LANCASTER COUNTY SHORELINE CONSERVATION AND DEVELOPMENT PLAN

COASTAL ZONE
INFORMATION CENTER

Virginia Coastal Zone Management Program

Table of Contents
1989

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

PAGE

Acknowledgements ---- i
Executive Summary ---- ii
I. Introduction ---- 1
II. Resource Analysis ---- 4
A. WATER ---- 4
A. 1. Groundwater ---- 5
A. 2. Surface Water ---- 8
B. WETLANDS ---- 11
C. SHELLFISH ---- 12
D. FLOOD HAZARDS ---- 12
E. PUBLIC ACCESS ---- 14
III. Water Management Options ---- 15
A. INTRODUCTION ---- 15
B. PRIORITY WATER BODIES ---- 16
C. GROUNDWATER MANAGEMENT AREA DESIGNATION ---- 18
D. DRASTIC MAPPING ---- 19
E. WATER CONSERVATION ---- 20
IV. Implementation Tools ---- 21
A. INTRODUCTION ---- 21
B. COMPREHENSIVE PLAN ---- 22
B. 1. Groundwater ---- 23
B. 2. Surface Water ---- 24
B. 3. Soils ---- 25
B. 4. Wetlands ---- 25
B. 5. Shellfish ---- 26
B. 6. Coastal Flood Hazards ---- 27
B. 7. Shoreline Erosion ---- 28
B. 8. Public Access ---- 28
C. ZONING ---- 29
D. SUBDIVISION ---- 36
E. FLOODPLAIN ORDINANCE EVALUATION ---- 43
F. EROSION AND SEDIMENT CONTROL ---- 45

Property of CSC Library

TC227 .W8 L36 1989
NOV 10 1997

G. WETLANDS ---------- 49
V. Land Management Area Delineation ---------- 52
A. INTRODUCTION ---------- 52
B. 50 FOOT CONTOUR ---------- 54
C. 600 FOOT WATERFRONT SETBACK ---------- 54
D. CHESAPEAKE BAY PRESERVATION ACT CRITERIA ---------- 55
E. RECOMMENDATIONS ---------- 56
VI. Conclusion ---------- 57
References ---------- 58

Acknowledgements

The entire project team would like to express sincere appreciation for the opportunity to apply the knowledge and skills acquired in the preparation of this document. It is a pleasure to work for a County with such a forward looking attitude toward resource management issues. A special note of gratitude is in order to the Board of Supervisors and the Planning Commission for allowing us to present our ideas for their consideration as well as to William Duncanson, Lancaster County Land Use Administrator. Next, we would like to acknowledge the efforts of the Northern Neck Planning District Commission and, especially, Collin Powers for his dedication to the project and his diligence as project co-coordinator. Dr. Timothy Beatley also deserves mention for his efforts as project co-coordinator, sharing his extensive knowledge and expertise, and his confidence in our abilities. Finally, we would like to acknowledge those who came before us in completing phase one of this project: Rupert Friday, Bill Gladden, Lee Goodwin, Peter Hill, Bill O'Beirne, Peyton Robertson, and Liz Sigal who prepared Lancaster County Shoreline Management Study Preliminary Results. Their work provided a solid foundation from which to proceed in considering resource management policy options.

The funding for this project originated with the United States National Oceanic and Atmospheric Administration (NOAA) through the Coastal Zone Management Program. The Virginia Council on the Environment received funding from NOAA for Virginia's Coastal Resource Management Grant Program. The Northern Neck Planning District (NNPDC) obtained funding from the state program, and the NNPDC and the University of Virginia Division of Urban and Environmental Planning arranged to utilize this source of funding to undertake this project (phases 1 and 2).

Project Coordinators
Collin Powers
Dr. Timothy Beatley

Editors
Jennifer Burmester
Bill Gladden

Project Team
Jennifer Burmester
Custis Coleman
Bill Gladden
Pamela Harris
Peter Hill
Marianna Knappenberger

Executive Summary

The following overview provides policies which can have a positive impact on the environment and can improve the ability of the County to sustain its current economic growth. This report was researched and compiled by six Masters students at the University of Virginia. This study is the final step in the preparation of a shoreline element for the County's comprehensive plan.

This report provides an overview of the resources, examines water quality management policy options, enumerates an assortment of goals, objectives and policies for managing specific resources, and provides implementation alternatives. The comprehensive plan section considers appropriate shoreline goals, objectives, and policies for each resource analyzed in this report. The current zoning, subdivision, erosion and sediment control, floodplain, and wetlands ordinances were reviewed and amendments were suggested. Finally, alternative land area management delineations and recommendations were included for the consideration of the County. To the best of our ability, we have provided Lancaster County with information necessary to comply with the Chesapeake Bay Preservation Act.

WATER MANAGEMENT OPTIONS

- Groundwater Management Area: The most productive, long term policy for the County to pursue would be to work with other jurisdictions in the Northern Neck to develop an awareness of the interjurisdictional nature of groundwater management. The most productive outcome of such efforts would be to have the entire Northern Neck designated as a groundwater management area.
- Water Conservation: The County should require installation of low flow toilets and faucets prior to the issuance of a building permit.
- DRASTIC: DRASTIC is a mapping system designed to evaluate the groundwater contamination potential of an area. The County should incorporate this source of information into their planning process.
- Priority Water Bodies: Efforts to improve and/or maintain surface water quality in the County, should focus on its three priority water bodies: Carter Creek, the Rappahannock River, and Indian Creek.

GROUNDWATER

- The County should require a certificate of septic tank inspection and pump out be submitted every four or five years with local tax payments. The inspection could be conducted by the person who pumps the tank or by the local sanitation officer.
- An 18 inch minimum separation should be maintained between septic systems and the water table.
- Tap fees should be required as a method of monitoring the number of wells dug each year. The revenue could provide funds for a wellhead protection program.
- The minimum distance between edges of septic system tile fields and water bodies should be 100 feet.

- All abandoned wells in the County should be capped.

SURFACE WATER

- The County should acquire at least one impoundment site for future drinking water supply.
- Impervious surfaces should be limited to 20% of the lot area which is suitable for development.
- Stormwater best management practices should be incorporated into the planning and subdivision review process.

SOILS

- The County should direct development away from soils which have a high water table, percolate rapidly or are highly erodible.
- A soil scientist should be contracted, on a consulting basis, to evaluate soil suitability and site plans.
- The County should determine the applicability and feasibility of compiling a geographic or resource information system which details the soil characteristics of the County (GIS or RIS).

WETLANDS

- The County should commission a Virginia Natural Heritage Inventory of rare and endangered species.
- All projects involving wetlands impacts should have a pre-and post-construction site visit.
- The Wetlands Board should work closely with the County legal staff to ensure enforcement of and compliance with the Wetlands Ordinance.
- The County should eliminate permitting that takes place after wetlands have been altered. This should be pursued through cooperating with the County Legal Staff.
- The County should establish a fund for contributions from individuals who destroy a tidal or non tidal wetland. The money should be used to acquire the most ecologically valuable wetland areas in the County.
- The County should work closely with the Virginia Institute of Marine Science to determine sections of the County's waterways where "No Wake" zones should be established.

SHELLFISH

- State regulations requiring sewage holding pump-out facilities at marina's should be rigorously enforced.
- The County should establish a shellfish grounds restoration and preservation program funded through a marina user fee.

COASTAL FLOOD HAZARDS

- High hazard areas should be zoned for the lowest rural density.
- Capital facilities and infrastructure should be sited out of flood prone areas.

- Land uses in the flood hazard zone should be limited to those that are water dependent.

SHORELINE EROSION

- View corridors should require the retention of 80% of existing vegetation should be required within a 100 foot waterfront buffer.

- A setback for shoreline structures equal to or greater than thirty times the average historical rate of erosion should be required.

- The construction or repair of shore-hardening devices on residential property should be prohibited. The County should encourage the use of vegetation for shoreline stabilization.

PUBLIC ACCESS

- The County should compile an outdoor recreation plan in which future public facilities are ranked and mapped. Land ownership, site suitability, and acquisition and development costs should be analyzed.

- Public access facilities should be developed at the Greenvale Landing on Route 662 and the ramp and dock at Windmill Point.

- Additional staff should be added to acquire and manage outdoor recreation facilities and public access points.

ZONING

- Density Bonus: The Board of Supervisors should have the option to permit an increase inthe number of dwelling units allowed by granting a density bonus if they find that increased density will not impair the character of the area and will be in the best interests of the general public. Suggestions for conditions which might warrant a density bonus are included in this report.

- Purpose: The purpose section of the zoning ordinance should be amended to incorporate environmental considerations and protection of water quality of the Chesapeake Bay. For example, page 1 (6) undue density considerations, should include environmental quality degradation. Other amendments could be considered as a purpose: To protect the health,safety and welfare of current and future generations of County residents located along Lancaster's shoreline; To prevent degradation and promote the sustainable use of the following resources: surface water, ground water, tidal and non-tidal wetlands, highly productive agricultural and forestal soils, shellfish, finfish and the Chesapeake Bay; and/or To preserve rare or unique flora and fauna found in the County and to preserve their respective habitat.

- Cluster Subdivisions: The County should encourage the clustering of single family housing when such developments: maintain average lot density, preserve the environmental integrity of the site, are consistent with the comprehensive plan, and complement the established character of the area.

SUBDIVISION

- Site Analysis: Pre and post-development site analysis should consist of the review criteria set forth in this report.

- Impervious Surfaces: Impervious surfaces should be documented as a percentage of the buildable lot and in total square feet.

- Section 5-2: The Subdivision Committee should require the subdivider to provide profiles of soil characteristics. In addition to requirements for percolation rates (as required by section 5-2), information regarding the presence of shrink swell soils and water table levels should be submitted.

- Section 5-7: The location and characteristics of soils should be analyzed together and not be considered mutually exclusive (as currently set forth in section 5-7 of the subdivision ordinance).

EROSION AND SEDIMENT CONTROL

- The County should increase fees for Erosion and Sedimentation Control Plans and contract with a soil scientist to review those plans.

- The submission of a vegetation protection plan (or soil conservation plan) should be required prior to issuance of a building permit. Such a plan should call for the protection of all trees in excess of 6 inches in diameter. Their protection should extend to the area encompassed by their canopy.

- A section for recommended/required practices should be inserted in the ordinance. Requirements should include: specific buffer zone requirements, an outline of expected natural drainage patterns should be utilized to the fullest extent possible, impervious surfaces should be minimized at all stages of construction (i.e. gravel access roads), and regulations limiting and controlling exposed soils should be adopted.

- A provision should be added in the ordinance explaining clean-up requirements. All applicants should be required to submit clean-up plans. A performance bond should be required. Violation should result in a sizeable fine ($1,000/day), which could fund immediate County clean-up of the site and offset the cost of monitoring and enforcement.

LAND MANAGEMENT AREA DESIGNATION

We recommend designating Chesapeake Bay Preservation Areas, as required by the Preservation Act, establishing a Conservation District which would serve as a shoreline overlay extending 1500 feet from the water, and establishment of a Management District with the 50 foot contour being its boundary. At a minimum, the Chesapeake Bay Criteria should be adopted as delineating a Preservation Area and the 50 foot contour should serve as the basis for a management area.

Report

I. INTRODUCTION

Background

The shoreline of Lancaster County is a valuable resource both in terms of economic and environmental considerations. The shoreline development experienced by the County provides revenue directly in the form of property taxes and indirectly through sales tax receipts. Additionally, the shoreline plays an important role in the quality of water which is related to the economic vitality of marine based industries. The reader is reminded of the study compiled last year, Lancaster County Shoreline Management Study Preliminary Results, and encouraged to use this as a source of detailed resource analysis. The following report summarizes pertinent information, analyzes important resources, and presents management strategies and options to protect and enhance the environment of the County in order to further the development oriented economy of Lancaster. This plan, including policy recommendations and implementation strategies, is offered to the County for final revision and approval.

Growth and Population

Lancaster County is experiencing a moderate growth rate. However, its traditionally rural low density pattern of development leads to impacts which are proportionately more significant. While the current population of Lancaster County is small, an estimated population of 11,520 persons by 1990, land development is occurring at a rapid pace. Between 1984 and 1989, Lancaster County has experienced a 1,800% increase in acres subdivided and a 400% increase in the number of lots recorded. However, less than one fourth of the platted lots have been built out.[1] This situation presents Lancaster with many challenges as it attempts to manage growth in a manner which is sustainable in the long term.

---

[1]"Land Rush: Bay preservation act stirs waterfront building boom," Cyril T. Zaneski, pp. A1, A3. April, 1989 Virginian Pilot (Norfolk, Virginia).

Economic Implications of Resource Management

The natural environment and rural character of the County are the primary reasons many people visit the area. The Virginia Division of Tourism showed an increase of 6.7 % over 1986 total travel expenditures in the County to a level of $39,603,000 in 1987. Lancaster County is the largest recipient of travel expenditures in the Northern Neck Region.[2]

Many citizens have chosen to live in Lancaster County because of the quality of the environment. Residential development contributes significantly to the tax base of the County. In the third quarter of 1988, Lancaster County issued 45 new permits for housing construction valued at approximately $3.2 million. The average value of newly authorized housing units in the region was highest in Lancaster County with an average value of $71,111.

However, locating residential development in sensitive environmental areas is a short sighted perspective which has significant economic, social and environmental consequences for the future well being of the County. Whether those who live in the County are permanent or seasonal residents, the effect they have on land development patterns is often irreversible and may accelerate environmental degradation.

There are substantial demands placed on a locality due to single family homes and larger developments. These demands result in increasing expenditures for education, public access to the shoreline, recreational needs, and environmental considerations. Environmental impacts resulting from development include increased use of groundwater, higher stormwater runoff rates, increased traffic, increased sewage, impaired views, and a decrease in water quality. The resource based amenities, and subsequent economic benefits, will be lost if development causes excessive environmental degradation, or if detached single family residential development is allowed to the exclusion of all other uses.

---

[2] Center for Public Service, University of Virginia.

Indigenous economic concerns such as the seafood industry, locally owned retail businesses (essential for capitalizing on tourism driven consumer demands), and potential wholesale businesses associated with seafood products are also an integral component of the character of Lancaster County's shoreline area. The County will suffer if social and emotional issues dominate land use planning considerations at the expense of innovative long term policy, planning, and development initiatives.

Development Trends

Residential development on or near the shoreline is the primary form of land conversion in the County. While construction activity in the County is increasing, only 23% to 30% of approved subdivision plats have been built on. Thus, the County has experienced only a small portion of the potential impact of shoreline development.

Traditionally, large subdivisions have been heavily regulated and subjected to an intense level of scrutiny. While comprehensive and careful review of such projects is necessary, such developments have the potential to use investment capital to produce a proposal which is environmentally sound and would contribute more to the long term local economic health of the County than would traditional single lot developments. The County must be aware of the opportunity which cluster developments offer to enhance the values of property inland from the shoreline. If done properly, such development can greatly increase the long term economic viability and environmental integrity of the County. Whether or not a planned development represents such an opportunity should be based on objective environmental criteria, sound planning principles (such as future community facilities needs) and a uniform review process.

While major shoreline subdivisions are open to intense public scrutiny, minor subdivisions have been viewed as an exercise of rights inherent in private property to develop or improve land. This view has resulted in far less attention paid to their environmental impacts. Minor subdivisions represented 42% of the lots subdivided in the County and are primarily located on the waterfront. Therefore, while small development may have a minimal environmental impact, the cumulative impact of this

type of development must receive attention. While attention may take the form of a regulation, such a regulation does not prohibit development. Regulation can take many forms, including information disclosure requirements. These could require someone who is developing a parcel of land to record certain details of the development with the County. Such a requirement would not represent an excessive burden since the information required could be that which a person would need to have in order to develop the site. When viewed in this way, such a "regulation" amounts to information sharing. This type of procedure would provide the County with information which is necessary to conduct development review and administration.

Specific information regarding setbacks, percentage of impervious surfaces, and open space for residential developments should accompany subdivision applications. The absence of this information inhibits the County 's ability to adequately consider the impacts (or lack thereof) of specific developments and design practices.

II. RESOURCE ANALYSIS

A. WATER

High water quality is indispensable to human, plant and animal well-being, as well as to the economic health of Lancaster County. Shoreline development will impact water quality through numerous and complex processes. The flow of water, both surface runoff and groundwater movement, transmits pollutants which are introduced in the coastal regions.

Events typically associated with development activities such as the removal of vegetation, disturbance of soils, and alteration of natural drainage patterns result in decreased infiltration of rainwater and increased runoff, leading to increased pollution loading of surface water bodies. These pollutants- including sediments, nutrients, pathogens, thermal pollution, toxic materials, and oxygen demanding wastes (BOD), result in a decrease in the water quality. Threats to human health from contaminated waters and marine life are also increased. Not only are species numbers and diversity

lost but production of economic species decreases with the associated loss of revenue for the area. Finally, the water quality degradation decreases recreational potential and shoreline aesthetics, both essential for the continued economic development through the attraction of tourism and new residents.

The removal of vegetation reduces infiltration and increases the rate of surface runoff in several ways. First, the loss of vegetation decreases the utilization of moisture in the soil by plants, thus decreasing the time it takes the soil to become saturated. At the same time, an increased amount of rainwater reaches the ground quicker and begins to pool faster. If the area has any slope, the water will begin to move downhill. The removal of vegetative cover increases the rate of surface flow by minimizing surface resistance and friction. Faster surface runoff increases the erosive capacity of the runoff, while decreasing the chance for water to infiltrate into the ground. Any increase in impervious surfaces decreases the potential of infiltration of water to groundwater, and results in rapid "sheetflow" across these surfaces, increasing the rate and quantity of surface runoff.

Disruption of the soil and alterations to natural drainage paths during construction effect water quality. The use of heavy equipment in construction tends to compact the soil, decreasing the ability of water to infiltrate or percolate through it. This results in faster saturation of the soil, leading to decreased infiltration, less recharge of groundwater aquifers and increased surface runoff. Therefore, construction activities effect both surface and groundwater quantity and quality. Special consideration should be given to development activities in the near shore environment.

A. 1. Groundwater

Groundwater is an important resource to Lancaster County because of its economic value for residential and commercial consumption as well as its relation to surface water quality. Currently, Lancaster County is totally dependent on groundwater as the source of their water supply. Because deep wells are expensive to drill, many

residents of Lancaster County have relied on shallow wells into the surface aquifer. If the surface aquifer become polluted, many residents will not be able to afford to replace shallow wells with deeper wells. If groundwater becomes scarce or contaminated, new development will be impossible without an alternative water supply, such as surface impoundments.

In 1976, total withdrawals from the Northern Neck were 2 million gallons per day (gpd) with use split evenly between domestic and industrial consumption. The coastal plain is underlain by 8-9 potable aquifers. The top aquifer is the unconfined surface aquifer is relatively shallow with wells dug or bored 6-80 feet deep. Wells in this aquifer are only suitable for single family residential and light farm uses, but they comprise most of the private wells in Lancaster County. Seasonal fluctuations and lack of sufficient storage make this aquifer an impractical water source except for smaller supplies.

Groundwater from the surface aquifer maintains base stream flows between periods of rainfall. The surface aquifer is recharged directly from rainfall infiltrating down through the soil. By feeding springs and seeps, the surface aquifer contributes significant quantities of fresh water to streams and rivers. Therefore, a decline in groundwater quality due to pollution is reflected in a decline in stream water quality. A drop in the water table results in lower stream flows and consequently less dilution and flushing of silt and pollutants from the streams, rivers, and estuaries. The surface aquifer is more important to the residents living in Eastern Lancaster County, where the upper and principal aquifers are commonly quite brackish and unsuitable for potable use. This aquifer is usually potable except for some wells adjacent to brackish surface water bodies.

The two confined aquifers, upper artesian and principal artesian aquifer, are widely depended upon as the primary source of groundwater for much of the larger water users in the region. The upper artesian aquifer, 60 feet thick and 200-375 feet deep, has moderate well yields of 20-40 gallons per minute (gpm). This aquifer is a

reliable source of water for individual homes, farms, and possibly for subdivisions and light to moderate water users.

The principal artesian aquifer, located at a depth of 500-600 feet, produces water ranging from 40-500 gpm with several wells in Lancaster County pumping in excess of 1 million gallons per day (gpd). This is a large reservoir of excellent quality water which is tapped by most of the major water users such as community wells, public water systems, and industrial users. A 1977 groundwater study indicated that 88% of the total groundwater withdrawn in the Northern Neck is from the principal aquifer. The depth to water makes it costly to tap so it is not widely used for domestic supplies.

Groundwater extraction faster than the rate of natural recharge is called water table drawdown and can cause two problems. First, the water level in the aquifer will lower causing some wells and possibly springs to dry up. A decline of over 23 feet has occurred in the principal aquifer since the wells have been monitored. This decline appears to be accelerating in recent years and is regional due to heavy pumping in areas such as West Point, and the Southeast portion of the State (Virginia Beach, Norfolk, etc...). [3] Groundwater flow within aquifers has changed significantly from natural patterns. Groundwater now flows directly toward areas which have high pumpage rates, such as West Point and Franklin. Second, saltwater can intrude into the freshwater aquifer. Saltwater intrusion can make groundwater unpalatable, unhealthy, or completely unusable. The use of groundwater faster than the recharges rate without developing an alternative water source, places limits on future construction and development.

An additional development impact on groundwater quality is the increase in the number of septic systems in place. More than 85% of Lancaster residents rely on septic tanks for sewage disposal. However, there are many resource based constraints on their use. In Lancaster County, 17% of the land (16,622 acres) has water tables that are seasonally too high for proper septic system functioning. An additional 25% of the land

[3]Conversation with Virginia Water Control Board Staff, 1989.

(25,485 acres) has soil which is too sandy and has a prohibitively high percolation rate to allow for proper treatment of septic effluent.

The Environmental Protection Agency (EPA) reports that septic systems represent the largest reported cause of groundwater contamination resulting in disease outbreaks in the United States. Surface ponding of septic tank leachates was also identified as a sanitary nuisance and potential health hazard. A study conducted by the North Carolina Department of Natural Resources and Community Development recommended septic tank densities for watersheds with a high proportion of unsuitable soils and they concluded that septic tank densities of approximately 1 septic tank system per 7 acres are necessary in watersheds adjacent to shellfish habitat to prevent the closure of shellfish beds.[4]

Thus, water quality and quantity for ground and surface water is an important concern to Lancaster County. The quality of water affects not only the health of County residents but, in many cases, their livelihood as well. The quality of potable water places limitations on growth which severely constrains a development oriented economy. Lancaster County can take an active role in protecting water resources by regulating land uses, encouraging Best Management Practices and guiding development activities.

A. 2. Surface Water

Surface waters in Lancaster County are a valued resource not only as a needed source of potable water but also opportunity for recreation and habitat for aquatic life. The two types of pollution are point and nonpoint source pollution. Surface water quality degradation is primarily the result of nonpoint source pollution. The runoff of nutrients from agricultural and silvicultural activities (fertilizers, pesticides and animal wastes) as well as sediment erosion associated with these activities contribute to nonpoint source pollution. Furthermore, as shoreline development increases, nonpoint source pollution will increase. Pollution increases associated with construction activities must be

[4] Division of Environmental Management, Water Quality Planning Branch, "The Impact of Septic Tanks on Shellfish Waters, unpublished manuscript, North Carolina Department of Natural Resources and Community Development, February, 1982.

minimized before degrading current water quality. The subsequent increasing demand for recreational boating facilities will also generate nonpoint source pollution. The primary point source contributors to water quality degradation are seafood processing plants, marinas, and sewage treatment effluent.

The intense development on the shoreline, and the subsequent level of water use, is the rationale for addressing the issue of water supply. Utilizing impoundments as a source of a public water supply is an important issue for Lancaster County to consider because of the limited supply of quality groundwater and the inability of the County (due to geological factors noted elsewhere) to insure an adequate supply of groundwater. The findings presented in the Water Quality Management Plan, produced by the Northern Neck Planning District Commission (NNPDC) [1973], offer the only available information on potential impoundment sites. The policy of acquiring impoundment sites has been considered previously by citizens and officials in Lancaster County.[5] The County is urged to reconsider this option in light of increasing concerns regarding groundwater supplies and continued violations of drinking water standards in the southeastern portion of the County.[6]

The following criteria used to determine desirable locations for future reservoirs are applicable to any decision which may be reached by the County:

1. The nearness of reservoirs to potential population centers.
2. The expense of constructing the initial reservoirs.
3. Flood control and cost of spillways to carry floodwaters.[7]
4. Affect of impoundment on wetlands.

The study emphasized the desirability of developing a series of small reservoirs located in the headwater of streams. The justification for such a policy in Lancaster County can be based on the fact that: a) these locations have less population near their headwaters which minimizes the probability of sewage entering the reservoirs through septic

---

[5] Interview with local residents, 2/89.

[6] Lancaster County Draft Shoreline Element to the Comprehensive Plan

[7] Water Quality Management Plan, Planning District-17, Northern Neck Planning District Commission 1973, Deward M. Martin & Associates, Williamsburg, Virginia, p. I-17.

leachate; and, b) reservoirs located upstream can be utilized to release water to help maintain low flows in downstream reaches, thereby improving the aesthetic, recreational, and habitat values of the stream.[8]

The major recommendation for Lancaster County calls for a group of reservoirs on the two branches of the Corrotoman River with a plant located near New Lancaster on Route 600. This plant would be used in conjunction with several smaller reservoirs on Brown Creek, Camp Mill Pond and Mill Creek to provide water supply to the southeastern part of Lancaster County.[9] "Criteria used in the initial design of desirable reservoirs included area and volume relationships, length and size of the structure of the dam, proximity to future population centers, downstream uses of impounded water, cost of land, obstructions such as roads and buildings, and possible eligibility for Federal Aid."[10]

The recommendations presented in the aforementioned study must be carefully reviewed in light of changes in circumstances since it was conducted in 1973. A review of sites which were proposed in the 1973 study should be undertaken to provide updated information regarding the status of the water flow, changes in land ownership and particularly development patterns. Specifically, the Eastern Branch of the Corrotoman alternative should be reviewed in light of changes over the last 16 years. However, the recommendation in the study for the provision of a water supply source for the southeastern portion of the County (which is currently not capable of providing its residents with safe drinking water) is still relevant. While the creation of impoundments has become increasingly regulated, this water supply option must be pursued. The potential impacts of impoundments on stream flows, wetlands, wildlife and recreational uses must be considered in location and design of future impoundments (i.e. recent Virginia legislation on minimum in-stream flow). However, the inability of Lancaster

[8] Ibid.
[9] Ibid. p. I-18.
[10] Ibid. P. I-19.

County to control uses of groundwater within and outside its political boundaries emphasizes the need to pursue other options for water supply.

II. B. WETLANDS

Definition

Wetlands, an ecologically significant resource, are found along the coastal area in Lancaster County. There are two types of wetlands, tidal and non-tidal. While there are several slightly different definition and classification schemes for wetlands., the definition of wetlands used by the U.S. Fish and Wildlife Service is considered the most comprehensive and is adopted by wetlands scientists. The definition is as follows:

> Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. ... Wetlands must have one or more of the following three attributes: 1. at least periodically, the land supports predominantly hydrophytes, 2. the substrate is predominantly undrained hydric soil, or 3. the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year. [11]

Tidal wetlands are subdivided into saline and freshwater, while non-tidal are only freshwater. All these types of wetlands consist of the following vegetation types: Submerged aquatic vegetation; non-vegetated; emergent; scrub-shrub; and forested. However, the specific vegetation species, salinity of the water, and soil type ratios provide a means for specifying among the various sub-categories. [12]

Importance of Wetlands

Wetlands play a significant role in maintaining environmental quality. They provide a buffer against flooding, sedimentation and shoreline erosion. Other significant water quality benefits include providing a site for groundwater recharge and infiltration. In addition, this resource presents an important habitat and refuge for many species of fish and wildlife. Studies have found that 2/3 of all commercial fish depend on wetlands

---

[11] Wetlands, James G Gosselink and William J. Mitsch, (Van Nostrand Reinhold Company, New York), 1976. p. 18.

[12] Conserving our Wetland Resources: Avenues for Citizen Participation An Action Handbook, Chesapeake Bay Foundation, p. 6.

in the early stages of life. Other significant uses include recreational, scientific research and educational.[13]

The total impact of wetland losses upon water quality, wildlife and surrounding environments has not been ascertained. By the mid 1970s', 54% of all wetlands, on a national scale, had been destroyed and converted to other uses. Activities such as drainage, stream channelization, filling and dredging, and impoundments have had a detrimental affect on wetlands.

II. C. SHELLFISH

Consideration of impacts on shellfish producing areas should remain a priority in making land use decisions in Lancaster County. The resource represents a significant contribution to the economy of the area and should be fostered through proper management and protection. Several programs are already underway to remedy existing problems.

Long term planning should include consideration of a more extensive network of public sewer and water systems to accommodate the increase in residential population. Improvements in pollution control technology and monitoring of treatment also make central sewage facilities easier to control.

II. D. FLOOD HAZARDS

Lancaster County is vulnerable to flooding from rivers and storm surges associated with large coastal storms. In recognition of the catastrophic loss of life and property which could result from these events, the undertaking of proper planning and precaution is necessary. Flooding results in the loss of life and the destruction of property. Furthermore, flooding contributes to deterioration of the water quality in the Chesapeake Bay by adding tremendous sediment loads and by transporting untreated runoff. The destruction of wetlands, runoff from impervious surfaces, and the loss of

[13] Ibid. pp. 7-8.

natural vegetated buffers increase the potential for flooding and the corresponding dangers.

As construction pressures continue for the development of the shoreline, the hazards associated with coastal flooding will escalate. In addition, localities will be forced to carry more of the burden for disaster assistance as the Federal Emergency Management Agency is paying for fewer costs associated with assistance programs.[14] As a result, Lancaster County should enforce strict rules governing development and construction in flood prone areas. Therefore, the shoreline management plan should address the hazards associated with flooding, both in terms of riverine flooding as well as coastal flooding resulting from storm surges and rising sea level.

Riverine Hazards

A flood occurs when a stream or river overflows its channel and spreads onto the floodplain. Most streams flood every several years. Larger rivers have a well developed floodplain and are frequently associated with wetlands. Floods, of different sizes and magnitudes, occur every year and are only dangerous when development occurs in the floodway. The magnitude of such events will continue to change as watersheds become more urbanized and runoff increases. In some cases, the 100 year floodplain is expanding as a result of higher rates of runoff. Therefore, the floodplain boundary should be expanded as circumstances dictate.

Coastal Hazards

Coastal flooding could result from a storm surge associated with hurricanes, tropical storms, "northeasters", or other large storms. According to National Flood Insurance Rate Maps (FIRM), the 100 year flood level is the basic designation used for flood hazards planning, which would result in flooding of areas at or below an elevation of 7 1/2 feet. This includes the Eastern half of Fleets Bay Neck, Fleets Island, Foxwells, the last part of Route 626 on Towles Point and Clark Point, the southwest peninsula along the Rappahannock and Corrotoman Rivers, Belle Isle and Morrattico. Under extreme

[14]Accomack County Coastal Plan, p. 35.

conditions, flooding could be as widespread as all of Windmill Point Peninsula east of Harpers Creek, Fleets Bay Neck and Poplar Neck.

II. E. PUBLIC ACCESS

Current public access to recreational opportunities in the County is inadequate to meet the present needs of County residents. As shoreline build-out occurs, traditional points of access will be eliminated. Furthermore, if the County is to expand recreational opportunities, additional sites must be acquired, developed and managed. Only by such actions, can the County expect to expand the economic benefits of its vast shoreline to inland parcels of land. Furthermore, the longer the County avoids such actions, the less land it will be able to purchase with its limited financial resources.

There are two public access points in Lancaster County, one is located at Greenvale Landing on Route 662. A 1985 Virginia Marine Resources Commission survey indicated that while the condition of the docking structure was generally good, the site was not well maintained and was used predominantly by commercial fishermen.[15] The site is surrounded by open woods and is easily accessible. However, the parking area needs to be graded and enlarged if it is to be promoted as a public launching site. The Virginia Boating Access Study indicates the presence of a ramp and dock at Windmill Point owned by the State Highway Department. Information available suggests that the ramp needs repairs before it can become usable for boats on trailers. [16] The County should examine these two sites and consider them for improvement and development. Included with this study are two documents from the Virginia Outdoor Fund. The Fund provides grants-in aid and loans from a revolving loan fund to municipalities to use in financing community wide recreational needs. Criteria for receiving the funds as well as instructions and applications are included with this materials.

---

[15] Master Listing of the Landing Sites and Public Landing Survey Report, Virginia Marine Resources Commission, February, 1985, Sheet 5.

[16] Tidewater Virginia Boating Access Inventory, Division for Planning and Recreation Resources, Virginia Department of Conservation and Historic Resources.

In order to meet outdoor recreational demands, the County should hire additional full-time planning staff to address the need for public facilities. The staff person would serve several functions which are essential to the implementation and attainment of the outdoor recreational needs. These would include serving as a contact person for multi-county efforts at providing regional recreational opportunities, formulating a comprehensive outdoor recreational facility siting priorities list, functioning as a contact for landowners, community outreach and education, and functioning as a land acquisition, management, and enforcement officer, and grantsperson. Frequently, funds for grant administration are available through land acquisition loans or grants. The utilization of such funds could contribute to the feasibility of funding this position.

There is a significant need for additional public access and outdoor recreational opportunities in Lancaster County. Information identifying current sites indicates that even those sites currently owned by the County are not properly developed to provide for public recreational activities. There are federal and state programs which offer financial assistance to provide these opportunities which should be utilized. Failure on the part of the County to address these needs will result in a short term development centered exclusively along the shoreline. By implementing some of the policies recommended in this report, the County will increase the value of its inland lots, thereby contributing to the long term economic growth of Lancaster County.

III. WATER MANAGEMENT OPTIONS

A. INTRODUCTION

The following discussion of water management options will reflect the management level which the County plans to address. Water management efforts must address surface water. A surface water policy could be based on their designation as priority water bodies. In combination with surface water, groundwater must also be managed. Several options exist for managing this resource. One management option is to request groundwater management area designation. Through such actions, the County

would be recognizing the interjurisdictional nature of the resource and the need to initiate an appropriate management approach. However, the pursuit of such a designation will be politically difficult and time consuming. A more direct management policy would be to utilize the DRASTIC information currently being assembled by the Northern Neck Planning District Commission (NNPDC) and the VirGIS laboratory at Virginia Polytechnic Institute and State University. The NNPDC and VirGIS are currently beginning this one year project and the completion date is projected as April, 1990. This planning tool will certainly have management implications for the coastal zone of the County. A fourth option is to focus on the individual level through the adoption of water conservation measures. While such measures may be viewed as an inconvenience, their broad application will facilitate a more equitable use of water resources and a decrease of wastewater production.

Due to the interrelated nature of groundwater and surface water, policies which improve the quality and/or quantity of groundwater will have a corresponding beneficial impact on surface water. The following discussion begins by describing a surface water management option based on priority water bodies. An analysis of groundwater management designation is included with recommendations. A groundwater program assessment project is described to provide County officials and residents with a background regarding its applicability and programmatic details. Finally, water conservation measures are examined in light of their costs and benefits. Regardless of other options, water conservation measures should be adopted.

B. PRIORITY WATER BODIES

Lancaster County has three "priority water bodies": Carter Creek, the Rappahannock River, and Indian Creek.

> The term 'priority water bodies' is a management concept originated by the Environmental Protection Agency to encourage states to focus resources and control activities in areas where water quality decisions are needed. ...Priority water bodies are those waters

experiencing significant water quality problems, that pose an unreasonable risk to human health, and evidence substantial use impairment.[17]

Water body rankings were calculated based on a three row, three column matrix scoring system. The three rows correspond to uses which require a high level of water quality: public water supply, aquatic life, and primary contact recreation. By protecting these high level uses many other uses requiring less stringent water quality are protected. The three columns used in the calculations are: degree of impairment, ability to control problem, and resource value importance.[18] While this classification may not satisfy all concerned parties, it does provide an objective basis upon which County programs can be organized by priorities. In light of the river classifications, efforts to improve and/or maintain surface water quality in the County, should focus on the three priority water bodies.

Available information on Carter and Indian Creeks indicates the local sewage treatment plant discharges, marinas, recreational boating activity and urban and agricultural runoff are the primary reasons for their inclusion as priority waterbodies. Recommended corrective measures include the development of Best management practices or soil and erosion conservation programs to limit both agricultural and urban nonpoint source runoff. A recommendation that two wastewater treatment plants and collection systems for the Carter Creek basin be built was rejected by local municipalities.

The problems identified as impacting the main stem of the Rappahannock include: elevated fecal coliform bacteria, point source discharges, marina activity, septic tank failures, urban and agricultural runoff and related nutrient enrichment. Many of the concerns listed above are addressed by the Chesapeake Bay initiatives. However, the need for more stringent enforcement of boat pollution and marina pump out facilities is not required in the Bay Act, and should be pursued by the County. Furthermore, all

---

[17] Priority Water Bodies Information Bulletin 576, produced by the Virginia Water Control Board (October 1988), p.1.

[18] Ibid. p. 3.

three of Lancaster County's priority waterbodies were recommended for inclusion in the Governor's "Shoreline Sanitation Residential Program."

A final consideration should include a close examination of the quality of the waters within the Corrotoman River. Information from a monitoring station located 3 miles up from the mouth of the river indicates that the water regularly is hypoxic (lacking sufficient oxygen) during the summer months.[19] Increased development along the Corrotoman shoreline will contribute to the further decline in water quality. The implementation and enforcement of new regulatory measures will be needed to minimize (and possibly prevent) excessive degradation of the Corrotoman.

C. GROUNDWATER MANAGEMENT AREA DESIGNATION

Groundwater Management Areas are established and designated by the State Water Control Board (SWCB). State statutory provisions allow a locality to petition the Board to establish a Groundwater Management Area. The minimum size for designation is a County. Within a designated management area the SWCB issues a permit to install or expand groundwater use which is equal to/or exceeds 30,000 gallons per month. Agricultural withdrawals are exempt from permit requirements. Therefore, we recommend that the County pursue additional steps to monitor groundwater withdrawals by agricultural users.

Conversations with the SWCB staff lead us to recommend that Lancaster not pursue designation of the County as a groundwater management area. As currently enforced, such an action would encumber the County with state regulations while Lancaster would not receive any appreciable benefits. Although detailed groundwater management recommendations are provided in Section IV of this report, a few will be mentioned at this point to support this recommendation. First, recent modeling conducted by the SWCB has generated substantial data which illustrates that not only are groundwater withdrawals from West Point affecting Lancaster County, but so are the

[19] Tributary Water Quality Characterization Report, Virginia Marine Resources Commission, 1985.

areas in the Southeastern Groundwater Management Area (i.e. Virginia Beach, Norfolk, Hampton Roads etc...). These results illustrate the need for a coordinated groundwater management effort which would encompass the entire coastal plain.

Therefore, an appropriate long term policy for the County to pursue is to work with other jurisdictions in the Northern Neck and the Middle Peninsula to develop an awareness of the interjurisdictional nature of groundwater management. The most productive outcome of such efforts (for the County and all participating localities) would be to have the entire Northern Neck designated as a groundwater management area. Such an action would greatly facilitate the process of incorporating all coastal plain jurisdictions into a comprehensive groundwater management area. Such a comprehensive management area would represent an opportunity for all participating localities to have their needs considered in the allocation of this resource.

D. DRASTIC

DRASTIC is an acronym that describes the factors used in a mapping system designed to evaluate the groundwater potential of an area. The parameters included in the DRASTIC system are (D) Depth to water, (R) Recharge [precipitation], (A) Aquifer media, (S) Soil media, (T) Topography, (I) Impact of the vadose zone, (C) Conductivity of the Aquifer. Information is gathered on these components and a numerical DRASTIC index is calculated. These indices can be mapped to show relative differences in pollution potential for groundwater in an area. DRASTIC is designed to be used as a planning or screening tool. In general, DRASTIC and associated maps cannot be used in site-specific evaluations because of local complexities in geological conditions and the scale at which they are produced. Typically, DRASTIC maps have a margin of error of plus or minus 100 acres. Some areas of the country have implemented modified DRASTIC groundwater protection on a site specific level which utilizes a much larger base scale and much more detailed input data.

Most localities are using DRASTIC as a screening tool for general site suitability and as an informational resource in making planning and zoning decisions. DRASTIC is used as a screening tool for siting facilities such as landfills, schools and roads as part of a general point rating system. If an area exceeds a certain number of points, then more stringent siting criteria/research/evidence of appropriateness are required before the site is approved. DRASTIC also has the potential to be used as a tool in determining target areas for code enforcement and designating groundwater protection areas. Some localities have overlayed the zoning map on protection areas and found the need to base certain uses and intensities on the DRASTIC site index. Such a situation highlights the need to integrate this type of information into the comprehensive land use planning process.

The Northern Neck Planning District Commission is currently incorporating DRASTIC mapping with the Virginia Geographic Information System (VirGIS). The County should support these efforts and utilize this source of information by incorporating relevant data into their planning process.

E. WATER CONSERVATION

Estimates show that using low-flow toilets, shower heads, kitchen faucets, lavatory faucets and urinals results in a reduction of indoor water consumption by at least 25%. While a low-flow toilet would cost $25 to $75 more than current models, sales literature for low-water toilets promise savings of $25 to $100 on water and sewer bills. Currently, at least fourteen plumbing manufacturers have added a low-flow model to their product lines and three more are gearing up to introduce their first water-saving products into the market. The City of Frederick changed its residential building code six months ago to require low-flush toilets as one of the few alternatives it had to allow for expansion and growth.[20]

---

[20] "Water-Saving Standards Debated," H. Jane Lehman, Washington Post, March 18, 1989, pp. F1, F10.

IV. IMPLEMENTATION TOOLS

A. INTRODUCTION

Because it is located in Tidewater Virginia, Lancaster County is required to comply with the Chesapeake Bay Preservation Act. The Criteria which are being promulgated require localities in the Tidewater region to incorporate specific environmental protection measures into their planning process. In some instances, the requirements have the effect of clearly stating the ability of localities to protect water quality through land use regulations. Therefore, the Criteria and the Act itself can be viewed as increasing the ability of local governments to protect their resource base.

The Chesapeake Bay Preservation Act Criteria calls for a two-year plan of implementation. The first year includes creating an environmental information base, designating preservation areas, adopting interim management criteria, and identifying Intensely Developed Areas (optional). The second year involves the development of local plans and ordinances for zoning, subdivisions, erosion and sedimentation control, stormwater management and building permit regulations. The Criteria does not affect existing laws or agencies (e.g. State Water Control Law) nor does it limit local authority with regard to planning, zoning and subdividing. In essence, the Criteria provides a vehicle for localities to increase environmental protection through the adoption of more stringent planning regulations.

The Commonwealth of Virginia is responsible for providing resources to localities for implementation of the provisions of the Act, and for ensuring that all state agencies act in harmony with the goals of the Act. In accordance with Virginia legislative tradition, localities maintain the bulk of the regulatory power and implementation responsibility. While the State has promulgated some mandatory provisions, the relevant agencies primarily play a supportive role.

The Chesapeake Bay Act planning criteria highlights several points relevant to Lancaster County planning initiatives. While the Act requires the inclusion of resource protection objectives in the local planning process, such a planning approach is not new

to Lancaster County. An extraordinarily high level of concern for, and knowledge of the natural resources which grace the County have been exhibited by residents and governmental officials for some time. The following section addresses resource management objectives within the context of providing numerous policy recommendations for the County. These options are intended to assist Lancaster County in charting a course for its future which is compatible with sustainable economic development, natural resource protection, and compliance with the Chesapeake Bay Preservation Act with minimal modifications.

B. COMPREHENSIVE PLAN

The purpose of this section is to provide the County with goals, objectives and policies for consideration in their shoreline planning process. In the goals portion of this section the authors suggest concepts for the County to consider endorsing in determining its future direction. The objectives represent a more detailed, issue oriented listing of general activities which are implied by the goals. The policies element provides concrete items upon which the County can act to implement the objectives in order to pursue the goals.

The County should agree on goals which will guide future actions. By focusing on goals, the County should clearly indicate its position on shoreline management issues. Once goals have been decided upon, it is imperative that they be implemented. In most cases, each resource which we have analyzed has numerous policy suggestions. We ask that the reader examine them all and identify those that are appropriate. However, we also ask that the proposed regulations be viewed as a two sided coin: on one side the obvious reaction to regulation is that it is an imposition on a person's rights (property, or individual rights); on the other side, regulations preserve the rights of other residents in the community. The notion of regulations as preserving rights is particularly relevant when considering environmental regulations. The environmental impacts of human activity do not stop at political boundaries, let alone property boundaries. By regulating

individual activities, local officials are protecting the welfare of local residents. The reader is encouraged to consider all of the recommendations contained in this section and support, advocate or implement those deemed appropriate. All of the recommendations were listed to provide management options.

B. 1. Groundwater

Goals

- The County should ensure that present and future County residents have an adequate supply of potable water.
- Degradation of water quality caused by the use of septic tank sewage systems should be prevented.
- Efficient use of groundwater should be maximized.
- The amount of groundwater available to contribute to streams during low flow periods should be preserved.
- The quantity and quality of water in the deep aquifers should be protected.

Objectives

- Those who currently rely upon wells that are vulnerable to contamination should be protected.
- The potential of septic tank contamination of shallow groundwater resources should be minimized.
- The County should incorporate public health concerns associated with septic tanks into their subdivision approval process.
- The efficiency and longevity of septic systems should be increased by ensuring proper maintenance and reducing domestic water consumption.
- Per capita water consumption should be reduced by imposing conservation measures.
- The potential for underground storage tank contamination of groundwater supply should be minimized.
- Withdrawal of ground water should be limited to rates that do not cause further intrusion of salt water.
- Recharge areas, highly permeable soils and areas with a high water table should be protected.
- Information regarding proper waste disposal should be distributed.

Policies

- Water conservation devices in the construction of new homes prior to the issuance of a building permit should be required.

- Water conservation practices for existing development should be adopted and applied.
- Limitations should be placed on the construction of impervious surfaces (especially on highly permeable soils and areas with a high water table).
- An 18 inch minimum separation should be maintained between suitable soils and groundwater.
- In suitable soils, the minimum recommended distance between edges of the tile fields and water bodies should be 100 feet.
- Require a certificate of septic tank inspection and maintenance be submitted every four or five years with local tax payments. The inspection could be undertaken by the person who pumps the tank or by the local sanitation officer.
- The County should encourage development which promotes infiltration of stormwater runoff.
- All contaminated wells should be located and recorded.
- All abandoned wells should be capped.
- In cooperation with the State Health Department, The County should develop public education programs for rural homeowners, farmers, well drillers and citizens regarding well water quality, septic tank construction and maintenance, and the proper use of fertilizers and pesticides.

B. 2. Surface Water

Goals

- The County should protect all remaining land which is suitable for water supply impoundments based on land cost, current development densities and surface water flow rates.
- Water quality standards that restore the integrity of the aquatic ecosystem should be achieved and maintained.

Objectives

- To prioritize impoundment sites to be acquired.
- To utilize the impoundment site(s) for recreational opportunities for County residents at least until the impoundment is needed as a source of drinking water.
- To minimize sedimentation of surface waterbodies.
- To promote development which minimizes stormwater runoff.

Policy

- The County should acquire at least one impoundment site for future drinking water supply.
- Post development runoff rates equal to pre development rates should be required.
- Best Management Practices should be required for stormwater facilities, construction sites, and agricultural and silvicultural activities prior to the issuance of a building permit.

B. 3. Soils

Goals

- Soil resources should be conserved.
- The importance and vulnerability of soils with a high shrink swell potential, are highly permeable and areas with a high water table should be recognized.
- The County should ensure that soil erosion is minimized.
- Residents should be educated as to the limitations of the soil, the pressures generated by conflicting demands over this resource and steps which can be taken to resolve these conflicts.

Objectives

- Optimal locations for future solid waste disposal sites should be determined.
- The feasibility of a multi-county solid waste recycling effort should be explored.
- A data base which can be used on a site specific basis for evaluating development capacity should be assembled.
- The County should prevent sheet runoff over high erosion areas such as steep slopes or highly erodible soils.
- Peak runoff rates should be reduced.
- Disturbance of vegetative cover should be minimized.
- Exposure of soils to weathering at construction sites should be minimized.
- The area disturbed during construction should be minimized.
- Land best suited for agricultural use should be protected.

Policies

- Stormwater retention and infiltration should be required in new construction.
- Local recycling initiatives should be encouraged.
- Development should be directed away from soils which have a high water table, percolate rapidly or are highly erodible.
- The County should contract with a soil scientist, on a consulting basis, to evaluate soil suitability and site plans.
- The County should study the applicability and feasibility of compiling a geographic or resource information system (GIS or RIS).
- The County should require detailed erosion and sedimentation plans including vegetation disturbance plans prior to issuing a building permit.

B. 4. Wetlands

Goals

- To provide adequate areas adjacent to wetlands to allow for their future migration, thus preserving (and possibly expanding) the wetlands acreage in the County.
- To have zero net loss of tidal and non-tidal wetlands.

Objectives

- To inventory the remaining natural areas of the County to determine the most ecologically valuable areas.
- To protect wetlands as a habitat for flora and fauna.
- To ensure that, if wetland development is unavoidable, measures be taken to mitigate the damage.
- To prevent pollution and contamination of wetlands.

Policies

- The County should commission the completion of a County Natural Heritage Program inventory of rare and endangered species.
- All projects involving wetlands impacts should have a pre-and post-construction site visit.
- The Wetlands Board should work closely with the County legal staff to ensure enforcement of and compliance with the Wetlands Ordinance.
- Permitting that takes place after wetlands have been altered should be eliminated. This should be pursued through cooperating with the County Legal Staff.
- Acquire the most ecologically valuable and sensitive areas which remain undisturbed.
- Those wishing to alter or develop wetland areas should demonstrate that proposed activities cannot be located at upland sites.
- The County should use a point system to review the impact of development proposals on wetlands This could be instituted through special permit procedures. Such a procedure could incorporate permit requirements regarding project design and site conditions for uses that impact wetlands.
- "No Wake" requirements should be established in areas where the tidal shoreline is vulnerable to high wave action.
- The County should establish a fund to which contributions could be made by those who destroy a tidal or non-tidal wetland. The money in the fund would be used to acquire the most ecologically valuable wetland areas in the County.
- The 1973 wetlands inventory of tidal wetlands should be updated.
- Draining and filling of tidal and non-tidal wetlands should be avoided.
- A buffer should be required between wetlands and upland activities.
- Cluster developments should be encouraged to protect wetlands as undisturbed open areas.

B. 5. Shellfish

Goal

- To maintain and restore productivity of shellfish producing areas in Lancaster County.

Objectives

- To continue and expand efforts to replenish local shellfish populations.
- To minimize the potential for condemnation of shellfish beds.

- To reduce pollutant loadings to the waterways of the County which have an adverse impact on the quality and quantity of shellfish.
- To educate the boating community about contamination of shellfish from improper discharge of sewage.

Policies

- Establish a shellfish grounds restoration and preservation program to be funded through a marina user fee.
- Placement of shell on the bottom to provide suitable substrate for shellfish growth should be continued.
- Prohibit the establishment or expansion of marina facilities which would result in shellfish bed closures.
- Enforcement of state regulations requiring sewage holding tank pump-out facilities should be rigorously pursued at marina facilities.
- Marinas should be required to install proper sewage disposal systems and provide adequate buffering or control zones around maintenance areas.
- Fuel stations should be equipped with automatic shut-off devices and adequate signage to instruct boaters about proper fueling procedures.
- Marina operators should be encouraged to distribute fact sheets provided by the County regarding proper maintenance procedures for holding tank effluent disposal and tips for minimizing impacts of painting boat bottoms.

B. 6. Coastal Flood Hazards

Goals

- The construction of permanent and/or seasonal residences in the flood plain should be minimized.
- All structures that lie within the flood hazard zone should be in compliance with all building and construction requirements.

Objectives

- A revolving loan fund should be established to assist low and moderate income residents in bringing current structures in flood hazard areas into compliance with code.
- Land in the flood hazard zone should be acquired for recreational and research purposes.

Policies

- High hazard areas should be zoned for the lowest rural density.
- Capital facilities and infrastructure should be sited out of flood hazard zones.
- Industrial, commercial and retail land uses in the flood hazard zone should be restricted to water dependent activity.
- Regulations for site development and construction techniques in the flood hazard zone should be strengthened and an emphasis should be placed on monitoring and enforcement.

B. 7. Shoreline Erosion

Goal

- To recognize and protect the integrity of the shoreline as a dynamic system.

Objectives

- The County should develop policies, in cooperation with the Wetlands Board, which ensure non-structural shoreline protection wherever feasible.
- The County should encourage location of all uses in areas that minimize the need for shore hardening.
- Shoreline stabilization and flood protection measures should be designed and constructed so that downstream property will not be adversely affected.

Policies

- A setback for shoreline structures equal to or greater than thirty times the average historical rate of erosion should be required.
- The use of vegetation for shoreline stabilization should be encouraged as a substitute for shore hardening structures.
- The preservation of an undisturbed vegetated buffer along the shoreline should be required.
- Immediate shoreline re-vegetation should be required following land clearing activities.
- Where shoreline stabilization is permitted, it should be located landward of vegetated wetlands and should be limited to the use of rip rap.
- Land clearing activities along the shoreline should be minimized.

B. 8. Public Access

Goal

- Adequate sites and facilities should be provided to meet the recreational needs of residents.

Objectives

- Citizen participation should be encouraged in determining recreational needs and priorities.
- Lancaster County should initiate and coordinate multi-county efforts at providing regional recreational facilities.
- Private sector cooperation and involvement should be encouraged in meeting recreational needs.

Policies

- Additional staff should be hired with a job description consistent with the public access goal.
- A consistent source of funding should be provided for site acquisition and management of public recreation sites.
- An outdoor recreation plan should be produced (including user projections, site identification, proposed uses, site and facility cost estimates, and schedule for the completion of each project).

C. ZONING

The zoning section of shoreline planning for Lancaster County should address the development patterns and environmental resources which distinguish this area from the rest of the County. Many of the key issues regarding the shoreline have been previously addressed for individual areas of concern. The zoning ordinance is the means by which the comprehensive plan is implemented and, as such, has the potential to direct County policy. While general goals are much easier to adopt than specific policies, the most important aspect of a policy is that it be clearly stated and consistently followed. The following discussion will offer suggestions regarding the shoreline zoning ordinance purpose, district names, densities and permitted uses.

Purpose

The purpose section should be amended to incorporate environmental considerations and protection of water quality of the Chesapeake Bay. For example, page 1 (6) undue density considerations should include environmental quality degradation. Other purposes of the zoning ordinance could include:

1) To protect the health, safety and welfare of current and future generations of County residents located along Lancaster's shoreline.

2) To prevent degradation and promote the sustainable use of the following resources: surface water, ground water, tidal and non-tidal wetlands, highly productive agricultural and forestal soils, shellfish, finfish and the Chesapeake Bay.

3) To preserve rare or unique flora and fauna found in the County and to preserve their respective habitat.

4) To encourage development which is creative and innovative in balancing the housing needs of a growing area which preserves the natural resource base.

Cluster Development

It should be the policy of the County to encourage the clustering of housing when such developments:

A. Preserve the environmental integrity of the site by protecting and/or promoting the preservation of features such as stream valleys, desirable vegetation, open space, farmland, and either:

(1) Produce a more efficient and practical development, or
(2) Provide land necessary for public or community facilities.

B. Is in accordance with the adopted comprehensive plan and the established character of the area. To accomplish this end, the cluster subdivision should be designed to maintain the character of the area by preserving, where applicable, rural views along major roads and from surrounding properties through the use of open space, buffers, minimum yard requirements, varied lot sizes, landscaping or other measures.

In a proposed residential subdivision, a cluster subdivision could be required if the Planning Commission and the Board of Supervisors determines that cluster development will promote the public interest by:

1) Conserving scenic, natural and/or historic resources or
2) Mitigating industrial, residential and/or agricultural (and other related uses) interface problems or
3) Maintaining the existing general character of the land, area or preserving land values.

In the approval of a cluster subdivision, the applicable density or use limitations for the district should be flexible. The Board could approve a modification to the minimum lot size and/or minimum yard requirements when they conclude that such modifications are consistent with the purpose of this section and the applicable zoning district.

Within every residential cluster development there should be planned and set aside permanently an amount of open space to be maintained exclusively for recreation and/or conservation purposes. The amount of such open space should not be less than 60% of the net developable area of the site.

Density Bonuses

The permitted number of dwelling units allowed should be increased upon the granting of a density bonus by the Board of Supervisors. Upon application, the Board of Supervisors could grant density bonuses in accordance with the following actions upon finding that the increased density would not impair the character of the area and would be in the best interests of the general public. A density bonus equalling 10% could be awarded for each condition (specified below) which is met by the cluster development.

- Dedication of land accepted by the County. Such land could be dedicated for use as a park site, or other public facility and shall be suitable for the proposed use.
- Undertaking an archaeological survey of the site according to guidelines provided by the Virginia Historic Landmarks Commission.
- Preserving any archaeological or historic site or structure judged to be of significant by the Virginia Historic Landmarks Commission or the Lancaster County Historic Landmarks Commission.
- Undertaking an endangered species survey of the site according to guidelines provided by The Virginia Natural Heritage Program.
- Preserving in its natural state, any area demonstrated to be a habitat for any endangered, rare, or threatened species of plant or wildlife (and an appropriate buffer area) so designated by the State of Virginia's Natural Heritage Program, the federal government or listed in Rare and Endangered Vascular Plant Species in Virginia. (Duncan M. Porter, Virginia Polytechnic Institute and State University, 1979).

District Names

To accurately reflect the level of environmental sensitivity, we recommend that areas which require the greatest attention regarding natural resources be designated as a conservation district. The sensitive area adjacent to the conservation district could be called the management district. The name preservation is not applicable to either of these physical areas as it is connotative of a prohibition of development. It is recommended that the name preservation area be utilized by the County when it purchases areas for conservation or recreation related uses.

Conservation District

In a conservation district, the County should limit uses to those which are water dependent. Where commercial activity is established special environmental

performance standards should be adopted. Furthermore, shoreline areas which are the least environmentally vulnerable to degradation should be designated for commercial or industrial water dependent uses. The uses which are allowed in a conservation area should be very limited. The larger the geographic area encompassed in such a designated area, the more diverse will be its uses. Therefore, while it is impossible to prescribe an appropriate listing of permitted uses at this juncture, we have generated a list of uses which should be permitted in any such area.

By Right Uses

- Single-family dwellings for use of year-round residents.
- Individual manufactured homes for year-round residents.
- Cluster Developments.
- Off-street parking as required.
- General farming, agriculture, dairying, forestry and horticulture.
- Preserves and conservation areas.
- Recreational areas.
- Areas of basic finfish and shellfish processing facilities such as oyster shucking houses and crab houses which are dependent on a waterfront location for their viability. It is up to the applicant to prove that the proposed use is water dependent and could not be located outside of the conservation area.
- Public boat docks and/or ramps.
- County sanctioned public facilities.
- Public utilities and facilities for the provision and maintenance of public utilities including water and sewer installations and electricity.

Conditional Uses

- Single-family dwellings for use of seasonal residents.
- Individual manufactured homes for use of seasonal residents.
- Schools and churches.
- Lodges and hunting clubs.
- Portable sawmills for temporary logging operations.
- Yacht clubs, marinas, boat railways (with repair) boat building and docks.
- Cemeteries.
- Golf courses.
- Private boat docks and/or ramps.

Densities

The residential density of the conservation district should consider the size of the zone being regulated. If the land area is very large, the density should not be too large, or middle income residents will be excluded. Yet, the lot should be large enough to allow for an alternative septic drainfield site, a minimal percentage of impervious surfaces, and to allow for the utilization of groundwater as a water supply.

The conservation zone should include all property from the shoreline landward 1500 feet. Based on this geographic boundary, the density for residential subdivisions in the management should be 1 dwelling unit for every 5 acres.

There can be misunderstandings regarding proposed densities. In order to avoid misrepresentations as to what is allowed and what is not, land that is not developable under existing County ordinances should not be utilized in density calculations. Such a policy would make it easier to evaluate and administer the regulations, and aid the public in assessing the merits of larger developments.

Guidelines for Sustainable Development in the Conservation District.

• Water Conservation Devices: Currently, the most common devices in use are toilets that use no more than 1.6 gallons of water per flush, kitchen faucets, lavatory faucets and (primarily in commercial or industrial buildings) urinals. It is recommended that all of these devices be required in new buildings constructed in the conservation district, unless the applicant for a building permit can prove that the installation of these deviceswould prove an undue hardship. At a minimum, it is recommended that low-flow toilets be required before a building permit is issued.

• Soil Conservation Plan: The County should require the submission of a vegetationprotection plan (or soil conservation plan) prior to issuance of a building permit. Such a plan should call for the protection of all trees in excess of 6 inches in diameter. Their protection should extend to the area encompassed by their canopy and could be ensured by roping off, or otherwise delineating, the protection area. All clearing limits should be clearly marked and observed. A 20% waterfront viewshed clearing should be permitted given that all reasonable steps are taken to ensure the preservation of trees in excess of 6 inches in diameter.

• Impervious Surfaces: All development projects, proposals, and designs in the conservation district should limit the construction of impervious surfaces and areas not allowing natural drainage. Impervious surfaces should not exceed 20% of the developable area of the lot unless the applicant can effectively demonstrate, through innovative design, that the protection provided by the design would be equal to, or exceed, the protection afforded by the 20% limitation. In all cases, the first 1/2 inch of rainfall should be retained on the site.

- Runoff Control: In order to obtain any variance from the above water quality protection provisions, the person submitting a subdivision application should be required to prove that post development runoff rates will not exceed pre-development rates. These calculations should take into account the runoff from any surfaces draining on to the property.

Management District

The variety of uses which are allowed in a management district are dependent on its size. The larger the geographic area encompassed in such a designated area, the more diverse will be its uses. Therefore, while it is impossible to prescribe an appropriate listing of permitted uses at this juncture, we have generated a list of uses which should be permitted in any such area. Additionally, the County should consider using overlay districts (or in some way delineating an appropriate area to allow for necessary commercial, retail or industrial uses. Such an area should be delineated by a growth boundary within which public services should be concentrated.

By Right Uses

- Single-family dwellings for use of year-round residents.
- Individual manufactured homes for year-round residents.
- Duplexes.
- Townhouses.
- Cluster Developments.
- Off-street parking as required.
- General farming, agriculture, dairying, forestry and horticulture.
- Preserves and conservation areas.
- Recreational areas.
- Areas of basic finfish and shellfish processing facilities such as oyster shucking houses and crab houses which are dependent on a waterfront location for their viability. It is up to the applicant to prove that the proposed use is water dependent and could not be located outside of the conservation area.
- County sanctioned public facilities.
- Facilities for the provision and maintenance of public utilities including water and sewer installations and electricity.
- Cemeteries.

Conditional Uses

- Single-family dwellings for use of seasonal residents.
- Individual manufactured homes for use of seasonal residents.
- Open air market for locally caught fresh seafood.
- Townhouses.
- Golf courses.
- Roadside stand.

Density

The residential density of the management area should consider the size of the zone being regulated. If the land area is very large, the density should not be too large, or middle income residents will, for all intents and purposes, be excluded. Yet, the lot should be large enough to allow for an alternative septic drainfield site, a minimal percentage of impervious surfaces, and residential density must be low enough to allow for the utilization of groundwater as a water supply.

The management zone should include land which is between the 50 foot contour and the conservation area (1500 feet from the shoreline). Based on this geographic boundary, the suggested density for residential subdivisions in the management is 1 dwelling unit for every 2 acres.

There can be misunderstandings regarding proposed densities. In order to avoid misrepresentations as to what is allowed and what is not, land that is not developable under existing County ordinances should not be utilized in density calculations. Such a policy would make it easier to evaluate and administer the regulations, and aid the public in assessing the merits of larger developments.

Guidelines for Sustainable Development in the Management District.

• Water Conservation Devices: Currently, the most common devices in use are toilets that use no more than 1.6 gallons or water per flush, kitchen faucets, lavatory faucets and (primarily in commercial or industrial buildings) urinals. It is recommended that all of these devices be required in new buildings constructed in the conservation district, unless the applicant for a building permit can prove that the installation of these devices would prove an undue hardship. At a minimum, it is recommended that low-flow toilets be required before a building permit is issued.

• Soil Conservation Plan: The County should require the submission of a vegetation protection plan (or soil conservation plan) prior to issuance of a building permit. Such a plan could call for the protection of all trees in excess of 6 inches in diameter. Their protection extend to the area encompassed by their canopy and should be ensured by roping off, or otherwise delineating, the protection area. All clearing limits should be clearly marked and observed.

• Impervious Surfaces: All development projects, proposals, and designs in the conservation district should limit the construction of impervious surfaces and areas not allowing natural drainage. Impervious surfaces should not exceed 30% of the developable area of the lot unless the applicant can effectively demonstrate, through innovative design, that the protection provided by the design would be equal to, or exceed, the protection afforded by the 30% limitation. In all cases, the first 1/2 inch of rainfall should be retained on the site.

• Runoff Control: In order to obtain any variance from the above water quality protection provisions, the person submitting a subdivision application should be required to prove that post development runoff rates will not exceed pre-development rates. These calculations should take into account the runoff from any surfaces draining on to the property.

D. SUBDIVISION

The purpose of the subdivision section is to establish guidelines for developers and potential homebuilders. The comprehensive plan has outlined certain goals, objectives and policies that will help the County pursue their vision for future development. The subdivision section provides for implementation through ordinances that should be consistent with the other planning documents and ordinances. This section reviews the existing subdivision ordinance for Lancaster County and recommends changes that will assist the County in formulating policy options, policy implementation and establishing a systematic procedure for evaluating subdivision proposals. The critical resources that the comprehensive plan focuses on are addressed in this section.

Before beginning a detailed analysis of specific impacts of development on environmentally sensitive areas and reviewing the ordinance, some general observations are in order. No regulatory program can be effective if it is insufficiently funded.

Furthermore, those who generate the need for increased County efforts should bear the costs of financing monitoring and enforcement activities. Currently, the County is subsidizing the cost of processing subdivision proposals through general property taxes. The County should utilize its statutory authority to increase the charge for subdivision applications from the maximum $150.00 charged today, to a cost which more accurately reflects the resources required to evaluate and monitor subdivision proposals. The State Code allows for a maximum fee of $1,000.00 for subdivision applications. With the expanded regulatory role given to localities, including Lancaster County, the fee charged should be substantially increased in order to facilitate an adequate level of review and an equitable financing structure.

Table 1 lists the criteria and issues that many subdivision ordinances address. The horizontal axis lists the critical resources that we think should be protected. The vertical axis (y) lists the components that make up a subdivision ordinance. The column labeled Lancaster County is our assessment on the adequacy of the present subdivision ordinance in addressing these concerns. This table demonstrates the degree to which different components of the subdivision ordinance relate to resources and potential impacts. The goal of the County should be to strengthen the pertinent elements of their ordinance to ensure that all vulnerable resources have the proper guidelines and procedures in place to protect them.

Table 1

Lancaster County Subdivision Ordinance Review

Component	Lancaster County	Ground Water Impact	Surface Water Impact	Erosion Impact	Wetlands Impact	Slope Impact
Purpose	weak	some	import	import	import	import
Definition	weak	import	import	import	import	import
Exceptions	yes	import	import	import	import	import
Design	yes	import	import	import	import	import
Street Layout	weak	import	import	import	import	import
Setback Requirements	some	import	import	import	import	import
Private Roads	some	some	some	some	some	some
Lot Dimensions	some	import	import	import	import	import
Waterfront Access	none	import	import	import	import	import
Land Suitability	some	import	import	import	import	import
Water Buffers	some	import	import	import	import	import
Water Dependent Uses	some	import	import	import	import	import
Shoreline Stabilization	some	import	import	import	import	import
Tree Protection	none	import	import	import	import	import
Flood Proofing	some	import	import	import	import	import
Open Space	none	import	import	import	import	import
Preservation Area	some	import	import	import	import	import
Water Supply	none	some	some	some	some	some
Septic	some	import	import	import	import	import
Ag. and Forest Preservation	none	some	some	some	some	some

The chart visually shows the need for the County to amend the subdivision ordinance. We think that the column labeled Lancaster County should read strong for each component.

D. 1. Groundwater Impact

The existing subdivision control ordinance addresses groundwater protection indirectly. The purpose statement of the ordinance explains that the objective is to create conditions favorable to health, safety, convenience and prosperity. If the groundwater becomes contaminated or depleted, the County will have failed to create these conditions. Therefore, a legal case could be presented that the regulation and conservation of groundwater are important to maintain consistency with the purpose.

Section 5-5, lot size, directly addresses groundwater impacts. It describes the footage needed to install a sewer and water system. Section 5-9, private water and/or sewer stipulates that the type of water and sewer system installed must meet the standards of the Water Control Board, the State Health Department, and any other state or local agency having authority over such installations. While these regulations are useful, they do not offer any management controls for sewage disposed of by septic tanks or water supplied by wells. This is a major deficiency since an overwhelming majority of shoreline residents sewer and water needs are meet through the use of septic systems and private wells.

We recommend that the County impose further regulations to insure that proper steps are taken to protect groundwater.

- Wells in all major subdivisions over 10 units should tap the deep aquifer.
- The purchase of tap fees should be required as a method of monitoring and managing the number of wells dug each year.
- Larger subdivisions should be required to bore fewer wells. This recommendation could be implemented by regulating the number of permits per number of units. For example, for every 10 lots allow only one well.
- The use of building materials that are pervious should be required.
- The County should promote the installation of water gauges that measure the water consumption of houses and subdivisions.

D. 2. Surface Water Impact

Portions of the existing subdivision control ordinance partially address the impact of development on surface water quality. However, amendments should be considered in order to increase the level of environmental protection.

Section 5-4, lot size, will have an impact on water quality. Additionally, the size of the building on the lot is a complementary factor which should be considered. The building will create an impervious surface that obstructs the percolation of water into the ground. In addition to reducing groundwater recharge, this condition also contributes runoff into tributaries. In light of this situation, the following management policies are offered for consideration.

- Impervious surfaces should cover no more than 20% of the lot. If this creates an undue hardship for the applicant, a variance could be granted if the applicant can show that best management practices will attain the same level of protection.
- The topography of the lot should be considered in site plan review.
- Grading and filling should occur only on 50% of the lot.
- Developments on lots with a slope greater than 15% should avoided when possible and conditionally approved when there is no feasible alternative..
- Land disturbing activities on slopes greater than 25% should be prohibited.

Section 5-6 regulates building set back and sideline restrictions. Presently, these regulations apply to all lots. For parcels not adjacent to water or fronting water the ordinance is adequate. However, for parcels in proximity to surface water bodies, a more detailed and conservative regulation should be considered. The County should consider adopting the following environmental provisions.

- The distance from the mean water line to construction site should be extended to a minimum of 100 feet.
- The area between the building and shoreline should be kept in a natural state.
- View corridors that retain 80% of the existing vegetation should be required.
- Impervious surfaces should be minimized. Plats should document their presence as a percentage of coverage of the buildable lot and in total square footage.

Section 5-7 recognizes that properly installed and maintained septic tanks can be a viable method of disposing of human waste. This section does a fairly good job covering

areas that could cause concern. However, the County should plan ahead for the time when septic tanks fail, which could be anywhere from seven to thirty years. In order to implement this policy, the following modification is suggested.

- A suitable site for a second septic drainfield should be required on the building site. This reserve drainfield site should be shown on the subdivision plat map and building should be prohibited on the area of the reserve field.

D. 3. Soil Suitability

The current ordinance does contain provisions regarding soil suitability. However, by amending some sections the County could provide a more comprehensive regulatory framework within which development could take place.

- The County should strengthen section 5-1 (mutual responsibility and suitability of land) to require the subdivider to prove that their proposal meets a certain standard level of land suitability for all subdivisions greater than 10 units.
- The developer should be required to provide profiles of soil characteristics not just for percolation rates (as required by section 5-2), but for shrink swell soils and water table levels.
- The location and characteristics of the soils should be analyzed together and should not be considered mutually exclusive (as currently set forth in 5-7).

D. 4. Erosion Impact

Most of the erosion impact analysis and mitigation methods are covered in the erosion and sediment control section. However, during the pre-development and post-development stages of construction, the potential exists for substantial damage to occur to sensitive resources. Therefore, in this section we have included a check list of information which we think the County should consider as a requirement for land development. Such a checklist would ensure that land is developed in an environmentally proper manner. Such a checklist could be incorporated into the development process by signing an agreement to abide with terms set forth in order to receive subdivision approval or a building permit.

Pre- and Post Development Checklist for Property Owners and Developers

Pre-Development

The County could require all applicants to submit the following material to the staff of the planning commission.

- Soils, slopes, natural and drainage patterns should be mapped.
- Natural vegetation and proposed alterations should be mapped.
- An erosion and sediment control maintenance plan should be submitted.
- Buffer areas and drainageways to exist during and after construction should be identified.
- Pervious surfaces should be used where possible: gravel access roads, driveways (also can be brick, "grasscrete", etc.). Impervious driveways should be prohibited.
- Vegetated buffers should be maintained along roadways
- On site natural vegetation should be preserved to the fullest possible extent: limit lawn space, and the use of chemical lawn products should be discouraged.
- Land between the shoreline or tributaries and the construction site should not be cleared for any purpose other than the construction of docks where permitted.
- Fill dirt and exposed soils should be covered while construction is not in progress.
- Clearing or grading should be prohibited on slopes greater than 15%.
- Hay bales and silt fences should be required to protect tributaries and shorelines from runoff. They should be maintained to ensure their effectiveness.
- Natural drainageways should be preserved where possible.
- Introduction of foreign vegetation in landscaping should be minimized.
- Splash plates should be installed and maintained under all drainspouts to prevent channelization of rainwater.
- Docks and other water access structures should be constructed only for small craft and low-scale access, on properties with shoreline slope less than 15%, and not in areas with viable shellfish beds, wetlands, or areas already delineated to have high levels of erosion.

Post-Development

- Site clean-up should commence expeditiously, no later than one week from end of project (major construction, not to include cosmetic work).
- Site clean-up should include disposal and/or stabilization of all collected sediments. This should take place prior to removal of erosion and sedimentation control devices.
- Extra fill dirt, gravel, and other construction materials should be included in the clean-up requirement.
- Fines for exceeding clean-up time should be approximately $1,000/day, with the County to begin clean-up after the allotted one week period, using developer's submitted clean-up plan.

- Re-vegetation of site should occur as soon as possible following construction.
- Chemically created or fortified lawns should be discouraged.
- The self-maintenance program should be adhered to by the owner after occupation of the site and should include:
  1. Monitoring stormwater runoff patterns (correcting drainage patterns as necessary to prevent fouling of waters caused by runoff);
  2. Maintenance of vegetation in buffer zones;
  3. Maintenance of pervious surfaces in order to retain their effectiveness (e.g. repairing gravel driveways to prevent exposure of underlying soils).
- Home gardens should be located in environmentally stable areas, planted or covered during the growing season, and covered during the off-season (tarps, mulch, or hay are recommended).

Conclusion

When the County adopts and implements ordinances that provide additional resource protection, some residents may not understand the need for these actions. To increase local understanding of the difficult decisions which the County confronts, the County should consider producing educational materials or conducting informal sessions to inform residents and developers of the need for taking additional regulatory action. Furthermore, a shoreline review committee composed of diverse interest groups could be formed to improve the understanding of development impacts on the shoreline environment. The purpose of stricter ordinances that establish higher performance standards is to improve efficient utilization of natural resources and better management of residential growth.

E. FLOODPLAIN ORDINANCE EVALUTATION

As a result of the creation of the National Flood Insurance Program (NFIP), localities have begun to regulate activities within flood prone areas. In Lancaster County, the areas regulated consist of the 100 year Flood Plain as designated by flood insurance rate maps (FIRMs) for the county dated March 1988, the Coastal Flood Plain (A Zone), which are subject to 100 Year Coastal floods and the Coastal High Hazard Area (V Zone) subject to high velocity waters and wave action. A building permit is required for construction activities within a flood plain district, indicating that development activities

are permitted in these areas. All new construction must meet certain standards requiring adequate anchoring to withstand flotation. New construction within the A Zone is required for the lowest floor subject to flooding be designed to allow the equalization of hydrostatic forces on the exterior walls. In addition, manufactured homes must be elevated and anchored above the base flood elevation. In the V-Zone, no development is allowed below the base flood elevation. Exceptions are allowed for structures landward of mean high tide and those which are elevated above the base flood level.

Recommendations to improve the Floodplain Management Ordinance center around the need for increased efforts on monitoring and enforcement. The present system requires the individual to obtain a building permit. At this stage, the County enforces the floodplain ordinance. However, in reality, the property specific boundaries are hard to identify and regulations are difficult to enforce without a property survey. Technical and financial constraints involved with site surveys in Lancaster County center around the lack of accessible bench markers which are necessary for an accurate survey.

At the present time, the Floodplain Management Ordinance is reasonably well written. However, the constraints of adequate resources for monitoring and enforcement are a major obstacle in the implementation. Detailed flood maps are available at the Lancaster County Land Use Administrators office. Individuals are encourage to review these maps. If their parcel could be/or is in a flood prone area the site should be surveyed in order to determine the elevation (and corresponding level of flood hazard). In order to improve its land management efforts in flood prone areas, the following recommendations are offered.

- Filling and grading should be restricted in floodprone areas.
- Detention ponds should be required in developments over 50 units.
- The County should consider the adoption of a stormwater management ordinance.
- A site survey conducted by a certified engineer should be required with subdivision applications. Specific attention should be paid to the relationship of the home site and flood prone areas.

- GIS/RIS technology should be utilized at a scale appropriate for site specific work. Parcels at risk for flooding should be identified.

For those who do reside in flood prone areas, the County should prepare an evacuation plan. Special consideration should be directed to the handicapped as well as individuals with communication restrictions (i.e. those who do not have a phone).

F. EROSION AND SEDIMENT CONTROL ORDINANCE

The 1988 Virginia Erosion and Sediment Control Law (§ 10.1-560-§ 10.1-571) replaces the 1973 code, maintaining its purpose of regulating land-disturbing activities in order to minimize erosion and sedimentation of any lands in the Commonwealth. The state Erosion and Sediment Control Program (ESCP) is established by the law, creating a state board and dictating the adoption of local ESCPs, compatible with state law, by each district, county, city, or town.

The state has the authority to devise a program to be used, should any locality fail to submit an ESCP. Any locality administering an ESCP may charge an application fee to defray costs, to an amount commensurate with the services provided, or $1,000, whichever is less.

Not all land-disturbing activities are covered under the law, with fourteen exceptions listed in § 10.1-560. Among them are: minor activities such as household gardening, single family residences not on subdivided land, land areas less than 10,000 square feet, projects on the shoreline already approved by the local Wetlands Board, the Marine Resources Commission, or the U.S. Army Corps of Engineers, and tilling, planting, and harvesting of agricultural and forest crops. These exceptions, along with the remaining nine listed in the law, may have extreme repercussions for erosion and sedimentation in certain areas.

For those activities included under the law, such as clearing, grading, excavating and filling land, an ESCP must be submitted by the developer (applicant). The local authority must approve or disapprove of the plan within 45 days, or it will be considered

approved. Approved plans may be changed if further inspection proves the plan to be unsatisfactory or if the applicant alters his plans. The local authority has the ability to inspect the area in question periodically as well as request progress reports from the applicant. A notice-to-comply may be issued in cases of violations of the approved plan. Failure to comply may result in a revoked permit. At this point, violators may be charged with a misdemeanor, and may be fined $1,000 or given a 30-day jail sentence. As well, the violator may be found liable of civil damages, depending on the circumstances.

Localities are authorized to implement and enforce more stringent regulations than are set forth in the state law. Even so, no regulation may limit the powers of the State Water Control Board, the Department of Mines, Minerals, and Energy, or the provisions of the Virginia Oil and Gas Act.

Lancaster County has responded with an Erosion and Sediment Control Ordinance which closely reflects state goals (in effect July 1, 1975 in response to the 1973 law). The ordinance establishes conservation standards, including criteria, guidelines, techniques and methods for controlling erosion and sedimentation. These standards are set forth in the Erosion Sediment Control Handbook, which is issued for the use of the applicant. Since July 1, 1975, any person engaging in land-disturbing activities has been required to submit a plan and comply with the ordinance before receiving a permit. Land-disturbing activities excepted from the law are defined similarly, with one exception. The state law includes agricultural engineering projects (terracing, dikes, land drainage, etc.) as an exception, whereas the County does not. It is highly probable that these differences reflect the fact that Lancaster's Ordinance has not been updated to correspond to the 1988 State provisions.

As with the state program, the applicant's plan must be reviewed within 45 days, or it is considered approved. The plan review fee is significantly different form the state's $1,000 limit - the County charges $25 for the first acre, plus $10 for each additional acre disturbed, with a maximum of $150.

The County permitting authority includes the power to inspect and-disturbing activity on-site at any reasonable time. Upon failure to comply with the approved plan, the permit holder is served with a notice-to-comply. Further failure is considered a violation, subject to a revocation of the permit. As with the state program, a violator may be charged with a misdemeanor and be subject to penalties.

The Virginia Erosion and Sedimentation Control Law and the Lancaster County Ordinance regulate the degradation of land and water through a permitting process. The state law serves as a guideline for localities to use in creating ordinances, allowing for more stringent regulations to be created according to local needs. Lancaster County should continue working with other localities and their state legislative representatives to pursue authority to control single-family dwellings. With some revision, zoning ordinance and construction permit requirements could be incorporated into the local ESCP Ordinance to create an effective watershed erosion control regime. While amendments to the ESCP Ordinance could address many of the deficiencies that currently exist, the benefits obtained through such amendments will only be realized if administration, oversight and enforcement efforts are increased. The importance of having adequate qualified personnel will increase as build out occurs.

The exceptions allowed by the state law may serve to harm the water quality of the Chesapeake Bay and its tributaries. Therefore, an effort should be made through local ordinances to restrict certain activities in sensitive areas. Included in this could be home gardening plots in excess of one acre, livestock operations, agriculture-type engineering operations, or any activity which effects the water table, such as wells, dams, and ponds.

Local Ordinance/Handbook (handbook to be applicable to *all* homebuilders)

The County needs to update the current local ordinance and handbook, adopting stricter regulations and identifying specific erosion and sediment control practices. Regulations should truly be aimed at protecting water quality - ease and equity should not

be the point of the ordinances. Specifically, land-disturbing activities should be restricted or prohibited in areas highly susceptible to erosion - bluffs, areas on the southeastern end of the County, land that is already eroding, and lands adjacent to shellfish habitats.

- Permitting fees should be increased to allow for the consulting services of a civil engineer or soil scientist.
- Preliminary Plans" in the Handbook, "c." should be changed to read "Temporary and permanent means of erosion and sediment control" (striking "tentative"). Such a change in wording would dispel ambiguities and be more consistent with the goals of the County.
- Natural and any proposed artificial drainage areas should be mapped and reviewed for effective stormwater management.
- A section listing recommended/required practices should be inserted in the ordinance. This will clarify the specifics of erosion and sediment control requirements. The following requirements should be considered:

  1. Specific buffer zone requirements should be stated. Disturbances in the buffer zone should be prohibited before, during, and after construction, with the maintenance of natural vegetation stressed,

  2. The timing of grading, construction, erosion and sedimentation control, and clean-up should be addressed.

  3. Expected drainage areas should be outlined and natural drainage patterns retained to the fullest extent possible. Effective stormwater management should be the priority here - impervious surfaces should be minimized at all stages of construction (i.e. gravel access roads) and,

  4. Regulations limiting and controlling exposed soils should be enforced. Efforts should be made to minimize soil exposure through pre-planning, covering fill dirt and excavated areas when not being used, such areas be covered during all precipitation, and areas where filter barriers are to be placed should be specified.

- A provision should be added in the ordinance detailing clean-up requirements. For example, all applicants should be required to submit clean-up plans (including a timetable for completion), to engage in clean-up operations no later than one week after the project is complete, and to be finished in a timely fashion (relative to the size of the project, but not to exceed one month).
- Violation should result in a sizeable fine ($1,000/day), which could help fund immediate County clean-up of the site and offset the cost of monitoring and enforcement. This could be an ordinance for all applicants under the law, as well as for some of those activities not covered by the State law (single family non-subdivision types).
- Extreme violations should be addressed in that if any land disturbing activity creates an imminent danger to the shoreline, water quality, or adjacent property owners, a stop-work order should be issued. At such time, the County should require immediate clean-up with the stipulations of the above paragraph.
- Clean-up should begin no later than 2 days after notification.
- A performance bond should be required. The amount of the bond should be sufficient to reimburse the County for any expenses incurred in site stabilization.

G. WETLANDS

Preservation of wetlands is an important to the integrity of the environmental resources in the County. In addition, wetlands creation is often used as a best management practice to prevent shoreline erosion. The creation of wetlands to control shoreline erosion costs significantly less than shore hardening structures.[21]

Low lying vegetation such as grass, vines and shrubs are most effective in preventing shoreline erosion. The most effective vegetative cover for shoreline erosion control are smooth cordgrass and saltmeadow hay.[22] Smooth cordgrass grows best between the mean low tide and mean high tide elevations. Saltmeadow hay grows above the mean high tide elevation. These grasses should be planted between the mean low water elevation and the base of the bank.[23] Tall shrubs and trees increase shoreline erosion because they add weight to the bank, thus increasing the chances of sloughing. Fallen trees undermined by erosion displace large quantities of soil and prevent the establishment of low lying vegetation by blocking sunlight. Tall trees and shrubs should have a minimum set back equal to the bank height.[24]

Monitoring and enforcement are the most serious problems in the protection of wetlands.

- The County should commission a Lancaster County Natural Heritage Inventory of rare and endangered species.
- All projects involving wetlands impacts should have a pre-and post-construction site visit.
- The Wetlands Board should work closely with the County legal staff to ensure enforcement of and compliance with the Wetlands Ordinance.
- The County should eliminate permitting that takes place after wetlands have been altered. This should be pursued through cooperating with the County Legal Staff.
- Best Management Practices should be required to prevent the disruption of wetlands.

---

[21] "Best Management Practices for Shoreline Erosion Control," Virginia Soil and Water Conservation Commission, Hill and Lee Shoreline Erosion Advisory Services, David Lambert and B. B. Ross, Extension Assistants, p.4.

[22] Ibid.

[23] Ibid.

[24] Ibid.

- The 1973 inventory of tidal wetlands in Lancaster should be updated.
- The Wetlands Board should continue to implement the recommendations of the Virginia Institute of Marine Sciences.
- Landowners should consult with VIMS before committing resources to shore hardening structures.
- The County should consider co-sponsoring workshops for land owners and developers for wetlands protection.

Lancaster County Wetlands

The tidal wetlands in the County can be divided into fourteen distinct geographical wetland areas.[25] For management purposes, the fourteen wetland areas can be grouped into six tidal wetland regions.[26]

Region I: 1. Indian Creek-Tabb's Creek;
2. Chesapeake Bay-Fleets Bay Area

This region consists primarily of individual marshes, while there are a few large marshes. The larger marshes account for 66% of the wetlands in this region and are vegetated by stands of black needlerush. The smaller marshes are located in the upper portion of creeks and coves, and are dominated by saltmarsh cordgrass.

Region II: 3. Rappahannock Bridge Area

This area contains 35 acres of marshes, most of which are undisturbed and consist of saltmarsh cordgrass.

Region III: 4. Carter Creek

This area consists of a large number of small marshes which provide wildlife refuges. Water hemp, an important food source for waterfowl, is a predominant species in four marshes in this region.

Region IV: 5. Mouth-Eastern Shoreline of the Corrotoman;
6. Eastern Branch of the Corrotoman;
7. Western Branch of the Corrotoman;
8. Belwood and Lancaster Swamps;
9. Little Branch of Corrotoman;
10. Mouth-western shoreline of the Corrotoman

---

[25] "Lancaster County Tidal Marsh Inventory," Special Report No. 45 in Applied Marine Science and Ocean Engineering, Gene M. Siberhorn, (Virginia Institute of Marine Sciences), December 1973, p. 3.

[26] Ibid. p.8.

The size of marshes is highly variable in this region. The total acreage is 475.8 acres with big cordgrass the dominant vegetative type.

Region V: 11. Wyatt-Paynes Creek Area;
12. Greenvale-Cage Creek Area

Nearly 105 acres of marshes make up region V. The four vegetative communities are saltmarsh cordgrass, black needlerush, salt grass and salt meadow hay, and saltbush communities.

Region VI: 13. Belle Isle;
14. Lancaster Creek

This area has the single largest marsh (156 acres) in the County. The major vegetative types are cattail, big cordgrass, arrow-arum, pickerelweed and wild rice.

These regions could be used to assist the County in managing its wetlands. Each region has specific management needs which are included in Table 2.

Table 2

Wetlands Management Analysis

Region	Plant Community	Threats	Priority	Management
I	Black Needlerush	Previous dredging	Very high	Focus protection efforts on smaller marshes with saltmarsh cordgrass.
II	Saltbushes Saltmarsh Cordgrass	Development of Whitestone	Moderate	Minimize or prevent development impacts through growth management and Best Management Practices.
III	Saltmarsh Cordgrass	Residential, commercial and resort development	High	Preservation of all wetlands in region do to extraordinary wildlife habitat
IV	Big Cordgrass Arrow-Arum Pickerelweed	Bulkheads	High	Encourage non-structural shoreline erosion controls. Enforce bulkhead standards.
V	Saltmarsh Cordgrass Black Needlerush Saltgrass and Saltbush	Few	Moderate	New development should be carefully reviewed and Best Management Practices should be required.
VI	Cattail, Big Cordgrass Arrow-Arum, Wild rice	Excessive forestry sediment, lack of vegetation	High	Encourage increased use ofForestal BMP's and re-vegetation.

V. LAND MANAGEMENT AREA DELINEATION

A. INTRODUCTION

In this section, the Planning Commission and the Board of Supervisors are presented with shoreline management options. The wetlands, slopes, exposed soils, and low coastal regions create an environment highly sensitive to disturbances. The land management area delineations are designed to protect sensitive contiguous resources that follow a naturally occurring boundary, or are based on a rational setback policy. While there are numerous management options, we note our reasons for reviewing three specific policies. The maps produced in the Lancaster County Shoreline Management Study Preliminary Results [27] and in our current study have focused on identifying

[27] Lancaster County Shoreline Management Study Preliminary Results, University of Virginia,

sensitive areas of land resources. These resources are individually mapped and include steep slopes, poor soils, wetlands, and flood hazard areas. The resource maps were then overlayed to identify the relative environmental sensitivity of the County. Our methodology was based on the assumption that an area containing two or more environmental sensitive characteristics was more vulnerable to degradation than an area with one environmental constraint. Before discussing specific management area options, an overview of our mapping efforts is included. Many of the maps serve several functions by showing certain environmentally sensitive areas and delineating management area options. The maps are included at the end of the report.

The Wetlands Maps [maps 1, 2 and 3] identify the three types of wetlands required by the Chesapeake Bay Preservation Act Draft Criteria, tidal (shown in Black), contiguous non-tidal (Yellow) and noncontiguous non-tidal (Red). The black and yellow areas represent the minimum components required for the Resource Conservation Zone in the Chesapeake Bay Preservation Act (CBPA) Discussion Documents. However, if the County is to comply with the "spirit" of the document, the conservation zone should also include "... other such sensitive areas as local governments deem necessary to protect the quality of state waters."[28]

On the Resource Conservation Area Maps, [maps 5, 6 and 7], areas that had two or more sensitive resources are colored green. Our study group considers these as sensitive areas that must be closely managed to protect the quality of state waters as well as the environment of the County.

The Resource Management Area Map [map 8] represents a composite of all areas possessing one or more of the resources. The areas not colored are not significantly sensitive. Most of the County is shown as sensitive as a result of the vast amount of shoreline and extensive system of tributaries found in Lancaster. This map illustrates

---

School of Architecture, Division of Urban and Environmental Planning, Spring 1988 for the Northern Neck Planning District Commission.

[28] Chesapeake Bay Preservation Act Criteria: Draft Discussion Document, Chesapeake Bay Local Assistance Department, March 22, 1989, p. 6

that comprehensive resource management would involve protection on a county-wide basis.

B. 50 FOOT CONTOUR

The boundaries of the 50 foot contour encompass a majority of the green area presented on the resource conservation area map [see map 4]. The 50 foot contour as the resource conservation boundary incorporates almost all of the sensitive areas identified in our mapping and resource analysis efforts. Within this region, specific areas could be set aside as conservation zones. This would provide an adequate management area delineation which is necessary in light of the environmental sensitivity of the area.

This management option would allow for more general resource management initiatives in a large area and more intensive protection efforts in a smaller geographic area. While there are many options available to the County in determining the boundaries of smaller conservation and/or preservation areas, the 50 foot contour provides the most appropriate outer shoreline management boundary. A management area based on the 50 foot contour and a conservation area extending from the shoreline to 1500 feet inland could be established. Such a delineation would place the County well within the letter and intent of the Draft CBPA Criteria.

C. 600 FOOT WATERFRONT SETBACK

The 600 foot setback, currently used as a waterfront overlay in Lancaster County, parallels the shoreline, creating a buffer zone of approximately one or two lots on the waterfront. This approach recognizes the necessity of controlling activity along the shoreline and facilitates regulation and enforcement. However, it fails to effectively deal with the environmentally sensitive nature of the coastal zone.

On the Wetlands [map 3] and Resource Conservation [map 6] maps, the light blue line represents the 600 foot waterfront setback. This area does not protect all of the components that the Draft CBPA Criteria or our study team have identified as

environmentally critical. Many contiguous non-tidal wetlands fall outside of the 600 foot setback. While the 600 foot setback does provide an easily identifiable management area, its failure to provide comprehensive coverage of critical habitat and sensitive resources suggests that it is not an appropriate selection as a regulatory zone.

D. CHESAPEAKE BAY PRESERVATION CRITERIA

The final alternative reviewed applies the Draft Preservation Act Criteria to Lancaster County. The Local Assistance Board has established a list of watershed components that must be managed. These criteria are divided into 3 categories, each of which is applied to two management areas. The fist management area is classified as a Resource Protection Area (RPA) and includes all tidal wetlands, all tidal shoreline, and nontidal wetlands that are contiguous to tidal wetlands and/or shoreline. The discussion document stipulates that the RPA must be surrounded by a 100 foot naturally vegetated buffer strip.

The RPA must be bordered by a Resource Management Area (RMA). The RMA must include floodplains, highly erodible soils, and highly permeable soils. The RMA for Lancaster County was not mapped due to difficulties in procuring a highly erodible soils map of appropriate scale. Therefore, the county should request a highly erodible soils map from VirGIS in the scale of USGS quadrangle maps. With the map at such a scale, the RMA criteria can be easily mapped.

The RMA should include the areas identified above as well as any other areas that the County feels should be classified as "sensitive lands" to be subject to higher performance standards than areas that are outside of a localities shoreline area. The RMA does not have a mandatory size, however, the Local Assistance Board has indicated that a 1500 foot zone would be the minimum that they would find acceptable for RMA designation.

To examine the effectiveness of this RMA boundary, we placed the 1500 foot line over the Wetlands Map [map 2] and the Resource Conservation Area [map 5]. This

management area would provide protection for tidal wetlands, a portion of the contiguous nontidal and none of the non-contiguous nontidal wetlands. When overlayed on the resource conservation area map, approximately half of the green area falls outside of the 1500 foot management area . Therefore, the County's RMA should be more inclusive than the 1500 foot zone.

E. RECOMMENDATIONS

In our judgement, there are two rational policy options to consider in delineating the management and conservation zones within Lancaster County. We recommend designating CBPA, as required by the Act, establishing a Conservation District which would serve as a shoreline overlay extending 1500 feet from the water, and establishment of a Management District with the 50 foot contour as the boundary.

Both zones should be managed with high performance standards and management practices. We recommend that the Conservation District have a 5 acre minimum residential lot size and a 2 acre minimum residential lot size for the Management District. Such a shoreline management strategy would protect a majority of the sensitive areas that have been identified through our analysis.

At a minimum, the CBPA Criteria should be adopted as delineating a Preservation area, and the 50 foot contour should serve as a basis for a management area. This management option would ensure compliance with the CBPA Criteria. However, such a narrow management area would fail to protect many highly sensitive areas. The protection of these areas is essential to protect the health, safety, and welfare of County residents and to increase the environmental stability of Lancaster County.

VI. CONCLUSION

The objective of this report is to raise issues which are central to the management of the Lancaster County shoreline and to suggest policies which the County can pursue. Our recommendations are the result of considering the social, economic, environmental, and political context within which Lancaster County promulgates its land use regulations.

Our findings indicate that new programs and policies are needed if Lancaster County is to manage its growth. To facilitate implementation of our suggestions, we have noted potential sources of revenue amd specific areas where additional personnel are needed. Furthermore, construction and development standards and enforcement efforts within the shoreline area must be upgraded to adequately protect the natural environment of Lancaster County as well as the water quality of the Chesapeake Bay.

References

General

Model Subdivision Ordinance Richmond County Workbook, October 1988, Chesapeake Bay Foundation (Suite 815, Heritage Building, 1001 E. Main Street, Richmond, VA).

Planning and Growth Management in Virginia: A Survey of Local Practice (and Technical Appendix), August 1988, Institute for Environmental Negotiation University of Virginia, for The Virginia Council on the Environment.

Lancaster County Shoreline Management Study Preliminary Results, University of Virginia, Division of Urban and Environmental Planning Spring 1988 for Northern Neck Planning District Commission.

Groundwater

Bird, Judy Campell, March 1985, Groundwater Protection: Emerging Issues and Policy Challenges, Environmental and Energy Study Institute.

A Groundwater Protection Strategy for Virginia, 1987, Virginia Groundwater Protection Steering Committee.

Hrezo, Margaret and Goldstein, Stephen, June 1986, Protecting Virginia's Groundwater: A Guide for Local Government.

Lancaster County Shoreline Management Study- Preliminary Results, Spring 1988, Division of Urban and Environmental Planning, University of Virginia.

Newton, V.P. and E. A. Siudyla, 1978, Groundwater of the Northern Neck Penisula, Virginia, Commonwealth of Virginia, State Water Control Board, Bureau of Water Control Management.

Virginia Groundwater Management Handbook- State Agency Programs for Groundwater Protection, 1988, The Virginia Groundwater Protection Steering Committee.

Virginia's Groundwater: You Can Help Protect It, 1988, U.S. Environmental Protection Agency.

Waller, Roger M., 1988, Groundwater and the Rural Homeowner, U.S. Department of the Interior, U.S. Geological Survey.

Weigmann, Dianna L. and Kroehler, Carolyn J., 1988, Threats to Virginia's Groundwater, Virginia Water Resources Research Center, VPI and SU.

Surface Water

Priority Water Bodies Information Bulletin 576, produced by the Virginia Water Control Board (October 1988).

Water Quality Management Plan, produced by the Northern Neck Planning District Commission (1973).

Technical data gathered from the water quality monitoring station on the Corrotoman.

Wetlands

Wetlands, James G Gosselink and William J. Mitsch, (Van Nostrand Reinhold Company, New York), 1976.

Chesapeake Bay: Introduction to an Ecosystem, (U.S. Environmental Protection Agency), 1982.

Conserving our Wetland Resources: Avenues for Citizen Participation An Action Handbook, Chesapeake Bay Foundation,

Wetlands: Their Use and Regulations, (U.S. Government Printing Office, Washington D.C.), 1984.

Wetlands Guidelines," Virginia Department of Wetlands Ecology, Virginia Institute of Marine Science, Virginia Marine Resource Commission).

Lancaster County Tidal Marsh Inventory," Special Report No. 45 in Applied Marine Science and Ocean Engineering, Gene M. Siberhorn, (Virginia Institute of Marine Sciences), December 1973.

Lancaster County Shoreline Management Study: Preliminary Results, University of Virginia, Northern Neck Planning District Commission.

Best Management Practices for Shoreline Erosion Control," Virginia Soil and Water Conservation Commission, Hill and Lee Shoreline Erosion Advisory Services, David Lambert and B. B. Ross, Extension Assistants.

Mid-Atlantic Wetlands: A Disappearing Natural Treasure," (U.S. Environmental Protection Agency), June 1987.

Public Access

Gloucester County Coastal Zone: Special Report in Applied Marine Science and Oceanographic Engineering, Kenneth Marsellus and Marvin Wass, (Virginia Institute of Marine Sciences, Gloucester Point, Virginia), 1972.

1985 Tidewater Virginia Boating Access Inventory, Virginia Department of Conservation and Historic Resources, Division of Parks and Recreation.

Copy Sheet 5, Master Listing of the Landing Sites and Public Landing Survey Report, Virginia Marine Resources Commission Report on Public Landingd, February, 1985.

Water Management Options

Annual Report of the Groundwater Protectio Steering Committee 1988, Virginia Water Control Board

DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings, National Well Water Association, May 1985.

Priority Water Bodies, Information Bulletin 576, October, 1988, Supplement to the 1988 Water Quality Assessment Information Bulletin 575, Virginia Water Control Board.

Priority Water Body Assessment-Segment Identification and Synopsis of Problem, September 1988, Virginia Water Control Board.

Water Conservation in Residential Development: Land-Use Techniques, By Welford Sanders and Charles Thurow, Planning Advisory Service Report Number 373, American Planning Association.

Water Conservation Primer: How to save water, energy and money at home, Virginia Water Control Board, Information Bulletin 528, Revised March 1981.

Handbook on Water-Saving and Wastewater-Reduction, Washington Suburban Sanitary Commission (4017 Hamilton Street, Hyattsville, Maryland), Revised May 1976.

Water-Saving and Waste Reduction Handbook for Apartment Residents, Washington Suburban Sanitary Commission, Revised, September 1976.

Flood Plain

Accomack County Coastal Plan, Spring 1987, Division of Urban and Environmental Planning, University of Virginia.

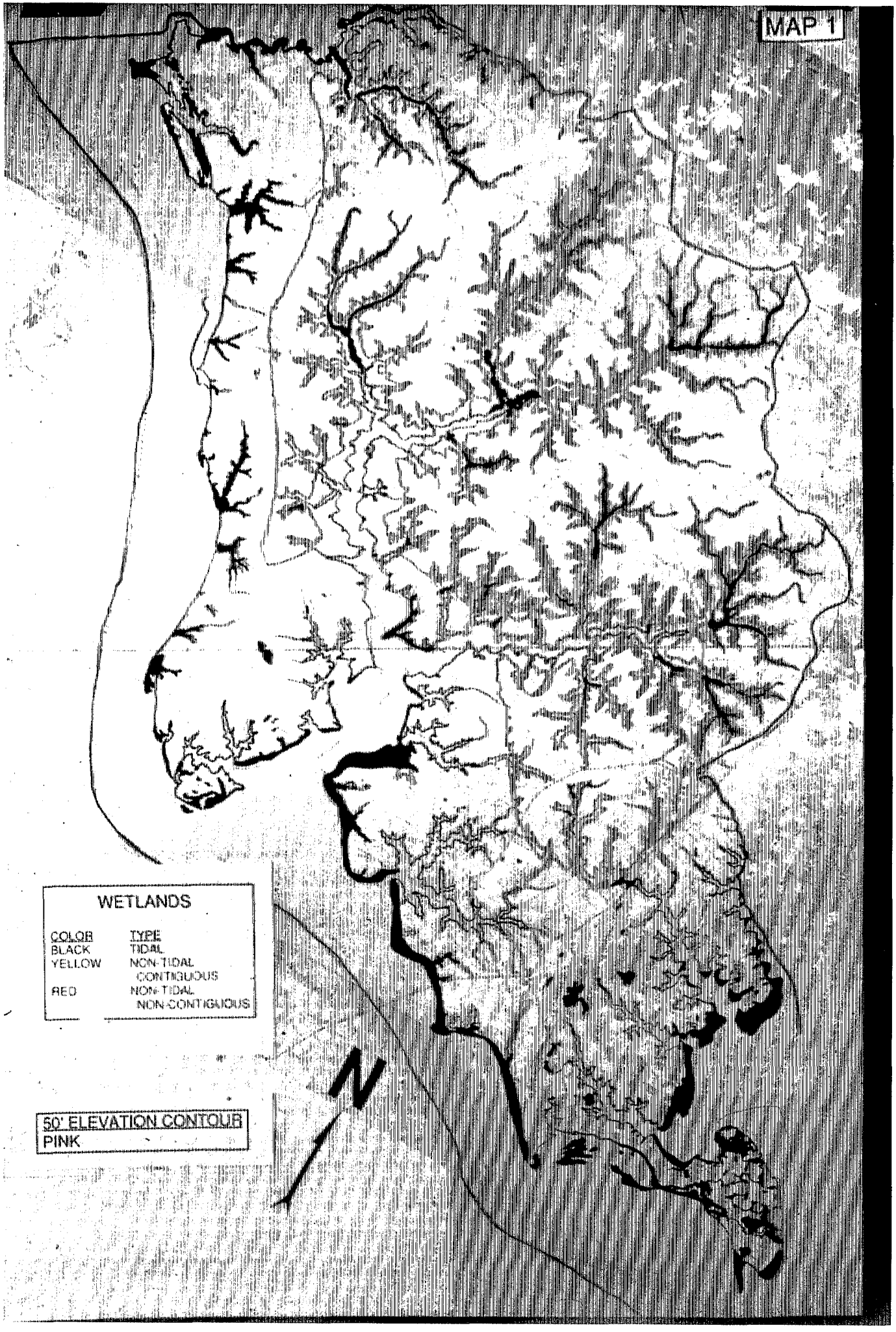
City of Virginia Beach: Flood Plain Ordinance

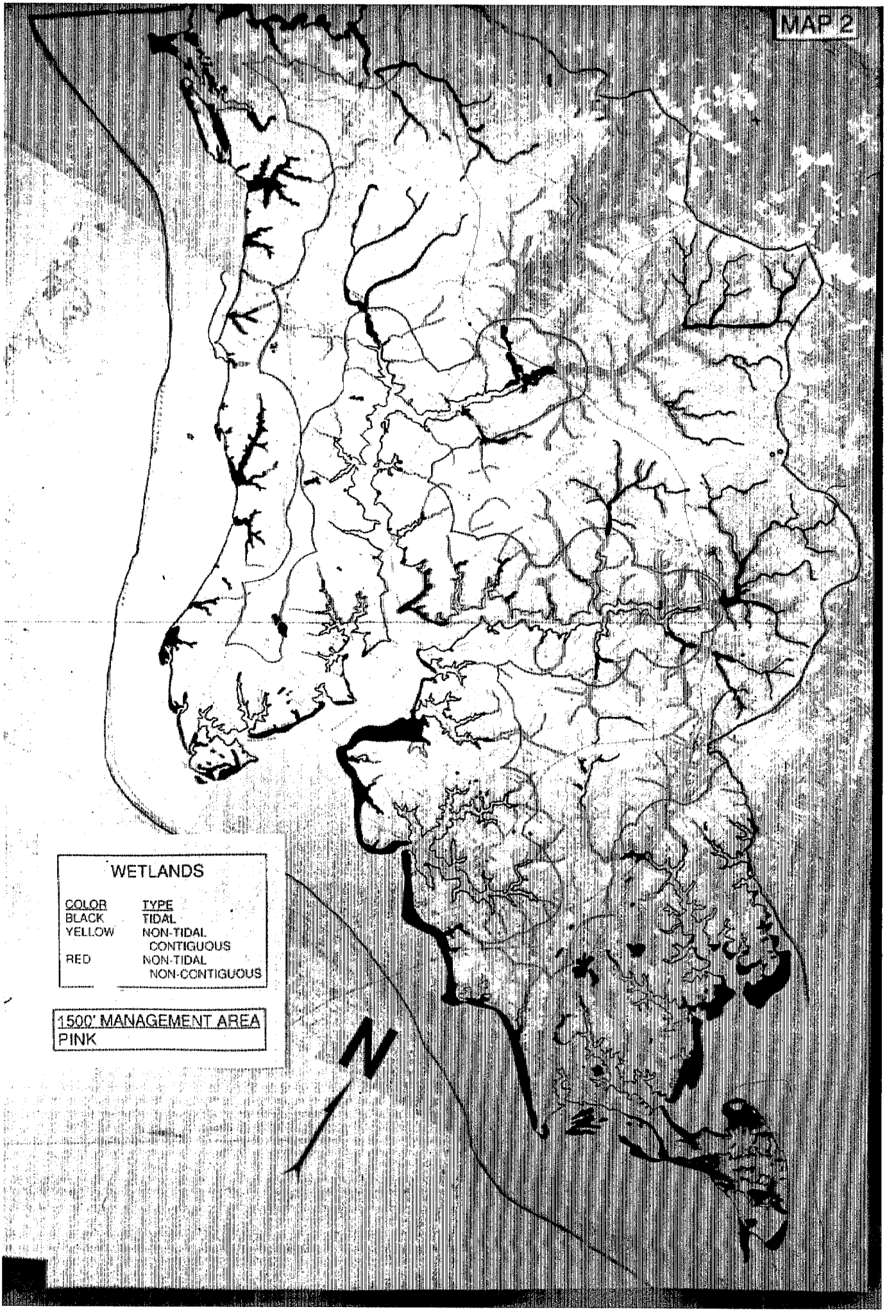
Flood Plain Management Ordinance of Lancaster County, Virginia, March 31, 1988.

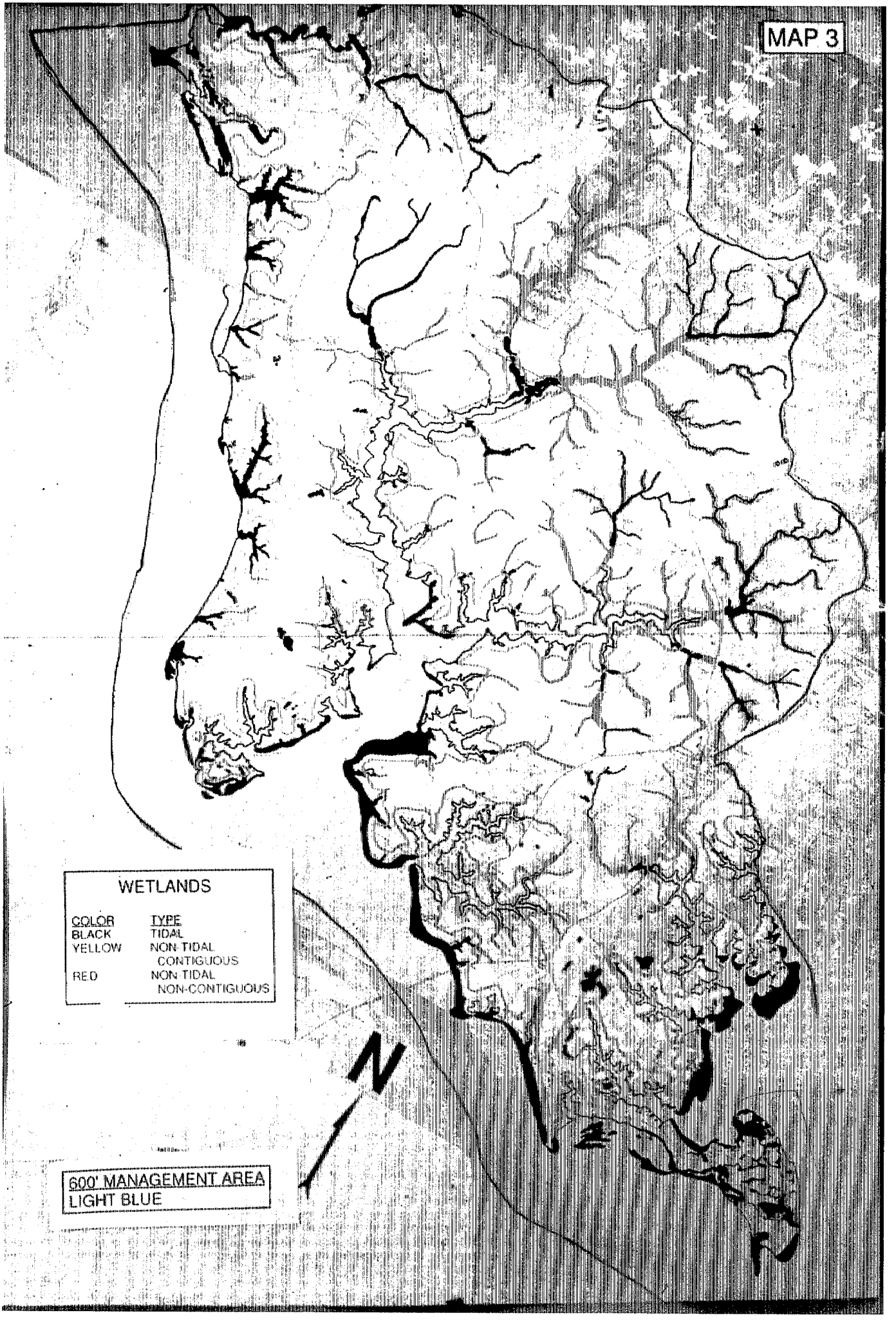
Lancaster County Shoreline Development Plan Element- Preliminary Draft,Northern Neck Planning District Commission.

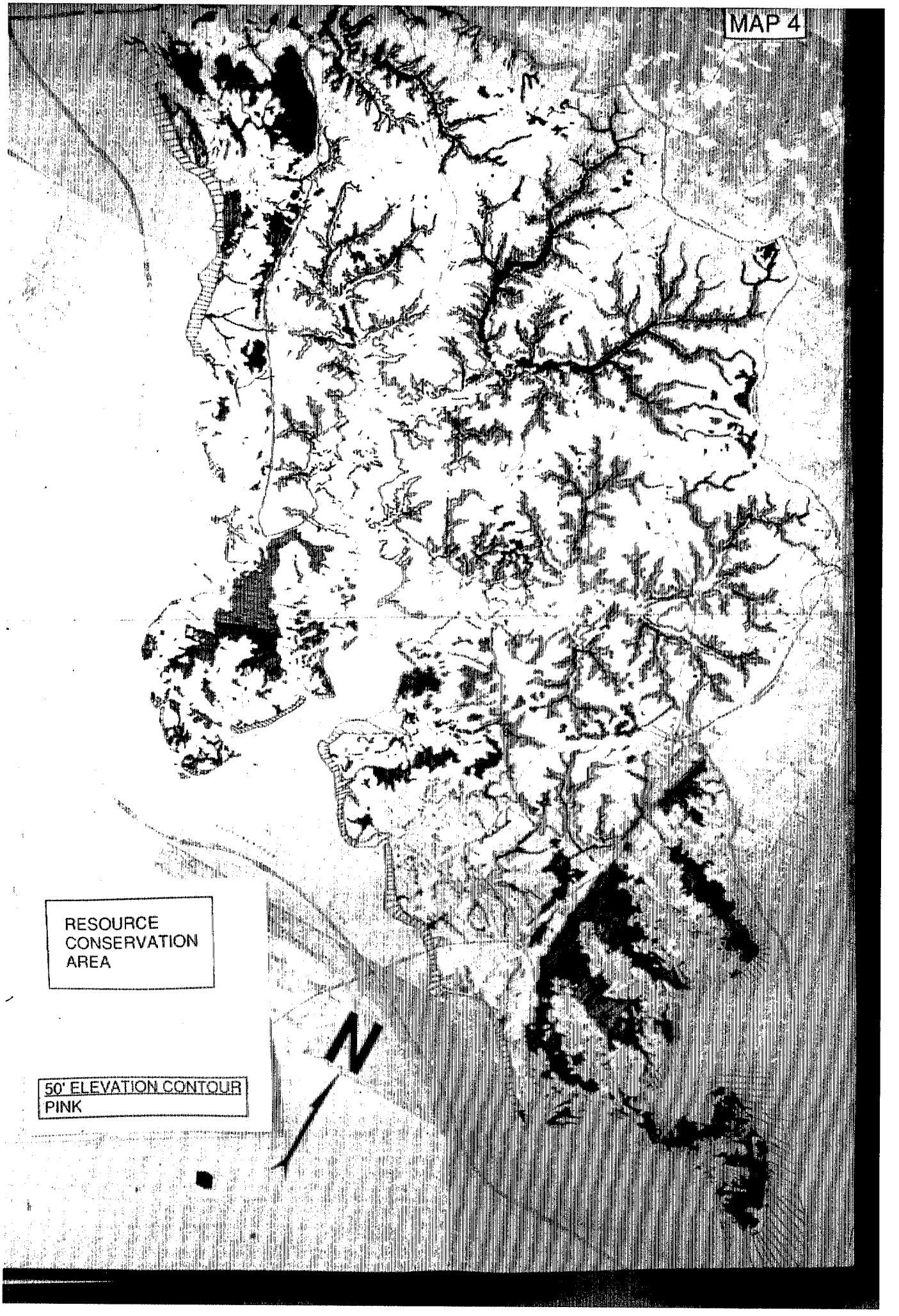
Volume I Shoreline Management Options for Virginia Coastal Localities, August, 1988, Institute for Environmental Negotiation, University of Virginia for the Council on the Environment.

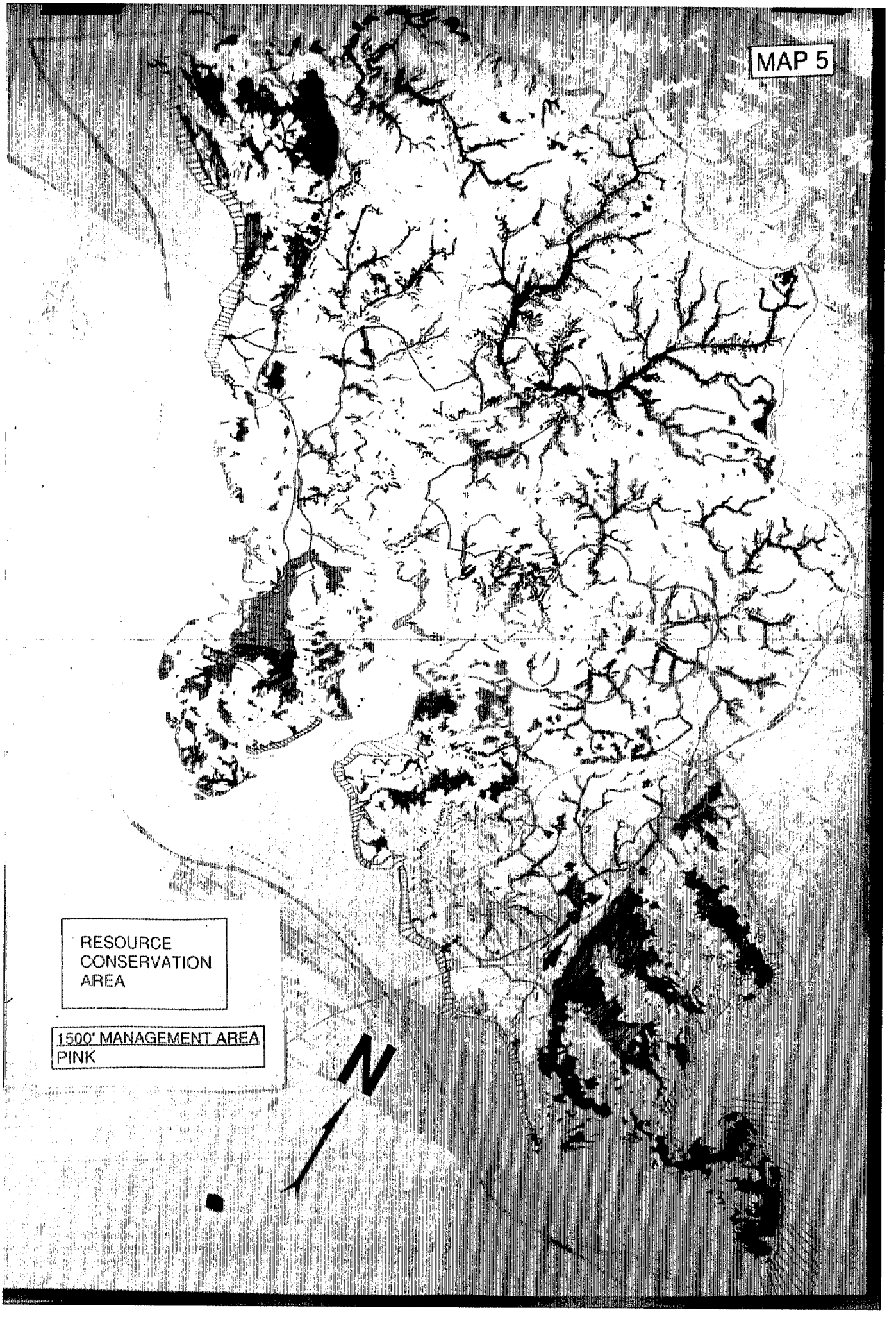
Griggs, Gary B. and Gilchrist, John A.,1983, Geologic Hazards, Resources andEnvironmental Planning, Wadsworth Publishing Company.

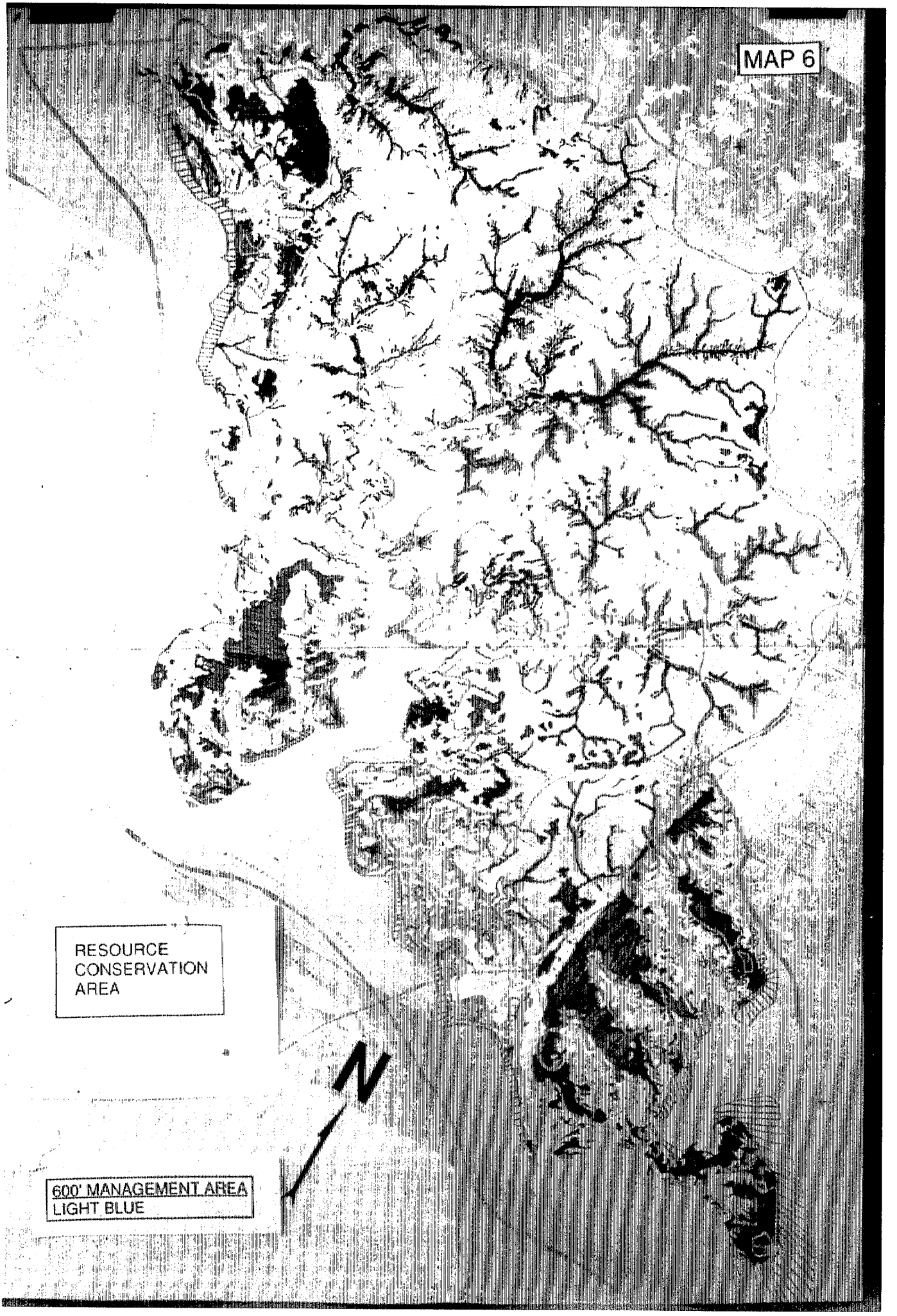

MAP 1
WETLANDS
COLOR
TYPE
BLACK
TIDAL
YELLOW
NON-TIDAL CONTIGUOUS
RED
NON-TIDAL NON-CONTIGUOUS
50' ELEVATION CONTOUR
PINK
N

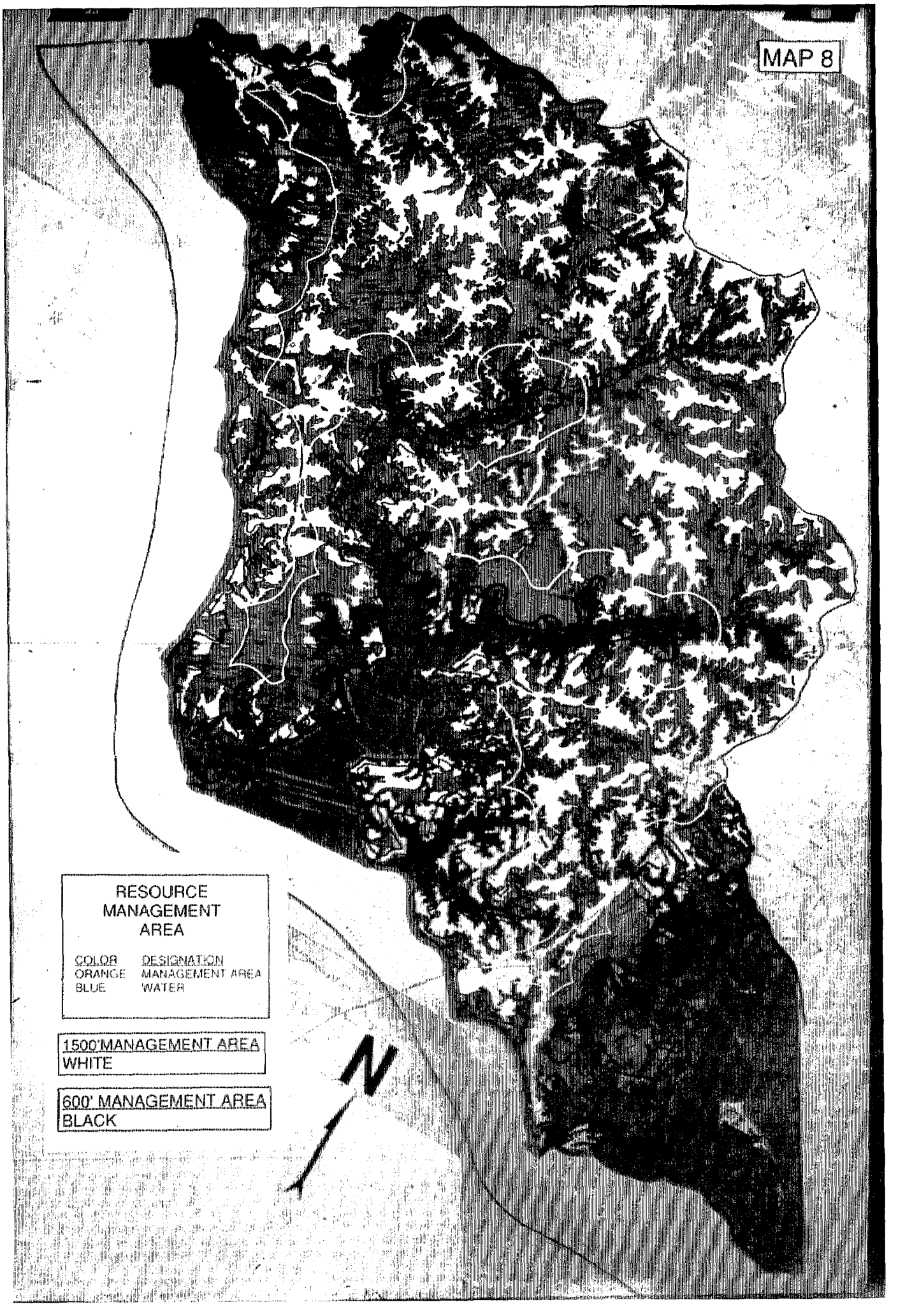

MAP 2
WETLANDS
COLOR
TYPE
BLACK
TIDAL
YELLOW
NON-TIDAL CONTIGUOUS
RED
NON-TIDAL NON-CONTIGUOUS
1500' MANAGEMENT AREA
PINK
N


MAP 3
WETLANDS
COLOR
TYPE
BLACK
TIDAL
YELLOW
NON-TIDAL CONTIGUOUS
RED
NON-TIDAL NON-CONTIGUOUS
N
600' MANAGEMENT AREA
LIGHT BLUE


MAP 4
RESOURCE
CONSERVATION
AREA
50' ELEVATION CONTOUR
PINK
N


MAP 5
RESOURCE CONSERVATION AREA
1500' MANAGEMENT AREA PINK
N


MAP 6
RESOURCE
CONSERVATION
AREA
N
600' MANAGEMENT AREA
LIGHT BLUE


MAP 8
RESOURCE MANAGEMENT AREA
COLOR DESIGNATION
ORANGE MANAGEMENT AREA
BLUE WATER
1500'MANAGEMENT AREA
WHITE
600' MANAGEMENT AREA
BLACK
N