virginia

Forestry

The forest industry has always been important to Caroline County. Approximately 76% of the County is covered by forest. Table 4-5 shows the acreage by timber type in the County.

**Table 4-5
Forestland Acreage by Timber Type**

Type	Acres	% Change Since 1986
Loblolly Pine	94,944	(+ 5%)
Upland Hardwood	113,672	(+ 5%)
Oak/Pine	33,976	(- 20%)
Bottomland Hardwood	19,110	(- 12%)
Total	261,702	

Forestlands provide a number of benefits, both economic and environmental. Forests provide raw materials for forest industries, which in turn provides employment for County residents. It provides income for owners of forestal property. Forests provide environmental benefits such as watershed protection, control of soil erosion and stream sedimentation, wildlife habitats, reduction of noise and air pollution, screening of incompatible land uses, and recreational opportunities.

While forestlands provide a number of benefits, the amount of forestland is gradually being reduced, not by timbering activities but through residential development. Because of its abundance of rural land, Caroline County is attractive for people desirous of rural lots. A significant amount of residential development over the last decade has been the development of 2 - 10 acre lots. County regulations and planning efforts have encouraged this type of development. While this type of development may be attractive to new residents, it represents a waste of a valuable resource that, once eliminated, is non-renewable. Table 4-6 indicates that of the 261,702 acres of forestland, 71% (185,993 acres) is privately owned, and therefore, potentially susceptible to development.

**Table 4-6
Commercial Forest in Caroline County**

Ft. A.P. Hill	55,565 acres
Forest Industry Owned	20,144 acres
Privately Owned	185,993 acres

Issues

As previously stated, land development and resource protection and preservation are often incompatible. Land use policies, decisions and regulations often encourage the development of resources that warrant protection. This, in turn, creates interface problems between the development and the agricultural/forestal industry.

Once land is developed, its resource potential is severely limited or eliminated altogether. In order to encourage positive development while preserving and protecting the County's agricultural/forestal resources, the following should be encouraged:

- Analyze the recently completed soil survey by the Soil Conservation Service. This was imperative to the identification of the prime agricultural/forestal soils as well as environmentally sensitive features.

The detailed soil survey has been completed by the Soil Conservation Service and is imperative to help identify prime agricultural and forestlands and to develop regulatory tools to preserve such lands. The County should use the survey to develop policies for specific areas to supplement the general policies and planning guidelines.

- Development of clustering regulations that preserve natural resources where development is permitted.

Cluster development regulations allow the owners of large tracts of agricultural or forestlands to develop part of the property as residential lots while preserving the majority of the land with the best resources for agricultural or forestal uses. In utilizing this concept, low density zoning of the parcel of land limits the number of residential lots that may be developed. The lots are then allowed to be arranged to occupy a small portion of the property with lot sizes smaller than that of a conventional lot in that zoning district. The remainder of the property is then preserved, through easements, for agricultural uses.

This type of development may also be used to protect other resources such as floodplains, wetlands, and steep slopes where development should be discouraged. The use of clustering, if used properly, may also have the added benefit of preserving the rural character of the County.

- Promoting conservation easements and other non-regulatory tools to protect these resources.

A number of non-regulatory preservation tools exist which the County should encourage, including conservation easements and the purchase of development rights. Conservation easements are voluntary restrictions on the use and development land entered into by a landowner with an agency permitted by law to hold such an easement. In return for granting such an easement, the owner receives certain tax benefits that offset the development value lost with the easement.

The voluntary purchase of development rights could be utilized in conjunction with conservation easements. Under this scenario, a developer seeking to obtain higher density zoning in the primary growth area, could work with property owners in rural areas and purchase their development rights. A conservation easement would then be placed on the agricultural land. Care must be taken to differentiate between a voluntary purchase of development rights and a formal Transfer of Development Rights (TDR) Program which is not authorized by State code.

FLOODPLAINS

Floodplains are relatively flat or lowland areas such as rivers, streams, or other watercourses which are subject to partial or complete inundation. Floodplains provide a number of beneficial uses as well as having certain natural values, including:

- Providing for the natural moderation of floods, the maintenance of water quality, and the recharge of groundwater.
- Supporting large and diverse populations of plants and animals which represent important renewable resources.
- The wetland areas of floodplains are highly biologically productive because they contain elements of both terrestrial and aquatic habitats

and provide vital breeding grounds for fish and wildlife.

- Containing cultural resources including archeological and historical sites, unique habitats for ecological study, open space, and recreational opportunities.
- Providing excellent resources for agricultural, aquacultural, and forestry production.
- Esthetic and other intangible attributes of floodplains have important social and economic values.

*Source: FEMA A National Program for Floodplain Management

Governments at all levels are becoming increasingly aware and concerned about floodplain development decisions. For years, floodplain use, development, and impacts were poorly understood. However, as flood losses continue to increase, which leads to higher financial costs, personal injury or loss of life, it has become increasingly evident that an effective floodplain management program is necessary.

In terms of floodplain identification, the designated frequency often used by the Federal Emergency Management Agency (FEMA) is the 100 year flood. The 100 year floodplain is an area that has a 100 percent chance of flooding at least once within 100 years or a one percent chance of flooding per year. The 100 year floodplain is divided into two areas: the floodway and the floodway fringe.

In August 1989, the Federal Emergency Management Agency completed its review of flood hazards in Caroline County by adopting a revised Flood Hazard Map. A general flood hazard map is shown in Figure 4-2. As watersheds develop, the amount of impervious surface will increase. The location and amount of future impervious area should be monitored for the effects on the 100 year floodplain.

GEOLOGY

Caroline County is located within the Coastal Plain and Piedmont Physiographic Provinces. The majority of the County lies within the Coastal Plain Province, while the western portion of the County, generally west of Interstate 95, lies within the Piedmont Province.

Caroline County is underlain mostly by Coastal Plain sediments, with smaller areas of metamorphic and sedimentary rocks. The metamorphic rocks occupy the

far western portion of the County and include granite gneiss and hornblende gneiss. By far, the most abundant rock is the granite gneiss, banded rock of quartz, feldspar, and mica (mostly biotite). This rock was probably a granite originally that was altered through heat and pressure miles below the surface to gneiss. Subsequent erosion through many eons removed overlying rock to expose the gneiss. The banding or foliation of the rock trends slightly east to north and the dip is variable, because of the intense folding that followed or accompanied the metamorphism. The gneiss lies predominantly west of U.S. Highway 1, although it extends east of I-95 in the valleys of Polecat Creek and the South River. The granite gneiss may extend considerably further east under the Coastal Plain sediments.

A small area of hornblende gneiss extends into the County from Hanover, two miles west of U.S. Highway 1. It is surrounded by gneiss except to the north where it passes beneath a cover of Coastal Plain sediments. The hornblende gneiss is a banded white and dark green rock containing plagioclase feldspar and hornblende. The foliation is generally the same direction as in the granite gneiss. Both rocks are Precambrian, which is greater than 500 million years old. The metamorphic rocks belong to the Piedmont Physiographic province.

Red sandstone and the conglomerate of Triassic age (about 180 million years old) occupy a relatively small area in the southern end of the County on both sides of U.S. 1 extending into Hanover County. Originally, they were stream-deposited sediments filling a down-faulted basin. The fault, which bounded the basin on the northwest, is now represented by a zone of breccia. This breccia can be observed in the headwaters of Long Creek, and is the result of crushing rock on both sides of the fault during its formation. The sandstone and conglomerate disappear northward beneath the Coastal Plain and may extend out for a considerable distance. Along the North Anna River, Triassic rocks plunge beneath thick alluvium.

Most of the County is underlain by unconsolidated sediments of the Coastal Plain, occurring in broad patches dissected by more recent valleys. The sediments are mainly sand and gravel of marine origin with some clay and marl. They are present in a system of high terraces. The Coastal Plain sediments extend west of U.S. 1 as isolated patches and tongues. These

sediments are Tertiary in age, deposited within the last 60 million years.

Floodplain deposits and low alluvial terraces are found in three main belts. One is found along the North Anna River below I-95. Another cuts across the middle of the County along the Mattaponi, which branches up to the lower courses of the Matta River, South River, Polecat Creek, and the Marracossic River. The third lies along the Rappahannock River. Sand and gravel with some silt and clay constitute these deposits, which are the youngest mapped in the County. Alluvium occurs naturally in all the smaller valleys but not on a scale important enough to map. A general map of the County's geological features is shown in Figure 4-3.

SOILS

The Soil Conservation Service of the United States Department of Agriculture is responsible for preparing generalized soil surveys. These soil surveys, although primarily for agricultural purposes, have potential for identifying the general suitability of soils for development. The Soil Conservation Service recently completed the Caroline County Soil Survey. The completion of the survey was a high priority of both the Soil Conservation Service and the County.

The soils are divided into one of eight general soil classifications. These classifications and descriptions of each are as follows:

Coastal Plain Soils

Areas dominated by soils with sandy loam surfaces and sandy clay loam to clay loam subsoils of moderate to slow permeability.

1. **Emporia-Rumford-Slagle Association:** Very deep, well-drained and moderately well-drained soils occurring on gently sloping to steep slopes of the Coastal Plain uplands.

Areas dominated by soils with loamy sand to sandy loam surface textures and loam to sandy clay loam subsoils of moderate permeability.

2. **Rumford-Suffolk-Emporia Association:** Very deep, well drained soils occurring on gently sloping to steep slopes of the Coastal Plain uplands.

Areas dominated by soils with sandy loam surface textures and clay loam subsoils of moderate to slow permeability.

3. **Slagle-Emporia-Yemassee Association:** Very deep well-drained to somewhat poorly drained soils occurring on nearly level to moderately steep slopes of Coastal Plain uplands.

Stream Terraces and Floodplains

Areas dominated by soils developed in alluvial stream deposits. These soils have loamy sand to sandy loam surfaces and sandy loam to clay subsoils.

4. **Altavista-State-Bojac Association:** Very deep, moderately well drained to well drained soils, occurring on nearly level to gentle sloping stream terraces and floodplains.
5. **Roanoke-Altavista-Bibb Association:** Very deep, poorly drained to moderately well drained soils occurring on nearly level to gently sloping stream terraces and floodplains.

Piedmont Soils

Soils which have developed from the weathering of crystalline rock. These soils have sandy loam surface textures with clay subsoils of moderate permeability.

6. **Appling-Cecil-Emporia Association:** Very deep, well-drained soils occurring on gently sloping to steep slopes in the Piedmont upland and the transition area between the Piedmont and Coastal Plain uplands.
7. **Cecil-Appling-Wedowee Association:** Very deep, well-drained soils occurring on gently sloping to steep slopes of the Piedmont uplands.

The general location of the soils classifications are shown in Figure 4-4.

In addition to the general soils classifications, the Soil Conservation Service also group soils on the basis of their ability to produce common cultivated crops and

pasture plants over long periods of time without deteriorating. This designation is referred to as the land capability class and is beneficial in identifying the most suitable soils for agricultural production.

Figure 4-5 identifies the different soil mapping units and their classification codes. Soils with an asterisk next to them are considered prime agricultural soils. Other class 2 and 3 soils may also have agricultural potential. Efforts should be made to preserve prime agricultural soils, especially in the areas designated for rural and agricultural land uses.

From an environmental perspective, the soil survey can assist both the County and landowners in land use decisions. The soil survey identifies soil types that, if developed improperly, can result in the degradation of the natural environment, and increase the cost of development. These soils include soils that are characterized as highly permeable, highly erodible, or hydric (wetlands). A brief description of these characteristics and their implications for development follows.

Highly Permeable Soils

Highly permeable soils are identified as any soil having permeability equal to or greater than six inches of water movement per hour in any part of the soil profile to a depth of 72 inches. In short, water percolates through these soils faster than other soils. The danger with development of these soils is that water carries pollutants with it through the soil profile. These soils provide a conduit for the pollution of both surface and groundwater, creating the potential for contamination of our water sources. Figure 4-6 identifies the general location of highly permeable soils, which tend to be situated in the river and stream valleys. Highly permeable soils account for approximately 59,000 acres of land (17% of land area) and qualify for designation as a Resource Management Area pursuant to the Chesapeake Bay Preservation Act.

Highly Erodible Soils

Highly erodible soils are classified as any soil with an erodibility index of 8 or greater, which is determined by a familiar method established in the Food Security Act Manual of 1988. These soils, if cleared of vegetation and exposed to the elements of nature, may experience significant erosion and sedimentation problems. This often results in the loss of topsoil, which is good for the

establishment of vegetation for “developed” sites, as well as nutrient enriched soils needed for agricultural production. These soils tend to be located on hillsides adjacent to the river valleys and their tributaries. Highly erodible soils constitute 21% of the County’s land area or 73,241 acres. These soils also constitute a resource worthy of designation as a component of the Resource Management Area. Highly erodible soils are shown in Figure 4-7.

WETLANDS (HYDRIC SOILS)

Wetlands are identified as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, perennial streams, and similar areas. (33CFR323.2(c); 1984)

Until recently, wetlands were considered to be useless. Wetlands were drained or filled for more beneficial uses such as agriculture, public improvements, or economic development efforts. However, the benefits of wetlands are increasingly more evident and efforts to drain or fill have been replaced by protection measures and mitigation.

Wetlands have both direct and indirect benefits, and perform important roles that contribute to the quality of life of residents as well as being economically beneficial. Wetlands perform the following functions:

- Protect surface water quality by trapping sediment and pollutants;
- Serve as a natural means of flood control by absorbing and storing water during high runoff periods;
- Produce nutrients, provide habitat, and supply food essential for numerous species of wildlife and aquatic organisms;
- Provide recreational benefits to hunters, fisherman, and campers;
- Provide open space buffers for incompatible land uses; and
- Maintain the critical base-flow of surface water during times of drought through the gradual release of stored waters.

There are 34,500 acres of wetlands within the County. Wetlands are classified as either tidal or nontidal. These classifications are further subdivided into a variety of wetland types such as emergent, shrub-scrub, forestal, marsh, etc. The National Wetlands Inventory Maps, produced by the U.S. Fish and Wildlife Service, utilized for the general delineation of wetlands within the County. However, the completion of the soil survey provides a better tool for wetlands identification, through the designation of hydric soils. Figure 4-8 identifies the hydric soil locations in the County.

Wetlands disturbance activities are regulated by a number of federal, state, and local agencies. The United States Army Corp of Engineers is responsible for regulating the disturbance of non-tidal wetlands. The Virginia Marine Resources Commission is responsible for enforcing and regulating activities within tidal wetlands. Most recently, tidewater localities were mandated to establish regulations governing the protection of wetlands and water quality through the Chesapeake Bay Protection Act.

In order to protect wetlands within the County, the following policies should be implemented:

- Wetlands should be avoided to the extent possible. Where it cannot be avoided, disturbance should be minimized to the extent possible and any impacts mitigated.
- As part of the site plan submittal, wetland, floodplains, etc., must be identified on the site plan maps and supporting documentation. If wetlands are present that are to be disturbed, the applicant should be required to demonstrate whether or not a permit is required by the Commonwealth of Virginia and/or the Army Corps of Engineers.
- When a wetland permit is required, a copy of the wetland permit should be submitted to the County prior to approving development requests and the issuance of any land disturbing permits.
- If mitigation is required then the applicant must submit the mitigation plans to the County. The plans should include where the mitigation will take place, the length of time before the project is completed, the length of time until the mitigation site is self-sustainable, and any long term responsibilities of the property owner for the mitigation site.

SURFACE WATER

Surface waters are susceptible to the adverse effects of land use. The sources of pollutants are many, but the primary sources are: runoff for agricultural, cultivation, runoff from impervious surfaces, failing drainfields, soil loss from timbering or agricultural operations and discharges from wastewater treatment plants. Changes in land use have resulted in increased point and non-point source pollution such as identified above, which in turn leads to water quality degradation.

Caroline County is located within two major river watersheds; the Rappahannock River and the York River. Both rivers are major tributaries of the Chesapeake Bay. The Rappahannock River watershed is further divided into several smaller sub-watersheds within the County.

The York River Watershed has three major sub-watersheds; the North Anna/Pamunkey River, the Mattaponi River, and Maracossic Creek. The Mattaponi subwatershed has several major tributaries, including: Polecat Creek, Reedy Creek, and the South River. The York River Watershed covers the southern two-thirds of the County. Figure 4-9 shows the watersheds within the County.

Several state agencies as well as the County are responsible for monitoring water quality and establishing regulations ensuring that acceptable standards for water quality are met. The Department of Environmental Quality monitors water quality for compliance with federal and state regulations through a series of monitoring stations throughout the County. This agency is also responsible for permitting point source discharges such as wastewater treatment plants to ensure that these dischargers meet certain minimum standards.

The Department of Conservation and Recreation establishes and administers Erosion and Sediment Control laws and regulations, stormwater management regulations, and the control of non-point source pollution through the use of Best Management Practices. These, in turn, are administered and enforced through local ordinances.

The County, in addition to enforcement of the Erosion Control and Stormwater Management regulations, is also responsible for water quality protection through its adopted Chesapeake Bay regulations. These are discussed later in the chapter.

SHORELINE CONDITIONS

Rappahannock River Basin

The Rappahannock River shoreline comprises approximately 42.6 miles of the County's total shoreline. The shore lands are divided about equally between low shore, moderate shore and moderately high-to-high shore lands, including bluff areas. Approximately 96% of the shoreline is comprised of fringe, embayed and extensive marshes, while the remaining 4% is comprised of beach areas. A detailed analysis of the river was undertaken in the late 70's by the Virginia Institute of Marine Science and their findings reported in the Shoreline Situation Report for King George and Caroline Counties, VIMS, 1979

Shoreline Erosion Situation

From the Caroline/Spotsylvania County boundary to White Marsh, the shoreline erosion rate is typically slight or no change to moderate/non critical. Most of the erosion takes place on the outside bend of the meanders. The Skinkers Neck and Moss Neck areas are experiencing rates of up to 2.0 feet per year.

From White Marsh to the James Madison Bridge, the erosion rate has been classified as slight or no change. Again, some slight erosion is occurring on the outside bend of the meanders, especially at the base of the cliffs. The marsh area opposite Cleave Marsh has an average historical accretion of 2.9 feet per year. Some artificial stabilization is located at the base of the James Madison Bridge, as well as the boat ramp on the southwest side of the bridge.

The last segment of the Rappahannock River within Caroline County, from the James Madison Bridge to Portabago Creek, has an erosion rate of slight or no change to moderate/non critical. The stretch of shoreline from the marsh north of Portabago Bay to Mill Creek has an average historical erosion rate of 1.5 feet per year. A review of 1991 and 1995 aerial photography indicates that there is no evidence of critical shoreline erosion.

York River Basin

Shoreline Erosion Conditions

Numerous perennial and intermittent streams flow directly or indirectly to the Mattaponi and Pamunkey rivers, which eventually flow into the York River. These streams are typically slow and meandering with extensive wetlands. An extensive survey of shoreline erosion conditions has not been performed on the Mattaponi or Pamunkey rivers. However, staff has analyzed both 1991 and 1995 aerial photography. Based upon this analysis, there does not appear to be any evidence of critical erosion. Due to the meandering nature of the streams, some erosion on the outside bends and accretion on the inside of bends is expected.

Shoreline Policies

Significant shoreline erosion can be an environmental hazard to shell fish, submerged aquatic vegetation, and water quality due to sedimentation. In addition, nutrients and other contaminants may be attached to sediments, further impacting water quality, and the flora and fauna inhabiting the streams. Land disturbing activities and shoreline development can aggravate shoreline erosion and sediment loss.

To minimize the adverse effects of shoreline development, the major rivers, associated wetlands and tributary streams are designated as Resource Protection Areas. However, water dependant facilities are permitted within areas designated as RPAs. To ensure shoreline erosion is minimized, the following strategies will be implemented.

1. Shoreline structures, including stabilization structures, piers, dock, water treatment facilities, shall have appropriate permits.
2. Shoreline stabilization projects should be reviewed by appropriate agencies to determine the extent of erosion problems and the adequacy of the proposed stabilization plans.
3. Physical development shall be removed from shoreline areas to the extent practical and legally permissible.
4. Where appropriate, a shoreline assessment shall be required with development applications. Where significant or critical shoreline erosion is identified, a shoreline plan will be required to be developed and implemented as part of the project.

5. The County will amend its ordinances to require the development and implementation of shoreline stabilization strategies where significant or critical shoreline erosion is occurring.

RIVER ACCESS

River access is an important resource to the residents of the County. River access includes access for shoreline fishing, instream fishing, powerboat and canoe launching, hunting, as well as other recreational opportunities. Due to the nature of the County many of the County's waterways are narrow and shallow and may accommodate only car top launching areas or shoreline access for scenic or passive recreation. The only developed sites are within the Rappahannock Basin. Two private sites are located at Portobago Bay and Hicks Landing. A public access site is available at Port Royal. However, the Port Royal site has limited capacity due to inadequate parking and poor access. A new semi-public facility has been constructed on the west side of A.P. Hill Boulevard. This may replace the existing public boat ramp in Port Royal. A new facility is also proposed at Haymount, further west on the river.

Poorly designed or inadequate water access may promote shoreline erosion through the development of random access points by the water users. Instead, the County should utilize the Chesapeake Bay Area Public Access Plan developed as part of the 1987 Chesapeake Bay Agreement between Virginia, Maryland, Pennsylvania, District of Columbia, the Environmental Protection Agency and the Chesapeake Bay Commission.

This plan identifies the potential for several car-top boat access points in the Mattaponi and Pamunkey River watersheds (Figure 4-10). Further investigation of these sites for the development of river access should be undertaken and funding sources identified.

River Access Development

When siting river access points, a number of issues should be considered to minimize potential impacts. The following policies should be utilized by the County in the development of river access sites.

- All non-water dependent structures should be located outside of any Resource Protection Areas.

- RPA development should be limited to water dependent facilities and passive recreation such as boardwalks, trails and picnic areas.
- Environmentally sensitive areas such as wetlands, natural heritage areas, cultural resources, or areas of critical shoreline erosion should be avoided when developing structures. Such features may be incorporated as passive recreation features of the river access site.
- When developing river access sites all potential uses should be considered and as many as possible included as part of the river access site. These uses may include:
 - Bank and pier fishing
 - Nature study and education;
 - Hiking;
 - Picnicking;
 - Camping; and
 - Hunting.

GROUNDWATER

Groundwater is the primary source of potable water in Caroline County. Only Lake Caroline is served by surface water withdrawal for its water requirements.

Groundwater in Caroline County is found in two different types of aquifers: consolidated rock of the Piedmont and unconsolidated sediments of the Coastal Plain. Figure 4-11 is a profile view of these aquifers. The aquifer in the western portion of the County consists of fractures and joints in the granite bedrock and decomposed granite above the bedrock. This aquifer is particularly vulnerable to contamination from any pollutants introduced at the land's surface.

Aquifers in eastern Caroline County are comprised of unconsolidated sand, gravel, silt, and clay. One of these aquifers known as the "water table aquifer" is located near the surface of the earth. Many private wells are withdrawing water from this aquifer. It does not appear that there are any public water supply wells withdrawing water in this area. This is fortunate since these wells are particularly susceptible to contamination from surface pollutants. The more water that is withdrawn from these wells, the greater the area around them that requires protection. Beneath these surface aquifers are thick layers of clay through which the water moves very slowly. Beneath the layers of clay are other aquifers known as "confined" or "artesian" aquifers. Most of the public water supply wells in the eastern

portion of Caroline County withdraw water from these aquifers.

The water recharging confined aquifers enters by two different routes. A portion of it leaks very slowly through the overlying clay layers. Most of the water enters the aquifer near the Mattaponi River where the aquifer is exposed at the land surface. These areas require protection from land uses which may leave contaminants on the land surface. Additionally, it is important to eliminate any conduits from the surface to the aquifers, such as improperly abandoned wells. Figure 4-12 depicts the interaction between land uses and groundwater. Groundwater withdrawals are regulated ensuring that the long term supply for future demand remains adequate. The quantity of water in the underground rock and sand formations are estimated so that withdrawals do not deplete the supply. The Department of Environmental Quality Water Division formerly State Water Control Board and the Virginia Department of Health manage the Commonwealth of Virginia's water resources. They maintain an inventory of available water sources and monitor withdrawals through permitting programs.

To avoid overuse of groundwater in areas of high withdrawal rates, the State Water Control Board regulates withdrawals in areas designated as Groundwater Management Areas. In these areas, new or expanded groundwater withdrawals must receive a permit from the State Water Control Board, unless the withdrawal rate will be less than 300,000 gallons per month. The State Water Control Board can deny, limit, or restrict a request for water if it determines that the withdrawal will interfere with existing users or if there will be a wasteful use of groundwater. One such area that affects Caroline County is in West Point, located in King William County. The James River Corporation has a large paper products plant that utilizes significant amounts of groundwater in its production processes. The County should carefully monitor any requests for additional withdrawals to evaluate potential impacts on the County.

TOPOGRAPHY

The topography in Caroline County is varied depending on whether the property is located in the eastern two-thirds (Coastal Plain Physiographic Province) or western one-third (Piedmont Physiographic Province) of the County. The topography in the Coastal Plain Province tends to be mostly level to gently sloping with elevations

of 30 to 250 feet above sea level. Some areas with steep slopes (>15%) exist along streams or rivers.

The topography in the Piedmont Province tends to be gently to moderately sloping with elevations of 50 to 350 feet above sea level. Again, areas that exist along streams or rivers have steep slopes in excess of 15%. These areas of steep slopes, regardless of where they are located, are of significant concern due to their sensitivity to development.

Steep slopes can be very scenic and attractive for development. These same slopes, however, are quite susceptible to erosion, depending on the length of the slope, grade, ground cover, soil characteristics, and the amount of rain. Care should be taken in allowing development in areas identified with steep slopes.

No inventory of slopes has ever been undertaken in the County. With the development of the County's geographic information system, environmentally sensitive features such as steep slopes should be inventoried and a database established to allow better land use decisions. The County regulations should also be reviewed and appropriate amendments made to ensure these features are protected.

SCENIC RESOURCES

Because the County still maintains its rural character, it also still retains many scenic areas which contribute to that character. A portion of the North Anna River from Landora Bridge Road (Route 601) to Jefferson Davis Highway (Route 1) has been identified by the Department of Conservation and Recreation as qualifying for scenic river status. Additional sections of the river have been requested to be evaluated. Sections of the Rappahannock River have also been noted as being worthy of consideration.

In addition to its waterways, the County also has attractive viewsheds that are visible from its roads. Tidewater Trail has long been noted for the scenery through which it traverses, as have other roads.

The County should undertake an analysis of its scenic resources and recognize those resources that merit protection through the Commonwealth's Scenic Rivers or scenic roads programs. Resources that do not qualify for state designation but are of local significance should also be identified.

CHESAPEAKE BAY PRESERVATION REGULATIONS

INTRODUCTION

Land use changes have resulted in increases in both point and nonpoint sources of pollution. These pollutants contribute significantly to the degradation of tributary streams and the Chesapeake Bay. Hence, the Commonwealth of Virginia, during the 1988 General Assembly, adopted the Chesapeake Bay Preservation Act (ACT). This legislation created a new agency, the Chesapeake Bay Local Assistance Department (CBLAD), which was charged with the task of developing regulations to protect water quality within the Chesapeake Bay Watershed for those localities situated within the Coastal plain.

The Final Chesapeake Bay Preservation Area Designation and Management Regulations were adopted on November 15, 1990. These regulations were designed for the purpose of protecting and improving the water quality of the Chesapeake Bay, its tributaries and other state waters by minimizing the effects of human activity upon these waters. Protection of these waters must be accomplished through the implementation of protective criteria on lands which are designated as Chesapeake Bay Preservation Areas (CBPAs). The regulations are based on the premise that the improper use or development of CBPA may result in substantial damage to the water quality of the Chesapeake Bay and its tributaries. The regulations also establish the criteria that local governments must use in determining CBPAs and managing land uses.

The overall Chesapeake Bay protection effort is to be implemented and managed at the local government level. Local programs are required to encourage and promote the following:

- Protect existing high quality state waters and restoring other state waters to a condition or quality that will permit reasonable public uses and will support the propagation and growth of all aquatic life, including game fish, which might reasonably be expected to inhabit them;
- Safeguarding the clean waters of the Commonwealth from pollution;
- Preventing any increase in pollution;
- Reducing existing pollution;

- Promoting water resource conservation to provide for the health, safety and welfare of the present and future citizens of the Commonwealth.

CHESAPEAKE BAY PRESERVATION AREAS

The ACT is designed to protect water quality of the Chesapeake Bay and its tributaries through land use management techniques. This is to be accomplished by identifying Chesapeake Bay Preservation Areas and implementing the criteria set forth in the regulations. CBPAs include both Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). A third designation of Intensely Developed Areas (IDAs) can also be designated as an overlay to the RPAs.

Resource Protection Areas

Resource Protection Areas are defined as lands at or near the shoreline that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may result in significant degradation to the quality of state waters. RPAs in a natural condition provide for the removal and/or reduction of sediments, nutrients and potentially harmful toxic substances in runoff.

RPAs include the following environmentally sensitive land areas:

- Tidal wetlands;
- Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams;
- Tidal shores;
- Other lands deemed by the governing body as necessary to protect the quality of state waters; and
- A buffer area not less than 100 feet in width located adjacent to and landward of the components listed above, and along both sides of any tributary stream.

Permitted land uses within RPAs are limited to the following:

- New or expanded water-dependent facilities that:
 - do not conflict with the comprehensive plan;
 - comply with the performance criteria of state regulations and local ordinances; and

- any non-water-dependent component must be located outside of Resource Protection Areas;
- Land development that constitutes redevelopment, provided it conforms to applicable stormwater management and erosion and sediment control criteria;
- The construction of roads and driveways across RPA's are not exempt from the regulations subject to the following conditions:
 - The County makes a finding that there are no reasonable alternatives to aligning the road or driveway in or across the RPA;
 - The alignment and design of the road or driveway optimized consistent with other applicable requirements to minimize encroachment in the RPA and adverse effects on water quality; and
 - The design and construction of the road or driveway satisfies all applicable criteria of the regulations and county ordinances;
- Vested uses including permitted uses in the underlying zoning district consistent with the performance criteria of the Chesapeake Bay Protection Ordinance.

Resource Management Areas

RMAs are defined as lands that, if improperly used or developed, have a potential for causing significant water quality degradation or diminishing the functional value of the RPA. The regulations require RMAs to be contiguous to the entire inland boundary of the Resource Protection Area.

The regulations require the following to be considered for inclusion in the Resource Management Area:

- Floodplains;
- Highly erodible soils, including steep slopes;
- Highly permeable soils;
- Nontidal wetlands not included in the Resource Protection Area;
- Other lands necessary to protect the quality of state waters.

All uses permitted in the underlying zoning district are permitted. However, stormwater management and erosion and sediment control measures as specified in the Chesapeake Bay Preservation Overlay District must be met. Additionally, any parcel of land subdivided and platted after October 1, 1989, is required to have a

drainfield and 100% reserve area if septic systems are to be utilized.

IDENTIFICATION AND DESIGNATION OF CHESAPEAKE BAY PRESERVATION AREAS

In designating the Chesapeake Bay Preservation Areas, the County used the National Wetlands Inventory Maps, United States Geological Survey (U.S.G.S.) 7.5' Topographic Maps and the Caroline County Soil Survey to identify the RPAs. The RPAs designated are those sensitive environmental lands or bodies identified in the regulations plus a 100 foot buffer landward and contiguous to those lands identified as RPA lands. Additionally, RPA lands are associated only with "Tributary Streams". Intermittent streams may be designated as RPAs if they are determined to be environmentally sensitive based on a site analysis.

Resource Management Areas were identified using the National Flood Insurance Program Flood Insurance Rate Maps (August 15, 1989), U.S.G.S. 7.5' Topographic Maps and the soil survey. RMAs are identified as slopes greater than 15%, the 100 year floodplain or a minimum distance of 300 feet landward and contiguous to the RPA 100 foot buffer.

The County, after much review, adopted its Chesapeake Bay Preservation Area Overlay District and the Chesapeake Bay Local Assistance Board approved the County's maps and regulations on in 1993.

Since the completion of the soil survey, the County has reevaluated its Chesapeake Bay Preservation Maps. The County secured the assistance of the United States Department of Agriculture's Natural Resource Conservation Service to analyze the soil survey and perform the mapping of the soil characteristics utilized for the analysis of the Chesapeake Bay Preservation maps. Figure 4-13 identifies the areas with development constraints in the County and generally represents the Chesapeake Bay Preservation Areas in the County.

GOALS, OBJECTIVES AND STRATEGIES

Goal - Locate Development In A Manner That Conserves Important Natural Resources.

Objective - Development should be located in a manner that preserves important environmental resources, agricultural lands, forestlands, open

space, scenic beauty, and high quality ground and surface water resources.

Strategy 1 - Assure that development proposals are consistent with the protection of environmentally sensitive areas and the maintenance of the County's overall environmental quality.

Strategy 2 - Encourage landscaping and physical improvement of existing development to improve the overall visual quality of the County.

Strategy 3 - Require underground utilities in all new developments. Encourage screening and buffering of existing above ground utilities and their placement below ground.

Strategy 4 - Encourage building, site and road designs that enhance the natural landscape and preserve scenic view sheds.

Objective - Identify existing or potential sources of surface and groundwater pollution and actions to address any identified pollution problems.

Strategy 1 - Undertake a countywide analysis of existing land uses to identify potential sources of surface and groundwater pollution; including but not limited to above ground storage tanks, underground storage tanks and animal feed lots.

Strategy 2 - Develop a well head protection program for public water supply wells.

Strategy 3 - Develop voluntary and regulatory measures to reduce pollution potential.

Objective - Encourage the preservation of agricultural lands, forestal lands, scenic areas, open space and environmentally sensitive areas through a combination of techniques, including: land use value assessment, cluster development provisions, conservation easements, land trusts, or the purchase of development rights.

Strategy 1 - Preserve open space, agricultural lands, forest lands and the rural character of the County by:

- Promoting land use value assessment practices.
- Identifying and encouraging the conservation of significant agricultural land.

- Encouraging the use of conservation easements, agricultural and forestal districts and land trusts.
- Developing and implementing cluster development regulations for areas designated to remain rural.

Strategy 2 - Educate the public about voluntary techniques to preserve and protect sensitive environmental lands; wildlife habitats; and agricultural, forestal and other open space land.

Objective - Continue the development and enforcement of zoning regulations, erosion and sediment control regulations, stormwater and best management practices regulations that preserve and protect wetlands, floodplains, natural areas, and other environmentally sensitive areas from the adverse effects of development.

Strategy 1 - Identify environmentally sensitive areas and develop recommendations for voluntary and regulatory means to protect resources identified in studies of environmentally sensitive areas.

Strategy 2 - Encourage the use of best management practices to mitigate water quality and runoff impacts by:

- Making technical assistance available.
- Promoting public awareness on the benefits of, and necessity for, best management practices, erosion and sedimentation controls, stormwater management and Chesapeake Bay Preservation Regulations.
- Assisting in the establishment of conservation plans for all farms. Utilizing the assistance of the Virginia Cooperative Extension Service, the U.S. Soil Conservation Service, the Colonial Soil and Water Conservation District, and other county agencies to encourage the participation of all landowners engaged in agricultural and forestal activities.
- Continuing to develop new, and to enforce existing regulations that require soils identification and the consideration of the limitations of these soils for development, agricultural and forestal activities.

Strategy 3 - Continue development and enforcement of zoning regulations and other county ordinances that ensure the preservation and protection of wetlands, floodplains, natural areas, and other environmentally sensitive areas and resources.

Strategy 4 - Identify the existing and potential uses of county streams and rivers and develop standards to support these uses. Protect the quality and quantity of these surface waters so they will continue to support these uses. Consideration should be given to existing and potential water resource uses when reviewing land development applications.

Objective - Protect the water quality and the flora and fauna which inhabit the waters of the county through the establishment and implementation of a Chesapeake Bay Preservation Plan for Caroline County.

Strategy 1 - Encourage, to the extent possible, increases in the amount of impervious surfaces.

Strategy 2 - Maintain a policy of no net increase in nonpoint source solution.

Strategy 3 - Encourage development to proceed in a manner in which only that land necessary to achieve the proposed use be disturbed.

Strategy 4 - Encourage development to identify any environmental constraints and to avoid environmentally sensitive features during land disturbing activities.

Strategy 5 - Preserve indigenous vegetation to the maximum extent possible.

Strategy 6 - Minimize any unavoidable environmental impacts.