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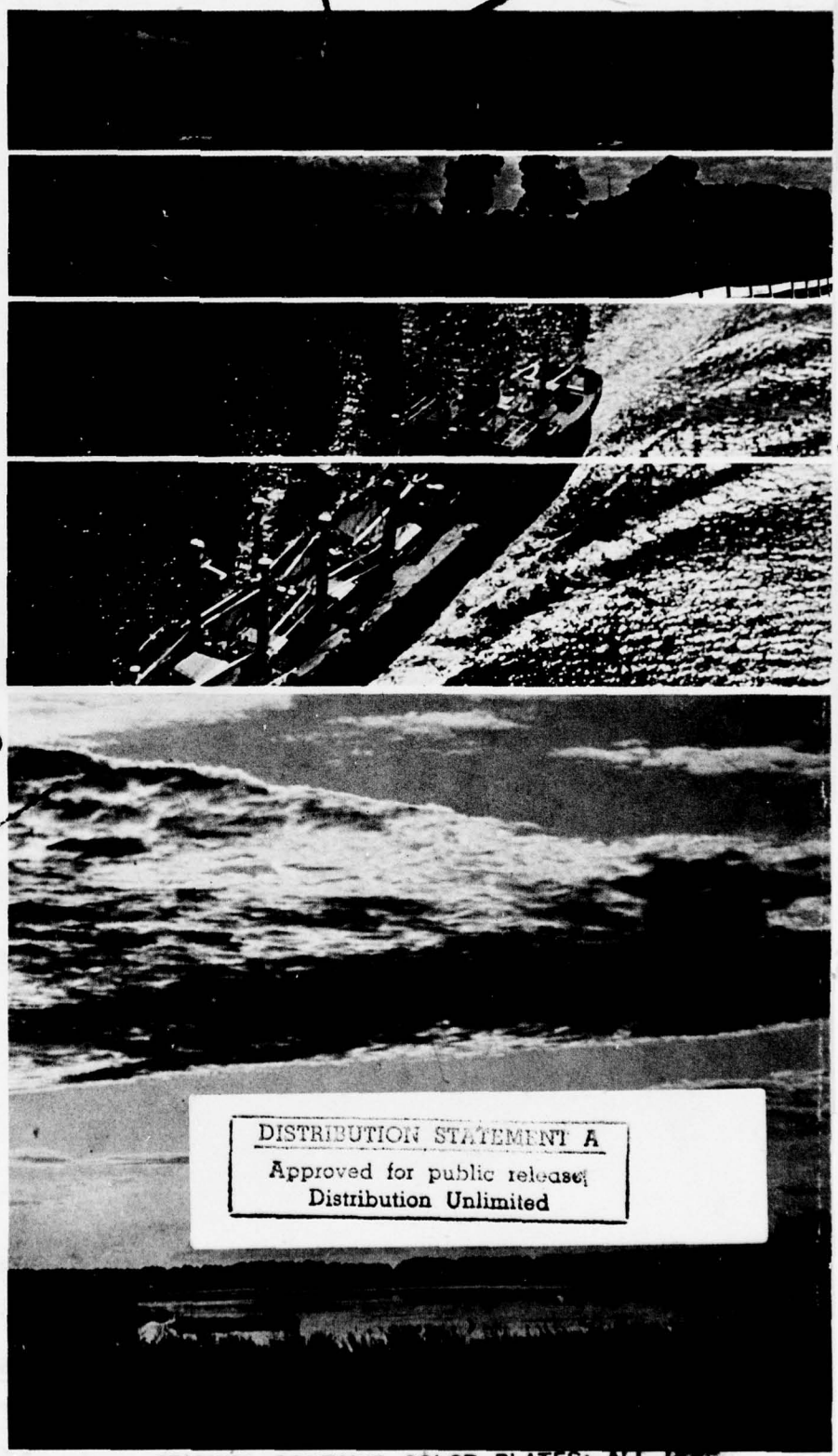
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PREFACE

The Corps of Engineers' comprehensive study of Chesapeake Bay is being accomplished in three distinct developmental stages or phases. Each of these phases is responsive to one of the following stated objectives of the study program.

1. To assess the existing physical, chemical, biological, economic and environmental conditions of Chesapeake Bay and its related land resources.
2. To project the future water resources needs of Chesapeake Bay to the year 2020.
3. To formulate and recommend solutions to priority problems using the Chesapeake Bay Hydraulic Model.

In response to the first objective of the study, the initial or inventory phase of the program was completed in 1973 and the findings were published in a document titled *Chesapeake Bay Existing Conditions Report.* Included in this seven-volume report is a description of the existing physical, economic, social, biological and environmental conditions of Chesapeake Bay. This was the first published report that presented a comprehensive survey of the entire Bay Region and treated the Chesapeake Bay as a single entity. Most importantly, the report contains the historical records and basic data required to project the future demands on the Bay and to assess the ability of the resource to meet those demands.

In response to the second objective of the study, the findings of the second or future projections phase of the program are provided in this the *Chesapeake Bay Future Conditions Report.* The primary focus of this report is the projection of water resources needs to the year 2020 and the identification of the problems and conflicts which would result from the unrestrained growth and use of the Bay's resources. This report, therefore, provides the basic information necessary to proceed into the next or plan formulation phase of the program. It should be emphasized that, by design, this report addresses only the water resources related needs and problems. No attempt has been made to identify or analyze solutions to specific problems. Solutions to priority problems will be evaluated in the third phase of the program and the findings will be published in subsequent reports.

The *Chesapeake Bay Future Conditions Report* consists of a summary document and 16 supporting appendices. Appendices 1 and 2 are general background

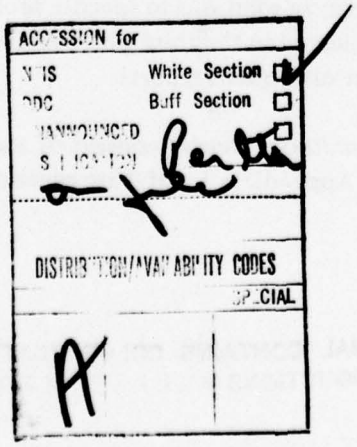
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documents containing information describing the history and conduct of the various Federal and State agencies, scientific institutions and the public. Appendices 3 through 15 each contain information on specific water and related land resource uses to include an inventory of the present status and expected future needs and problems. Appendix 16 focuses on the formulation of the initial testing program for the Chesapeake Bay Hydraulic model, a list of problems considered for inclusion in the initial testing program and a detailed description of the selected first year model studies program.

The published volumes of the *Chesapeake Bay Future Conditions Report* include:

Volume Number	Appendix Number and Title
1	Summary Report
2	1 – Study Organization, Coordination and History 2 – Public Participation and Information
3	3 – Economic and Social Profile
4	4 – Water-Related Land Resources
5	5 – Municipal and Industrial Water Supply 6 – Agricultural Water Supply
6	7 – Water Quality
7	8 – Recreation
8	9 – Navigation 10 – Flood Control 11 – Shoreline Erosion
9	12 – Fish and Wildlife
10	13 – Power 14 – Noxious Weeds
11	15 – Biota
12	16 – Hydraulic Model Testing



CHESAPEAKE BAY FUTURE CONDITIONS REPORT

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CHAPTER I

THE STUDY AND THE REPORT

INTRODUCTION

The Chesapeake Bay Study was spawned from the need for a complete and comprehensive investigation of the use and control of the water resources of the Bay Area. In the Phase I, or inventory phase of the Study, an assessment was made of the Bay's existing physical, chemical, biological, economic, social, and environmental conditions and problem areas. Set forth in the *Existing Conditions Report*, this information was used as a common source of reference for the second or future projections phase of the Chesapeake Bay Study Program. The *Future Conditions Report*, of which this Appendix is a part, presents the findings of the Phase II portion of the Study. Included are: projections of future water resource needs and problem areas, general means that might best be used to satisfy those needs, and recommendations for future studies and hydraulic model testing. As a result, this Report constitutes the next step toward the goal of developing a comprehensive water resource management program for the Chesapeake Bay Region.

Chesapeake Bay serves as a vast natural asset to the surrounding land area. Along with its tributaries, the Bay provides a natural transportation network on which the economic development of the Region has been based, a wide variety of water-oriented recreational opportunities, a source of water supply for both municipalities and industries, and the site for final disposal of waste products. All of the resources provided by the Bay interact with each other in forming the Chesapeake Bay ecosystem. Unfortunately, problems often arise when man's intended use of one resource conflicts with another resource.

The use being made of a region's land at any one time is what ultimately makes land a resource. It has been said that the use of the land is fundamental to all other environmental concerns. The Chesapeake Bay Estuary Area's land resources produce a significant impact on the Region's water resources and consequently have a decidedly strong application to many aspects of water resource investigation including water quality, water supply, shoreline erosion, flood control, and recreation. The various land uses which exist within the Study Area frequently conflict with each other as well as with the Region's water resources. Therefore, in order to provide an accurate assessment of the Bay's present and future water resource problems and needs, there must be a clear understanding of the Region's land use. Only

through such an evaluation can there be recommendations for future studies and model testing required to develop a comprehensive management program for the Bay Region.

In the "Water-Related Land Resources Appendix," focus will first be placed on the general land use within the Bay Region. Following this, the various land resources will be investigated including the intensive land resources, the agricultural and forest land resources, and the mineral resources. Also included will be an inventory of historic, archeological, and natural environmental areas of the Bay Region. Generally, for each of the elements assessed in this Appendix, an analysis is made of their present status (including existing problems and conflicts and current Federal, State, and local management responsibilities as they apply to the land resources), and future needs and problem areas. The final chapter of the Appendix discusses the means with which to satisfy identified needs and the future studies required to develop the land management portion of an overall water-land management program for the Chesapeake Bay Region.

AUTHORITY

The authority for the Chesapeake Bay Study and the construction of the hydraulic model is contained in Section 312 of the River and Harbor Act of 1965, adopted 27 October 1965, which reads as follows:

> (a) The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to make a complete investigation and study of water utilization and control of the Chesapeake Bay Basin, including the waters of the Baltimore Harbor and including, but not limited to, the following: navigation, fisheries, flood control, control of noxious weeds, water pollution, water quality control, beach erosion, and recreation. In order to carry out the purposes of this section, the Secretary, acting through the Chief of Engineers, shall construct, operate, and maintain in the State of Maryland a hydraulic model of the Chesapeake Bay Basin and associated technical center. Such model and center may be utilized, subject to such terms and conditions as the Secretary deems necessary, by any department, agency, or instrumentality of the Federal Government or of the States of Maryland, Virginia, and Pennsylvania, in connection with any research, investigation, or study being carried on by them of any aspect of the Chesapeake Bay Basin. The study authorized by this section shall be given priority.

(b) There is authorized to be appropriated not to exceed $6,000,000 to carry out this section.

An additional appropriation for the study was provided in Section 3 of the River Basin Monetary Authorization Act of 1970, adopted 19 June 1969, which reads as follows:

> In addition to the previous authorization, the completion of the Chesapeake Bay Basin Comprehensive Study, Maryland, Virginia, and Pennsylvania, authorized by the River and Harbor Act of 1965 is hereby authorized at an estimated cost of $9,000,000.

As a result of Tropical Storm Agnes, which caused extensive damage in Chesapeake Bay, Public Law 92-607, the Supplemental Appropriation Act of 1973, signed by the President on 31 October 1972, included $275,000 for additional studies of the impact of the storm on Chesapeake Bay. A report was consequently published in March, 1975 entitled "Impact of Tropical Storm Agnes on Chesapeake Bay."

PURPOSE

Previously, measures taken to utilize and control the water and land related resources of the Chesapeake Bay Basin have generally been toward solving individual problems. The Chesapeake Bay Study provides a comprehensive study of the entire Bay Area in order that the most beneficial use be made of the water-related resources. The major objectives of the Study are to:

a. Assess the existing physical, chemical, biological, economic and environmental conditions of Chesapeake Bay and its water resources.

b. Project the future water resources needs of Chesapeake Bay to the year 2020.

c. To formulate and recommend solutions to priority problems using the hydraulic model.

The *Chesapeake Bay Existing Conditions Report*, published in 1973, met the first objective of the Study by presenting a detailed inventory of the Chesapeake Bay and its water resources. Divided into a summary and four supporting appendixes, the report presented an overview of the Bay Area and the economy; a survey of the Bay's land resources and use; and a description of the Bay's life forms and hydrodynamics.

The purpose of the *Future Conditions Report* is to project the future water resource needs and problem areas of Chesapeake Bay to the year 2020. The Report also includes recommendations for future studies and model testing required to develop a comprehensive management program for the Bay.

The basic purpose of the "Water-Related Land Resources Appendix" is to present the findings of the Chesapeake Bay Study concerning future conditions of the region's land resources. The inventory and mapping of historic, archeological, and natural environmental areas make up a major portion of the Appendix. It represents one of the most comprehensive inventories of its kind to be compiled for the entire Chesapeake Bay Region.

SCOPE

The scope of the Chesapeake Bay Study and *Future Conditions Report* includes the multi-disciplinary fields of engineering and the social, physical, and biological sciences. The Study is being coordinated with all Federal, State, and local agencies having an interest in Chesapeake Bay. All conclusions are based on historical information supplied by the preparing agencies having expertise in that field. In addition, the basic assumptions and methodologies are quantified for accuracy in the sensitivity sections. Only general means to satisfy the projected resource needs are presented, as specific recommendations are beyond the scope of the Report.

Water quantity and quality considerations directly affect the way in which the land can be used. Conversely, the manner in which the land is used has a significant effect on the water resources of a region. As a result, the examination of existing and future land use comprises the most important single element of this Appendix.

Existing land use mapping was developed from maps supplied by the U.S. Geological Survey (USGS) prepared as part of its Central Atlantic Regional Ecological Test Site project. This was a demonstration project to test the applicability of data from the Earth Resources Technology Satellite (ERTS) as input to a land resources information system. The USGS maps were prepared from high altitude aerial photography. Future land use was projected and mapped by using county and regional comprehensive plans produced by local and regional planning agencies. These plans provided an indication of how local authorities foresee future development within their respective planning region. As such, they do not necessarily reflect the Baltimore District's perception of where and how future growth and development will take place.

Those parts of the Appendix dealing with the water-related land resources of agriculture, forestry, and minerals employ the most current data available to accomplish the following:

a. assess the present status of each land resource

b. project the future conditions of each

c. determine the future problem areas of each resource

The environmental resources inventory includes a complete mapping and listing of historic and archeological sites; Federal and State forests and parks; wildlife management areas and refuges; natural and scenic rivers; research, education, and military areas; wetlands; and primary aquatic resources such as commercial and sport fishing areas.

The geographic study area used in this Appendix includes the entire State of Delaware; the State of Maryland excluding the four western counties of Frederick, Washington, Allegany, and Garrett; the nine contiguous planning districts defined as the Coastal Zone in the Commonwealth of Virginia (Planning Districts 8, 15, 16, 17, 18, 19, 20, 21, and 22 are defined as the Coastal Zone by the Governor's Office, Division of State Planning and Community Affairs); and Washington, D.C. To avoid cutting across boundaries, whole planning districts were included in this Appendix. As a result, the Study Area does not necessarily coincide with those developed for other Appendixes of the *Future Conditions Report*.

Due to the availability, and for conventionality, data were collected at the county/independent city level. Many of the county planning agencies have either produced comprehensive land use plans in the past or have information readily at hand dealing with the same. Analysis at this level offers the advantage of working with small enough units to provide an accurate picture of land use patterns and yet not so small as to have an infinite and cumbersome number of units with which to work. Only those independent cities with greater than 25,000 inhabitants, according to the 1970 Census of Population (U.S. Bureau of the Census), were considered separately from their surrounding county or counties. Table 4-1 lists the 59 counties and 11 independent cities included within the study area. Figure 4-1 shows the study area for the "Water-Related Land Resources" Appendix.

TABLE 4-1

COUNTIES AND INDEPENDENT CITIES USED IN THE COLLECTION OF LAND USE DATA

COUNTIES & CITIES

MARYLAND

1. Anne Arundel
2. Baltimore
3. Baltimore City
4. Calvert
5. Caroline
6. Carroll
7. Cecil
8. Charles
9. Dorchester
10. Harford
11. Howard
12. Kent
13. Montgomery
14. Prince Georges
15. Queen Annes
16. Somerset
17. St. Marys
18. Talbot
19. Wicomico
20. Worcester

VIRGINIA

21. Accomack
22. Arlington
23. Caroline
24. Charles City
25. Chesapeake (City)
26. Chesterfield
27. Dinwiddie
28. Essex
29. Fairfax
30. Gloucester
31. Goochland
32. Greensville
33. Hampton (City)
34. Hanover
35. Henrico
36. Isle of Wight
37. James City
38. King and Queen
39. King George
40. King William
41. Lancaster
42. Loudoun
43. Mathews
44. Middlesex
45. New Kent
46. Newport News (City)
47. Norfolk (City)
48. Northampton
49. Northumberland
50. Prince George
51. Prince William
52. Portsmouth (City)
53. Powhatan
54. Richmond
55. Richmond (City)
56. Spotsylvania
57. Stafford
58. Southampton
59. Suffolk (City)
60. Sussex
61. Surry
62. Virginia Beach (City)
63. Westmoreland
64. York
65. Alexandria (City)
66. Petersburg (City)

DELAWARE

67. Kent
68. New Castle
69. Sussex

OTHERS

70. District of Columbia

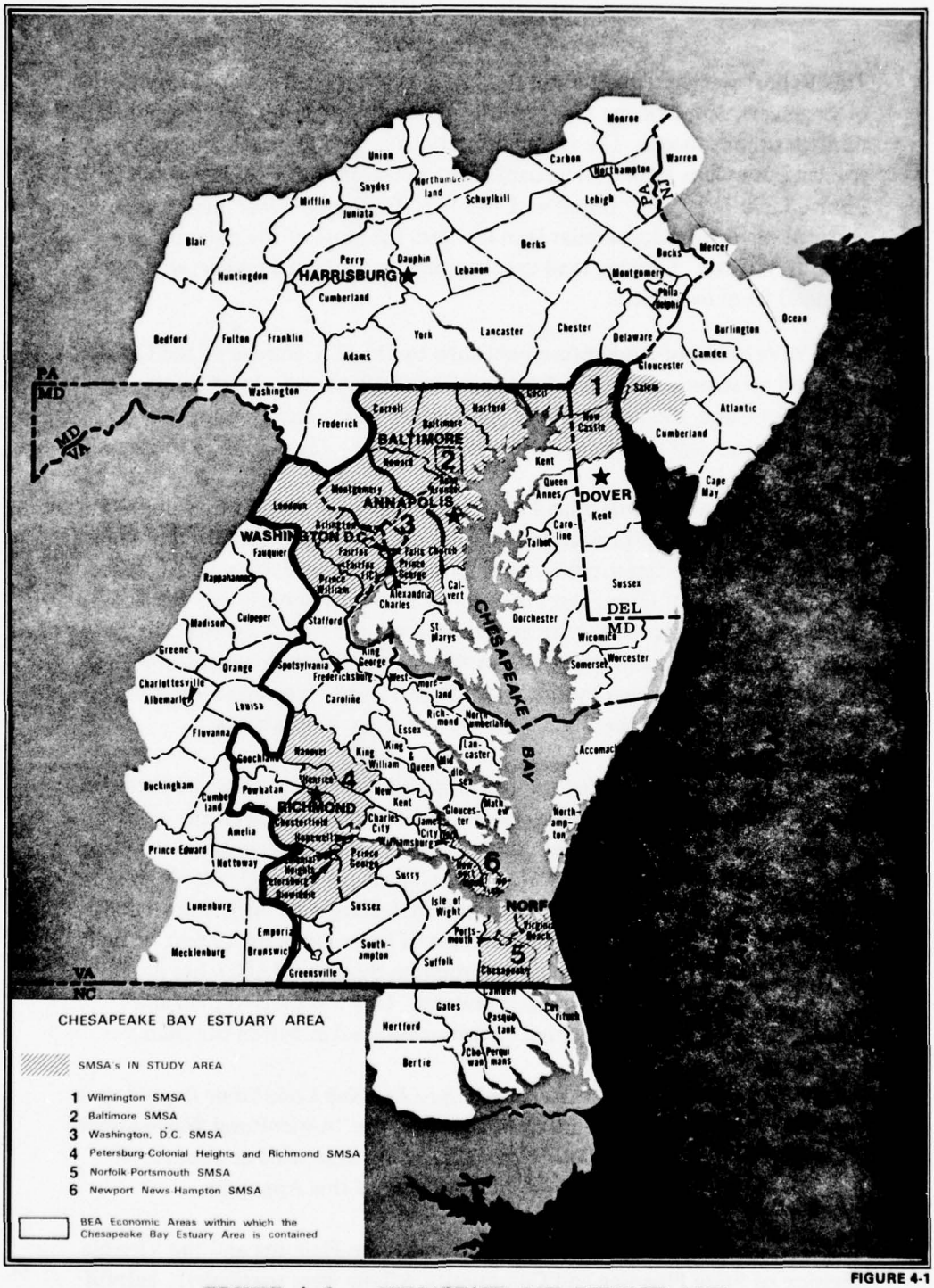


FIGURE 4-1

FIGURE 4-1: CHESAPEAKE BAY ESTUARY AREA

SUPPORTING STUDIES

This Report was prepared by the Baltimore District Office, U.S. Army Corps of Engineers. Much of the input to this Appendix, however, was developed through other sources. The various county, city, and regional comprehensive land use plans were of invaluable use in preparing the "Existing and Future Land Use" and "Intensive Land Use" Chapters. Water quality management plans provided similar land use data for most of the planning districts of Virginia. Existing land use mapping, as explained earlier, was obtained from the USGS.

The 1969 Census of Agriculture published by the U.S. Bureau of the Census was used to acquire data on existing agricultural land use. In addition, the 1954, 1959, and 1964 Censuses of Agriculture were consulted for data to prepare a historical study of farm production in the Chesapeake Bay Region.

Both agricultural and forest land use projections were derived by using the 1972 Series C OBERS Projections of Regional Economic Activity developed for the U.S. Water Resources Council by the Bureau of Economic Analysis, U.S. Department of Commerce, Economic Research Service, and the U.S. Department of Agriculture with assistance from the Forest Service. Information on future treatment needs and problem areas for both agricultural and forest lands was provided by the State conservation needs inventories made under the guidance of the State conservation needs committees.

The *National Register of Historic Places*, published by the National Park Service, was used as the primary source for the mapping and inventory of historic sites within the Chesapeake Bay Study Area. For the archeological resources portion of the inventory, the State Archeologists from Maryland, Virginia, and Delaware provided primary information dealing with both known and potential sites. The Maryland Department of State Planning, as part of their Maryland Automated Geographic Information System (MAGI), has developed and made available a public lands inventory. This was used to map and develop a listing of all the natural environmental areas within the State.

All four Appendixes of the *Chesapeake Bay Existing Conditions Report* were used in preparing this Appendix. In addition, the "Agricultural Water Supply Appendix" of the *Future Conditions Report* has been used as a source of data for the agricultural land resources portion of this Appendix.

The Maryland and Delaware Departments of State Planning and the Virginia Division of State Planning and Community Affairs were particularly helpful

in the compilation and analysis of land use data. More specific information on sources of data and publications used in preparing the "Water-Related Land Resources Appendix" is provided in each chapter of the Appendix.

STUDY PARTICIPATION AND COORDINATION

Due to the wide scope, large geographical area, and many resources covered by the Chesapeake Bay Study, data input was required from many sources. Various Federal, State, and local agencies throughout the Bay Region have customarily developed expertise in certain areas of water resource development. Although overall coordination of the study effort was provided by the Corps of Engineers, input from these various sources was required in order to obtain the best study coordination and problem identification. Therefore, an Advisory Group and a Steering Committee were established. Five Task Groups were also formed to guide preparation of reports on related resources categories. They are:

(1) Economic Projection Task Group

(2) Water Quality and Supply, Waste Treatment, and Noxious Weeds Task Group

(3) Flood Control, Navigation, Erosion, and Fisheries Task Group

(4) Recreation Task Group

(5) Fish and Wildlife Coordination Group

Detailed information on the composition of each task group as well as the members of the Advisory Group is presented in the Chesapeake Bay Plan of Study and in Appendix 1, "Study Organization, Coordination and History."

This Appendix was prepared under the guidance of the Flood Control, Navigation, Erosion, and Fisheries Task Group. Members include: the Army Corps of Engineers; Soil Conservation Service; Maritime Administration; Federal Power Commission; Energy Research and Development Administration; National Marine Fisheries Service, Environmental Protection Agency; Geological Survey; Fish and Wildlife Service; Bureau of Mines; Department of the Navy; Coast Guard; District of Columbia; Maryland; Pennsylvania; Delaware; and Virginia. This task group is involved in studying the relation-

ships between the construction of navigation works, storm flooding, beach and bank erosion, fin and shellfish fisheries, and the present and future uses of Chesapeake Bay as a mechanism of mercantile transport. As such, it is more closely associated with the water-related land resources considered in this Appendix than any other task group.

CHAPTER II

EXISTING AND FUTURE LAND USE IN THE CHESAPEAKE BAY REGION

Increasingly, the manner in which land is used is being recognized as a major influence to the physical, economic, and social well being of all people. The misuse or proper use of land is what determines the overall quality of the area in which man lives, works, and recreates. Certain land uses frequently act as the point of conflict between man and his physical environment, imposing serious implications to water and related-land resources. For example, large industrialized regions create both water quality problems and large water supply demands for adjacent waterways. In still other cases, the particular use of land can determine the amount of damage caused by such water-related problems as shoreline erosion and hurricane flooding.

In regard to the implications of appropriate use or misuse of land, a former President, in a message to Congress said, "The uses to which our generation puts the land can either expand or severely limit the choices our children have. The time has come when we must accept the idea that none of us has a right to abuse the land, and that on the contrary, society as a whole has a legitimate interest in planning proper land use..." Effective land and water management warrants a thorough investigation into the trends in land use and actions for land use planning that will contribute to a quality environment. In this chapter, existing and future land use in the Chesapeake Bay Region is investigated. Some of the more important means by which a quality environment can be achieved will be examined in Chapter VIII.

DESCRIPTION OF REGION

Since the earliest European settlement of this country, the Chesapeake Bay Region has been a rapidly developing area where a number of large urban centers have germinated and flourished. These metropolitan areas include Wilmington, Baltimore, the District of Columbia, Richmond, Petersburg,

Newport News, Hampton, Norfolk, and Portsmouth. Urban centers have typically grown out from a densely knit area of intensive land uses which include residential, commercial, industrial, institutional, and extractive (mining and quarrying) activities; transportation, communication, and utilities networks; and strip and clustered settlement.

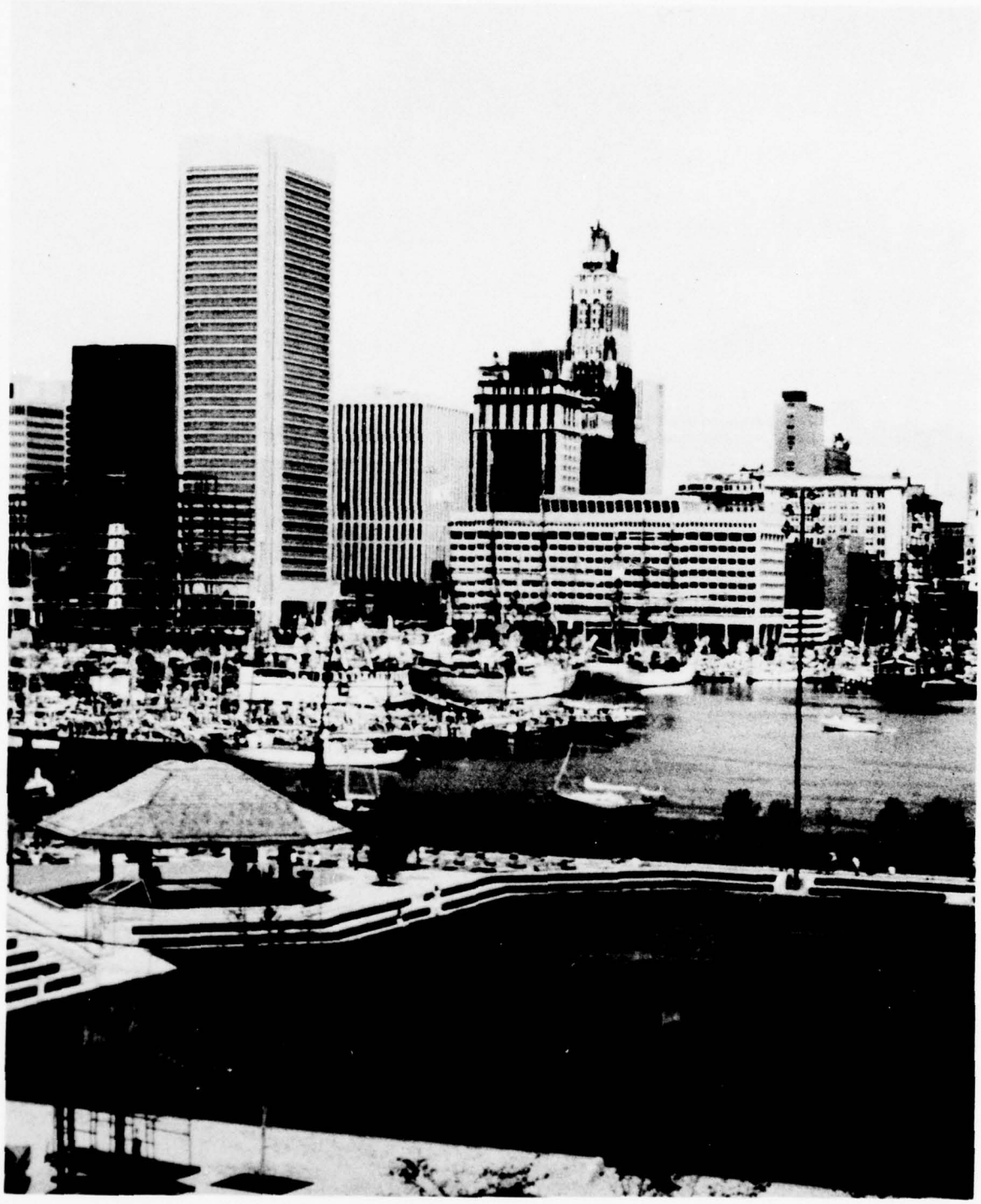
Wilmington, Baltimore, Washington, D.C., and other smaller cities in between form the southern portion of megalopolis, a twentieth century phenomenon where the distinction between city and country disappears. In this "economic center" of the country, many rural areas – woodlands, farms, and wildlife areas – have become threatened by man's encroachment. Manufacturing and commerce have expanded simultaneously and "megalopolis" as a whole seems destined to be one of the wealthiest, most densely populated, and productive urban areas in the world.

Although large segments of the Study Area are committed to urban land use, the overwhelming portion is in less intensive uses. In terms of actual geographic area, forest and agricultural lands dominate the overall landscapes of Maryland, Virginia, and Delaware while wetlands predominate along large portions of the shoreline, particularly on the Eastern Shore.

Population growth and changes in land use patterns will continue to have a major impact on water resources in the coming years. To accurately assess future impacts, it is important to examine future land use. The use of land is a dynamic process, however, and any predictions of future use are difficult to make. Land uses are constantly converting from one activity to another and some times reverting back. Nevertheless, certain trends and absolute changes can be forecast. Before this can be done, however, it is first essential to survey the past and present situation with regard to land use in the Chesapeake Bay Region.

HISTORY OF DEVELOPMENT

The overwhelming majority of the Chesapeake Bay Region was originally in forest. Almost immediately upon settlement of the Bay Region came the widespread use of the plantation system. Fields were cleared and tobacco, wheat, corn, potatoes, and certain other agricultural crops were planted. The system was particularly well suited to the Bay Region since the rich and fertile lands were accessible to the outside by way of Chesapeake Bay and its many sub-estuaries. Transportation of goods and people was inexpensive, fast, and easy. The plantation system tended to discourage the growth of towns since many of the functions provided by towns could be accomplished on planta-



The Bay Region also includes heavily urbanized areas.



Farmland dominates much of the landscape of the Chesapeake Bay Region.

tions. As a result, only a few small ports and scattered settlements existed at that time. The steady influx of settlers to the area, however, helped bring about the need for the town.

Transportation was to play one of the major roles in the settlement and development of the city in the Bay Region. Centers of population began to spring up on rivers at the Fall Line—the boundary where softer sedimentary formations of the Coastal Plain feather out as they come into contact with the harder crystalline rocks of the Piedmont Plateau. This, for all practical purposes is the head of ocean going navigation on rivers feeding into the Bay. Here, cargo was discharged by ocean-going vessels to be further distributed to points inland. In addition, water power was available. Water, falling from the Piedmont Plateau to the Coastal Plain, was used to operate grist and textile mills and iron foundries. Because of this, these centers rapidly developed as market and processing points. Such centers as Baltimore (Patapsco River), Fredericksburg (Rappahannock River), Alexandria and Georgetown (Potomac River), and Richmond (James River) developed on the major tributaries of Chesapeake Bay. Due to their inland location, these cities were, for the most part, ideally situated to capture a large part of the trade from the hinterlands on their west.

Baltimore, near the northern end of the Bay, and Norfolk, at the southern end, developed into prominent ports because of their relatively deep, natural harbors. Certain related industries such as shipbuilding and repair sprang up there as well. With the completion of the Chesapeake and Delaware Canal in 1829, trade was increased between the expanding cities of the Northeast and those of the Bay Region. Richmond and the towns of Alexandria and Georgetown, on the other hand, were well situated on large rivers to gain commercial control of their respective hinterlands. But the towns also initiated projects toward the end of the 18th century to build canals above the Fall Line, thus improving navigability to the west and expanding their market areas.

The advent of the railroad, which offered obvious advantages over other existing modes of transportation, was also to prove a valuable boost to Baltimore, Richmond, Norfolk, and other developing cities of the Estuary Area. Some became both railroad centers and ports of national significance. Such improvements in transportation were to go far in enabling these cities to mature into thriving metropolises and in assisting the Bay Region in becoming a significant economic area.

An independent factor was to be responsible for development of another prominent city in the Chesapeake Bay Region. The founding of the Nation's

capital on the Potomac River at the Fall Line turned a sleepy farming community and two small but growing ports (Georgetown and Alexandria) into a most important center of activity which owed its existence, for the most part, to the affairs of State. As the Federal Government expanded in both eminence and size, so too did the Washington Metropolitan Area – to presently rank as one of the 10 largest metropolitan areas of the country.

In addition to the number of large urban nucleations which currently exist, many smaller cities, towns, and regional centers have developed throughout the Estuary Area. Major transportation networks–highways, roads, and railroads–traverse sometimes wide expanses of forest and farmland to link these urban centers.

The Delmarva Peninsula has remained strongly agricultural throughout its history. Small ports such as Chestertown, Oxford, and St. Michaels sprang up early but never really developed into large centers. Today, these older seaports are dwarfed by more commercially significant ports like Cambridge and Salisbury. Regional farm centers such as Denton, Easton, and Princess Anne served as marketing focal points while towns like Crisfield became seafood packing and processing centers. The expansion of the railroad helped many of these to maintain their importance on a regional level. But none of these centers experienced the industrialization and growth which was characteristic of those towns and cities of the Western Shore. The completion of the Chesapeake Bay Bridge from Sandy Point to Kent Island in the early 50's brought about the most radical change ever experienced on the Eastern Shore. The sudden increase in accessibility has been responsible for the commercialization and industrialization of a number of areas on the Delmarva Peninsula. New highways have been completed and residential developments have sprung up during the last 20 years. The flow of traffic across the Bay

Bridge has increased manyfold, particularly during the summer when the ocean resorts beckon hundreds of thousands of visitors to their sandy shores. All has had a significant impact on the still largely rural Eastern Shore. In similar fashion to the Eastern Shore, the Northern and Middle Peninsulas of Tidewater Virginia have remained rural in character. While the Eastern Shore has long been primarily agricultural, however, these Peninsulas have remained predominantly forested.

The Estuary Area is a dynamic region, ever changing. Yet, as one author has said, "The past dies slowly; the charm of the Chesapeake lies in its blend of the old with the new." (1) Although the new is ever present, the old will continue to leave its imprint on the land.

DESCRIPTIVE PUBLICATIONS

A wide variety of data sources was used to obtain existing and future land use information. Data used in this Appendix, but which may not be available through conventional sources of information, include the following:

a. *CARETS Land Use Maps.* The Central Atlantic Regional Ecological Test Site (CARETS) project has been a jointly sponsored U.S. Geological Survey/National Aeronautics and Space Administration demonstration project. Its purpose has been to test the applicability of data from the Earth Resources Technology Satellite (ERTS-1) as input to a regional land resources information system including resource base inventory, change detection, and the effects of land use change on environmental quality. A product of the CARETS project, the 1970 land use maps were prepared at a scale of 1:100,000 from high altitude aerial photography using a classification scheme developed specifically for the project. These maps, in turn, were used to develop the "Existing Land Use Map of the Chesapeake Bay Region" (which will be discussed in greater detail in the following section).

b. *County/Regional Comprehensive Development Plans.* These plans were used to obtain information on existing land use patterns plus knowledge of what local authorities project future land use to be within the county or region. In addition, the future land use maps contained in each comprehensive plan were used to develop a composite map of projected land use in the Chesapeake Bay Region (presented in Chapter III).

c. *County Water and Sewer Plans.* These plans were prepared by counties and municipalities of the Study Area in order to provide comprehensive planning guidelines for water and sewerage development. The plans were used here to assess the influence which future water and sewer development will exert on land use patterns.

d. *Transportation Plans.* These plans were developed by a number of local and State governments to provide information on highway needs, priorities, and costs. The plans were used to determine the effect which future road and highway development will exert on land use patterns.

PRESENT STATUS OF LAND USE IN THE CHESAPEAKE BAY REGION

Land use is a dynamic process. What is currently assessed as "existing or present" will not be such in the future. Any predictions of future land use

impacts on water and land resources must start with what exists to insure that the estimates and projections will be drawn from a sound base.

PRESENT LAND USE

For the existing or present land use phase of this Chapter, the latest available data were selected. The following subsections include a discussion of existing land use mapping and a description of present land use patterns in the Chesapeake Bay Study Area.

Existing Land Use Mapping

One of the tools used in gaining knowledge of the arrangement of land and the relative proportions of land devoted to those uses is the existing land use map. For this Appendix, existing land use information was mapped using remote sensing data obtained from high altitude aerial photography taken in 1970. These data were supplied by the U.S. Geological Survey (USGS) and are a product of its CARETS project. A composite map of the Study Area was developed by using land use map sheets provided by the USGS. Plates 4-1, 4-2, and 4-3, "Existing Land Use in the Chesapeake Bay Region," show the type and general distribution of land activities in the Study Area.

The land use maps provided by the USGS offered certain advantages which other data sources could not. Land use classifications and classification definitions are consistent for the entire Study Area. Prior to this time, a large number of data sources would have had to be used, each with a different land use breakdown. Secondly, data were collected for the entire study area over a relatively short period of time, thus minimizing the opportunity for inconsistencies.

It should be noted that the boundaries for the CARETS project do not coincide exactly with those of the Study Area used in this Appendix. This is because of the limitation imposed by the 1970 high altitude aerial photography. Therefore, the existing land use map presented here includes only a portion of the following counties in Virginia: Chesterfield, Dinwiddie, Goochland, Hanover, Loudoun, Powhatan, Southampton, Spotsylvania, and Sussex. In addition, the entire County of Greensville (Virginia) is not included.

Land use data for the CARETS project were broken down into two major classifications (known as Levels I and II). The first is a generalized classification which considers broad land use types such as "urban and built-up

land," "agricultural land," and "forest land." The second classification (Level II) subdivides the first. For example, "forest land" is broken down into three types: "deciduous," "evergreen (coniferous and other)," and "mixed." The U.S. Geological Survey Circular 671 entitled "A Land Use Classification System for Use with Remote-Sensor Data" presents more specific information on the land use classifications used in the CARETS project.

For this Appendix, a simplified version of Level II was used. It consists of the following breakdown:

a. Urban and built-up land which coincides with USGS's "urban and built-up classification" minus industrial and extractive activities.

b. Industrial land which includes industrial areas such as light manufacturing, industrial parks, and heavy manufacturing plants.

c. Extractive land which contains surface and subsurface mining operations. (Industrial and extractive land use types were mapped together because of their similar impacts on water resources. They are discussed separately, however.)

d. Agricultural land which coincides with USGS's corresponding classification.

e. Forest land which coincides with USGS's corresponding classification.

f. Wetlands which coincide with USGS's corresponding classification.

g. Barren land which coincides with USGS's corresponding classification.

Maps prepared for the report are at a scale of 1:250,000 and depict political and municipal boundaries, railroads, major highways, and certain physical features.

Existing Land Use Patterns

A breakdown of land use in acres, by State, for the Chesapeake Bay Region is shown in Table 4-2. These data were provided as part of the CARETS project. They were derived from ERTS imagery and digitized by the

Canada Geographic Information System. The urban classification includes the same land use types as those found in the CARETS Level II "urban and built-up" land classification. Thus, acreage figures for extractive and industrial land use types have not been disaggregated.

It should be noted that the totals for agriculture and forest land use differ from those figures presented in Chapters 4 and 5 of this report. There are two explanations for this. First, data from the *Census of Agriculture* were used in Chapter 4 in order to show "number of acres of land by county." That data included " woodland on farms." Remote sensing data were used in this Chapter, however, in order to digitize acreage for all land use types within the Bay Region. This digitized data did not distinguish between commercial forest and "woodland on farms." Therefore all forests were considered to be woodland. Hence, the figure for land use in forests set forth in Table 4-2 in this chapter is greater than that expressed in Chapter 5. In addition, the figure for agricultural land set forth in Table 4-2 is lower than that of Chapter 4, again due to the digitized remote sensing figures not including "woodland on farms." Secondly, public forest lands were not inventoried in Chapter 5—only private commercial forest lands. The remote sensing data, however, included both public and private forestlands.

TABLE 4-2

LAND USE IN ACRES FOR THE CHESAPEAKE BAY REGION

STATE	LAND USE				
	Urban	Agriculture	Forest*	Wetland	Barren
Delaware	79,473	703,407	395,281	79,720	182
District of Columbia	34,103	—	5,101	—	—
Maryland	449,204	2,220,706	2,042,102	151,228	4,631
Virginia	454,654	2,059,829	4,920,814	157,394	13,466
Bay Region TOTAL	1,017,434	4,983,942	7,363,298	388,342	18,279

*Includes woodland on farms and both public and private-commercial forests

The various land use types found within the Chesapeake Bay Regions (Plates 4-1, 4-2, and 4-3) are described below:

a. *Nonforested Wetlands.* These are relatively low-lying areas consisting of seasonally flooded basins and flats, meadows, marshes, and bogs (wetlands with a 10 percent forest crown cover are considered forest lands). Due to their very nature, these areas are difficult to identify because they change as the result of such factors as drought, high rainfall, seasonal precipitation fluctuations, and diurnal tides. Thus, the area measured by remote sensing techniques may differ from survey to survey, depending on conditions. Legally wetland boundaries are much less subject to change. Each of the States of the Study Area has carefully and precisely defined its wetlands. Maryland defines its wetlands as all land under the navigable waters of the State below the mean high tide which is affected by the regular rise and fall of the tide. Virginia wetlands are defined as all that land lying between mean low water and an elevation above mean low water equal to the factor 1.5 times the tide range. . . . Delaware defines its wetlands as those lands above the mean low water elevation including any bank, marsh, swamp, meadow, flat or other land subject to tidal action and including those areas connected to tidal waters whose surface is at or below an elevation of two feet above local mean high tide. The Chesapeake Bay Region contains over 388,000 acres of wetland. These wetlands are found in almost every county, although they are most prevalent on the Eastern Shore (the smaller areas of wetlands are not shown in Plates 4-1, 4-2, and 4-3 because the map scale is too small). More specifically, wetlands are found in the following general areas:

(1) large lengths of shoreline bordering Delaware Bay and the Atlantic Coast from Cape Henlopen in Delaware to Cape Charles in Virginia.

(2) sizeable portions of shoreline in Dorchester, Somerset, and Wicomico Counties, Maryland and most of the shoreline of Accomack County, Virginia bordering Chesapeake Bay.

(3) certain lengths of shoreline along many of the subestuaries feeding into Chesapeake Bay.

(4) major land areas of certain islands in Chesapeake Bay.

These valuable areas are of extreme importance for their biotic relationships, wildlife and waterfowl use, and recreational use. In addition, they have great hydrologic value in retarding flood water (wetlands serve as water storage areas during periods of high rainfall and flooding), protecting fastland from erosion, and maintaining water quality.

b. *Urban and Built-up Land.* Intensive land uses are found in a large number of locations within the Study Area. Most of the principal urban centers, however, are located on the Western Shore along the major tributaries of Chesapeake Bay at the Fall Line. Many smaller urban centers are found scattered throughout the Study Area, some serving as small ports, others as regional market centers or political centers (State capitols or county seats).

Institutional facilities, including military reservations, are also classified as urban and built-up land uses. The Bay Region has a number of military reservations which are listed in Table 4-3 (a more complete inventory of military properties is included in Chapter VII of this Appendix). All of the large military facilities, with the exception of Dover Air Force Base, Delaware, and the National Aeronautic Space Administration's facility at Wallops Island, Virginia are located on the Western Shore. Several explanations exist to explain the unusual number of large facilities within the Estuary Area. First, the area contains the U.S. Capital, Washington, D.C. Since earliest times military reservations have developed in the Washington Area as a deterrent to invasions. Second, the Bay and its tributaries provide well-protected, deep-water harbors suitable for naval bases and related naval operations, especially in the Hampton Roads Area which is the location of one of the major naval bases in the United States.

c. *Industrial Lands.* Industrial activities include a variety of uses ranging from those involved in design, assembly, finishing, and packaging of light products to heavy manufacturing activities such as steel, pulp, or lumber milling, electric power generating, oil refining, chemical processing, and brick making. Most frequently, industries are found in or adjacent to urban areas where good transportation facilities and ample manpower are found. Thus, with the possible exception of the District of Columbia, the largest urban centers are also the most heavily industrialized areas of the Bay Region

TABLE 4-3

INVENTORY OF LARGE MILITARY RESERVATIONS
IN THE CHESAPEAKE BAY REGION

Delaware

Dover Air Force Base

Maryland

Andrews Air Force Base

Patuxent Naval Air Test Center

Aberdeen Proving Grounds

Edgewood Arsenal

Ft. Meade

Bainbridge Naval Training Center

Naval Ordnance Station & Research Lab at Indian Head

Virginia

Ft. Belvoir Military Reservation

Langley Air Force Base

Dahlgren Weapons Lab

Oceana Naval Air Station

Naval Reservation at Chesapeake

Ft. Story Military Reservation

Quantico Marine Corps School

National Aeronautics and Space Administration at Wallops Island

d. *Extractive Lands.* Extractive activities which include surface and subsurface mining from stone quarries and clay, sand, and gravel pits, are scattered wherever the resources have been found and can be worked. Most frequently this is on the Western Shore in or adjacent to the heavily populated counties where labor is abundant and demand for building materials (stone, sand, gravel, and clay) is greatest. Most of the minerals mined within the Bay Region are used there also. Consequently, very little is shipped outside the region. Most of the sand and gravel produced comes from either dredging of river bottoms or from pits and quarries dug into certain formations of the Coastal Plain.

e. *Agricultural Lands.* Land in use for production of farm commodities makes up over a third of the Chesapeake Bay Region's land area. As such, it constitutes the second largest land use type in the Study Area. Over 4,983,000 acres of pasture, cropland, orchards, vineyards, horticultural areas, or feeding operations exist within the Study Area.

Frequently farmland is located along rivers and estuaries on the fertile and relatively level flood plains where cultivation is easy. This is especially evident along the Wicomico, Patuxent, and Chester Rivers in Maryland and the Rappahannock, Pamunkey, and James Rivers in Virginia. Many believe that those lands presently in farm use rank among the most fertile in the Bay Region. By the same token, however, some very productive lands are currently in some other use. The intensity of the use of land in farms depends on a number of factors including rainfall, growing season, soil, drainage, temperature, evaporation, and amount of sunshine. Some of these are relatively constant for most of the Study Area (rainfall, temperature, evaporation) with minor differences on a local level. Others, such as soil and drainage, differ considerably throughout the Estuary Area and can determine whether land will be used for agriculture and, if it is, what type of agriculture will predominate. Social factors such as tax laws, land tenure arrangements, and farming practices will also influence intensity and type of agriculture.

f. *Forestlands.* Of the rural lands, forests occupy more area than any other land use type. Almost 7,363,300 acres of land are in forest in the Estuary Area. Although the amount of land in forests has declined considerably since earliest European settlement, over 50 percent of the Chesapeake Bay Region is still in productive woodlands and forests. In Virginia, almost two-thirds of the land within the Study Area is in forest. Maryland and Delaware are less forested, although Southern Maryland has a high proportion of woodlands.

g. *Barren Lands.* Beaches make up the majority of the barren lands in the Bay Region. Most of these smooth, sloping accumulations of sand and gravel are found along the Atlantic Coast as well as in a few scattered shoreline portions of Chesapeake Bay. Since the barren lands (beaches and dunes), for the most part, are adjacent to the Atlantic Ocean, their value for recreation and as a natural barrier from the sea is inestimable.

MANAGEMENT RESPONSIBILITIES

There has been a growing consensus that management of land use is probably the most important single factor in improving the quality of the environment. This section will discuss some of the more noteworthy management responsibilities of Federal, State, and local levels of government.

Generally, land use management can be thought of as having two major objectives which are:

a. To guide use of land

b. To curb misuse of land

The Federal Government as well as many of the State and local governments of the Study Area have passed at least some form of land use control legislation. Land use management has traditionally been in the hands of local authorities. The Federal and State governments, however, are beginning to take a bigger role in such matters.

In regard to local authorities, many of the counties and municipalities of the Chesapeake Bay Region have established planning and zoning commissions whose responsibilities include such activities as:

a. preparing comprehensive plans

b. establishing and administering zoning codes and subdivision regulations

c. developing capital improvement programs

d. producing water and sewer plans

e. developing housing, building, and health codes.

All of these tools, if used properly, can be effective in guiding the use and preventing the misuse of the land. Some of the more important tools will be discussed at greater length in Chapter VIII under the section "Means to Satisfy Needs" (which will present alternatives that could be employed to provide the proper management of the Estuary Area's water-related land resources).

A number of organizations within the Study Area are involved in comprehensive metropolitan or regional planning. As such, they exert a considerable influence over land use decisions. These bodies do not usually have legislative power and therefore plan implementation depends almost entirely on cooperation with local governments and special purpose agencies. Table 4-4 lists some of these organizations and the regions which each represents. The very nature of the Washington Metropolitan Area, in particular, requires that strong coordination exist between various legislative bodies there.

TABLE 4-4

REGIONAL PLANNING ORGANIZATIONS WITHIN THE CHESAPEAKE BAY REGION

Organization	Region
Metropolitan Washington Council of Governments	Washington, D.C. Metropolitan Area
Maryland-National Capital Park & Planning Commission	Montgomery/Prince Georges Counties
Tri-County Council	Southern Maryland
Regional Planning Council	Baltimore Metro Area
Wilmington Metropolitan Area Planning Coordination Council	Wilmington Metro Area

States are usually involved in land use decisions in a variety of ways:

a. States control land use through acquisition of lands for parks, forests, wildlife management areas, and miscellaneous properties.

Those State agencies with responsibility for acquiring such lands will be discussed in Chapter VII "Historic, Archeological and Natural Environmental Areas".

b. Each State, through its state planning body provides leadership, assistance, and coordination of planning efforts between functional agencies, geographic areas, and levels of government. In Maryland, that body is the Department of State Planning; in Virginia, the Department of Intergovernmental Affairs; and in Delaware, the Office of State Planning.

c. States frequently review and approve local sewer and water plans.

d. States are usually involved in at least some highway construction and finance.

The States also encourage counties and municipalities to undertake planning programs through grants in aid. Technical, advisory, and educational assistance is provided by the State planning body to the subdivisions, within the State. Maryland and Virginia have established planning districts whose responsibility is to assist in coordinating planning activities between the local planning agencies and the respective State planning body. Many of the planning district commissions are also responsible for development of comprehensive planning documents, policies, and guidelines.

Faced with the problem of providing good management of resources on a State-wide basis, the Maryland Department of State Planning is producing a "State Development Plan" to better guide development within certain areas of the State. Maryland also exercises considerable influence over the location of major electric generating facilities through its power plant siting program administered by the Energy and Coastal Zone Administration, Department of Natural Resources.

Maryland, Virginia, and Delaware have all enacted wetlands laws to help control and regulate the uses made of these valuable lands. In Maryland, the Wetland Licences and Permits Section of the Department of Natural Resources is the body charged with administering Maryland's wetlands program. A number of counties and independent cities within Virginia have local wetlands boards which actually grant permits for dredging and filling of wetlands. The Virginia Marine Resources Commission, a State agency, grants permits for those areas which do not have local wetlands boards. In addition, the Commission acts as an appeal board when permits are turned down by local-

ities. The Delaware Department of Natural Resources and Environmental Control handles that State's wetlands program.

The Federal Government through its Coastal Zone Management (CZM) Program (the Office of Coastal Zone Management was created within the National Oceanic and Atmospheric Administration) assists the various States in developing a plan for the management of land and water areas in the coastal zone as well as a method of implementing this plan. In addition, the Federal Program coordinates state activities and safeguards the regional and national interests in the coastal zone.

All of the States within the Estuary Area are currently developing CZM plans. The responsibility for developing the CZM Program in Maryland lies with the Energy and Coastal Zone Administration, Department of Natural Resources. In Virginia, the Commerce and Resources Section under the Secretary of Commerce and Resources has responsibility for development of the CZM Program for the Commonwealth.

Delaware was the first State in the Nation to bar construction of new industry in coastal regions. It passed its own Coastal Zone Act in 1971. Through its State Planning Office, Delaware is currently expanding its program under the auspices of the Federal CZM Program.

Through this cooperative program with the States, the Federal Government hopes to preserve, protect, develop and restore the resources of the coastal zone.

The Federal, State, and local governments are generally held accountable for management responsibilities regarding land use. However, each individual user has, in many respects, certain responsibilities toward the proper use and management of land resources. Such responsibilities are reflected in public attitudes toward conservation, education programs, tax policy, support of research, and laisez-faire versus scientific management of resources, and in public observance of regulations governing land use. The cumulative impact of individual decisions regarding land use is at least as important as Federal, State, and local management decisions.

PROBLEMS AND CONFLICTS

The Chesapeake Bay Region has been and continues to be a rapidly developing area. The Region's population increased significantly more than the

national rate during the 1960-1970 decade. Most of this increase was registered in the Standard Metropolitan Statistical Areas (SMSA) of the Region. In general, people tended to move out of both the inner cities and rural areas and into the suburban counties. Most of these suburban counties experienced growth rates in excess of 30 percent.(2) An increase in population and resultant urbanization has brought about a number of problems and conflicts for water and related land resources. Basically, these can be divided into two broad categories: conflicts over various land uses and problems involving land use activities and the Region's water resources. The former group of conflicts will be considered here while the latter group will be addressed in the appropriate chapter that follows.

CONFLICTS OVER LAND USE

At times there developes a fierce competition between individuals or groups who wish to use the land for different purposes. The best lands for agriculture and forests are relatively level, fertile, well-drained areas. These are precisely the same lands which are most attractive for residential, commercial, and industrial land uses. It is on these prime lands that urban construction costs are lower than on poorer quality lands. In many cases, savings in construction costs outweigh increased purchase cost of more productive lands. This cost advantage thus results in the selection of the prime lands for urban development. In addition to the "cost factor," construction of residential neighborhoods require proper sewage disposal. Where municipal or other public or private sewer systems do not exist, housing can be built only if soil properties are favorable to adequate drainage. Since prime agricultural lands usually possess such soil properties, they have become particularly susceptible to residential development.

Frequently, areas conducive to farming are found on the fertile flood plains of rivers and estuaries. Many industries compete with farmers for this land because it can provide industries with a waterfront location from which to ship raw materials and finished products (large bulk or high weight cargo is more economical to ship by water, hence a waterfront location is desirous). A location on the flood plain is also attractive to industry because the adjacent water body can act as a source of water supply as well as a receiving stream for wastes.

Since urban land uses command a higher economic rent than the less intensive land use types, the urban activities usually "win out." The result has been the conversion of hundreds of thousands of acres of valuable farmland,

forests, and other rural land uses to streets, houses, shopping centers, and factories. The pressures for conversion commonly vent themselves by way of increasing property taxes (the landowner frequently cannot meet these taxes and must therefore sell part or all of his land), offers to buy farmland at attractive prices, and speculation by developers. A continuing conversion of this magnitude could cause a severe impact on the resource balance of this area. Counter to this trend of conversion of farmland, however, is the effort on the part of some State and local governments as well as many individuals to preserve and protect prime agricultural lands. Maryland, for example, has passed legislation which gives farmers voluntary privilege to grant all development rights on their land to the state in return for estate and property tax advantages.

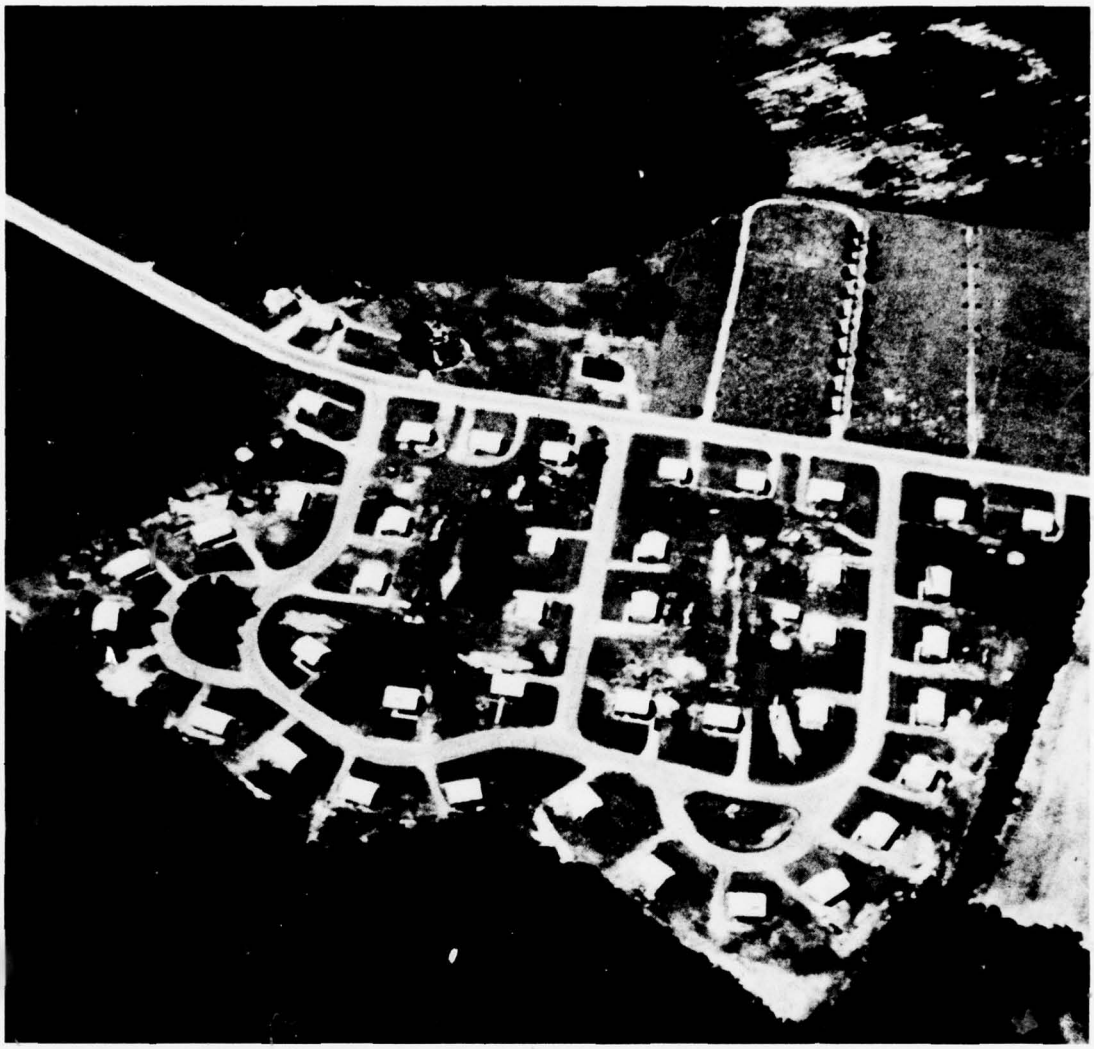
With the actual transformation of land from rural use to urban use, serious conservation problems such as erosion can occur. During the transition, large areas are frequently denuded and left bare for extended periods of time. Studies indicate that sloping land, left denuded of cover, can produce and deliver up to 50 times more sediment than most agricultural areas. If the trend from "rural" to "urban" continues, many of the conservation problems facing the Chesapeake Bay Region can also expect to continue.

Many types of land uses are frequently incompatible. The situation is complicated by the close physical proximity of these conflicting activities. For example, industries and commercial establishments are from time to time responsible for seriously degrading the living conditions of a particular region. Congestion, noise, air and water pollution produced by these activities often make an area rather undesirable for residential development. Some industries such as slaughter houses and chemical manufacturers, are offensive enough to create extremely incompatible conditions.

Since the Chesapeake Bay Region supports one of the fastest growing populations in the Nation, it is not surprising that urban development has spilled over into certain natural areas. It is important to note that urban type use of these lands is in direct conflict with the role they play in nature. Increasingly, the Chesapeake Bay Region with its vast recreation potential has become the site of private recreational facilities along the largely rural shoreline areas. The demand for marinas, summer cottages, retirement homes, and recreational development has brought about the filling or dredging of wetlands. Through such actions, the ecological value of wetlands is impaired or even destroyed. The barren lands of the Bay Region are similar to the wetlands in the sense that they are in a very delicate ecological balance which can be easily upset. Haphazard and poorly planned development has largely resulted in their be-



Hundreds of marinas and boatyards dot the rural shoreline.



Residential development has encroached upon both forests and agricultural lands.

ing altered. When this occurs, their value in protecting the mainland from the sea can be hampered.

The rapid growth of urban development in the Study Area has also preempted the use of much of the land for mineral production. For example, the availability of such commercially valuable mineral resources as stone, sand, gravel, and clay has been reduced not because of depletion but due to inaccessibility. Urban land uses frequently have the competitive edge over extractive land uses. As a result, the encroachment of residential, commercial, and industrial land uses upon extractive sites will ultimately deprive future generations of needed resources.

FUTURE LAND USE IN THE CHESAPEAKE BAY REGION

The process of planning for future land use is a relatively young discipline but one which is rapidly gaining in both acceptance and practice. Its value in guiding orderly growth cannot be overstated. In this section, land use patterns, as projected by local and regional planning authorities, will be examined.

METHODOLOGY

Planning authorities have projected future land use in county, municipal, and regional comprehensive plans. Since these were the best projections available for the Chesapeake Bay Region, they were used in this Appendix. Generally, the Metropolitan/Regional Water Quality Management plans were used for the Virginia portion of the Study Area. For Maryland and Delaware, county or regional comprehensive development plans were employed. Where a choice existed between county plans and a regional plan, the regional plan was selected. Thus, for the Baltimore Metropolitan Area, the Regional Planning Council's *General Development Plan* was used rather than the individual county plans. In cases where regional plans exist, the local jurisdictions are usually encouraged by planning authorities to adopt the overall regional plan to insure consistency throughout the region in terms of both planning and development. Although the comprehensive plans were used in this Section for the analysis of future land use in the Study Area, full detail of each plan cannot be provided here. Therefore, only the general trends in future land use as expressed in these plans are presented in the discussion in this Section.

With regard to certain counties and municipalities within the Study Area, comprehensive master plans could not be used. For Somerset and Calvert Counties, Maryland and Wilmington, Delaware, zoning maps were substituted at the suggestion of the local or State planning officials because comprehensive plans were unavailable. Only a partial comprehensive plan was available for Chesterfield County, Virginia at the time of data collection. Therefore, only that portion which was complete is included on the future land use maps. There were also a few predominantly rural counties in Virginia where neither development plans nor zoning maps were available. In these cases, existing land use information was substituted since such counties are expected to experience little change in the future (these counties consisted of Accomack, Northampton, Essex, Middlesex, King and Queen, King William, and Mathews Counties, Virginia). A Bibliography at the end of the Chapter lists specific data sources used in developing the future land use map and the accompanying analysis.

Data sources for future land use projections were somewhat inadequate for use in this Appendix because they were frequently outdated, used different base years for their projections, and employed various land use classifications. There appeared to be very little agreement between data sources on land use definitions or concepts. Bearing these deficiencies in mind, however, the comprehensive development plans and water quality management plans can be utilized effectively as at least an indication of how the local authorities perceive future development in the Chesapeake Bay Region. It must be stressed however, that the future land use data presented in this Chapter is based on the local and regional planning authorities interpretation of development and therefore does not necessarily reflect the Baltimore District's perception of future growth.

Due to the large number of data sources, a consistent land use classification had to be developed for the entire Study Area. This meant that, in some cases, an arbitrary decision had to be made as to how a particular county's land use breakdown would best fit into the classification developed for the Report. That classification is as follows:

Residential/Commercial Uses

Industrial/Extractive Uses

Government/Military/Institutional Activities

Open Space/Parks/Conservation Areas

Rural/Agricultural/Low Density Residential Uses

Mapping has been done at a scale of 1:250,000 and contains primary political and municipal boundaries, railroads, major highways and road systems, and certain physical features. It must be borne in mind that much of the data may have been revised, thus those data which are presented here may be out-of-date at the time of this printing. Nevertheless, the comprehensive development plans probably represent the best data sources available at the time of data collection.

FUTURE LAND USE PROJECTIONS

Plates 4-4, 4-5, and 4-6 show projected land use in the Chesapeake Bay Region based on local planning authorities interpretation of how they perceive future growth. Obvious problems exist in attempting to reproduce a series of maps at various scales and land use classifications. Nevertheless, the above plates provide a general perspective of future land use patterns. As such, it should prove useful in determining where future pressures on land and water resources can be expected. Parts of several counties in Virginia, in the western portion of the Study Area, are not included on the map. These include Powhatan, Goochland, Chesterfield, Dinwiddie, Loudoun, and Spotsylvania Counties. The reason for this is twofold. First, the Study Area used in this Appendix coincides with official State planning district boundaries and thus is larger than the Study Area used in other Appendixes of the *Future Conditions Report*. Secondly, physical limitations of the Chesapeake Bay Study Base Map made it impossible to include these counties in their entirety.

In analyzing future land use, the Chesapeake Bay Study Area is broken down into a number of subregions which, for the most part, coincide with planning district boundaries. Table 4-5 lists the subregions to be considered. Figure 4-2 shows these subregions.

TABLE 4-5

FUTURE LAND USE SUBREGIONS

Subregion	Counties/Cities Included
Baltimore Metropolitan Region	Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties and Baltimore City
Southern Maryland	Calvert, Charles, and St. Mary's Counties

TABLE 4-5 (Continued)

Upper Eastern Shore	Caroline, Cecil, Kent, Queen Annes and Talbot Counties
Lower Eastern Shore	Dorchester, Somerset, Wicomico, and Worcester Counties
Maryland-Washington Regional District	Montgomery and Prince George's Counties
Washington, D. C.	
Northern Virginia Planning District	Arlington, Fairfax, Loudoun, and Prince William Counties and the City of Alexandria
Rappahannock Area Development Commission District	Caroline, King George, Spotsylvania, and Stafford Counties
Northern Neck Planning District	Lancaster, Northumberland, Richmond, and Westmoreland Counties
Middle Peninsula Planning District	Essex, Gloucester, King and Queen, King William, Mathews, and Middlesex Counties
Richmond Regional Planning District	Charles City, Chesterfield, Goochland, Hanover, Henrico, New Kent, and Powhatan Counties and the City of Richmond
Crater Planning District	Dinwiddie, Greensville, Prince George, Surry, and Sussex Counties and the City of Petersburg
Southeastern Virginia Planning District	Isle of Wight and Southampton Counties and the Cities of Suffolk, Portsmouth, Norfolk, Chesapeake, and Virginia Beach
Peninsula Planning District	James City and York Counties and the Cities of Newport News and Hampton

TABLE 4-5 (Continued)

Accomack-Northampton Planning District	Accomack and Northampton Counties
Delaware	Kent, New Castle, and Sussex Counties

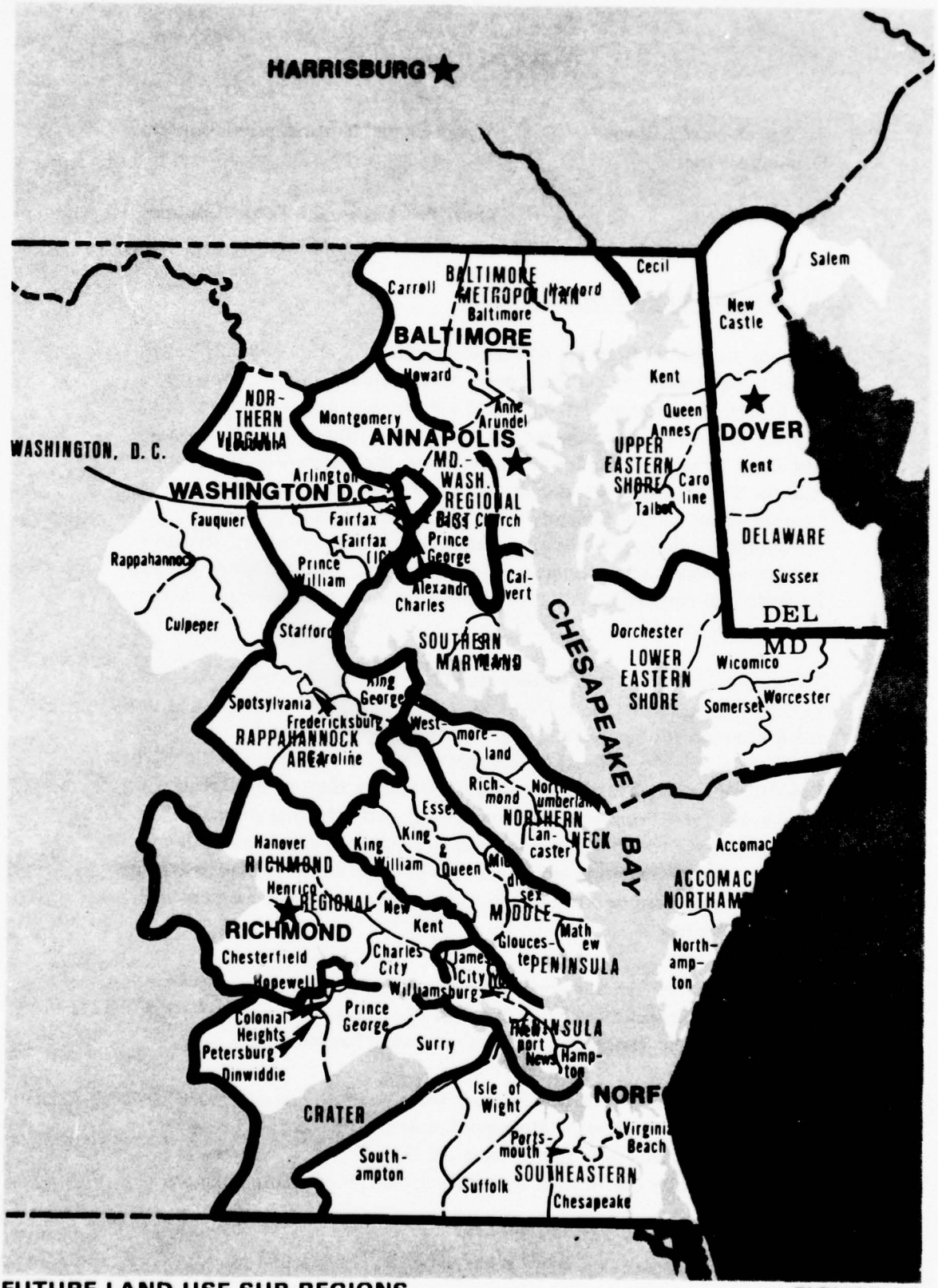
BALTIMORE METROPOLITAN AREA

Planning authorities from the Baltimore Regional Planning Council (which includes Baltimore City and Baltimore, Anne Arundel, Harford, Howard, and Carroll Counties) are attempting to achieve two major objectives. First, to guide urban expansion and second, to conserve land with valuable ecological characteristics. In order to achieve these, the *General Development Plan* for the Baltimore Metropolitan area seeks to limit future development to areas where activity presently exists. The Plan establishes so called "development districts" where population densities, levels of activity, landscaping, and the most appropriate land uses are set. The Plan also provides for parks and conservation zones in environmentally sensitive areas such as along creeks and rivers.

To maintain good industrial growth, the Plan suggests an extensive network of expressways and arterials. These are to be limited-access routes so as to reduce the threat of uncontrolled growth along the network. It is predicted that urban expansion will take place throughout the Region but particularly in Baltimore, Anne Arundel, and Howard Counties. Most of this urbanization will consist of residential, commercial, and industrial growth. The Plan emphasizes transportation planning as a means of determining growth patterns. Improvements in existing modes of travel and a rapid mass transit system are proposed to provide such things as easy access for workers to job opportunities.

In addition to emphasizing open space, recreational lands, and the protection of high quality agricultural lands, the Plan also recommends a major effort to increase public accessibility to the Chesapeake Bay shoreline.

Growth pressure is expected to be greatest in the southwest due to the close proximity of the Washington Metropolitan Area. The fact that people are moving into the area from the Washington, D.C. Region is expected to account for nearly one-third of the total regional growth during the pro-



FUTURE LAND USE SUB-REGIONS **FIGURE 4-2**

jected period. The Plan stresses the importance of maintaining the high level of industrial and shipping activity in the region. Thus, emphasis is given to port development and new industry and commercial sites, particularly on the waterfront and along the major rail and highway networks.

SOUTHERN MARYLAND

The area formed by Calvert, Charles, and St. Mary's Counties is known as both "Southern Maryland" and the "Tri-County Region." As set forth in the county comprehensive master plans for this region, one of the strongest influences on future growth will be the expansion of the Washington, D. C. urbanized area into the Tri-County Region. Improvements in transportation networks will bring about a "spill over" from the Washington Metropolitan Area. Tentative plans for improvements such as an outer capital beltway and a new Patuxent River crossing would make all three counties more accessible, fostering additional growth. Development plans for the region predict strongest growth trends in the northern portion of Charles County. This is the area where development is generally encouraged, thereby reserving the remaining portions for agriculture, conservation, and rural activities. Corridor development from the District of Columbia southward along primary highways can be expected. The Waldorf-LaPlata corridor will likely experience one of the greatest pressures. Since growth is encouraged in areas of existing activity, the concept of "cluster development" is promoted wherein industrial, commercial, and residential activity is concentrated. Lexington Park, Waldorf, and LaPlata can expect to remain major population centers.

Southern Maryland is largely agricultural but with extensive shorelines plus close proximity to both the Baltimore and Washington Metropolitan Areas, pressures for second homes and vacation cottages will probably increase. Development plans for the region, however, suggest limitations on development in certain conservation zones and environmentally valuable areas: flood plains, wetlands, steep slopes, waterfront areas, and agricultural lands. In these locations most industry is discouraged and housing densities are to be kept low.

UPPER EASTERN SHORE

As expressed in the various comprehensive master plans, it appears that the local planning authorities on the Upper Eastern Shore (which includes Cecil, Kent, Queen Anne's, Talbot, and Caroline Counties) are encouraging residential, commercial, and industrial development in and around existing centers where labor, water and sewer utilities, and transportation networks

already exist. The presently incorporated towns such as Easton, Denton, and Chestertown will most likely remain the principal centers of population. Some of the major towns of Cecil County (Elkton, Northeast, and Perryville) have great potential for expansion due to their close proximity to both rail and highway networks. In addition, these towns are in the main corridor between the giant industrial cities of the Northeast and Baltimore and Washington.

The possibility exists of an Upper Bay bridge linking the Baltimore Metropolitan Area with the Eastern Shore at Kent County. Such a link would have a dramatic impact on the Upper Shore. Rapid growth of second homes, recreation facilities, and commercial activities could ultimately occur.

A major concern described in the county comprehensive master plans is the continued and largely uncontrolled strip or linear development taking place along major arteries. Such growth is primarily due to the impact of large flows of traffic from the Baltimore and Washington Areas to the recreational areas of the Atlantic Coast. The various development plans promote the continuation of the rural character of the area and the preservation of certain "sensitive" land areas such as wetlands, stream valleys, and waterfront. Officials predict continued demand for waterfront property in this region for second homes and vacation cottages as well as commercial recreation facilities. To discourage overdevelopment of such areas, officials are encouraging a continuation of such controls as low density zoning.

LOWER EASTERN SHORE

Two of the primary goals of the various county development plans for the Lower Eastern Shore (which includes Dorchester, Somerset, Wicomico, and Worcester Counties, Maryland) are, first, to funnel growth to and promote expansion of the existing towns and cities, and, second, to preserve the valuable conservation areas of the Region. Such cities as Cambridge, Salisbury, Crisfield, Pocomoke City, and Princess Anne with their nuclei of facilities and services, are the logical centers for expansion. Industry is encouraged in these existing centers, particularly along the rail and highway networks or, where applicable, along the waterfront. To maintain their prominence, cities like Cambridge, Salisbury, and Crisfield must expand and improve their port facilities. Plans encourage such development.

As the ocean continues to increase in importance as a recreational attraction, expansion of existing coastal communities and the development of new ones can be expected.

In controlling growth outside these centers, local planning authorities concur that the vast wetlands and other environmentally sensitive areas of the region must be protected. Certain physical factors have aided in curtailing development outside the growth areas. Soil and drainage conditions in extensive portions of the Lower Eastern Shore are such that the density of development is limited. In addition, a high water table restricts drainage and consequently prohibits most development. Thus, certain areas by nature become more desirable for growth than others.

It is difficult to overstate the importance of accessibility in influencing an area's character. The development which followed the completion of the first Bay Bridge in 1952 exemplifies how improved accessibility results in increased development. As a consequence, some development plans are encouraging local authorities to review any major road proposal since it could open up and expose an area to development. As in other areas, local planning authorities see that transportation planning has a large influence in directing growth in the Region.

As with the Upper Eastern Shore, this Region faces two pressures. One is the demand for waterfront property for vacation and retirement homes, recreation facilities, and certain commercial activities. County master plans recommend that such development be restricted in order to preserve the character of the Region. The second pressure concerns strip development which has occurred along two major corridors dissecting the region. One corridor, Route 50, links the population centers to the west and the beaches along the coast. The second, Route 13, is a major north - south artery on the Eastern Shore. County plans encourage the limitation of this undesirable growth through such measures as limiting access along certain portions of highways thereby restricting areas where development may take place.

MARYLAND - WASHINGTON REGIONAL DISTRICT

The General Plan for Montgomery and Prince Georges Counties produced by the Maryland-National Capital Park and Planning Commission proposes an urban pattern consisting of several corridors of intensive development radiating outward from the presently developed areas. Each corridor is to contain several nodes of high density commercial, industrial, and residential development. In addition, employment centers are to be designated within these corridors. The various corridors are separated by a "wedge" of agricultural land or rural space, natural resource, recreation facility, or low-density residential area. Frequently, these wedges are located in the stream valleys and flood plains of those streams draining the metropolitan

areas. The corridors are to center around a major highway or road system. This plan for development will be most effective outside the present Capital Beltway since the area inside is, for the most part, already intensively developed.

Montgomery and Prince Georges County planning authorities suggest that such tools as water and sewer development be used to direct this growth. Thus, public facilities will not be extended into areas planned as "wedges," thereby reducing the possibility of development there. Another concept to control growth is the "staging policy" . Such a policy divides a county into four types of areas: limited growth areas, preferred development areas, economic potential areas, and deferred development areas. The capital improvements programs and the ten year water and sewerage plan would be directed, in desired phases, to the corridor areas designated by the General Plan.

WASHINGTON, D. C.

The comprehensive plan for the National Capital produced by the National Capital Planning Commission states that "the extent of the land area of the District of Columbia is fixed. This land must be used efficiently in order to meet the increasing demands placed on the city and to avoid conflicts among land uses."(3) Planning authorities believe that transportation systems inside the District should be upgraded so as to assist in the development of new employment and commercial centers in the city while at the same time protecting residential areas from so called excessive traffic intrusion. In addition, mass transit systems should support downtown employment as well as stimulate growth in those areas which it serves.

The comprehensive plan also encourages additional public open space. Areas to be so designated include the shoreline of the Potomac and Anacostia Rivers.

NORTHERN VIRGINIA PLANNING DISTRICT

The Northern Virginia Region (which includes Alexandria plus several small independent cities and Arlington, Prince William, Fairfax, and Loudoun Counties) can be thought of in terms of three major areas: the currently developed core lying within the Capital Beltway; those areas west and south of the Beltway which are undergoing development (including the low density residential areas and new communities); and outlying rural areas served by small towns.

Future development is to be concentrated within transportation and utility corridors and in major new towns within these corridors. Intensification of land use is expected within the core area. Additional offices, motels, hotels and retail development is already occurring and will likely continue. The major transportation facilities of the Region can also be expected to have a significant effect on development in Northern Virginia. High densities and mixed land uses are planned for accessible locations adjacent to I-95, the Capital Beltway, and those areas along the metro system network (the rail rapid transit system).

The *Water Quality Management Plan for Northern Virginia* recommends that to preserve the rural setting of large portions of the region, development should be concentrated in presently existing areas, within new towns and communities (such as Reston, Lorton, Centreville, and Burke), and within the transportation/utility corridors. Generally, three corridors of development can be expected: a Northwest Corridor extending from Western Fairfax County into Eastern Loudoun County; a Western Corridor paralleling Routes 50 and I-66; and a Southwest Corridor along I-95 extending from the Capital Beltway into Eastern Prince William County. Conservation and low-density areas are encouraged along certain waterways such as the Potomac and Occoquan Rivers. The District's water quality management plan suggests that waste load limits of waterways can and should be used to influence the land use plan. On the basis of water quality standards and acceptable waste load allocations for receiving waters, desired discharge limitations are known and the amount and distribution of population and associated development can be calculated.

It is hoped that the water resource carrying capacity can be used along with other environmental constraints, transportation plans, and the provision of urban services as tools in implementing plans for the location, density, and timing of future development.

RAPPAHANNOCK AREA DEVELOPMENT COMMISSION PLANNING DISTRICT

The growth and economic expansion of the Rappahannock Area Development Commission Planning District (RADCO District) depends primarily on its position along the Route 1 - I-95 corridor extending between Washington, D.C. and Richmond (the RADCO District includes Caroline, King George, Spotsylvania, and Stafford Counties plus the City of Fredericksburg). RADCO Planning District authorities in their management plan encourage industrial facilities adjacent to key transportation networks, preferably at the intersection of two highways or a highway and railroad. As the regional focal point of the highway and rail network, Fredericksburg has been the leading urban center of the region and is expected to remain so. Several other regions are projected as growth areas as well. These include: the Aquia Creek Region in Northern Stafford County; the area along the U.S. 301 – Virginia Route 207 Corridor; and, the area adjacent to the Naval Weapons Lab at Dahlgren.

Residential and commercial growth is promoted in existing areas or where physiographic features can support these land uses and where community services (utilities) exist or can be provided. Open space and conservation zones are designated in areas with significant natural features such as flood plains, steep slopes, and wetlands.

The military facitlites within the Region (A.P. Hill Military Reservation and the U.S. Naval Weapons Lab at Dahlgren) are major employers in the area and therefore exert a major economic influence. Future growth in areas adjacent to these facilities will be dependent on status of these military installations.

NORTHERN NECK PLANNING DISTRICT

In the water quality management plan for Northern Neck, planning authorities propose that residential areas be held to either low or medium density except in or around existing population centers (the Northern Neck includes Lancaster, Northumberland, Richmond, and Westmoreland Counties). Commercial and industrial land uses are encouraged in areas where sewerage facilities are or can be provided. Officials believe that development within the Region can be effectively directed through use of such tools as water and sewer plans. If proper facilities and services are provided, residential, commercial, and industrial growth can be expected.

In order to maintain the character of the Northern Neck and to preserve certain conservation zones such as wetlands, water and sewerage facilities are proposed primarily for existing population centers.

MIDDLE PENINSULA PLANNING DISTRICT

The Middle Peninsula (which includes Essex, Gloucester, King and Queen, King William, Mathews, and Middlesex Counties) had no water quality management plan completed at the time of data collection for this report. With the exception of Gloucester County, there were also no comprehensive plans available. State planning officials of the Commonwealth identified a number of existing small towns where future growth could be expected. Table 4-6 lists areas of future growth projected for those counties which did not have a comprehensive plan. Since the Middle Peninsula is predominantly rural, few other areas besides these existing population centers should experience significant development. It is important to restate that for these counties, existing land use information was shown on Plates 4-4, 4-5, and 4-6.

TABLE 4-6

PROJECTED FUTURE GROWTH AREAS FOR
ESSEX, KING AND QUEEN, KING WILLIAM,
MATHEWS, AND MIDDLESEX COUNTIES, VIRGINIA

Growth Areas	County
Tappahannock	Essex
Walkerton	King and Queen
Manquin	King William
West Point	King William
Gwynn's Island	Mathews
Mathews Court House	Mathews
Deltaville	Middlesex
Saluda	Middlesex
Urbanna	Middlesex

Residential growth in Gloucester County is expected at Gloucester Point and the Village of Gloucester where public utilities and transportation accessibility are currently available. Commercial development is encouraged in shopping centers and local convenience centers while strip development is discouraged. Industry is promoted in planned industrial districts where water and sewer facilities and highway networks exist.

RICHMOND REGIONAL PLANNING DISTRICT

Based on the *Lower James River Basin Comprehensive Water Quality Management Study*, the future transportation network should have a sharp effect on the pattern of growth in the Richmond Region (which includes the City of Richmond and Colonial Heights and Chesterfield, Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan Counties). The beltway, planned to skirt the City of Richmond, is expected to have a great effect on the rate of growth already experienced in Central and Eastern Henrico County, Central Chesterfield County, and adjacent areas. Much of this same network will have an impact, in terms of growth, on the western portions of Henrico and Chesterfield Counties and neighboring Powhatan and Goochland Counties. As a whole, those counties fartherest away from the City of Richmond (Hanover, New Kent, Charles City, Powhatan, and Goochland Counties) should experience less development pressures than those counties immediately adjacent. Richmond itself will undergo considerable growth, particularly in that area just recently annexed from Chesterfield County.

Industrial activity is expected to double in Richmond proper. Nevertheless, such activity has increasingly dispersed in the Region due to improved accessibility, lower taxes, and little congestion in the suburbs. In addition, the outlying areas have an abundance of developable land which is relatively inexpensive. Improvement in the transportation network is expected to increase this out-migration trend. Major industrial development is planned for Charles City, New Kent, and Chesterfield Counties, particularly in areas adjacent to the Chickahominy, Pamunkey, and James Rivers. Such locations offer ready access to water transportation, water supply, and waste disposal potential. In Hanover County, industrial land uses are expected along major rail and highway networks crossing the county.

To a large degree, future commercial land uses are to be prevalent in regional shopping centers and office parks with two particularly strong corridors emerging. One extending northwest from the Richmond Central Business District (CBD) and a second extending southwest from the CBD.

CRATER PLANNING DISTRICT

Authorities from the Crater Planning District Commission (which includes Petersburg, Emporia and Hopewell and Dinwiddie, Greensville, Prince George, Surry, and Sussex Counties) propose that a multiple nuclei approach be used to accommodate future growth in and around existing towns and communities in the region. Such an approach encourages an open space conservation area around each nucleus. In addition, nuclei would be self-sufficient in terms of provision of community services. Better and stronger transportation systems, including a beltway around the tri-cities area (Petersburg, Hopewell, and Colonial Heights), are proposed to provide greater accessibility between existing population centers.

The tri-cities area has the most potential for future residential, commercial, and industrial growth in the planning district. The major highway systems which serve these cities should be responsible to a large extent, for such growth. These three cities can be expected to maintain their industrial dominance of the region.

Little developmental activity outside the tri-cities area is expected. Population is projected to decline in some portions of the region such as Greenville County. There, small growth potential exists with the exception of areas immediately adjacent to the City of Emporia where a "spill over" may be experienced.

A proposal to build a bridge connecting Surry County with Williamsburg could result in a rapid increase in development for that county. Otherwise, it may experience population declines in similar fashion to Greensville County.

SOUTHEASTERN VIRGINIA PLANNING DISTRICT

A large portion of Southeastern Virginia (which includes Southampton and Isle of Wight Counties plus the cities of Franklin, Suffolk, Portsmouth, Norfolk, Chesapeake, and Virginia Beach) is already characterized by extensive urban development. Norfolk and Portsmouth have traditionally been important urban centers and development is expected to intensify in the near future. Both will continue as important sites for industries requiring waterfront locations.

According to the *Lower James River Basin Comprehensive Water Quality Management Study*, the cities of Chesapeake and Virginia Beach are likely

to undergo substantial urban growth in the future, particularly in areas adjacent to Norfolk and Portsmouth. In Chesapeake, most commercial and industrial growth will likely occur along the Elizabeth River, the Chesapeake and Albemarle Canal, or along one of the major transportation routes in the region. Residential land use will focus on the West Branch of the Elizabeth River and south of the aforementioned canal. Virginia Beach, as a major recreation attraction, will be characterized by considerable commercial development along its major arteries. Industrial growth is most likely along roadway and rail facilities and in those areas in close proximity to Norfolk. In addition, because both Virginia Beach and Chesapeake comprise large geographic areas which are not urbanized, farm lands and other rural areas will continue to make up the bulk of both cities.

Within the City of Suffolk, development will be greatest at the hub of the rail and roadway network, near the city's geographic center. This is the area that constituted the City of Suffolk before annexation of Nansemond County. In addition, that portion of the city adjacent to the James River can expect an increase in residential, commercial, and industrial development brought about by a "spill over" from Portsmouth. Development will also be aided if the proposed James River crossing linking Suffolk with Newport News is completed.

The overwhelming portion of the counties of Southampton and Isle of Wight and the City of Suffolk are projected to remain rural. Only those areas in or adjacent to existing towns and communities (Smithfield, Franklin, Windsor, Ivor, and Courtland) or along transportation networks are likely to experience urban growth.

PENINSULA PLANNING DISTRICT

Significant growth is projected by the *Lower James River Basin Comprehensive Water Quality Management Study* over the next 20 years for most of the Peninsula Planning District which includes James City and York Counties and the cities of Newport News, Williamsburg, and Hampton. James City County which is currently the least developed area of the District will undergo considerable residential and commercial development, particularly in the Williamsburg area. The water quality management study encourages the growth of parks and open space in this portion of the District due to the region's historic significance.

In similar fashion to Norfolk and Portsmouth, the Cities of Newport News and Hamption have served as important urban centers. Urban residential,

commercial, and industrial development can be expected to intensify in both. Parks and recreation facilities are also encouraged. Institutional land uses (primarily military installations) will remain a major land use in each.

It is predicted that York County will increase its residential and commercial land use development by several fold. Most of this will center around the Towns of Williamsburg and Poquoson, and in the lower York River Area south of Yorktown. Major industrial areas will remain in the Yorktown Area, while smaller lighter industries will likely locate in the western portion of the county near Patrick Henry Airport. Institutions, parks, and recreation land uses will remain major users of land.

ACCOMACK - NORTHAMPTION PLANNING DISTRICT

With the completion of the Chesapeake Bay Bridge Tunnel linking Virginia's Eastern Shore with southeastern Virginia has come a growth in traffic flow along the major north-south artery (Route 13) through Accomack and Northampton Counties. This increase in accessibility has brought about an expansion of commercial growth as well as summer home residential development. Planning authorities have stated however, that "the next twenty to thirty years will not bring fundamental changes or considerable development to the Eastern Shore."(4) Some changes which are likely to occur, however, include:

a. Possible residential, commercial, industrial, and institutional development in some existing towns along Route 13 and in Cape Charles.

b. Commercial and residential growth in coastal areas of Chincoteague and Wachapreague-Quinby.

c. Summer home development along both the ocean and Chesapeake Bay shorelines.

d. Recreational land use development along the shorelines.

Officials from the Planning District Commission seek to preserve the rural/agricultural character of the Eastern Shore by directing the orderly growth of residential, commercial, and industrial land use.

DELAWARE

The Wilmington Metropolitan Area in northern Delaware is presently the major urban center in the State. New Castle County Planning and Zoning Commission Officials predict that this area plus neighboring Newark will experience continued residential, commercial, and industrial development. The presence of major rail and highway networks plus water and sewer facilities makes the region particularly attractive to such development. Industry will also be drawn to the area because of the favorable tax structure, availability of labor, and central location in "megalopolis" (heavy industry is barred from the coastal regions by Delaware's Coastal Zone Act).

Areas adjacent to the Chesapeake and Delaware Canal are also projected for industrial growth, providing proposed facilities do not hamper canal traffic. With the possible exception of several new towns (or planned communities) and the expansion of existing towns, the southern portion of New Castle County will remain predominantly agricultural.

Central Delaware (Kent County) will likely have three primary growth areas: the Smyrna-Clayton Area, Dover (the State Capital), and the Milford-Harrington Area. All three centers are located adjacent to the main north-south transportation spine which is made up of Routes 13 and 113. Each center should experience considerable residential and commercial growth. Some will also undergo industrial expansion.

The Comprehensive Plan for Kent County, Delaware recommends a city center type of growth for the county whereby development would be concentrated in existing centers. Community services including water and sewer, transportation, and certain other utilities would be set up only in those regions where development is desirous and feasible. Most officials agree that the planning policy for the future "should be aimed at filling in vacant areas in the urban units and encouraging orderly and concentrated future development."(5) Areas in between existing centers will remain largely rural/agricultural. In addition, the valuable conservation areas such as wetlands and stream valleys are to be preserved as open space.

Southern Delaware (Sussex County), which contains the coastal resort areas of the State, can expect substantial residential growth along the coast, adjacent to Rehoboth and Indian River Bays, and in the Seaford-Laurel Area. Much of this growth will be in the form of summer cottages and second homes. These areas will likely experience commercial growth as well. In addition, Seaford can expect industrial development. The comprehensive de-

velopment plan for Sussex County recommends that residential areas be located in places that can be efficiently provided with utility services. When water and sewer facilities are not available, soil and water table conditions and lot sizes should be such that healthy living conditions can be provided. Certain transportation improvements projected for southern Delaware will make the resort areas more accessible. This, in turn, should increase chances for growth in those areas. Development plans call for the preservation of open space which includes wetlands, flood plains, and areas of unique character (historical, natural, geological, and botanical). Such open space is also encouraged adjacent to or within urban areas to act as buffers between conflicting land uses.

FOOTNOTES

(1) Carnell Hall Blair and Willits Dyer Ansel, *Chesapeake Bay: Notes and Sketches* (Cambridge, Maryland: Tidewater Publishers, 1970), p. 36.

(2) *Chesapeake Bay Existing Conditions Report*. Appendix A - "The People and the Economy." Chapter III: Population Characteristics, p. A-III-4.

(3) National Capital Planning Commission, *Elements of the Comprehensive Plan for the National Capital* (Washington, D.C.), p. 2.

(4) Accomack-Northampton Planning District Commission, *Land-Use Report for Accomack-Northampton* (Accomac, Virginia, 1973), p. 65.

(5) Kent County Regional Planning Commission, *The Comprehensive Plan for Kent County, Delaware* (Dover, Delaware), p. 43.

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CHAPTER III

INTENSIVE LAND USE IN THE CHESAPEAKE BAY REGION

During the last few decades, with more and more emphasis placed on land use planning, a wealth of information has been written in an attempt to explain existing land use patterns and define what future patterns will be. The urban and built-up activities, which may be considered intensive land resources, are more complex than any other land use types in terms of why and how they came about. Their patterns of development are more intricate and they are commonly thought of as having a greater impact on water resources than the less intensive land resources. In this chapter, the existing intensive land resources of the Bay Region will be carefully examined. Future resources will be discussed only briefly. Projections of intensive land use will not be presented as in the case of the other land resources considered in this Appendix since the OBERS projections of population and economic activity do not project intensive land use. (The OBERS projections, which were prepared for the U.S. Water Resources Council by the Bureau of Economic Analysis and the Economic Research Service with assistance from the Forest Service, were used in Chapters IV and V to project future agricultural lands and future commercial forest lands.)

EXISTING INTENSIVE LAND USE

While an indepth analysis of all those factors accountable for development patterns in the Chesapeake Bay Region is beyond the scope of this Study, a brief explanation of some of the more important elements is provided.

The urban areas are made up of a variety of land use types as discussed in Chapter II. The factors responsible for shaping the use made of urban areas are many and varied. These include so-called economic factors such as land value, property taxes, and market accessibility; social factors such as suburbanization, location of the labor force, zoning, the availability and provision of community services, location of related land use activities, and the impact of transportation types; and physical factors such as the location of raw materials, soil and drainage characteristics, and topography. These economic, social, and physical factors interact in varying degrees to create a complex set of elements which ultimately determines the land use. For example, an industrial firm may consider property taxes and land value before deciding where to build its plant. But the location of the

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labor force is equally important as is the availability of transportation and raw materials. The zoning must also be right or the other factors do not matter. Thus, an industry must weigh all of these elements plus others in its choice of a site. Many believe that the determination of land use, particularly urban land use, is largely a market process wherein the use of each parcel is the result of economic competition among alternative uses.

To understand how land uses sort themselves out within the urban region, it is necessary to take a closer look at the structure of the metropolitan area.

Urban and built-up land is usually covered by structures and includes cities, towns, and villages; strip developments along highways; transportation, power, and communications facilities; and isolated units such as institutions and shopping centers. The largest uses of urban land are most often for housing and transportation networks such as streets and railroads.

Most of the urban centers of the Chesapeake Bay Region owe much of their present economic existence to manufacturing, and shipping (referred to here as industrial activity). Industrial activity is generally credited with helping to create the modern metropolis. Baltimore, Richmond, Norfolk and other cities of the Estuary Area developed early as ports for the export of grain and certain other agricultural commodities. These cities were frequently far inland at the head of navigation and could be reached by ocean-going vessels. Many offered good water power which proved to be of prime importance to milling industries. As these cities developed, they attracted more and more manpower. The presence of labor in turn helped lure more industrial activities as well as certain commercial activities to support larger populations.

Industry initially located along the waterfront. After its development, the railroad was built to connect waterfront industry with the city's hinterlands, thus strengthening the importance of the port areas and the urban region as a whole. Industrial activities which handled large bulk or high weight cargo were especially attracted to these port locations since these items could be transported most economically by water. Today, many of these heavy industries, such as iron, steel, and nonferrous metal refining companies, remain adjacent to ports.

The extension of the railroad throughout the urban area also allowed firms to locate along the rail network. Later, with the advent of the truck, industrial activity was no longer bound to the cities. Industries began to

locate along the highway corridors leading into and out of urban centers. Highway networks connected established industries with their raw materials and markets. In time, new businesses were attracted to these arteries so that today, industrial activity can be found along all the major networks. Increasingly, some businesses have found it valuable to situate near an airport. This is particularly true of those which produce perishable or valuable products of low-bulk weight. Proximity to airports is also a major consideration for those businesses with international markets or whose employees travel frequently.

Locating adjacent to raw material sources is an incentive for those industries involved in the processing of such heavy or bulky materials as stone and clay products. It is normally cheaper to process the materials near the quarry or mine and then ship the finished product to the market rather than ship the unprocessed raw materials.

All industries are sensitive to the availability of utilities and public services—gas, electricity, water, and sewerage. Since many require a large water supply (for the processing of their product or for cooling purposes) and must discharge equally large effluents, the availability of water and sewerage is a major consideration in site selection. On occasion, the presence of a large receiving stream may be a sufficient incentive to determine location. Certainly the availability of cooling water was a factor in the Baltimore Gas and Electric Company's decision to locate its nuclear power plant at Calvert Cliffs in southern Maryland. However, with an increase in public and governmental pressures to control discharges, waste disposal is becoming an even more significant consideration in selecting a site.

Industrial site determination is controlled by other factors as well. Management is increasingly concerned with the welfare of the worker as manifested in the availability of suitable homes, educational facilities, social opportunities, and recreation. Proximity to markets is of major significance to still other industries. Physical factors may force industries to look elsewhere even though social and economic conditions might be right. Finally, elements such as land availability and taxes can encourage or deter industrial activities from locating in a particular area. To an increasing degree, businesses are finding suburbs more attractive than the conventional locations within cities or along transportation routes. Unless an industry has a specific need, such as a location along the waterfront or proximity to some other related industry, decentralization is becoming more and more appealing. The lower tax rates and less expensive property combine with certain other advantages such as less traffic congestion, avail-

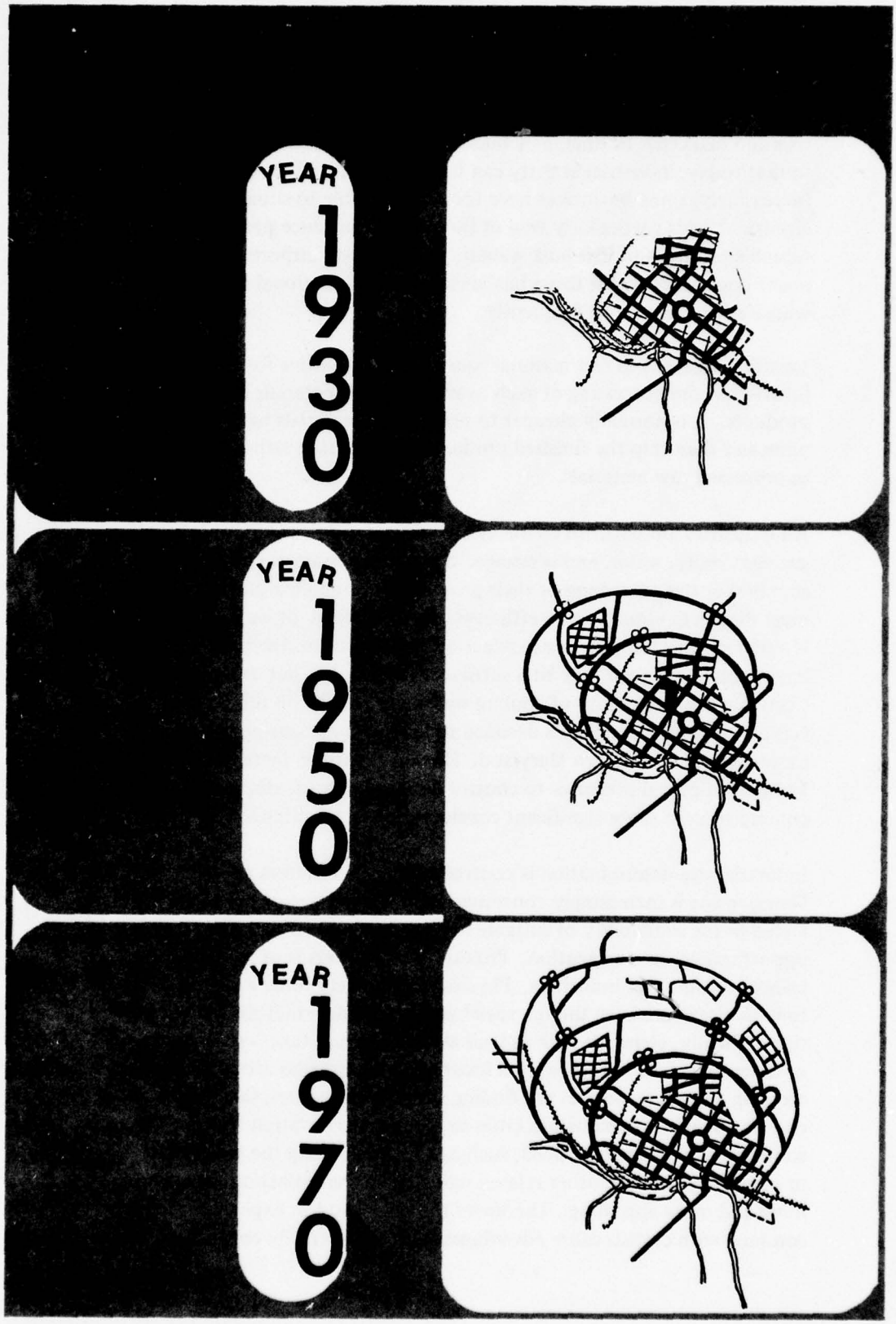


FIGURE 4-3

ability of large, attractive parcels of land and accessibility to extensive highway facilities to make the suburbs appealing. The above elements are but a few factors which explain in part the location of industry in the Chesapeake Bay Region. Nevertheless, they begin to provide an insight to the complex process of land use development which exists in the Estuary Area.

During the Twentieth Century, the suburbs have increasingly become attractive not only for location of industry but as a place to live. Before the improvement of transportation, man was forced to live and work in the same general vicinity. With the widespread use of the automobile and mass transit systems, the worker was, for the first time, free to locate where he pleased. As a result, the predominantly rural areas outside the center city developed into residential suburbs. Since World War II, more and more people have chosen to live in these suburbs where densities are lower and room exists to build single homes on large lots. The net result has been a tremendous increase in the geographic size of urban regions over what they were fifty years ago. Figure 4-3 is a schematic of the growth of the typical city of the Chesapeake Bay Region since 1930. The growth of suburbs, frequently referred to as "suburbanization," has been further enhanced by the move of industry to these areas. This development, in turn, has brought about the migration of more and more workers to their place of employment–in the suburbs.

Along with the outward migration of many industries and residences has come the move of retail stores and business services to the suburbs in order to support increased numbers of people. In addition, there has been a definite increase in the relocation and establishment of office activities (considered commercial land use) in regions adjacent to the cities. Such moves are multi-purpose. First, it allows businesses to associate with a nearby manufacturing plant or some other related land use. Second, it offers a business flexible and expandable space. Finally, it permits office workers and executives to live in the suburbs and at the same time avoid the congestion of commuting to work. For many businesses, these advantages outweigh the prestige and accessibility which a location in the center city has to offer. Thus, the trend will likely continue and more and more commercial activity can be expected in the suburbs.

Although cities are continuing their expansion outward into the suburbs and beyond, the city proper remains the socio-economic core of the metropolitan area. In the city center, neighborhoods are primarily bordered by commercial land use activities such as those of the Central Business District (commonly referred to as the "CBD"). The CBD is most often located in

or near the original site of the city and serves as the focus of transportation arteries. It thus acts as the "hub" of the city. The overwhelming portion of the CBD is in commercial use—retail and wholesale establishments; insurance, real estate, and financial institutions; professional and business services. Containing some of the most important commercial activities of the urban region, the CBD also has most of the tallest buildings, highest land values, and greatest pedestrian traffic of the metropolitan area. As commercial land uses developed in the CBD, the residential land uses were pushed out. Today, nothing but a few luxury high-rise apartments, townhouses, and a scattering of slum residences exist near the city center. Just beyond the CBD is a belt of rather high density residences intermixed with commercial land uses. Beyond this inner residential belt are the suburban residences reaching out in all directions, but particularly along corridors of easiest travel. These patterns of development are easily seen in Plates 4-1, 4-2, and 4-3. The density of residential land decreases away from the CBD.

While the CBD contains the greatest concentration of commercial activity in the urban area, there are outlying commercial centers which have usually developed at one of the focal points of intracity transportation. Regional centers are normally built around one or more department stores and other variety and convenience stores. Community centers are smaller yet and are centered around a junior department store. Neighborhood centers are more numerous than the other commercial centers and normally contain a supermarket as well as some other smaller stores. In addition to these centers, there are other forms of commercial activity present within or adjacent to the city proper. Minor commercial establishments with small volumes of trade are frequently found at intersections where establishments may take advantage of high traffic flow. Certain functions, such as retail stores, benefit from "public exposure" by locating along major arteries in what is known as "ribbon development." Frequently one type of business activity—such as automobile or furniture sales—will locate near competitors along an artery. These areas are known as "rows" (automobile rows, furniture rows, and so on).

The structure of some urban areas is influenced by certain independent factors. For example, some residential and commercial areas have developed around industrial areas. In the Baltimore Metropolitan Area, relatively dense neighborhoods grew up adjacent to the large Bethlehem Steel mills at Sparrows Point. Recently, such development has been taking place near industrial parks and complexes. In other instances, residential and commercial land uses have developed around college campuses (College Park, MD). Still other neighborhoods have been planned such as Greenbelt and

Columbia, Maryland and Reston, Virginia. These latter areas normally include commercial and industrial activities along with the residential areas. Most are phenomena of recent times, although Greenbelt was one of the first planned communities in the Country.

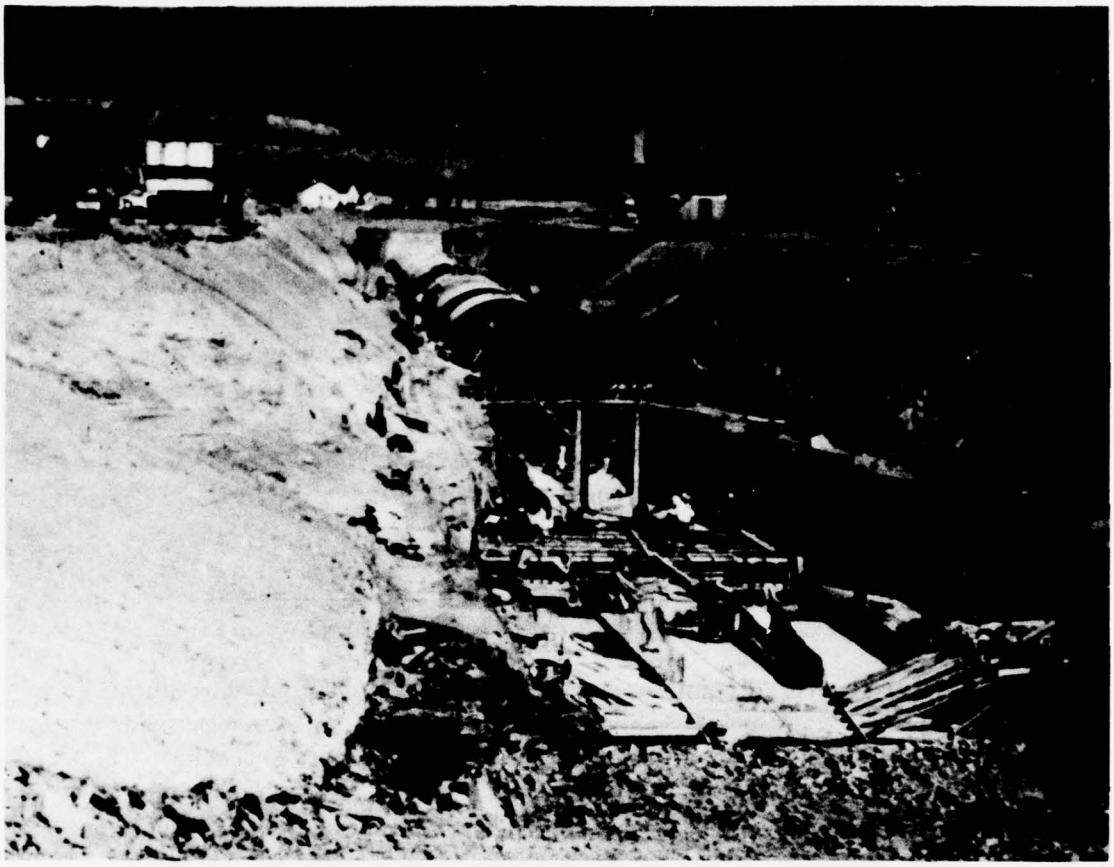
Rugged or unusual land features continue to act as a barrier to the uniform spread of population. With the exception of wetlands and water bodies, however, few other physical features, on a large scale, have inhibited growth in the Chesapeake Bay Region. Land which was previously set aside as public park land or for institutional use, however, often acts as a man-made barrier to the uniform spread of residential neighborhoods. Such has been the case in all of the major cities of the Estuary Area (and many of the minor ones, as well) where founding fathers set aside lands for recreation and parks. Such barriers are desirable from the point of view that they make urban living more pleasant and enjoyable.

CONFLICTS INVOLVING INTENSIVE LAND RESOURCES AND THE REGION'S WATER RESOURCES

A variety of wastes are contributed to the area's waterways from lands which are intensively used, including: industrial effluents, domestic sewerage, solid wastes, and storm runoff. If not properly treated, all of these can create severe water quality problems in the Bay and its tributaries. Concentrations of wastes are normally highest where urban land use is most intense. While the water quality of Chesapeake Bay as a whole is good, some serious problems exist in the water bodies adjacent to Wilmington; Baltimore; Washington, D.C.; Richmond; and the Hampton Roads Area. Water quality problems can be severe enough to result in fish kills, destruction of other valuable biota, and loss of fish and wildlife habitats. Water quality of the Chesapeake Bay Region is investigated in further detail in Appendix 7 of this Report.

As stated earlier, urban construction is responsible for denuding the natural cover and exposing the soil beneath. According to some sources, the amount of sediment derived by erosion from areas under construction for highways or residential, commercial, or industrial development may exceed by several hundred-fold the yields from lands in forests and grazing.(1) The rapid urbanization/suburbanization which has characterized the Estuary Area, particularly since World War II, has magnified the problem.

Increased stormwater runoff from urban areas can be attributed to the large amounts of land which have been "paved over" by the construction of



Denuding the earth's surface can lead to serious erosion problems.

buildings, roads, parking lots, and other structures. This paving can limit the absorption capabilities of the basin and without the proper drainage facilities, severe flooding problems can result. Many examples of this can be seen in the metropolitan areas of the region. Urban runoff is also a major source of settleable solids, pathogens, and bacteria and a contributor of oil, herbicides, insecticides, and organic compounds.

As discussed earlier, the relatively level, productive flood plains are attractive for a variety of urban uses. Many of the cities and towns of the Bay Region developed wholly or in part on these flood plains. While these locations have proven beneficial to intensive land use development in many ways, they have also been detrimental as witnessed by the periodic flooding which occurs on the flood plains.

An increase in population in the Estuary Area coupled with expanded per capita consumption of water has brought about greater demand for water supply. Urban dwellers have particularly high rates of consumption since they require large amounts of pure water for domestic consumption, industrial processing and cooling, recreation, fire control, and numerous other uses. The water supply demands in the Bay Region are investigated to a greater degree in Appendix 5 of this Report entitled "Municipal and Industrial Water Supply."

Sizable portions of the Chesapeake Bay Study Area have undergone rapid urbanization during the twentieth century and even earlier. While the trend has intensified since World War II, recent indications show that there may be a slowing down, at least in some areas. Much of the past urban development has been uncoordinated, rampant sprawl resulting in many of the conflicts discussed above. With projected increases in population and expansion of existing urban areas, these conflicts can be expected to continue. As highway and building construction intensifies, pollution and sedimentation of receiving streams can expect to increase. As larger and larger areas are paved, larger amounts of stormwater runoff and erosion of exposed soil will occur. These have had serious consequences in the past and should prove even more of a threat in the future. Water for municipal and industrial uses is another important consideration in assessing the impact of future development. With ever-growing populations and continuing suburbanization comes a growing demand for water. Studies have shown that substantially more water per capita is required by low density sprawl development than that required by high density development. Thus, increased water demands can be expected.

The above analysis discusses but a few of the conflicts and problems between intensive land uses and the water resources of the Chesapeake Bay Region. Nevertheless, it serves to provide a more thorough understanding of some of the pressures placed on a region's water resources by its land use.

FACTORS EXPECTED TO INFLUENCE FUTURE LAND USE DEVELOPMENT

Planning authorities recognize that a number of factors have influenced (hindered or promoted) intensive land use development in the past and that these same determining factors will have a role in shaping future land use. Several of the primary determining factors will be considered below.

WATER AND SEWER SYSTEM DEVELOPMENT

More and more planning authorities are recognizing the fact that urban development cannot and should not be allowed without adequate provision of water and sewer systems. The furnishing of such utilities is and will continue to be a "leading" land development variable. Generally, the extension of utility services during a given period of time will be reflected as urban growth in the subsequent period. More specifically, the location and quality of water and sewerage facilities help determine the location, amount, and timing of urban development. It is particularly essential that areas with high water tables or poorly drained soils have some form of central treatment in order to support development.

To date, utility service policies have not purposely been used to any great extent to determine the location and timing of urbanization. In the future, this is likely to change as water and sewer development become a widely used tool in guiding growth. In some cases, waste load limits of waterways are or will be used to shape the land use plan. The carrying capacity of water resources can be used as a primary constraint upon preparation of the land use plan. In some areas, development is being prohibited if public sewerage facilities are not available and if soil and topographic conditions are unsuitable for individual septic tanks. The provision of water and sewer services are being used in other cases to actually phase new growth in conjunction with existing water and sewer service capabilities and rational extension of such services to comply with the comprehensive plan. In still other locations, development of residential, commercial, and industrial land uses have been effectively aborted because of overtaxing of existing facilities.

Most of the county and municipal governments within the Study Area have published master plan guidelines for water and sewerage. To become familar with specific guidelines and plans for utility development within the Chesapeake Bay Region, it is suggested that the individual county and city master plans for water and sewerage be consulted.

TRANSPORTATION DEVELOPMENT

The importance of efficient transportation networks to the development of an urban center cannot be overstated. As discussed earlier, cities and towns have traditionally located at the intersection of or adjacent to transportation systems. Today, more than ever, the growth of residential, commercial, and industrial activities requires accessibility to a roadway or rail "lifeline." Such a lifeline is essential to full growth and enjoyment of economic, social, cultural, and educational opportunities. The Washington Metro, for example will likely aid longer distance commuting. People will find it easier to work in the city center while living in the outer suburbs.

Much of the new highway and road construction in the Estuary Area will be aimed at relieving congestion in metropolitan areas and opening up rural areas that were previously inaccessible. This new development will obviously alleviate many traffic problems. But the consequences will be more far reaching than this. Urban development may occur in certain areas where new transportation networks are planned, particularly in areas near interchanges or at crossroads.

FUEL COST AND AVAILABILITY

During the post World War II period, most of the urban centers within the Estuary Area have experienced varying degrees of suburban sprawl. Only a few land use controls (such as zoning and an occasional sewer moratorium) have been effective in curbing this "rampant" development. Since 1973 however, a new factor has been introduced which may prove to have an important "limiting" effect on growth. With the advent of the "fuel crisis" has come a sharp increase in gasoline prices and a concurrent fear of a decrease in fuel availability. The higher cost of commuting from the outer urban fringe areas to the center of the city for work or shopping could be a great enough factor to help curb the uncontrolled push of residential, commercial, and industrial activities outward.

FUTURE INTENSIVE LAND USE IN THE CHESAPEAKE BAY REGION

The rapid growth which the Bay Region has undergone during the Twentieth Century, and particularly since World War II, is not necessarily an indication of what future growth and development will be like. However, urban development is expected to continue at least during the rest of this century in the cities and suburbs of the Estuary Area. More people in expanding urban nucleations is what the future appears to hold. These people will, in all probability, continue to opt for low-density living. Most patterns of growth are likely to occur in a manner similar to the past. Generally, counties which are moderately or heavily urbanized are expected to experience additional growth. Some counties which are lightly urbanized (particularly those within Standard Metropolitan Statistical Areas) can expect sharp increases in growth rates. Development pressures will remain highest in those counties closest to the large cities of the Region. Areas which are primarily rural will likely remain so. In such rural areas, only land in or immediately adjacent to existing towns and communities or along transportation networks are likely to experience limited urban development in the future.

Continued pressure for second home and recreational development along the shoreline of Chesapeake Bay and its tributaries as well as along the Atlantic Ocean can be expected to increase as leisure time increases and better and faster means of transportation are developed.

Planned communities, for the most part a product of the post World War II period, are likely to grow in number during the last part of the Twentieth Century. Many planning authorities are promoting these "self-contained" centers which offer a more efficient alternative to the strip settlement which presently characterizes large portions of the Region.

A proposal exists to develop oil and natural gas resources from the Baltimore Canyon Trough Area of the Mid-Atlantic Outer Continental Shelf. Such energy development, by requiring the construction of staging areas, pipelines, tank farms, gas processing plants, and perhaps new refineries, would have a significant impact on adjacent land areas within the Study Area. In addition to construction of the above energy-related facilities, it would be necessary to provide public facilities and services to support increases in population and industrial operations. Such public facilities include new or expanded roads, schools, water and sewerage and other community services.

Much of the land within the Chesapeake Bay Region needed for future urban use will be provided by the existing agricultural and forestry land resources. These resources will be examined in Chapters IV and V, respectively.

FOOTNOTES

(1) M. Gordon Wolman, *A Cycle of Sedimentation and Erosion in the Urban River Channels* (Department of Geography, Johns Hopkins University – Reprint from *Geografiska Annaler*, Vol. 49, Series A 1967 – 2-4), p. 387.

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CHAPTER IV

AGRICULTURAL LAND IN THE CHESAPEAKE BAY REGION

Since earliest settlement the Chesapeake Bay Region has been an important agricultural area, offering excellent physical parameters for farming. Over the years, however, increased urbanization and ready markets have caused a change in the type of agriculture and the nature of farm production. In this chapter agricultural land will be assessed as a resource in terms of its past, present, and future use. In addition, both existing problems and conflicts involving the resource as well as future problem areas will be investigated.

DESCRIPTION OF REGION

Two of the most important physical parameters affecting agriculture are climate and soil, though such factors as geology, slope, and drainage have a substantial influence as well. The Chesapeake Bay Region's climate is probably best described as temperate with certain minor variations from subregion to subregion. For the most part, the climate of the entire Estuary Area is conducive to general farming. The portions of the Study Area adjacent to or in close proximity to Chesapeake Bay and its Sub-estuaries have what is described as a "moderating" climate with relatively even day/night temperatures. Winters are usually mild and summers are characterized by high humidity and warm days and nights. Areas further "inland" (to the west of Chesapeake Bay) generally have a more "continental" type climate characterized by slightly more extreme temperatures and somewhat less humidity. Growing seasons are longer in the southern portion of the Study Area than areas approximately 200 miles to the north.

Soil types, unlike climate, vary significantly from area to area. The quality of soil within the Estuary Area ranges from some of the best on the east coast of the United States to soils that are incapable of producing any agricultural product. Soils of such poor quality include rock outcrops, sandy beaches, tidal marshes, and other barren lands.

Soils of the Coastal Plain, which make up a significant portion of the Chesapeake Bay Study Area, are generally sandy or silty and of very light to medium texture. In some areas, these soils suffer from inadequate water holding capacity (because the sand composition is so high) or poor

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drainage, particularly in low-lying areas. Extensive use of conservation practices such as providing adequate drainage systems is helping to correct certain of these problems.

The Piedmont Province, to the west of the Coastal Plain, contains residual soils which tend to be medium textured, moderately permeable, easily tilled, and of higher fertility than those of the Coastal Plain. On slopes of the Piedmont, these soils may become shallow and quite often are gravelly or shaly.

When properly treated with lime and/or fertilizer, the Bay Region's soils are ordinarily quite fertile and will produce for an almost indefinite period. Soils can differ markedly, however, over a very small geographic area. Thus, one geographic region may be characterized by high agricultural productivity but in certain localized areas, due to other "intervening" factors such as size and shape of soil particles, the soil may be unproductive. The best agricultural soils are loams, silty loams, or fine sandy loams which are a blending of fine and coarse materials. Soil survey maps, produced by the soil Conservation Service in cooperation with the State Agricultural Experiment Stations, are available for almost every county within the Bay Region.

Other "non-physical" factors responsible for the agricultural importance of the Chesapeake Bay Region are the close proximity of sizeable markets and the availability of good transportation facilities. These factors have helped bring about the development of certain specialized-type farming including truck farms, dairying, poultry farms, and nurseries.

HISTORY OF AGRICULTURE IN THE REGION

From the time the first European settlers came to the shores of Chesapeake Bay, one of man's chief pursuits has been agriculture. The early farmers soon became self-sufficient, growing their own food and providing most of their other staples. Agricultural yields of the virgin soil were quick and certain. Indian corn, potatoes, and tobacco came to dominate in a relatively short period.

With increased demand, particularly in Europe, tobacco rapidly became the chief export, dominating the economy. The Bay's extensive network of waterways opened up thousands of square miles of land to cultivation and allowed planters to load their crops, with little effort, onto ships almost at their doorsteps.

Gradually, due to socio-economic conditions which prevailed at the time, and because the once-fertile soils were "wearing-out," many of the farmers of the Chesapeake Bay Region began to diversify. Although tobacco still remained dominant in many areas (particularly southern Virginia and southern Maryland), corn and wheat were found to do well on the impoverished soil and were therefore substituted. Wheat markets sprang up in the West Indies, southern Europe, and New England and by the mid-19th Century, the crop had replaced tobacco as the chief staple of much of the tidewater portions of the Estuary Area. By 1830, Maryland and Virginia alone were producing over one-half of the wheat raised in North America.(1)

Just prior to the Civil War, the agriculture of the Region became increasingly diversified. The Coastal Plain's relatively level topography, sandy soil, moderate climate, and advanced growing season made the production of "truck crops" particularly advantageous. "Truck crops" include such vegetables as tomatoes, corn, melons, potatoes, cucumbers, and beans and such fruits as apples, peaches, pears, cherries, and strawberries. In 1854, the first shipment of such crops was sent from the Eastern Shore to New York. This trade has thrived to the present. Around 1900, farmers on the lower Eastern Shore began planting Irish potatoes and sweet potatoes, early in the season. These crops were then followed with corn. Kale, cabbage, onions, strawberries, and tomatoes were also grown. By 1920, over 50,000 acres in this subregion were annually planted in potatoes.(2) Accomack and Northampton Counties in Virginia and Worcester and Somerset Counties in Maryland were among the leading potato producing counties in the U.S. By 1960, soybeans, tomatoes, and potatoes were the main crops on the lower Shore. And, the broiler industry had become one of the largest industries on the entire Eastern Shore. Additionally, this same region had the distinction of being one of the leading tomato producing areas in the country.

The region is today one of the most important suppliers of fruits and vegetables to the heavily populated Northeast. Faster marketing brought about by the advent of the railroad and later the truck, aided in this development. Refrigeration as well as the growth of the canning and freezing

industries was also beneficial in making truck farming a lucrative activity. The demand for fresh produce has continued to increase as urban populations in close proximity have expanded.

Due to the perishable nature of milk, regions adjacent to or in close proximity to urban centers became important dairying regions. Grasses, alfalfa, and oats grew well in the Estuary Area and thereby further supported the dairy industry.

During more than 300 years of agriculture in the Bay Region, significant changes have occurred. The early plantation system has been replaced by a more highly mechanized type farming. In addition, technological developments in transportation and other fields, the rapid increase in population in the East, and favorable physical parameters have combined to stimulate the production of a variety of agricultural products such as milk, vegetables, fruit, soybeans, wheat, tobacco, peanuts, and poultry and thus helped maintain the agricultural significance of the Chesapeake Bay Region.

PRESENT STATUS OF AGRICULTURE AND AGRICULTURAL LANDS IN THE CHESAPEAKE BAY REGION

At present, agriculture within the Study Area is well diversified with poultry and poultry products, vegetables, livestock, dairy products, corn, oil crops (soybeans and peanuts), tobacco, nursery and greenhouse products, and wheat representing the major farm commodities produced. Information dealing with the value of farm commodities produced within the Chesapeake Bay Region can be found in Appendix 3 "Economic and Social Profile." The quantity of land in farms has declined from almost 7.7 million acres in 1954 to less than 5.5 million acres in 1969, a reduction of close to 30 percent. In this Section, the present status of both agriculture and agricultural land in the Estuary Area will be examined along with the various Federal and State management responsibilities related to farm activity.

PRESENT RESOURCE USE

As with certain other areas of the U.S., the decline in the amount of land in farms in the Bay Region is due in large part to urbanization. Those portions of Maryland, Virginia, and Delaware within the Study Area all experienced steady declines in the number of acres in farms. A specific breakdown, by County in 1969 is found in Table 4-7.

TABLE 4-7
NUMBER OF ACRES OF FARMLAND IN 1969,
BY COUNTY, WITHIN THE CHESAPEAKE
BAY STUDY AREA

STATE/COUNTIES		ACRES
Delaware		
Kent		219,788
New Castle		113,251
Sussex		340,856
	STATE TOTAL	673,895
Maryland		
Anne Arundel		63,159
Baltimore		117,723
Calvert		62,306
Caroline		132,782
Carroll		188,656
Cecil		113,710
Charles		106,662
Dorchester		139,583
Harford		133,452
Howard		75,843
Kent		148,420
Montgomery		116,006
Prince Georges		92,156
Queen Annes		170,589
St. Marys		95,146
Somerset		69,744
Talbot		125,154
Wicomico		112,545
Worcester		128,142
	STATE TOTAL	2,191,778
Virginia		
Accomack		105,031
Caroline		84,533
Charles City		25,199
City of Chesapeake		69,333
Chesterfield		31,851

STATES/COUNTIES	ACRES
Virginia (cont'd)	
Dinwiddie	121,797
Essex	72,022
Fairfax	36,211
Gloucester	35,206
Goochland	85,346
Greensville	74,674
Hanover	142,169
Henrico	40,192
Isle of Wight	102,108
James City	20,580
King & Queen	54,508
King George	40,492
King William	61,285
Lancaster	26,468
Loudoun	216,574
Mathews	11,326
Middlesex	26,436
Nansemond (now City of Suffolk)	104,660
New Kent	30,410
Northampton	51,160
Northumberland	50,140
Prince George	66,476
Prince William	62,600
Powhatan	47,623
Richmond	47,109
Southampton	202,909
Spotsylvania	72,030
Stafford	35,530
Surry	71,826
Sussex	131,544
Virginia Beach	52,486
Westmoreland	64,978
York	10,642
STATE TOTAL	2,585,464
STUDY AREA TOTAL	5,451,137

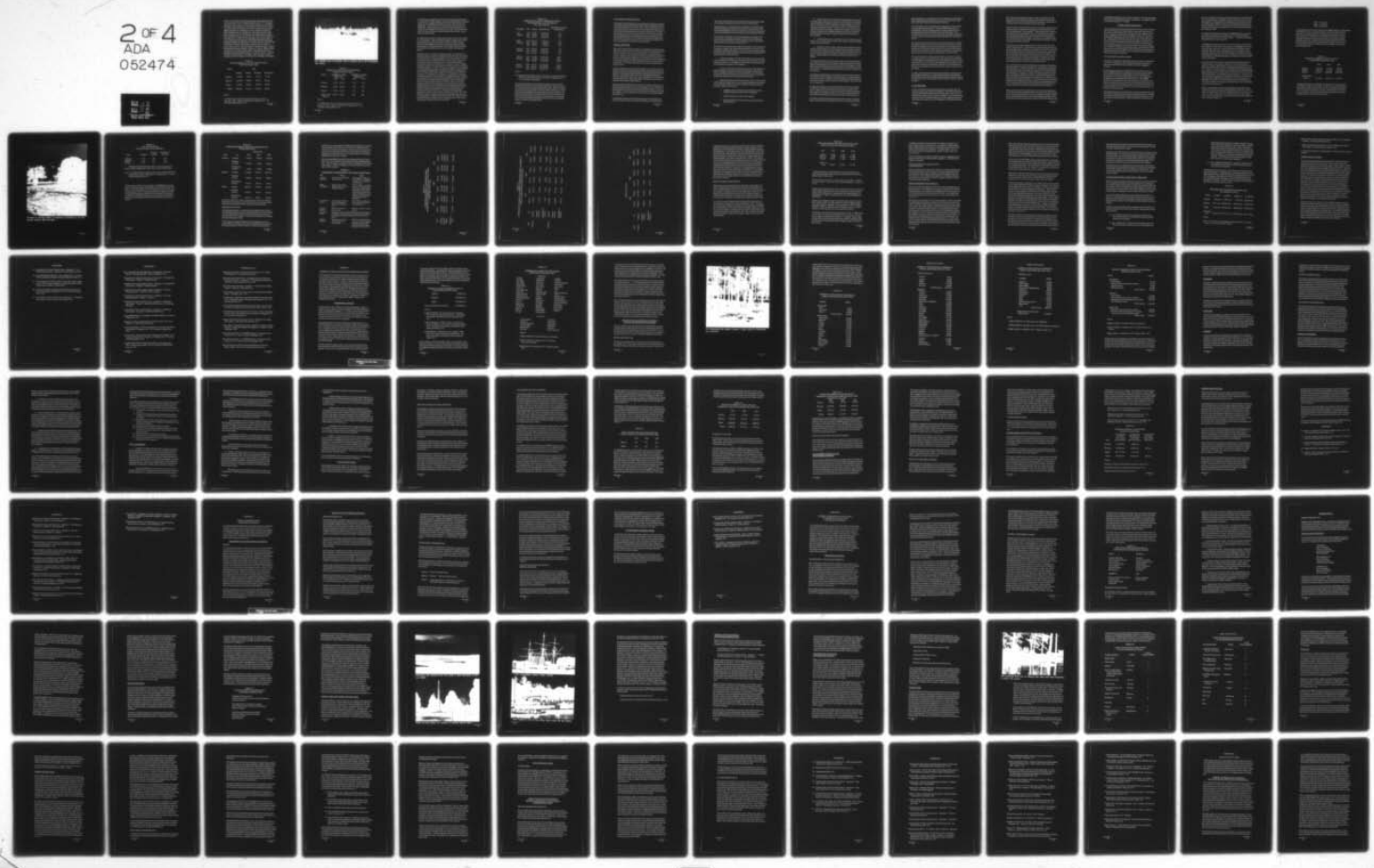
Source:

U.S. Department of Commerce, Bureau of the Census. *Census of Agriculture, 1969.* Volume I Area Reports. Washington, D.C.: U.S. Government Printing Office, 1972.

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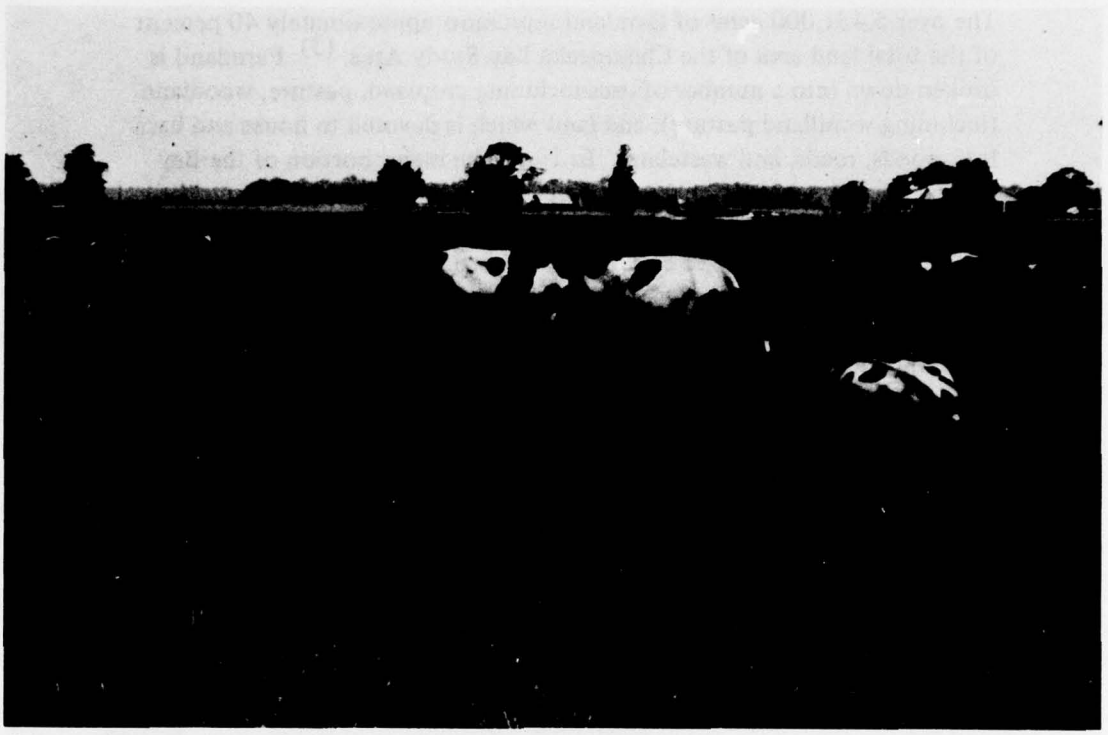
The over 5,451,000 acres of farmland represents approximately 40 percent of the total land area of the Chesapeake Bay Study Area. (3) Farmland is broken down into a number of uses including cropland, pasture, woodland (including woodland pasture), and land which is devoted to house and barn lots, ponds, roads, and wasteland. In 1969, the major portion of the Bay Region's farmland, over 2,866,500 acres was in cropland; woodland on farms constituted almost 1,582,500 acres; and pasture, almost 451,500 acres. The balance, or over 550,600 acres was in miscellaneous farmland. Table 4-8 shows the various uses of farmland in 1969, in acres, by State, for the Estuary Area. It should be noted once again that the total number of acres of agricultural land presented in this Chapter differs from that figure presented in Chapter II of this report. The reason for this is that the *Census of Agriculture* was used in this chapter in order to show the number of acres of land by county. That data included "woodland on farms". Remote sensing data were used in Chapter II, however, in order to digitize acreage for all land use types within the Bay Region. This digitized data did not distinguish between commercial forest and "woodland on farms." Therefore all forests were considered to be woodland. Hence, the figure for agricultural land set forth in Chapter II is less than that presented in this Chapter

TABLE 4-8
USE OF FARMLAND, IN 1969, IN ACRES, BY STATE,
FOR THE ESTUARY AREA

STATE	USE			
	Cropland	Pasture	Woodland	Miscellaneous
Delaware	478,709	26,647	121,117	47,422
Maryland	1,253,924	190,887	497,623	249,344
Virginia	1,133,899	233,925	963,759	253,881
TOTAL	2,866,532	451,459	1,582,499	550,647

Source:

U.S. Department of Commerce, Bureau of the Census. *Census of Agriculture, 1969.* Volume I, Area Reports. Washington, D.C.: U.S. Government Printing Office, 1972.



Over 450,000 acres of farmland were in pasture use in the Chesapeake Bay Region.

TABLE 4-9
NUMBER OF ACRES AND FARMS IRRIGATED
WITHIN THE STUDY AREA

STATE	NUMBER OF ACRES IRRIGATED		NUMBER OF FARMS IRRIGATED	
	1964	1969	1964	1969
Delaware	17,542	20,421	158	164
Maryland	14,307	19,825	419	491
Virginia	17,453	18,387	439	294
STUDY AREA TOTAL	49,302	58,633	1,016	949

Source:

U.S. Department of Commerce, Bureau of the Census. *Census of Agriculture, 1969.* Volume I, Area Reports. Washington, D.C.: U.S. Government Printing Office, 1972.

In discussing the agricultural land resources of the Chesapeake Bay Region, it is important to consider irrigation, a farming technique which an increasing number of farm managers are turning to in order to improve their land's productivity. In 1969, 949 farms in the Study Area were irrigating over 58,600 acres. This represented an increase of almost 20 percent over the number of acres irrigated in the Estuary Area in 1964. Table 4-9 shows the number of acres and number of farms irrigated within the Study Area, by State, for 1964 and 1969.

For additional information on farms irrigated within the Study Area, Appendix 6 of this Report ("Agricultural Water Supply"), prepared by the Economic Research Service, may be consulted. It should be noted that table figures may differ slightly from those of the Economic Research Service because Sussex, Goochland, Powhatan, and Greensville Counties (Virginia) were included in this Appendix in order to incorporate whole planning districts.

While there has been a decrease in agricultural lands, farm production has steadily increased. An analysis of production within the Study Area between 1959 and 1969 for five select commodities (corn, wheat, soybeans, tobacco, and peanuts) indicates a definite increase in output. (These crops were selected because they represented some of the most valuable agricultural commodities produced in the Study Area. In addition, data were available showing the number of acres in production for each product and the number of bushels produced, by county.) The production analysis was accomplished by conducting a historical study of production for the five crops using the 1959, 1964, and 1969 Censuses of Agriculture published by the Bureau of the Census, U.S. Department of Commerce. It was possible to determine overall productivity for each commodity by dividing the number of bushels (or pounds) of each crop produced within the Study Area by the number of acres in production in that particular commodity. Table 4-10 shows the number of acres in production for each product, number of bushels (or) pounds) produced, and the productivity for each commodity (number of bushels or pounds per acre). Examination of productivity figures indicates that there has been an overall increase for those commodities surveyed between the years 1959 and 1969. It should be noted that soybean production in 1964 was down from that experienced in 1959. This is most likely due to adverse weather conditions such as drought which may have been responsible for a smaller crop within the Study Area. While total land in farms has declined, acreage in some commodities such as corn, peanuts, and soybeans, increased between 1959 and 1969.

TABLE 4-10
PRODUCTION OF SELECT COMMODITIES WITHIN
THE CHESAPEAKE BAY STUDY AREA IN
1959, 1964, AND 1969

Commodity	Year	Acreage	Bushels/Pounds	Bushels/Pounds per Acre (Productivity)
Corn	1959	783,043	40,284,138	51.4
(Bushels)	1964	750,687	47,523,305	63.3
	1969	851,976	69,283,378	81.3
Wheat	1959	225,128	5,812,334	25.8
(Bushels)	1964	189,877	5,789,610	30.5
	1969	174,026	7,130,676	41.0
Soybeans	1959	595,659	13,262,487	22.3
(Bushels)	1964	663,463	10,854,766	16.4
	1969	615,351	17,002,024	27.6
Tobacco	1959	45,466	41,141,278	904.9
(Pounds)	1964	42,304	45,273,289	1,070.2
	1969	27,687	31,521,986	1,138.5
Peanuts	1959	98,745	176,706,834	1,789.5
(Pounds)	1964	100,134	189,193,988	1,889.4
	1969	102,461	232,132,356	2,265.6

Source:

U.S. Department of Commerce, Bureau of the Census. *Census of Agriculture* (For 1959, 1964, 1969) Volume I Area Reports. Washington, D.C.: U.S. Government Printing Office.

Increases in farm production are generally attributable to better farming methods which include the use of chemical fertilization, effective crop rotation, contour plowing, and irrigation during dry seasons. Proper soil conservation practices have also helped achieve these higher yields per acre. Such practices include planning for the agricultural use of land according to soil types and terrain conditions, thus allowing the farmer to use his land to its optimum; leaving the banks of waterways and steep slopes in sod or forest cover; and practicing intensive farming on soils that are level, well-drained, resistant to erosion, and generally fertile.

MANAGEMENT RESPONSIBILITIES

The outlook of the average farmer in the Chesapeake Bay Region has changed considerably from his early forebears, many of whom regarded the land as a more or less expendable resource. The "present day" agriculturalist is concerned with the preservation and conservation of his holdings. The cumulative impact of his decisions regarding land use cannot be overestimated. To aid him in making wise decisions, there are presently numerous Federal, State and local agencies and organizations whose programs are specifically designed to help solve problems relating to the conservation and improvement of agricultural lands. This section will discuss some of the more important programs which have been established to assist the farmer in his efforts.

FEDERAL PROGRAMS

Many of the Federal assistance programs are established in cooperation with State and local agencies in order to more effectively encourage landowners to initiate conservation practices. The U.S. Department of Agriculture has a number of agencies under its jurisdiction which have agricultural research and resource conservation responsibilities. These include the Soil Conservation Service, the Farmers Home Administration, the Cooperative Extension Service, the Agricultural Stabilization and Conservation Service, the Agricultural Research Service, the Economic Research Service, and the Cooperative State Research Service.

The Soil Conservation Service (hereafter referred to as the SCS), through its Resource Conservation and Development program, assists local people in initiating and carrying out long-range programs involving technical and financial assistance. Such programs help the farmer in initiating flood prevention measures, sedimentation and erosion control, agricultural water management, rural community water supply, water quality management, and control and abatement of agriculture-related pollution.

Through the SCS's Establishing Act technical and consultive assistance is offered to individuals, groups, and units of government in the development and productive use of the nation's soil, water, and related resources. The agency also publishes soil surveys of counties and other units to aid landowners, planners, engineers, zoning commissions, and developers in locating soils suitable for specific uses.

The Watershed Protection and Flood Prevention Act, also administered by the SCS, provides for assistance in planning, designing, and installing water-

shed works of improvement and in sharing costs of flood prevention, irrigation, drainage, and sedimentation control in small watershed areas.

Through another act, the Soil and Water Conservation Act, the SCS works with cooperating agencies and groups in providing new and improved plant materials including grasses, shrubs, and legumes for conservation purposes and environmental improvements such as erosion control and sediment reduction.

Finally, the SCS assists States and other Federal agencies, through its river basin program, in preparing comprehensive plans for the development of water and related land resources. Full consideration is given to agricultural program impacts on resource development and use.

The Farmers Home Administration makes loans available to various State and local agencies, organizations, and individual landowners for a variety of conservation and improvement programs. Some of the more important programs administered by the FHA with regard to the preservation and maintenance of agricultural lands are discussed below.

a. *Irrigation, Drainage, and Other Soil and Water Conservation Loans.* Loans are provided for facilities associated with irrigation, drainage, and other conservation measures. To be eligible for these loans, the proposed facilities must primarily serve farmers and rural residents.

b. *Resource Conservation and Development Loans.* These loans are to accelerate programs of resource conservation, development, and utilization when such programs will increase economic opportunities for local people. Among other things, these loans may be used for soil and water development, conservation, and control as well as shift-in-land use facilities.

c. *Watershed Protection and Flood Prevention Loans.* Loans are made to sponsoring local organizations, such as municipal corporations and soil and water conservation districts to be used for watershed protection and flood prevention. Monies can be used for:

1. installation, repair, and improvement of facilities to drain farmland and store and convey water for irrigation.

2. pollution abatement by stream flow regulation.

3. special land treatment measures and structures primarily for flood prevention.

d. *Soil and Water Loans.* The objectives of this program are to facilitate improvement, protection, and proper use of farmland by providing adequate financing and supervisory assistance for soil conservation; water development, conservation, and use; drainage of farmland; establishment and improvement of permanent pastures. Loans are used to: carry out basic land treatment practices such as liming, fertilizing, and seeding; purchase pumps, sprinkler systems and other irrigation equipment; restore and repair ponds and tanks, ditches, and canals for irrigation; dig ditches and install tile to drain farmland.

e. *Farm Operating Loans.* Loan funds are used to purchase livestock, poultry, and other farm animals; purchase farm equipment; provide operating expenses for farm enterprises.

f. *Emergency Livestock Loans.* Funds are made available to farmers, ranchers, and oyster planters to cover losses resulting from designated disasters so that they may continue farming or livestock operations. Monies are to be used for replacing equipment and livestock damaged or destroyed by natural disasters, to make repairs, and to refinance debts made necessary by the disasters.

The Cooperative Extension Service provides grants for educational programs based upon local needs in the broad fields of agricultural production and marketing, rural development, home economics, and youth development. These grants are made to land-grant institutions which provide educational and technical assistance to the general public through State and county extension service personnel.

The Agricultural Stabilization and Conservation Service (hereafter referred to as the ASCS) provides emergency conservation measures to enable farmers to control wind erosion on farmlands, and to rehabilitate farmlands damaged by wind erosion, floods, hurricanes, and other natural disasters. Grants are made on a cost-share basis.

Through another program, the Rural Environmental Conservation program, the ASCS helps farmers and woodland owners to carry out approved soil, water, woodland, and forestry incentives and wildlife conservation practices. This program was established to assure the wise use and adequate protection of the Nation's agricultural lands and to improve man's total environment.

The ASCS's Cropland Adjustment program is another voluntary program designed to help farmers divert cropland to protective conservation uses under

long-term agreements. Land is taken out of crop production and participants receive adjusted payments calculated as a portion of the value of the crops which would have otherwise been produced on the land.

Two other agencies of the U.S. Department of Agriculture are also involved in assisting agricultural landowners. The Agricultural Research Service, through grants, performs agricultural research, evaluates alternate ways of attaining goals, and provides scientific and technical information. The Economic Research Service conducts research and disseminates information on the economic factors affecting commercial agriculture and rural community life.

The Cooperative State Research Service provides research grants to the State Agricultural Experiment Stations, forestry schools, and land-grant colleges for basic and applied research to further the programs of the Department of Agriculture. Such programs include research for crop and livestock improvement as well as in the areas of rural community development, environmental quality, human nutrition, plant and animal diseases, and pest control.

The Rural Electrification Administration (REA) is not involved in research or conservation but has, nevertheless, had a major influence on development in the Bay Region. The Administration finances dependable, modern, central station electric service in rural areas. Providing long-term, low-interest loans to rural electric cooperatives, public utility companies, and municipalities, the REA has been responsible for much of the electric power in rural areas of the Bay Region.

To qualify for Federal technical and/or financial assistance, applicants must meet specified requirements. For additional information on the programs discussed above as well as other Federal program benefits available to agricultural landowners, the *1974 Catalogue of Federal Domestic Assistance* may be consulted.

STATE PROGRAMS

As part of the Federal Cooperative Extension Service program, State and county extension service offices are established to help achieve the broad objectives of the Federal Extension Service discussed above. Each county extension service prepares a plan of work and forwards it to the respective State extension service. The State extension service then prepares State plans of work which are forwarded to the U.S. Department of Agriculture Extension

Service for review and subsequent action. Grants are made to State land-grant institutions and distributed primarily on the basis of farm and rural population and on the basis of special problems and needs. The director of the State extension service administers these Federal grants

Each of the States within the Study Area has a Conservation Needs Inventory Committee which is assigned the responsibility of identifying soils of the State according to their "land capability." These committees are chaired by the respective State Conservationist of the U.S. Soil Conservation Service, and include representatives from a number of Federal and State agencies. Each committee periodically publishes a soil and water conservation needs inventory which serves as a foundation for bringing about optimum use and treatment of the land in that State.

Soil and water conservation districts have been set up in each of the three states of the Estuary Area. These districts are operated under State law and are supervised by State commissions or committees. Each district works with and encourages landowners to plan and initiate soil and water conservation practices through cooperation with Federal, State, and local agencies. The State commissions offer financial and technical assistance to the directors of conservation districts in executing their programs. In addition, they help secure Federal and State cooperation and disseminate information concerning the programs of the soil and water conservation districts.

Each of the three states of the Bay Region has a lead agency with regard to agricultural affairs. In Virginia, the Department of Agriculture and Commerce has responsibility for promoting agriculture and generally improving agricultural activity within the Commonwealth. Delaware's counterpart, the Delaware Department of Agriculture, is primarily a regulatory and promotional agency with regard to agricultural activities. The Maryland Department of Agriculture deals with the inspection and regulation of the production, marketing, and sale of agricultural products. It also administers the pesticide and herbicide control program and promotes agriculture drainage program activities. The Department has created the Agricultural Lands Preservation Committee to study means to preserve prime agricultural lands in the State.

Some of the more specific responsibilities of the various State Departments of Agriculture include improving the health of livestock and poultry through disease prevention and eradication, and waste management programs protecting crops from harmful pests and other environmental hazards while protecting the agricultural environment and providing its broadest beneficial use; and,

investigating complaints on use or misuse of pesticides. For additional information on State responsibilities with regard to agriculture, it is suggested that the individual State agencies be consulted.

FUTURE AGRICULTURE NEEDS

The preceeding section of this Chapter discussed the present status of agriculture in the Chesapeake Bay Region. Based on past trends, indications are that urban and built-up land in the Bay region will increase largely at the expense of cropland, pasture land, and woodland on farms. The Council on Environmental Quality sums up this conversion in a comment which states that "unfortunately, insufficient effort has been made to keep the most attractive rural lands near cities from being consumed in the massive conversion to urban life"(4) Statistics show that farm acreage in the Bay Region has declined but predictions are that the trend will continue at a decreasing rate. Even with a decrease in farm acreage, however, the importance of agricultural activity to both the Region as well as the Nation will remain high. In this section the projected number of acres of farmland will be presented along with the projected use of farmland.

TOTAL PROJECTED LAND IN FARMS

Any long-term projection of agricultural resources is subject to uncertainties and reflect, to a large degree, the assumptions that must be made about future agricultural lands, levels of protection, and other management activities.

For this Chapter, projections of total land in farms are based on the 1972 Series C OBERS projections of population and economic activity prepared by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce and the Economic Research Service, of the U.S. Department of Agriculture with assistance from the Forest Service. The OBERS projections were prepared for the U.S. Water Resources Council. When this Report was initiated, the Water Resources Council required that Series C projections be used in all water resources studies. The projections are based on long-term historical trends. The validity of the projections depends on a continuation of these basic trends.

The agricultural projections are derived from national demands for food and fiber based on a product-by-product analysis of historical trends of consumption under specified assumptions relating to population growth, levels of per capita income, and foreign trade. Food includes that for both human and

livestock consumption. Projections assume that patterns of consumption will not be altered materially by shortages or sharp increases in the prices of agricultural products. This assumption is supported by known reserves of potential cropland and established trends in the development and adoption of production technology. If future conditions differ markedly from assumptions influencing both demand and supply, then it can be expected that the projections will not be valid.

For additional information pertaining to the OBERS projections in general or the agricultural projections, specifically, the *1972 OBERS Projections: Regional Economic Activity in the U.S.* Volume I: "Concepts, Methodology and Summary Data" may be consulted.

The OBERS projections of total land in farms for selected years 1962-2020 were published on a State basis. Thus, there was no disaggregation of data to the county level. Since only a portion of Maryland and Virginia are in the Chesapeake Bay Study Area, a methodology had to be developed whereby projections could be made for only those portions of each State within the established Study Area. The entire State of Delaware is included in the Study Area; therefore, the OBERS projections for the entire State could be applied without modification.

In order to project land in farms for the Maryland and Virginia portions of the Study Area, it was necessary to identify any historical trends which might exist. Based on data available in the Censuses of Agriculture for 1954, 1959, 1964, and 1969 there were no statistically significant trends for Maryland. Therefore, to make projections, the average percent of farmlands within the Maryland portion of the Study Area for the years 1954, 1959, 1964, and 1969 was determined. It was found that, on the average, 77.5 percent of the State's farmland lay within the Chesapeake Bay Study Area. This percentage was applied to the OBERS Series C projections of "total land in farms" in Maryland for the selected years 1980, 2000, and 2020. The Study projections, shown in Table 4-11 represent the projected land in farms for the Maryland portion of the Study Area.

Based on data available in the Censuses of Agriculture as described above, trends did exist for that portion of Virginia within the Study Area. There, a decline in the percentage of the State's farmland within the Estuary Area was indicated. Based on this trend, it was possible to define the percentage of State farmland within the Study Area for the selected years 1980, 2000, and 2020. These percentages are:

1980 – 22.9 percent
2000 – 21.3 percent
2020 – 20.0 percent

The percentages listed above were applied to the OBERS Series C projections of "total land in farms" in Virginia for selected years 1980, 2000, and 2020 respectively. The projections for the Virginia portion of the Study Area are shown in Table 4-11 along with those of Maryland and Delaware. The total represents the projected number of acres of land in farms within the Chesapeake Bay Study Area. It should be noted that these projections differ from those presented in Appendix 6 "Agricultural Water Supply" because of differences in Study Areas (as explained earlier in the chapter) and differences in methodologies used.

TABLE 4-11
PROJECTED NUMBER OF ACRES OF LAND IN FARMS WITHIN THE STUDY AREA

	1980	2000	2020
Delaware	663,300	632,800	600,800
Maryland	2,088,470	1,931,068	1,762,195
Virginia	2,361,265	2,082,288	1,830,060
STUDY AREA TOTAL:	5,113,035	4,646,156	4,193,055

To project the future use of farmland in the Estuary Area for selected years 1980, 2000, and 2020, it was necessary to determine the present breakdown of farmland use within the Study Area. This was accomplished through use of the *1969 Census of Agriculture*, Volume I "Area Reports", U.S. Department of Commerce. Table 4-12 shows the percentage breakdown of use of farmland, by State, for the Study Area in 1969.



Farmland in the Bay Region is projected to decrease by over 20 percent between 1969 and 2020.

TABLE 4-12
USE OF FARMLAND IN
THE STUDY AREA IN 1969 (PERCENT)

State	Cropland	Woodland on Farms	Miscellaneous Farmland*
Delaware	71.0	18.0	11.0
Maryland	57.2	22.7	20.1
Virginia	43.9	37.3	18.8

*Miscellaneous farmland includes pasture, range, lands occupied by houses or other buildings, lanes, roads, ditches, ponds, and waste lands.

Source: U.S. Department of Commerce, Bureau of the Census, *1969 Census of Agriculture*, Volume I "Area Reports." Washington, D.C.: U.S. Government Printing Office, 1972.

The percentages in Table 4-12 were applied to the OBERS Series C projections, "Use of Land in Farms, Selected Historical and Projected Years 1954-2020", to obtain the number of acres of farmland in each use for the aforementioned years. Table 4-13 shows the projections of cropland, woodland on farms, and miscellaneous farmland for the Chesapeake Bay Study Area. (It should be noted that these projections do not take into consideration a shift in the use of farmland which could take place during the projection period).

TABLE 4-13
PROJECTED NUMBER OF ACRES OF FARMLAND IN USE
IN THE STUDY AREA

State	Use	Selected Year 1980	2000	2020
Delaware	Cropland	470,943	449,288	426,568
	Woodland on farms	119,394	113,904	108,144
	Miscellaneous farmland	72,963	69,608	66,088
Maryland	Cropland	1,194,605	1,104,571	1,007,976
	Woodland on farms	474,083	438,352	400,018
	Miscellaneous farmland	419,782	388,145	354,201
Virginia	Cropland	1,036,595	914,124	803,396
	Woodland on farms	880,752	776,693	682,612
	Miscellaneous farmland	443,918	391,471	344,051

Projections of future use of land on farms within the Study Area indicate a general decline in number of acres in each land use type. This trend follows the decline in total farmland which is projected for the Bay Region.

SENSITIVITY ANALYSIS

In developing projections, a certain number of assumptions must be made. In the Sensitivity Analysis, one of the assumptions made in the previous analysis will be changed and the effects of this change upon the projections of agricultural lands will be analyzed. In this way, the sensitivity of the assumptions made above can be tested.

For the analysis, the Series E OBERS projections of population and economic activity were substituted for the Series C OBERS projections used in the original projections of agricultural land. Differences between Series C

and Series E are caused primarily by changes in the assumptions concerning National fertility rates. Figure 4-4, below, shows the chief differences between Series C and Series E projections. Generally, population projected by Series E is lower than those of Series C for a given region. For additional information on other differences in the two projections, the 1972 Series E OBERS Projections may be consulted.

The exact methodology developed for the original projections of "land in farms" and "use of farmland" were applied to the Series E OBERS projections. Table 4-14 shows a comparison of Series C and Series E projections of "land in farms." Table 4-15 compares the two sets of projections in reference to "use of farmland."

FIGURE 4-4

A COMPARISON OF OBERS SERIES C AND SERIES E PROJECTIONS

Item	Series C	Series E
Growth of Population	Fertility rate of 2,800 children per 1,000 women	Gradual decline of fertility rate from 2,800 to the "replacement fertility rate" of 2,100 children per 1,000 women.
Military Establishment	Projects a decline to 2.07 million people by 1975 and thereafter a constant.	Projects a decline to 1.57 million persons by 1975 and thereafter a constant (due to smaller military establishment and the resultant smaller need for equipment and supplies, a significantly slow rate of growth in the defense-related manufacturing industries is anticipated).
Hours Worked Per Year	Hours worked per employee per year are projected to decline at 0.25 percent per year.	Hours worked per employee per year are projected to decline at 0.35 percent per year.
Product Per Man-Hour	Projected to increase 3.0 percent per year.	Projected to increase 2.9 percent per year.
Earnings Per Worker	Earnings per worker in the individual industries at the national level are projected to converge toward the combined rate for all industries more slowly in the Series E projections than in the Series C projections.	
Employed Population	Projected to increase from 40 to 41 percent of the total population.	Projected to be between 43 and 45 percent of the total population (higher percentages with the E Series reflects expected higher participation rates by women).

TABLE 4-14
A COMPARISON OF SERIES C AND SERIES E OBERS
PROJECTIONS OF NUMBER OF ACRES OF LAND IN FARMS
WITHIN THE STUDY AREA

	1980		2000		2020	
State	Series C	Series E	Series C	Series E	Series C	Series E
Delaware	663,300	663,700	632,800	639,700	600,800	618,300
Maryland	2,088,470	2,096,608	1,931,068	1,969,353	1,762,195	1,849,460
Virginia	2,361,265	2,363,509	2,082,288	2,093,875	1,830,060	1,855,540
Study Area Total	5,113,035	5,123,817	4,646,156	4,702,928	4,193,055	4,323,300

TABLE 4-15
A COMPARISON OF SERIES C AND SERIES E OBERS PROJECTIONS OF NUMBER OF ACRES OF FARMLAND USE IN THE STUDY AREA

		1980		2000		2020	
State	Use	Series C	Series E	Series C	Series E	Series C	Series E
Delaware	Cropland	470,943	471,227	449,288	454,187	426,568	438,993
	Woodland on Farms	119,394	119,466	113,904	115,146	108,144	111,294
	Miscellaneous Farmland	72,963	73,007	69,608	70,367	66,088	68,013
Maryland	Cropland	1,194,605	1,199,260	1,104,571	1,126,470	1,007,976	1,057,891
	Woodland on farms	474,083	475,930	438,352	447,043	400,018	419,827
	Miscellaneous Farmland	419,782	421,418	388,145	395,840	354,201	371,741

TABLE 4-15 (cont'd)

State	Use	1980 Series C	1980 Series E	2000 Series C	2000 Series E	2020 Series C	2020 Series E
Virginia	Cropland	1,036,595	1,037,580	914,124	919,211	803,396	814,582
	Woodland on farms	880,752	881,589	776,693	781,015	682,612	692,116
	Miscellaneous farmland	443,918	444,340	391,471	393,649	344,051	348,842

Comparing the initial set of projections of land in farms with the Sensitivity Analysis set, it becomes apparent that there is a greater number of acres in farmland projected for the Study Area based on Series E OBERS projections than with Series C. For example, there are over 130,000 more acres of farmland projected for the Study Area for the year 2020 with Series E than with Series C projections. This amounts to better than a 3 percent difference in farmland acreages. The reason for this difference is twofold. First, population projections in Series E are noticeably lower, thus there should be less pressure to convert agricultural land to intensive land uses such as residential, commercial, and industrial activities. Second, in the Series E projections, it is assumed that annual man-hours of work per man (productivity) will be lower than that of the Series C projections. Although demand for agricultural products will be lower with Series E than with Series C, due to smaller populations, this apparently will not offset the reduction in productivity. A greater amount of farmland will, therefore, be needed to achieve the same farm output. Hence, a larger number of acres of farmland is projected in Series E than in Series C.

PROJECTED IRRIGATION ACREAGE

Although the Economic Research Service, Department of Agriculture, prepared an Appendix for the Chesapeake Bay *Future Conditions Report* entitled "Agricultural Water Supply" in which projections of irrigation acreage are included, it is important to present those figures here in order that the Region's future agricultural land resources can be effectively assessed. In developing these projections, it was necessary to determine acreage projections of "land to be irrigated" at selected points (target dates) in the future.

For that study, present irrigated acreage was identified as a proportion of total acreage in the most recent *Census of Agriculture* (1969). The proportion of acreage to be irrigated was estimated for the target dates by individuals who had knowledge of the present agriculture irrigation usage in the area. The amount of acreage to be irrigated was projected by applying these proportions to the estimates of total acreage by crop. Table 4-16 shows the Economic Research Service's projections of irrigation acreage, by State, for 1980, 2000, and 2020.

TABLE 4-16
"PROJECTED IRRIGATION ACREAGE FOR THE STUDY AREA, BY STATE, FOR 1980, 2000 AND 2020"

State	1980	2000	2020
Delaware	67,000	77,000	91,000
Maryland	39,500	97,600	217,800
Virginia*	40,500	71,400	68,300
Study Area Total:	147,000	246,000	377,100

* Virginia's total does not include figures for Sussex, Greensville, Powhatan, and Goochland Counties which were not included in the Economic Research Service's Study Area.

Source: *Chesapeake Bay Future Conditions Report.* Appendix 6–"Agricultural Water Supply." Chapter III: Future Water Supply Needs, Tables 6-C-12 – 6-C-25.

Irrigated acreage within the Estuary Area as a whole is expected to more than double between 1980 and 2020. A few exceptions exist: on the southern Eastern Shore of Maryland and Virginia and in the Virginia Beach-City of Chesapeake area, irrigation acreage is expected to decline throughout the Study Period.

Delaware's total irrigated acreage is expected to increase almost fivefold between 1980 and 2020. The major portion of acres to be irrigated in Delaware will be planted in vegetables. It is predicted that by 2020, 55,000 of Delaware's 91,000 acres irrigated will be in vegetables. By the year 2000, virtually the entire vegetable crop in the State will be irrigated.

In Maryland, the total irrigated acreage will increase by over 177,000 acres by the year 2020. A variety of crops including nursery crops, corn, soybeans, tobacco, silage, and vegetables will continue to be irrigated. Nursery crops are presently the primary agricultural products irrigated on Maryland's Western Shore while corn makes up the highest irrigation acreage on the State's Eastern Shore.

In Virginia, the number of acres projected to be irrigated is expected to increase, though not nearly at the same rate as in Maryland. Irrigated acreage for the Virginia portion of the Study Area will reach its peak around the year 2000 and will thereafter drop off slightly. As with Maryland, a variety of crops will be irrigated, including potatoes, vegetables, nursery crops, corn, hay, and silage.

For more information on projected irrigation acreage, it is suggested that the Chesapeake Bay Future Conditions Report, Appendix 6, "Agricultural Water Supply" be consulted.

CONFLICTS INVOLVING AGRICULTURAL LAND RESOURCES

Some very serious and not easily solved problems are currently plaguing many of the agricultural lands of the Estuary Area. In return, agricultural activity has helped create certain adverse conditions for both the Region's land and water resources. These conflicts will be addressed in this Section along with those physical and social elements which are expected to impose future agricultural land supply limitations.

EXISTING PROBLEMS AND CONFLICTS

Soil erosion constitutes perhaps one of the most severe and widespread problems to the farmer. The denuding of the soil can be directly linked with poor farming practices as, in situations where farmland is left bare or certain treatment measures not taken, excessive soil loss will follow. It is estimated that untreated cropland may produce from one to over ten tons of sediment per acre per year.

Besides destroying thousands of acres of fertile farmland, erosion is responsible for sedimentation and pollution of streams, rivers, estuaries, and other water bodies. In addition, erosion induces flooding and general deterioration of the environment. Since early settlement, the farmer has contributed to the forces of erosion by allowing his pasture lands to be over grazed; leaving his fields bare during part or in some cases, all of the year; and cultivating steep slopes and riverbanks. In terms of volume, sedimentation ranks above domestic sewage, industrial wastes, and chemicals as a major cause of water pollution. In many instances, sedimentation has been responsible for the silting up of tributaries and river channels making navigation impossible. As a result, commerce, recreation, industry, and the Bay's biota have been adversely affected. Sediment load has also interfered with fish production and reduced the capacity of reservoirs.

Many of the lands best suited for cropland use are found on fluvial and tidal flood plains where the terrain is level and soils fertile. Land is easy to cultivate and production is high. But these croplands are frequently subject to inundation from tidal or fluvial flooding. Tidal flooding complicates the situation by introducing saline water which leaves residual salts following a flood. These salts can be quite damaging to crops. Care must be taken to plant these lands in such a way that occasional flooding will not cause severe loss.

In many areas of the Bay Region, soils are unproductive due to two factors. First, a large number of soils are naturally of poor quality. The second factor is a result of man's misuse. During colonial times it was thought that the supply of farmland was endless. As a result, little care was taken to preserve fertile agricultural land. Crops such as tobacco, were planted year after year until the land was depleted of many of its rich minerals.

When this occurred, farmers frequently moved to new lands as fertile as the original tracts. The net results are obvious: large areas of agricultural land became temporarily worthless from a farming standpoint (with proper treatment, many of these lands have become fertile once again).

In terms of the impact of agriculture on the region's water resources, several types of agricultural activity results in a variety of pollutants. One such pollutant, sedimentation, has already been discussed. A second type, chemicals, has proven to be of serious consequence to the Estuary Area's water resources. Chemical fertilizers, which have been at least partially responsible for increased agricultural productivity, add excessive nutrients to water bodies which intensifies eutrophication—a process whereby nutrients stimulate the excessive growth of algae and other aquatic plants. As these aquatic plants decay, oxygen is utilized robbing fish of the vital gas and resulting in fish kills. The presence of chemical nitrates in farm ponds can be dangerous to livestock who use the pond for drinking water. Animals receiving abnormally high amounts of nitrates can contract a disease called "methoglobinemia" in which the blood is deprived of needed oxygen. This causes the livestock to lose their appetites resulting in a loss of weight and consequently diminished productivity.[5]

Herbicides which are used for the control of weeds and pesticides, used for the control of insects and crop diseases can have definite adverse environmental effects. A heavy flushing rain can wash sprayed croplands of these chemicals, producing extremely toxic conditions for plant as well as animal life. Such toxic conditions can result in losses in production and changes in estuarine plant life; reduction in shellfish growth; fish kills and destruction of

other aquatic life; and pollution of ground water used for water supply. As with chemical fertilizers, the use of some herbicides and pesticides is being controlled, although problems remain.

The large poultry and livestock farms within the Estuary Area present another pollution problem. The sizeable concentrations of animal wastes which are produced on these farms are sufficiently high in pollutants such as nitrates that operations of over one thousand livestock units have been designated point sources of effluent by the Environmental Protection Agency. As a consequence, discharges into streams from these farms are regulated.

An additional source of pollutants from farming activities is that emitted during the processing of agricultural products. For example, the processing of such things as poultry involves the discharge of organic wastes. Such wastes produce high biochemical oxygen demand which may ultimately result in fish kills.

FUTURE AGRICULTURAL LAND SUPPLY LIMITATIONS

There are certain physical features present in some of the soils and landforms of the Chesapeake Bay Region which limit agricultural use of large land areas. These features can be thought to impose future agricultural land supply limitations. Soil and landform features restricting land use include root zone limitations, excessive wetness, steep terrain, shallow soils, low-moisture holding capacity, susceptibility to water erosion, and frequent overflows.

One or more of these limiting features can simply reduce the choice of plants to be cultivated and require moderate conservation practices, or the features can be so restrictive as to preclude an area's use for commercial plant production and force it to be used for recreation, wildlife, or aesthetic purposes.

The State conservation needs inventory (discussed above) assesses the soil capability of that respective State. Each inventory classifies soils into three major categories:

(1) The "capability unit" which is a grouping of soils that have about the same influence on production and respond similarly to systems of management.

(2) The "capability class" which sorts soils into eight groups. The risks of soil damage or limitations in use become progressively

greater from Class I to Class VIII. Classes I through IV are capable, under good management, of producing common cultivated crops, pasture plants, and forest trees. Classes V through VII should not be used for cultivated annual or short-lived crops but can be used for orchards, pastures, forest trees, or wildlife. Class VIII is the single group of soils which has such severe limitations that the soils offer no continuing commercial plant production capability. These soils do not return onsite benefits for crops, grasses, or trees even with proper management,

(3) The "capability subclass" which is a grouping of capability units having similar kinds of limitations such as erosion hazards, wetness, or root zone limitations.

According to the latest *Conservation Needs Inventories* for Maryland, Virginia, and Delaware, over 2,300,000 acres of cropland, pasture, forest, and miscellaneous rural land, within the Study Area, belong to Classes V, VI, and VII. Consequently, these lands have limited use for agricultural activity. Over 469,000 additional acres belong to Class VIII and therefore have no agricultural use whatever. Table 4-17 shows a breakdown of soils within the Study Area by capability class and by State.

TABLE 4-17

BREAKDOWN OF SOILS WITHIN THE STUDY AREA,
BY CAPABILITY CLASS

STATE	CLASS V	CLASS VI	CLASS VII	CLASS VIII
Delaware	1,494 acres	22,442 acres	4,231 acres	103,580 acres
Maryland	94,517 acres	480,605 acres	248,748 acres	152,042 acres
Virginia	91,523 acres	454,424 acres	905,680 acres	213,492 acres
Study Area Total:	187,534 acres	957,471 acres	1,158,659 acres	469,114 acres

Sources:

Delaware's Inventory of Soil and Water Conservation Needs, 1971. Dover, Delaware: U.S. Soil Conservation Service.

Maryland Soil and Water Conservation Needs Inventory, 1971. College Park, Maryland: U.S. Soil Conservation Service.

Virginia Conservation Needs Inventory of 1967. Publication 384. Blacksburg, Virginia: Virginia Polytechnic Institute, 1970.

For additional information on land capability, the above table sources may be consulted.

LIMITING SOCIAL FACTORS

Aside from the physical limitations discussed above, there are certain problems and conflicts which can be expected to pose future threats to the agricultural resources of the Estuary Area. Many of these conflicts currently exist and were addressed in the "Existing Problems and Conflicts" Section. One of the biggest offenders to the agricultural land resource as a whole is its misuse. The President's Council on Environmental Quality considers this to be one of the most serious and difficult challenges to environmental quality because of its rampant and frequently irreversible nature. With expanding demands for space and without tighter restrictions, valuable farmland has and will continue to disappear into suburban development. Traffic, neon signs, power lines, and sprawl will replace the scenery of diversified rural landscapes. Certain tax policies such as real estate and inheritance taxes are responsible for forcing landowners to sell or convert their farmland to some other use which can earn a great return for their money. Farmland, which normally commands lower economic rent than intensified land uses, has made up a large portion of that land converted to residential, commercial, and industrial activities. This trend is expected to continue in the future. While conversion of agricultural land is expected everywhere, it will be greatest in areas adjacent to such urban centers as Wilmington, Baltimore, Richmond, Washington, and the Hampton Roads Area.

A future decrease in the number of acres of cropland, pasture, and other farmland due to their conversion to some other use or because of problems associated with either poor farming techniques (erosion, sedimentation, pollution) or natural limitations, would force an increase in output per acre in order to maintain present levels of production. If the problems confronting the Chesapeake Bay Region's agricultural resources are not rectified, their severity and detrimental impact can be expected to intensify in the future. Chapter VIII includes an assessment of the various means with which many of these conflicts and problems can be prevented or alleviated.

FOOTNOTES

(1) *Chesapeake Bay Existing Conditions Report.* Appendix A - "The People and the Economy." Chapter II: Economic History, p. A-II-9.

(2) Carnell Hall Blair and Willits Dyer Ansel, *Chesapeake Bay: Notes and Sketches* (Cambridge, Maryland: Tidewater Publishers, 1970), p. 34.

(3) U.S. Department of Commerce, Bureau of the Census, *Census of Agriculture, 1969,* Volume I Area Reports - County Data, Table I "Farms, Land in Farms, Land Use: 1969 and 1964."

(4) *Environmental Quality,* The First Annual Report of the Council on Environmental Quality (Washington, D.C.: U.S. Government Printing Office, 1970).

(5) *Chesapeake Bay Future Conditions Report.* Appendix 6 – "Agricultural Water Supply." Chapter III Future Water Supply Needs.

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CHAPTER V

COMMERCIAL FOREST LANDS IN THE CHESAPEAKE BAY REGION

The forest lands of the Chesapeake Bay Region represent a multiple use resource. With proper management the forest can be used for the protection of watersheds, food and cover for wildlife, outdoor recreation, and the enhancement of natural beauty. In terms of commercial use, the forest supplies raw materials to hundreds of primary wood processing plants which in turn produce a variety of products including lumber, barrel staves, furniture, veneer products, paneling and flooring, pulp and paper, mine timbers, railroad ties, posts, piling, and other products. This valuable resource will be discussed in this Chapter in terms of both present and future commercial resource use, as well as future needs and problem areas. The publicly-owned forest lands will be examined in the "Historic, Archeological and Natural Environmental Areas of the Chesapeake Bay Region" Chapter of this Appendix (Chapter VII).

DESCRIPTION OF REGION

Commercial forest land is defined as "forest land producing or capable of producing crops of industrial wood not withdrawn from timber utilization by statute or administrative regulation."(1) In spite of the vast urban areas and suburban sprawl which have developed in the Chesapeake Bay Region, large woodland (forest) areas still remain, particularly in the tidewater areas of Virginia and Southern Maryland. In some counties of the Region, as much as two-thirds of the land area is still in woodlands.

Approximately 50 percent of the total land area within the Study Area, or about 6,950,000 acres, is in productive woodland. (While this acreage qualifies as commercial forest land, it does not mean that all of it is in commercial use). A breakdown of the total acreage by state, is found in Table 4-18. Totals for Maryland and Virginia include only those forest lands within the Chesapeake Bay Study Area. Delaware's figure includes acreage for all forest lands since the entire State is included in the Study Area. As noted below, the primary sources of information for this report were the latest timber surveys conducted by the U.S. Forest Service and represent the most up-to-date information available.

Attention should once again be drawn to the fact that the totals for forest land presented here differ from those figures presented in Chapter II of this Appendix. There are two explanations for this. First, remote sensing data

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were used in Chapter II in order to digitize acreage for all land use types within the Bay Region. This digitized data did not distinguish between commercial forest and "woodland on farms". Therefore all forests were considered to be woodland. Hence, the figure for land use in forests set forth in Table 4-2 of Chapter II is greater than that expressed in this Chapter. Secondly, public forest lands were not inventoried in this Chapter—only private commercial forest lands. The remote sensing data, however, included both public and private forestlands.

TABLE 4-18

NUMBER OF ACRES OF COMMERCIAL FOREST LAND WITHIN THE STUDY AREA

Delaware	370,400 acres
Maryland	2,076,600 acres
Virginia	4,503,800 acres
Chesapeake Bay Estuary Area Total	6,950,800 acres

Sources:

Ferguson, Roland H. *The Timber Resources of Maryland.* U.S. Forest Service Resource Bulletin NE-7. Upper Darby. Pennsylvania: Northeastern Forest Experiment Station, 1967.

Ferguson, Roland H., and Mayer, Carl E. *The Timber Resources of Delaware.* U.S. Forest Service Resource Bulletin NE-32. Upper Darby, Pennsylvania: Northeastern Forest Experiment Station, 1974.

Knight, Herbert A., and McClure, Joe P. *Virginia's Timber, 1966.* U.S. Forest Service Resource Bulletin SE-8. Asheville, North Carolina: Southeastern Forest Experiment Station, 1967.

Before settlement, the Chesapeake Bay region was covered with a rather dense forest made up of a great variety of species of broadleaf deciduous hardwoods and numerous varieties of softwoods. Tree species of commercial significance presently identified in the Study Area are listed in Table 4-19.

TABLE 4-19

COMMERCIALLY SIGNIFICANT TREE SPECIES IDENTIFIED IN THE STUDY AREA

Hardwoods

boxelder	overcup oak	magnolia
red maple	shingle oak	sweetbay
silver maple	sweet birch	American sycamore
sugar maple	river birch	cottonwood
Florida maple	yellow birch	black cherry
white oak	green ash	willow
swamp white oak	white ash	elm
scarlet oak	northern catalpa	American basswood
southern red oak	bigtooth aspen	hickory
northern red oak	buckeye	American beech
swamp chestnut oak	hackberry	American holly
water oak	loblolly bay	flowering dogwood
pin oak	butternut	common persimmon
willow oak	sweetgum	honeylocust
chestnut oak	blackgum	black walnut
post oak	water tupelo	black locust
black oak	yellow-poplar	mulberry
bur oak	cucumber tree	

Softwoods

eastern hemlock	scotch pine
red spruce	loblolly pine
Atlantic white-cedar	Virginia pine
eastern redcedar	Baldcypress
shortleaf pine	pond pine
pitch pine	eastern white pine

Sources:

Ferguson, Roland H. *The Timber Resources of Maryland.*

Ferguson, Roland H., and Mayer, Carl E. *The Timber Resources of Delaware.*

Knight, Herbert A., and McClure, Joe P. *Virginia's Timber, 1966.*

A term used to refer to commercially useable forest resources is "growing-stock", defined as all trees of commercial species except those which do not contain at least one 12-foot saw log due to rot, roughness, or poor form. Of the many species of trees identified, the hardwoods account for approximately three-fourths of the growing-stock volume in Maryland(2), 70 percent in Delaware(3), and slightly less than one-half in Virginia(4). The oaks comprise the principal species of hardwoods within the Estuary Area.

The earliest settlers of the Bay region described the dense stands of timber as "fine groves of trees" . . . "not choked with thorns or undergrowth, but growing at intervals as if planted by the hand of man, so that you can drive a four-horse carriage wherever you choose through the midst of the trees." The hickories, oaks, and other hardwoods were "so straight and tall that beams sixty feet long and two and a half feet wide can be made of them." Cypress trees were found to be "growing to a height of eighty feet before they have any branches and three men with arms extended can barely reach around their trunks."(5)

The early colonists realized the true commercial value of these rich stands of forests. Today, the variety of species and number and size of forest lands attest to their continuing value. Aside from their usefulness in preventing erosion, influencing water quality, providing the basis for recreational activities, generating humus, increasing water storage capabilities by increasing the porosity of soil, and reducing flood peaks and damages, the forests of the Chesapeake Bay region have proven to be of commercial utility to many manufacturing activities. The commercial usefulness of the Bay's forest resources will be discussed at greater length in the following section.

PRESENT STATUS OF FORESTRY AND FOREST LANDS IN THE CHESAPEAKE BAY REGION

The total number of acres of forest land in the Chesapeake Bay region has remained relatively stable during the last decade (generally there has been less than one percent change between the last two forest surveys). Loss of forest land due to conversion to some intensive land use, such as industry, is frequently offset by the reversion of abandoned farmland to forest land.

PRESENT RESOURCE USE

According to the timber surveys conducted by the U.S. Forest Survey, approximately 29, 42, and 59 percent of the land area within the Study Area is woodland in Delaware, Maryland, and Virginia, respectively. These are sur-



The Chesapeake Bay Region contains a great variety of hardwoods and softwoods

prising statistics when one considers that the southern portion of the intensively urbanized "megalopolis" cuts across the Chesapeake Bay region from Wilmington in the northeast to Richmond in the south. Table 4-20 shows the number of acres of private commercial forest land by county. Private commercial forest land constitutes lands that are farmer owned, in ownership by companies and individuals operating wood-using plants (forest industry), or privately owned lands other than farmer-owned or forest industry. The breakdown of ownership among these three groups differs from state to state. Generally, however, the major portion of woodlands is in the hands of small landowners. Table 4-21 shows the breakdown of private ownership for each portion of the Study Area.

TABLE 4-20

NUMBER OF ACRES OF PRIVATE COMMERCIAL FOREST LAND WITHIN THE STUDY AREA

COUNTY	ACRES
DELAWARE	
Kent	87,800
New Castle	54,300
Sussex	228,300
STATE TOTAL	370,400
MARYLAND	
Anne Arundel	116,500
Baltimore	145,400
Calvert	91,600
Caroline	81,100
Carroll	74,600
Cecil	93,700
Charles	181,100
Dorchester	153,700
Harford	131,900
Howard	53,500
Kent	52,900
Montgomery	98,100
Prince Georges	151,800
Queen Annes	75,400
St. Marys	155,000

TABLE 4-20 (Continued)

NUMBER OF ACRES OF PRIVATE COMMERCIAL FOREST LAND WITHIN THE STUDY AREA

MARYLAND (cont'd)

COUNTY	ACRES
Somerset	84,900
Talbot	48,600
Wicomico	111,800
Worcester	175,000
STATE TOTAL	2,076,600
VIRGINIA	
Accomack	96,900
Caroline	210,100
Charles City	86,800
Chesterfield	213,200
Dinwiddie	239,400
Elizabeth City (Hampton)	3,400
Essex	100,000
Fairfax	102,900
Gloucester	98,400
Goochland	128,500
Greensville	137,700
Hanover	200,000
Henrico	86,700
Isle of Wight	118,100
James City	66,600
King and Queen	157,700
King George	78,700
King William	128,800
Lancaster	46,000
Loudoun	92,200
Mathews	29,700
Middlesex	54,000
Nansemond (City of Suffolk)	166,000
New Kent	107,600
Norfolk	134,800
Northampton	31,400
Northumberland	77,500

TABLE 4-20 (Continued)

NUMBER OF ACRES OF PRIVATE COMMERCIAL
FOREST LAND WITHIN THE STUDY AREA

VIRGINIA (cont'd)

COUNTY	ACRES
Powhatan	120,800
Prince George	123,600
Prince William	85,800
Princess Anne (Virginia Beach)	44,900
Richmond	80,800
Southampton	254,300
Spotsylvania	193,400
Stafford	97,300
Surry	134,600
Sussex	247,500
Warwick (Newport News)	14,800
Westmoreland	86,400
York	26,500
STATE TOTAL	4,503,800
CHESAPEAKE BAY ESTUARY AREA TOTAL	6,950,800

Sources:

Ferguson, Roland H. *The Timber Resources of Maryland.*

Ferguson, Roland H., and Mayer, Carl E. *The Timber Resources of Delaware.*

Knight, Herbert A., and McClure, Joe P. *Virginia's Timber, 1966.*

TABLE 4-21

PRIVATE COMMERCIAL FOREST LAND OWNERSHIP
WITHIN THE STUDY AREA

STATE	ACRES
DELAWARE	
Forest Industry	29,700
Farmer-Owned (owned by farm operators)	178,100
Corporate Owned	19,400
Individually Owned	143,200
STATE TOTAL	370,400
VIRGINIA	
Forest Industry	779,600
Farmer-Owned (owned by farm operators)	2,030,000
Miscellaneous Private (including corporate owned and individually owned)	1,694,200
STATE TOTAL	4,503,800
MARYLAND	
Farmer-Owned (owned by farm operators)	588,200
Miscellaneous Private (including forest industry, corporate owned and individually owned)	1,488,400
STATE TOTAL	2,076,600

Sources:

Ferguson, Roland H. *The Timber Resources of Maryland.*

Ferguson, Roland H., and Mayer, Carl E. *The Timber Resources of Delaware.*

Knight, Herbert A., and McClure, Joe P. *Virginia's Timber, 1966.*

While forestry plays a significantly less important economic role within the Estuary Area than does agriculture, it can be quite important on a local level in terms of work force employed and value of products sold. Almost every species of tree found within the Study Area is used in some way, if only for fuelwood. The output of industrial products (which accounts for all timber

products except fuelwood) has increased steadily in Maryland during the past 50 years. For Virginia and Delaware, however, the overall timber product output has decreased. Due to the fact that variations exist from state to state in terms of types of timber products produced and size of output, the forest resources within the Estuary Area are discussed separately for each state.

DELAWARE

Although no woodpulp mills exist in Delaware, the harvest of pulpwood increased threefold between 1956 and 1970. Pulpwood production was over twice as great as any other industrial wood product within the State. Saw logs ranked second in production, a substantial decline for that product since the record high for lumber production was reached in Delaware in 1909. Fuelwood, veneer logs, piling, poles, posts, and cooperage accounted for the balance of the timber products output in 1970. The combined volumes of these made up 29 percent of the total output.

Although the timber industry contributes less to the economy of the State than many other manufacturing industries, timber is a valuable resource in certain localized areas such as Sussex County where 61 percent of the State's forest resources are located.

MARYLAND

Although declining slightly in production, saw logs continued to be the major wood product produced in Maryland. Saw logs accounted for over 50 percent of the total cubic-foot output during the latest survey. At the time of the last survey (1963), pulpwood ranked second but has increased in both volume and importance since 1938. Fuelwood was the third most important product in output while veneer logs and bolts, piling, and cooperage logs and bolts made up about 14 percent of the timber products of the State.

VIRGINIA

As in the case of Delaware and Maryland, the production of pulpwood in Virginia has increased according to the latest timber survey. The increase in pulpwood—an all time high for this product—was offset by decreases in production of saw logs, veneer logs, fuelwood, cooperage, poles, piling, posts, mine timber, handle stock, particle board, pallets, and excelsior. Saw logs continued to be the leading timber product even though the number of saw mills declined.

A large share of the forest industry in Virginia is concentrated on the Coastal Plain where rich timber resources, availability of labor and markets, and good transportation facilities combine to make the area attractive for lumbering activity.

PRESENT RESOURCE SUPPLY

The volume of growing stock has continued to increase in each of the three states of the Estuary Area during the last two timber surveys. Hardwoods have accounted for most of this increase while softwood growing stock has declined substantially. The annual net growth (the difference between growth of growing stock and timber removal) has also increased. The growth-removal relationships for softwoods, however, are quite different than those for hardwoods. Due to heavy demand for such woods as pine, the number of cubic feet of softwood cut per year exceeds growth. This problem is compounded because normal species succession in this region tends toward the more tolerant hardwood species. Thus, in each succeeding year less softwoods will be available for harvest than in the preceding year.

MANAGEMENT RESPONSIBILITIES

The Federal Government and those State governments within the Chesapeake Bay Region have come to realize that increased forest management will help make the forests a more valuable resource. As a result, the various levels of government have established agencies to direct the protection and wise use of the Nation's timber resources. The Federal agency with primary responsibility in this area is the U.S. Forest Service, a branch of the Department of Agriculture. Maryland, Delaware, and Virginia have each set up corresponding agencies at the state level. These are, the Maryland Forest Service; the Delaware Department of Agriculture, Division of Production and Promotion, Forestry Section; and the Virginia Division of Forestry. These Federal and State agencies cooperate closely in their efforts to maintain and improve the forest resources of the tri-State area. A brief discussion of the respective responsibilities and programs offered by each agency, follows.

FEDERAL GOVERNMENT

The U.S. Forest Service has the responsibility for the development, protection, and management of lands in the National Forest System. It also administers a cooperative program with the States for furthering the concept of multiple-use, environmental protection, and sound management practices among all forest landowners through example, cooperation, technical as-

sistance, research, and the dissemination of information. A more detailed breakdown of the major programs and activities in which the U.S. Forest Service is involved follows.

a. Cooperation with states and with private forest owners. The Forest Service cooperates with state agencies and private forest owners to improve forest product utilization, provide opportunity for increased recreation in fish and wildlife areas and conserve soil and water. They also provide technical assistance and share in the cost of installing watershed protection and flood prevention measures and practices on forest lands.

b. Forest and range research. The Forest Service carries on a broad spectrum of research concerning water and related land including forest surveys; forest economics; fire, insect, and disease control; wildlife habitat; and forest, range, recreation, and watershed management. Watershed management investigations are aimed at the development of methods for managing forest and related lands to improve the quantity, quality and timing of water yields; provide adequate protection to the soil and water resource; rehabilitate critical watersheds; and aid forest soil development and improvement.

c. Specific water and related land resource planning activities. In addition to its other functions, the Forest Service has a coordinate planning responsibility for the forested areas of river basin surveys and investigations. The Forest Service reviews, makes impact determinations, develops mitigation requirements and prepares covering reports for survey investigations and project proposals of other agencies as to the economic and environmental effects upon forestry programs, forest resources as a whole, and related forest industries.

d. Administration of National Forests. The Forest Service has jurisdiction over all National forests. Other than the Prince William Forest Park in Virginia, however, there are no national forests within the Study Area.

A second Federal agency, the Soil Conservation Service (also under the auspices of the U.S. Department of Agriculture) is involved in assisting landowners in making resource conservation and development plans based upon soil surveys. These surveys indicate the suitability and productive potential of the various soils for woodland use. The Soil Conservation Service, also active in reforestation, helps establish forest cover on cut-over or abandoned farms through incentives to landowners as well as through distribution of low-cost seedlings to forest owners interested in replenishing diminished timber stands. Incentive programs encourage landowners to plant more trees on

their property and to maintain preserved forest stands properly. As with the Forest Service, the Soil Conservation Service is involved in providing grants, loans, technical assistance, and information to concerned and interested landowners.

Also under the Department of Agriculture is the Cooperative State Research Service. Through the Cooperative Forestry Research program, States are encouraged and assisted in carrying on programs of forestry research at forestry schools. Research is conducted in eight categories which include:

(1) reforestation and management of land for the production of crops of timber;
(2) management of forest and related watershed lands to improve conditions of waterflow and to protect resources against flood and erosion;
(3) management of forest and related rangeland for production of forage and domestic livestock and game and improvement of food and habitat for wildlife;
(4) management of forest lands for outdoor recreation;
(5) protection of forest lands for outdoor recreation; protection of forest land and resources against fire, insects, diseases, or other destructive agents;
(6) utilization of wood and other forest products;
(7) development of sound policies for the management of forest lands;
(8) such other studies as may be necessary to obtain the fullest and most effective use of forest resources.

STATE GOVERNMENT

a. *Maryland.* The Maryland Forest Service describes its forest program as maximizing the economic, esthetic, and recreational needs of the people of Maryland through the most constructive possible use of their forest resources. The State manages five state forests along with the Seth Demonstration Forest in Talbot County and the Buckingham Forest Tree Nursery in Anne Arundel County. The multiple-use management concept is employed in the State Forests. This concept promotes timber production, watershed protection, enhancement of wildlife habitat and natural beauty, low density recreational uses, and fire and pest prevention and control.

The scope of Maryland forestry programs goes far beyond management of State Forests. The agency provides valuable technical assistance to private landowners. The technical forestry and reforestation activity is

set up to advise and assist landowners in multiple-use management of their woodlands. The program covers such areas as marking timber for harvest or stand improvement and watershed and wildlife habitat development.

The Maryland Forest Service is also involved in activities related to promotion of the planting of trees in metropolitan areas for environmental and esthetic reasons. In connection with this promotional activity, the service distributes millions of seedlings and trees for reforestation and community betterment.

Protection of forest resources from fire, insects, and disease is another important function of the Maryland Forest Service. In the area of fire control, the State works closely with both Federal and local authorities in developing effective means of dealing with forest fires.

Another program, the Forest Products Utilization Program, establishes research demonstration projects to enable harvesting to take place at more favorable times of the year and to assure a continuous supply of raw materials. A watershed management program provides assistance to landowners for the improvement of watershed timber stands to enable the betterment of water quality.

The Maryland Forest Service is constantly working to improve the recreational opportunities afforded by the state forest lands by developing trails for hiking and skiing, and by promoting hunting, fishing, canoeing, and camping.

At the local level, the service works closely with 23 county forestry boards and a number of private groups to protect and make wise use of the State's woodlands.

b. *Virginia.* The Virginia Division of Foresty, in similar fashion to the equivalent Maryland agency, offers a forest management program for all private forest landowners. One of the major elements of the program provides for State coordination with the county foresters who are involved in examining an individual's woodlands, supplying landowners with a description of the property and making a recommendation for multiple-use management of the resource. In addition, the Division of Forestry makes estimates of timber volumes.

The Division has a Seed Tree Program for areas where timber sale is recommended. The Program permits the landowner to leave seed trees or

secure the State Forester's approval for an alternate form of forest management.

Another program offered by the Commonwealth is called the Virginia Reforestation of Timberland Program which provides for the landowner to receive up to 50 percent of the cost of reforesting his land—if he chooses to convert the area to be harvested to pine or if an area of brushland is to be converted to pine.

Federal forestry incentives programs are administered at the county level by the U.S. Department of Agriculture's Agricultural Stabilization and Conservation Service. Benefits are available for tree planting, timber stand improvement, planting site preparation, and woodland fencing. Technical responsibility is handled by foresters from the Virginia Division of Forestry. The Commonwealth also has specialized forestry equipment which may be rented for nominal fees. County foresters are available to assist with implementation of forestry projects.

In addition to the reforestation and management programs offered by Virginia, the Division of Forestry is also responsible for the development of forest fire prevention programs and investigation and control measures for insect and disease problems associated with woodlands.

c. *Delaware.* The major impetus of Delaware's forestry program is directed toward encouraging private landowners to produce more and better forest crops and to establishing new forest crops on idle land. To aid in this program, the Forestry Section of the Delaware Department of Agriculture supplies trees, at cost, to farmers and other woodland owners to plant on cut-over forest land or idle crop land. The State is involved in various cooperative programs with the Federal Government in an attempt to manage and improve the State's forest resources. The Forestry Section also has management control of all State forests.

For more information on the various forestry programs, it is recommended that the respective Federal and State agencies be contacted.

FUTURE FOREST NEEDS

The preceding sections of this chapter have described the value of forest resources in the Chesapeake Bay Study Area. The region's woodlands should continue to play an important role as a wildlife habitat, as the basis for a variety of recreational activities, as a major deterrent to erosion, and most

importantly, as a valuable commercial commodity. While man's technology will enable him to substitute synthetic materials for certain wood products, this same technology will find new uses for wood for which there will be no substitutes. Thus, the Bay region's forest lands should continue to be one of the region's important resources.

EXPECTED CHANGES IN FOREST RESOURCES

The availability of Survey data on timber volume allows for the determination of trends with regard to timber growth and harvest. Currently, softwoods are cut at a greater rate than their growth, while the hardwood cut represents only a fraction of its growth. An examination of the data also reveals that the annual hardwood cut has been increasing substantially. Indications are that this last trend will probably continue. As for softwoods, however, it is believed that landowners wish to modify the situation to prevent further drastic reductions in the softwood inventory. Thus, softwood cut will likely decrease in order to reach more of a balance between cut and growth.

Trends show that growing stock volume, as a whole, will likely increase but probably at a decreasing rate. The percentage of softwoods can be expected to decrease except in those areas where an active softwood planting program is underway.

Some species of hardwoods are also currently being overcut. Unless a considerably large acreage of privately owned forest land is put under some kind of management to favor the more valuable species, the composition of timber stands will change to a larger percentage of the less desirable and unwanted species.

With intensified forest management the expected changes in forest resources could be quite different. Accelerated management over the next 50 years could develop enough timber resources to sustain a level of production that would more nearly reflect the capacity of the Chesapeake Bay region's forest land. Such an intensified program would likely concentrate on improving the quality of certain hardwood species and the quantity and quality of select softwood species. The implementation of an improvement program of the magnitude required to reach full timber capacity would challenge the entire timber-based industry as well as timber owners and managers.

TOTAL PROJECTED LAND IN FORESTS

Any long-term projection of forest resources is subject to many uncertainties and the results largely reflect the assumptions that must be made about future forest area, levels of protection, and other management activities. Projections of private commercial forest land in this Appendix are based on the Series C OBERS projections of population and economic activity prepared by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce, and the Economic Research Service, of the U.S. Department of Agriculture with assistance from the Forest Service. The OBERS projections show a general decline in commercial forest area in all three States for the period 1980 to 2020. This reflects the assumption that conversion from forest lands for such things as urban development will be greater than reversion of such things as abandoned farmlands to forest lands. Net reductions can expect to result from competing land uses including urban and industrial, transportation, parks and recreation, wildlife sanctuaries, vacation communities, reservoirs, and surface mining.

The OBERS projections are based on long-run historical trends. The validity of the projections depends on a continuation of these basic trends. The OBERS forestry projections are based upon a detailed analysis of prospective growth in the major timber using industries, such as construction, manufacturing, and shipping. The projected demands indicate level of consumption that might be expected in the future if all assumptions influencing both demand and supply were realized. If future conditions differ appreciably from these assumptions, then it can be expected that the projections will not be valid.

For additional information pertaining to the OBERS projections, in general, and the forestry projections specifically, the *1972 OBERS Projections:* Regional Economic Activity in the U.S., Series C Population, Volume 1: Concepts, Methodology, and Summary Data, may be consulted.

The OBERS projections of commercial forest area for selected years 1962-2020 were published on a state basis. There was no disaggregation of data to the county level. Since only a portion of Maryland and Virginia lay within the Chesapeake Bay Study Area, a methodology had to be developed whereby projections could be made for those portions of each state within the established Study Area. The entire State of Delaware is included in the Study Area; therefore, the OBERS projections for the State, as a whole, could be applied without modification. For Virginia, historical trends, established by comparing the 1959 survey of the U.S. Forest Service entitled

Virginia's Timber and the 1966 survey by the same title, were extended to the year 2020. It was found that in 1956, 32.9 percent of the commercial forest land in Virginia was located within the Study Area. In 1966, that figure had dropped 1.0 percent to 31.9 percent. Extending this trend, it was possible to project the percentage of Virginia's forest land within the Study Area for the selected years 1980, 2000, and 2020. These percentages are found in Table 4-22.

For Maryland, *the Maryland Soil and Water Conservation Needs Inventory, 1971*, prepared by the Maryland State Conservation Needs Committee under Chairmanship of the Maryland State Conservationist, U.S. Soil Conservation Service, was used to determine historical trends for commercial forest land. It was found that in 1958, 73.7 percent of the forest land was within the Study Area while in 1967, that figure had dropped to 73.0 percent. This historical trend was extended and percentages of Maryland's forest land within the Study Area for selected years 1980, 2000, and 2020 are found in Table 4-22.

TABLE 4-22

PROJECTED PERCENTAGE OF MARYLAND AND VIRGINIA FOREST LAND WITHIN THE STUDY AREA

	1980	2000	2020
Maryland	72.0	70.5	69.0
Virginia	30.5	28.5	26.5

The OBERS projections of commercial forest area, by state, included both publicly and privately-owned forest lands. Since publicly-owned forest lands are examined in Chapter VII of this Appendix, it was necessary to break out "private commercial forest lands" (which include farmer-owned, forest industry, and miscellaneous private forest land) from the OBERS projections for selected years 1980, 2000, and 2020. Timber surveys for Maryland, Virginia, and Delaware, which break forest area into ownership, were used to accomplish this. After determining the percentage of private forest ownership in that portion of each state within the Study Area (Delaware - 92.2 percent, Maryland - 97.0 percent, Virginia - 95.9 percent), it was possible to apply these percentages to the OBERS projections to determine the projected number of acres of private forest land. Next, the per-

centages of state forest land within the Study Area for the selected years were applied to the private forest projections. The final projections, shown in Table 4-23 represent the projected number of acres of private commercial forest land within the Study Area for selected years 1980, 2000, and 2020.

TABLE 4-23
PROJECTED NUMBER OF ACRES OF PRIVATE
COMMERCIAL FOREST LAND WITHIN THE STUDY AREA

	1980	2000	2020
Delaware	365,560	355,940	346,320
Maryland	1,983,456	1,935,296	1,860,654
Virginia	4,533,673	4,222,717	3,900,972
TOTAL:	6,882,689	6,513,953	6,107,946

SENSITIVITY ANALYSIS

In making projections, there are a certain number of assumptions which must be made. In this section, one of the assumptions made in the previous analysis will be varied, and the effects of this variation upon the projections of forest land will be explored.

For purposes of analysis, the Series E OBERS projections of population and economic activity were substituted for the Series C OBERS projections used in the original projections of forest land. Differences between Series C and Series E are caused primarily by changes in the assumptions concerning national fertility rates Figure 4-4, in Chapter IV, shows a comparison of Series C and Series E OBERS Projections. Generally, population projected by Series E is lower than those of Series C for a given region. For additional information on other differences in the two projections, the *1972 Series E OBERS Projections* may be consulted.

The exact methodology developed for the original projections was applied to the Series E OBERS projections. The projections for the Sensitivity Analysis are shown in Table 4-24.

TABLE 4-24
PROJECTED NUMBER OF ACRES OF PRIVATE
COMMERCIAL FOREST LAND WITHIN THE STUDY AREA
(SENSITIVITY ANALYSIS)

	1980	2000	2020
Delaware	375,180	365,560	355,940
Maryland	2,039,328	1,990,003	1,914,198
Virginia	4,533,673	4,219,984	3,939,093
TOTAL:	6,948,181	6,575,547	6,209,231

Comparing the two sets of projections, it is apparent that there are, generally, a greater number of acres of private commercial forest land projected for the Study Area based on the Series E OBERS projections than with Series C. For example, in 2020, Series E projects over 100,000 more acres of private commercial forest land than Series C. This can be attributed to the fact that population projections in Series E are noticeably lower, thus there should be less pressures to convert forests to such intensive land uses as residential, commercial, and industrial activities.

CONFLICTS INVOLVING THE FOREST RESOURCE

Poor management of forest resources has proven of serious consequence to both the land and water resources of the Bay Region. Without proper forest cover, severe erosion can occur, denuding the land and at the same time silting up water bodies. Consequently, good forest management techniques are essential in maintaining both proper soil conservation practices and the high quality of water.

RELATIONSHIP OF FOREST COVER TO WATERSHED CONDITION

Forest cover has a significant effect on the quality, quantity, and timing of runoff from forested areas. Root systems together with organic matter supplied by the litter and humus layer, improve soil permeability and structure. During the growing season, these root systems remove moisture from the soil, thus providing storage for storm waters. In addition, the combination of root systems and organic cover effectively holds the soil against the forces of erosion. The litter and humus cover also reduces the overland flow by protecting the soil pores that allow percolation to the stratum below.

The removal of vegetation by cutting, burning, or overgrazing directly affects flow relationships. If the organic layer is destroyed by fire or damaged by logging, areas of mineral soil open to the erosive action of raindrops and overland flow are increased. Soil structure is frequently disturbed by compaction by machinery or by pores plugged with ash and debris from fires. When confined to a woodlot over a prolonged period of time, cattle can also compact soil. These factors all bring about an increase in overland flow. Thus, storm water is delivered to streams at a faster rate and damage to soils as well as stream channels can occur.

Well-maintained forests, particularly in headwater areas as well as on steeper slopes, on poor, shallow soils, and at the higher elevations, can greatly aid in the reduction of flood peaks. During the growing season, forests use the soil moisture, transpiring water each day. In the spring, when soil is often completely recharged with water, a forest may act as a delaying factor for snowmelt.

In addition to helping reduce flood peaks, thickly-forested areas are responsible for delivering water of high quality. Water from such a forest is filtered through the litter and humus layer into the upper portions of the mineral soil where it either continues its downward journey into the water table or finds an outlet into a nearby stream.

Through proper forest management, water flow can be regulated. Experiments have shown that by cutting forests, the flow of water from these lands can actually be increased for a period of time (usually a few years). Careful but intensive management of hardwood forests, particularly in high water table areas or along stream courses, can yield more water. This can be an effective tool for use in municipal watersheds.

Properly maintained forests also play an important role in the recharge of aquifers by keeping soils free of silt or other agents that can plug the aquifer. Forests keep the soil receptive to water it receives from precipitation, whether in the form of rain or snow.

EFFECTS OF THE FOREST INDUSTRY

Through proper forest management, many of the problems associated with forest land can be alleviated and valuable resources produced. It is in association with the production of commercial timber products that a conflict arises which can result in the degradation of water quality. The processing of certain industrial wood products can create serious

water resource problems. One such activity is the wood pulp industry which not only uses large quantities of water in its processing, but frequently discharges its effluent back into surrounding streams and rivers. This wastewater includes spent cooling water. In addition, if the effluent is not adequately treated, it will be high in biochemical oxygen demand (BOD). The BOD measurement is used to determine the approximate quantity of oxygen that will be required to stabilize, biologically, the organic matter present. Unless the assimilative capacity of the receiving stream is great enough, serious oxygen depletion will occur which can prove harmful to fish and other marine organisms. Thus, forest related industries, as with certain other manufacturing activities, must be carefully monitored in order to maintain proper water quality standards to support aquatic life.

FUTURE PROBLEM AREAS

Aside from some of the conflicts discussed above, there are certain factors which may contribute to the reduction of future forest land. These factors can be broken down into two broad groups: physical factors, referred to as "forest land supply limitations," and social factors. Each will be discussed below.

FUTURE FOREST LAND SUPPLY LIMITATIONS

Certain physical factors produce soils and landforms which have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or aesthetic purposes. Land which is so physically restricted in its use is singled out and designated as having severe limitations.

As was discussed in Chapter IV, each state has a conservation needs inventory committee which is charged with the responsibility of identifying soils of the State according to their "land capability."

Of the eight "capability classes" described in the previous chapter, Class VIII is the single group of soils which have such severe limitations that they offer no continuing commercial plant production capability. According to the latest conservation needs inventories for Maryland, Virginia, and Delaware there are over 469,000 acres of cropland, forest land, range, and pasture within the Study Area belonging to Class VIII. These soils do not return onsite benefits for crops, grasses, or trees, even with proper management. Of the total, almost 432,000 acres are made up of soils where excess water

is the limitation to its use as woodlands. The soils are characterized by poor soil drainage, wetness, high water table, and/or overflow. Another 36,000 acres are made up of soils whose shallowness, stoniness, low moisture holding capacity, and/or low fertility create serious limitations to use. The remainder of the total, about 500 acres, is composed of soils where susceptibility to erosion is the dominant problem in their use. The breakdown of Class VIII soils, by State, for the Study Area is found in Table 4-25 below. For additional information on land capability, the following may be consulted:

Delaware's Inventory of Soil and Water Conservation Needs, 1971. Dover, Delaware: U.S. Soil Conservation Service.

Maryland Soil and Water Conservation Needs Inventory, 1971. College Park, Maryland: U.S. Soil Conservation Service.

Virginia Conservation Needs Inventory of 1967. Publication 384. Blacksburg, Virginia: Virginia Polytechnic Institute, 1970.

TABLE 4-25

NUMBER OF ACRES OF CLASS VIII SOILS WITHIN THE STUDY AREA

State	Acreage Having Soils Whose Use is Limited By Excess Water	Acreage Having Soils Whose Use is Limited By Root Zone Factors	Acreage Having Soils Whose Use is Limited By Erosion
Delaware	99,180 acres	4,400 acres	–
Maryland	128,048 acres	23,494 acres	500 acres
Virginia	204, 757 acres	8,735 acres	–
TOTAL	431,985 acres	36,629 acres	500 acres

Sources:

Delaware's Inventory of Soil and Water Conservation Needs, 1971.

Maryland Soil and Water Conservation Needs Inventory, 1971.

Virginia Conservation Needs Inventory of 1967.

LIMITING SOCIAL FACTORS

Certain man-induced forces pose potentially serious threats to the Bay Region's forest lands and thus may possibly limit the future supply of forest resources. These "social factors" will be considered here along with certain natural forest predators such as insects.

As discussed earlier, one of the major threats to the forestlands is the infringement of intensive land use activities through residential expansion, commercial and industrial development, and highway construction. With expanding populations and resultant demands for space, urban sprawl will continue, though not at the same rate as in the past due to stricter land use controls. The forest land, which commands a relatively low economic rent, is one of the land use types most likely to be converted to the intensive land uses. Even agricultural land is considered more valuable. Without proper controls, this conversion may become one-sided. On the surface, it may seem economically wise to turn forest land into some urban or agricultural use but these benefits may be short-term ones.

A second problem involves poor forestry practices and mismanagement. The great bulk of forests is owned by small landowners, many of whom are uninterested in realizing a return from timber and other forest-oriented activities. Consequently, it is often difficult to involve these landowners in forestry practices because their motivations for owning forest land are often clouded and not identifiable, even to the owners themselves.

Some of the larger private forest tracts represent more of a mismanagement problem than a lack of management. With these lands, destructive lumbering practices often means that the better trees are cut and the less desirable species left to replenish the stand. As a result, the forest becomes a stand of poorer species. In other cases, all trees are cut, regardless of quality. Hence, no trees are left to reseed.

Some of the most serious enemies of forest resources are fire, insects, and disease. Man's careless nature has brought about the senseless destruction of millions of acres of valuable forest and killed unknown quantities of wildlife. The various states have come to realize the necessity of fire prevention. Over the years, annual acreage burned has been drastically reduced through improvement of Federal, State, and local fire fighting organizations and with the aid of citizen cooperation.

Numerous insects attack forest trees but because they often attack just one host specie, they do not pose a serious problem to the forest as a whole. Not so with the gypsy moth which during the current decade is defoliating thousands of acres of forest in the Northeastern United States. The pest has already moved into the Chesapeake Bay Region where it presents a very real threat to the timber stands there. Scientists are now trying to develop biological methods to control the gypsy moth while avoiding unnecessary harm to the environment.

Diseases such as the Chestnut blight have had serious consequences for certain types of trees in the Bay Region, wiping out whole species at a time. Close spraying which can control such diseases in certain isolated areas is sometimes too costly to be used in large forest expanses. Thus, in the past, out of lack of corrective action, diseases have often been left to run their course.

The means by which many of the problems and conflicts addressed here can be alleviated will be discussed in Chapter VIII of this Appendix.

FOOTNOTES

(1) Herbert A. Knight and Joe P. McClure, *Virginia's Timber, 1966.* U.S. Forest Service Resource Bulletin SE-8, p. 22.

(2) Roland H. Ferguson, *The Timber Resources of Maryland.* U.S. Forest Service Resource Bulletin NE-7, pp. 90-91.

(3) Roland H. Ferguson and Carl E. Mayer, *The Timber Resources of Delaware.* U.S. Forest Service Resource Bulletin NE-32, p. 2.

(4) Knight and McClure, *Virginia's Timber, 1966*, p. 46

(5) Harold E. Vokes, *Geography and Geology of Maryland.* Bulletin 19 (Revised and reprinted 1968), p. 163.

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CHAPTER VI

MINERAL RESOURCES IN THE CHESAPEAKE BAY REGION

The Chesapeake Bay Region has been, at one time or another, an important supplier of a variety of mineral resources. While the variety mined commercially has decreased, those minerals currently produced are nevertheless of considerable economic value. In this chapter, a brief look will be taken of some of the valuable resources mined in the past as well as the present status of resource use. In addition, an assessment will be made of the Region's future mineral resource needs.

DESCRIPTION OF REGION'S MINERAL RESOURCES

HISTORY

The Chesapeake Bay Region has been the producer of substantial quantities of nonmetals such as stone, clay, diatomaceous earth (known more commonly as silica; it is composed of minute shells and microscopic plants called diatoms), marl (made up of a combination of a dark green mineral called glauconite and shells of organisms), peat, sand, and gravel, as well as smaller amounts of flint, feldspar, kaolin (white clay), soapstone, talc, asbestos, and mica. In addition, a few metallic mineral resources have been mined, including iron mineral paints and ores of iron, copper, chromium, lead, zinc, and gold. Iron, copper and chromium were especially important minerals produced within the Region until discoveries were made of richer deposits in other parts of the country and world. Building or dimension stones are also included among the most valuable mineral resources ever worked in the Chesapeake Bay Region. Granite, slate, sandstone, gneiss, and limestone have all been used in the construction of buildings. Marble such as the Cockeysville variety have been of fine enough quality to grace such structures as the Washington Monuments in Baltimore and Washington, D. C., and parts of St. Patrick's Cathedral in New York City, Peabody Institute in Baltimore, and the National Capital Building in Washington, D. C. Serpentine with its rich emerald green color made it especially useful as interior trim in buildings such as the Empire State Building.

The latest available data for the entire Chesapeake Bay Region (Bureau of Mines, *Minerals Yearbook 1973*, U.S. Department of the Interior) shows that only a few of the above resources are currently of any economic value. The rest have either been depleted or are available in such small amounts that they are commercially insignificant.

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PRESENT STATUS OF MINERAL RESOURCES

PRESENT RESOURCE USE

The mining of certain nonmetallic resources has proven of particular value to the physical development of the Bay Region The majority have been used locally, playing an important role in the construction sector. Rocks suitable for crushed stone such as gabbro, serpentine, gneiss, granite, marble, and quartzite, are available in a number of geological formations throughout the Piedmont Province of the Study Area. Such rocks, when crushed or broken, are valuable for their use in the construction of roads, airports, and buildings and as poultry grit, fertilizer, and agricultural lime.

The increase in the amount of construction within the Chesapeake Bay Region has been of considerable significance to the crushed stone industry. Some crushed marble within the region is combined with small quantities of shale, sandstone, and other rock ingredients and then processed to produce Portland cement.

Sand and gravel are available in large quantities and have also been useful in local construction. Both of these resources are found primarily in Coastal Plain formations such as the Patuxent and Brandywine Formations and in terrace deposits and streams of the Coastal Plain. They are most often obtained from either open pit or surface mining, crushed sandstone and quartzite, or through the processing of kyanite (an aluminum silicate).

A great variety of sedimentary clays are presently found in the Estuary Area with the greatest portion being used in the manufacturing of bricks. The available brick, fire, and ball clays are also used in the making of pottery, stoneware, ceramic products, tile, and sewer pipe.

During the last fifteen years, tons of oystershells have been dredged from Chesapeake Bay and its tributaries for use in rehabilitating existing oyster bars or establishing new bars. In addition, the ground shells have been used as crushed stone, poultry grit, and for agricultural lime.

Besides the above resources, relatively small quantities of aplite and talc were quarried at two locations in the Estuary Area in 1973. Aplite is chiefly used in glassmaking with a minor amount used as brick flux. Talc from the Bay region is used primarily in making a variety of machined articles which when fired are transformed into very hard finished products.

Total mineral production for Maryland, Virginia, and Delaware in 1973 amounted to over $676 million. (This figure reflects the total for the entire three state area. No figures were available for just that portion of each state within the Cheaspeake Bay Study Area.) This represented approximately an 11 percent increase in total value over that of 1972. For the Study Area portions of these three states, most production, in terms of both value and quantity, consisted of the quarrying of stone, sand, gravel, and clay. In Maryland and Virginia, stone was the leading commodity, while in Delaware, sand and gravel were the most important mineral resources worked. The value and quantity of minerals produced in 1973, by state, can be found in the U.S. Department of the Interior's *Bureau of Mines Minerals Yearbook, Vol. II, Area Reports: Domestic, 1973.*

MANAGEMENT RESPONSIBILITIES

The Bureau of Mines, U.S. Department of the Interior, conducts research to stimulate the private sector toward the production of a substantial share of the national mineral and fuel needs. The Bureau, in addition to performing research, provides information to the public and conducts inquiries in accordance with laws pertinent to the technology of processing, use, reuse, and disposal of minerals and mineral fuels.

Mineral industry studies are prepared by the Bureau of Mines in cooperation with the appropriate state agencies. Those state agencies within the Chesapeake Bay Study Area with jurisdiction over mineral resource production are as follows:

Delaware:	Delaware Geological Survey
Maryland:	Maryland: Maryland Geological Survey
Virginia:	Virginia Department of Conservation and Economic Development, Division of Mineral Resources

Each of the above agencies is charged with such responsibilities as conducting topographic, geologic, geochemical, and geophysical surveys; environmental studies; and the collection, collation, and analysis of geological data and economically oriented scientific information as it applies to the state's existing or potential mineral resources. As discussed earlier, mining and dredging oper-

ations can have adverse effects on the environment. The Corps of Engineers under Section 10 of the River and Harbor Act of 1899 requires that a permit be obtained before materials such as sand and gravel are dredged from navigable waters of the United States. In addition to the Federal permit, a State permit is required prior to initiation of dredging operations. For Maryland, the agency granting such a permit is the Water Resources Administration under the Department of Natural Resources. That agency is also responsible for regulating all other mining activities within the State. For Virginia, the agency with such permit responsibilities is the State Water Control Board, and for Delaware it is the Division of Environmental Control under the Department of Natural Resources and Environmental Control.

From a water quality standpoint, the Environmental Protection Agency through the Federal Water Pollution Control Act Amendments of 1972 has authority to establish a surveillance system in cooperation with the States and other Federal agencies for the purpose of monitoring the quality of navigable waters and ground waters. In addition to its many other elements, the 1972 Amendments require that every point source discharger of pollutants obtain a permit which specifies the allowable amount and constituents of the effluent. At the same time, EPA is supporting research to design better control methods for abating nonpoint pollution such as that associated with many mining operations.

For additional information on specific management responsibilities, it is suggested that the various Federal and State agencies mentioned above be contacted.

CONFLICTS INVOLVING THE REGION'S MINERAL RESOURCES

The production of stone, sand, gravel, clay, and a few other nonmetal resources has proven to be of considerable importance to the Bay Region, particularly in areas where quarries and pits are located. Mining activity, however, often creates environmental problems. Quarrying and open pit mining results in denudation of relatively large geographic areas. The devegetated surfaces in turn erode and cause consequent sedimentation of the adjacent waterways. In addition, the pits and quarries which pockmark the landscape are not esthetically pleasing.

A significant portion of the sand and gravel produced in the Estuary Area comes from the dredging of river bottoms. Such activities stir-up bottom materials silting the host waterway and damaging both finfish and shellfish.

The river also becomes esthetically degraded because of the clouding conditions resulting from dredging operations. In at least one case, such operations have been suspended. The State of Maryland, in 1971, made it "unlawful to dredge for sand, gravel, or other aggregates or minerals, in any of the tidal waters or marshlands of Charles County, providing that this section should not conflict with any necessary channel dredging operation for the purposes of navigation." Other portions of rivers and streams within the Bay Region may be closed to such operations in the future.

FUTURE MINERAL RESOURCE NEEDS

As the Study Area's population continues to grow and urban nucleations continue to expand, the demand for the Region's mineral resources will also increase. This is due to both the nature of those resources produced and the purpose for which they are used. Clay, stone, sand, and gravel are available in plentiful supplies throughout much of the Study Area. Their use in a great variety of construction activities assures their continued importance. Examination of the above minerals for trends in terms of value and quantity produced during the last few years supports the assumption that their demand can be expected to increase.

Growing environmental awareness together with the frequently severe problems associated with mining and quarrying of mineral resources has brought about a tightening of Federal and State laws controlling such activities. Increased monitoring of mineral production is likely in the future as demands for natural resources continue to mount.

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CHAPTER VII

HISTORIC, ARCHEOLOGICAL, AND NATURAL ENVIRONMENTAL AREAS OF THE CHESAPEAKE BAY REGION

The Chesapeake Bay Region contains some of the richest and most varied assortments of historic, archeological, and environmental areas in the Nation. Rated as one of the most productive estuarine systems in the world, it is made up of many areas particularly sensitive to man's impact including wetlands, marshes, and forests. The Region's cultural heritage is equally as significant. The inestimable value of these natural resources requires that they be mapped and cataloged to assure their identification and designation as well as their protection and preservation. This chapter provides an inventory of significant historic and archeological resources plus such environmentally important areas as Federal and State forests, parks, and wildlife areas; major military, education, and research areas; natural and scenic rivers; wetlands; and primary aquatic areas. In addition, the existing (and projected) problems confronting environmentally sensitive areas are assessed.

DESCRIPTION OF REGION

ARCHEOLOGICAL AND HISTORIC RESOURCES

Man, his cultural environment, and his civilization are the products of history. A knowledge of the past can be considered an important contribution to man's well-being. An accurate picture of the past can be provided through archeological discoveries of products of earlier civilizations. The primary prehistoric archeological resources within the Study Area are associated with indian artifacts (objects modified or produced by man) and features (rearrangements of rocks, soil, or other natural materials). Archeological sites are usually uncovered by erosion, cultivation, or construction and are heavily influenced by certain physical variables including soils and ground cover. These variables ultimately determine whether or not a site will be discovered and, if it is, whether the archeological resources are recognizable and useful in tracing the past.

Those elements which are responsible for uncovering artifacts are frequently responsible for destroying them as well. Plowing and erosion have ruined much of the stratigraphy and features of many archeological sites in the Bay

Region. Fortunately, even when disturbed, such remnants of important archeological deposits can provide some information on civilizations which existed thousands of years ago.

Archeologists believe that the first exploration and settlement of the Estuary Area took place about 12,000 years before Captain John Smith plied the Bay's waters. These first inhabitants, known as Indians today, were descended from thr people of northeastern Asia who came to North America in search of food by way of a land bridged where the Bering Strait now exists. The cultural and physical characteristics of these people developed in at least partial isolation from the rest of the world. Regional variations within North America also evolved.

The variety of Indian cultures which developed in the Bay region reflects their long presence. Fragmentary pottery, stone artifacts such as arrowheads, and burial mounds are the chief archeological resources uncovered. To date, thousands of sites have been recorded in the region; many fold more remain to be found or reported. It is essential that as many of these uncovered sites as possible be preserved in order to gain an accurate picture of prehistoric life in the Chesapeake Bay region. A more thorough description of types of archeological sites encountered in the Study Area will be discussed later in the chapter.

The Bay region's recorded history is as rich as its prehistoric archeology. It has been said of extensive portions of the Bay region that nowhere is history a more pervasive component of the environment. Its glittering pageant of history is believed to rival any America has seen. This is epitomized at Jamestown, where English America and the frontier experience began. Indeed, much of America's early history is centered in the Bay region. St. Mary's City was one of the earliest English settlements in America and the first capital of Maryland. Williamsburg, which was the capital of Virginia from 1699 to 1780, became one of the most important cities of Colonial America and today represents one of the most elaborately restored areas in the nation. The Revolutionary War ended at Yorktown. The British were repulsed at Fort McHenry during the War of 1812, giving birth to the National Anthem. During the Civil War, the Bay region became a military highway for the north and the site of numerous and decisive battles. In addition, the region has served as the seat of the Federal Government during the overwhelming portion of its existence. Much evidence of American history still remains here in the battlefields, monuments, memorials, cemeteries, and old houses which dot the countryside.

The literally thousands of historic sites within Maryland, Virginia, Delaware, and the District of Columbia nominated for inclusion on National and State historic registers attest to the major historical significance of the region. Pride in this heritage has often found expression in an affectionate regard for the historic homes and properties found in the Bay region. Such historic structures shed light on or confirm the role of a particular cultural tradition. Through the careful study of these sites, the historian is able to add to the understandings of the customs, habits, and values of the persons who created and used them. Additional information on the historic landmarks of the Bay region will be provided later in the chapter.

NATURAL ENVIRONMENTAL AREAS

The Bay region's vast natural areas–bogs, tidal wetlands, scenic areas, fresh water and saltwater marshes, swamp forests, scenic rivers, upland forests, ponds, and other areas of ecological significance–are of untold value to the fauna and flora as well as to man himself. The waters of the Estuary Area have long provided a variety and abundance of fish and wildlife. For example, millions of pounds of fish and shellfish are caught each year. In addition, sport fishing has been a major source of recreation while the wetlands have served as prime hunting grounds for waterfowlers. The Bay region forms a major part of the Atlantic flyway providing one of the primary wintering habitats for waterfowl migrating from the north. It is generally agreed that the Chesapeake Bay wetlands have few equals. They are principally responsible for the high production rates of many types of wildlife including muskrats, racoon, white-tailed deer, rails, and snipe.
The Bay region also serves as a habitat for a number of endangered and threatened species (Endangered species are those which are in danger of extinction throughout all or a significant portion of their range. Threatened species are those species which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.). These include birds, mammals, reptiles, and fish. Table 4-26 lists those threatened and endangered species. In addition to these rare species of animals (fauna) are a number of endangered plants (flora) such as the seaside alder and several species of ferns (not as much research has been conducted on rare and endangered species of flora as endangered species of fauna). The Center for Natural Areas, Ecology Program, Smithsonian Institution has recently prepared a report entitled "Natural Areas of the Chesapeake Bay Region: Ecological Priorities," which surveys, among other things, the endangered flora and fauna of the Bay region.

In addition to their usefulness as discussed above, the natural environmental areas have value in a variety of other ways. Marshes, wetlands, and related areas tend to preserve the genetic stock of organisms. For man, they provide important points of research investigation and serve as living museums where nature can be observed firsthand. Their value in providing esthetic enjoyment probably cannot be fully assessed. The wetlands have hydrologic value, helping in flood control by serving as water storage areas during periods of high rainfall and flooding. They also protect fastland from erosion and help maintain the quality of adjacent waters.

The various states are conducting surveys of natural environmental areas as part of their coastal zone management (CZM) program. These surveys, which include such things as vegetation mapping studies of wetlands and studies of upland natural areas and geographic areas of particular concern, can be obtained in report form from the appropriate state agency involved in developing its state's CZM program.

TABLE 4-26
THREATENED AND ENDANGERED SPECIES
THROUGHOUT THE CHESAPEAKE BAY REGION

BIRDS	REPTILES
Southern Bald Eagle	Bog Turtle
Red-Cockaded Woodpecker	Atlantic Green Turtle
Eskimo Curlew	Atlantic Hawksbill Turtle
Arctic Peregrine Falcon	Atlantic Ridley
Ipswich Sparrow	Atlantic Leatherback
Bachman's Warbler	Rainbow Snake
Brown Pelican	Coal Skunk
MAMMALS	**FISH**
Delmarva Peninsula Fox Squirrel	Shortnose Sturgeon
Eastern Cougar	Maryland Darter
Virginia Big-eared Bat	
Indiana Bat	

DESCRIPTIVE PUBLICATIONS

In developing an inventory of natural environmental areas in the Chesapeake Bay region, data were compiled from a number of sources. Most of the infor-

mation was collected on a state basis. However, for certain types of natural areas (scenic rivers, major research, and education facilities) data were not available in report form for portions of the Study Area. In those cases State officials were consulted to obtain the required information. Other data used in this chapter but which may not be available through normal sources of information include the following:

a. *Maryland Public Lands Inventory.* The Maryland Department of State Planning has prepared an inventory and mapping of Federal and State properties within Maryland. The inventory includes the size and use of the parcel and the agency holding title or using the parcel. This information was used to map and inventory a number of properties within Maryland including Federal and State forest and park areas, Federal and State fish and wildlife management areas, and major military, education and research facilities.

b. *Archeological Resource Maps.* The State Archeologists for Maryland and Delaware have prepared county maps showing the approximate sites of known archeological resources within each State. These maps were used in the inventory for this chapter.

c. *General Highway Maps.* The State Roads Commission of Maryland, Division of Planning, and the Delaware State Highway Department, Bureau of Highway Planning, have each prepared general highway maps at a scale of 1 inch to 1 mile for each of the counties within their jurisdiction. The maps were used as work sheets in preparing the mapping for this chapter.

d. *Delaware Outdoor Recreation Plan Inventory Update.* This study was conducted by the Delaware State Planning Office and provides an up-to-date inventory of outdoor recreation facilities within the State of Delaware. It was used specifically to map and inventory Federal and State forests and parks and Federal and State wildlife refuges.

e. *Delaware State Historic Preservation Plan.* This publication was prepared by the Division of Historical and Cultural Affairs and represents Delaware's official State plan for historic preservation. The report was used in the discussion of management responsibilities of the State of Delaware with regard to its historic landmarks.

f. *Virginia Outdoors Plan.* This document was prepared by the Virginia Outdoor Recreation Study Commission to serve as a recreation plan for the Commonwealth. The Plan was used for this study to inventory and map Federal and State forests and parks, Federal and State wildlife refuges and potential scenic rivers.

PRESENT STATUS

PRESENT RESOURCE USE

Mapping of the archeological, historic, and natural environmental resources of the Chesapeake Bay Region was done at a scale of 1:250,000 on Chesapeake Bay Study base maps. The significant nature and present status of those elements assessed in this inventory are discussed below along with certain other relevant information such as the specific source of data for each.

ARCHEOLOGICAL RESOURCES

To access and inventory existing and potential archeological resources, it was necessary to contact each of the three state Archelogists within the study area. At the time of data collection, these persons were:

Tyler Bastian
State Archeologist
Division of Archeology
Maryland Geological Survey
State of Maryland

Howard MacCord, Sr.
State Archeologist
Virginia State Library
Commonwealth of Virginia

Ronald Thomas
State Archeologist
Section of Archeology
State of Delaware

Each State Archeologist has the responsibility of maintaining the archeological program or programs of his State. These programs are aimed at accomplishing the necessary investigations and providing technical advice to government agencies and private groups involved in excavation and salvage activity.

Two types of data were provided by the State Archeologists: first, information on those resource sites which have been fully or partially dug or at least located and recorded for possible future excavation (these resources have been designated as "existing"); secondly, information concerning those areas where potential archeological resources may be found (desig-

nated as "potential"). Plates 4-7, 4-8, and 4-9 show the existing and potential archeological resources within the Study Area. The exact locations of these resources have purposely not been pinpointed. The reason for this is simple: there exists a very real danger that the fragile artifacts will be destroyed (as many have been) by over-zealous amateur archeologists and "souvenir hunters."

Due to monetary and manpower limitations, only a fraction of the archeological resources have presently been discovered. Thus, large geographic areas remain to be surveyed. Almost the entire shoreline of the bay and its tributaries are thought to be potential archelogical sites. Most of the known sites are located in areas which have experienced high levels of construction and/or cultivation.

The numerous Indian tribes which inhabited what is now Maryland, Virginia, and Delaware left much evidence of their existence. Some of the most frequently found artifacts have consisted of various types of clay pottery representing different periods of development and varying customs; stone objects such as fluted projectile points, spear tips, chipped stone knives, stone axes, grinding stones, stemmed darts, bowls, scrapers, and drills; copper cups and pendants; and burial mounds. Oyster shell middens, which prevail along lower tidal portions of waterways, attest to the use of oysters as a primary element of early Indian's diet. Carefully supervised excavation can reveal the location and dimensions of post holes, storage pits and burial mounds; allow for the recovery of bones, seeds, cracked and flaked stones, and other debris indicative of food habits; and illustrate manufacturing practices and other life styles. The resources used, the techniques employed to shape and modify these resources, the design styles favored, the geographic distribution of these materials and techniques, and the marks resulting from the object's use can tell much about the history of the people, the era, and the area.

The earliest inhabitants in this area probably came to the Bay region between 11,000 and 9,000 B.C. This was the Paleo-Indian culture, a highly mobile, nomadic and gathering people. Settlements consisted of temporary campsites. Artifacts identified from this culture are made up of fluted spear points, spurred scrapers, and pointed side scrapers, all made of chipped stone. The Archaic Indian Culture existed from 9,000 to 1,000 B.C. This was a semi-nomadic, hunting and gathering culture whose people confined themselves to more restricted areas near food and water than did the earlier indians. The utilization of river resources such as oysters as well as deer and other small game, made up the major hunting activities. Repre-

sentative artifacts include a variety of stemmed and notched spear and dart points of chipped stone as well as stone tools such as axes and chisels. During the Woodland Indian Culture (1000 B.C. to A.D. 1600), the first pottery came into use in the region. Toward the end of the period, agriculture and permanent villages also appeared. Burial sites representing the early and middle part of this culture have been found containing stone tools and copper beads and pendants. Temporary villages made up of the same kin or clan groups were established during certain times of the year, possibly to gather and harvest seasonal foods. Permanent villages were established around 1000 A.D. With the arrival of the Europeans came the Historic Indian Culture (AD 1600 - 1800). During this time, the indians began trading with the Europeans for goods such as tools, weapons, and brass and iron pots. By 1800, the majority of these indians had migrated out of the Region. For additional information on archeological resources and artifacts and prehistoric Indian cultures, it is suggested that the respective State Archeologist be contacted. Each state is also involved in inventorying its archeological resources as part of its Coastal Zone Management (CZM) program. For example the Maryland Energy and Coastal Zone Administration has completed a Study entitled the "Archeological Resources Management Study" which will serve as an important component of the State's CZM program. Other respective agencies charged with developing the State CZM programs may be contacted for more information concerning the archeological/historic resources of the various States.

HISTORIC RESOURCES

To inventory and map the historic resources within the Chesapeake Bay region, the *National Register of Historic Places*, compiled and put out by the National Park Service, was used. Properties included in the National Register are made up of areas of historical significance including historic buildings, structures, districts, and objects significant in American history. Such historic areas are added to the National Park System by Acts of Congress through Executive Order, through designation as "National Historic Landmarks" by the Secretary of the Interior, and through nomination by Federal and State agencies. The names and locations of properties in the National Register are published annually in the "Federal Register." Historic places are constantly being nominated and added to the Register.

The goal of the National Register is to stimulate preservation of historic properties that together will represent, to the fullest extent possible, every aspect of the Nation's prehistory and history. Certain properties are selected

as National Historic Landmarks because they are considered to be nationally-important reminders of the Nation's heritage. In return for this special status the owner agrees to preserve the significant historic values for which the property was "singled out."

The National Historic Preservation Act of 1966 recognized that the spirit and direction of the Nation are founded upon and reflected in its historic past and that the historical and cultural foundations of the Nation should be preserved as a living part of community life and development in order to give a sense of orientation to the American people. The Act expanded the National Register to include districts, sites, structures, and objects significant in American history, architecture, archeology and culture. In addition, historic properties of State and local importance are authorized for inclusion. The Act also provides matching grants in aid to the States to assist them in historic preservation. Each State prepares a statewide historic site survey from which a comprehensive historic preservation plan is prepared. Upon approval of the plan, the State may nominate sites to the National Register.

Maryland, Virginia, and Delaware each have a lead agency whose main responsibility is preserving and maintaining historical, aesthetic, and cultural properties, buildings, fixtures, and furnishings. The agencies, (listed in Table 4-27), are also involved in promoting interest in and the study of historical matters. Other government institutions, private concerns, and individual citizens are encouraged to preserve and maintain historical

TABLE 4-27
STATE AGENCIES WITH RESPONSIBILITY
OF HISTORICAL PRESERVATION

The Maryland Historical Trust
Department of Economic and Community Development
Annapolis, Maryland

The Virginia Historic Landmarks Commission
Office of the Secretary of Commerce and Resources
Richmond, Virginia

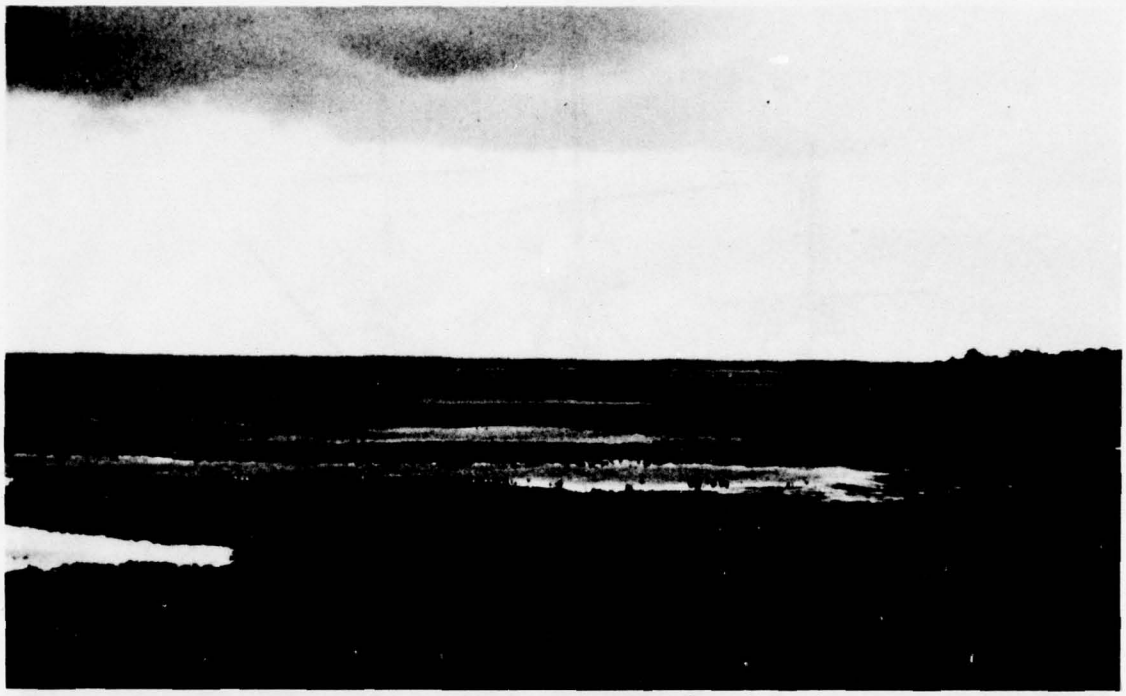
The Delaware Historic Preservation Section
Division of Historical and Cultural Affairs
Department of State
Dover, Delaware

properties under the States' jurisdiction. Each agency works closely with the National Park Service. Under the National Historic Preservation Act of 1966, they administer the grant program of the National Register and are charged with development of the State plan for historic preservation discussed above.

All properties within the Study Area nominated for inclusion to the National Register prior to 30 June 1974 have been included in this inventory. Plates 4-10, 4-11, and 4-12 show these historic sites. Attachment A at the rear of this Appendix, lists the sites shown in the above plates. The large number of historic places present in the Bay region provides proof of the region's historic significance and its fundamental role in development of the Nation. Many of the sites deal largely with the earliest colonial settlements, the winning of National independence, founding of the Union, the Civil War struggle, and the lives of national leaders. Within the Study Area are found such historically important properties as the U.S. Frigate Constellation, nation's oldest warship and flagship of the Atlantic Fleet during World War II; Annapolis Historic District, early colonial port and capital of the U.S. during a short period in 1783-1784; Stratford Hall, home of Robert E. Lee, great Commander of the Confederate Armies; Mt. Vernon, home of the first President of the United States; Petersburg National Battlefield, scene of one of the decisive confrontations between the North and South during the Civil War; Richmond National Battlefield Park, commemorating the struggle for possession of the Confederate Capital during the Civil War; Jamestown National Historic Site, first permanent English colony in North America; Williamsburg Historic District, capital of the Virginia Colony during much of the eighteenth century and an important social and cultural center of the English colonies during that period; the Chesapeake and Ohio Canal National Historic Park, site of one of the early canals built in this country and operated from 1850 to 1924; and the Jefferson and Lincoln Memorials in Washington, D.C.

FEDERAL AND STATE FOREST AND PARK AREAS

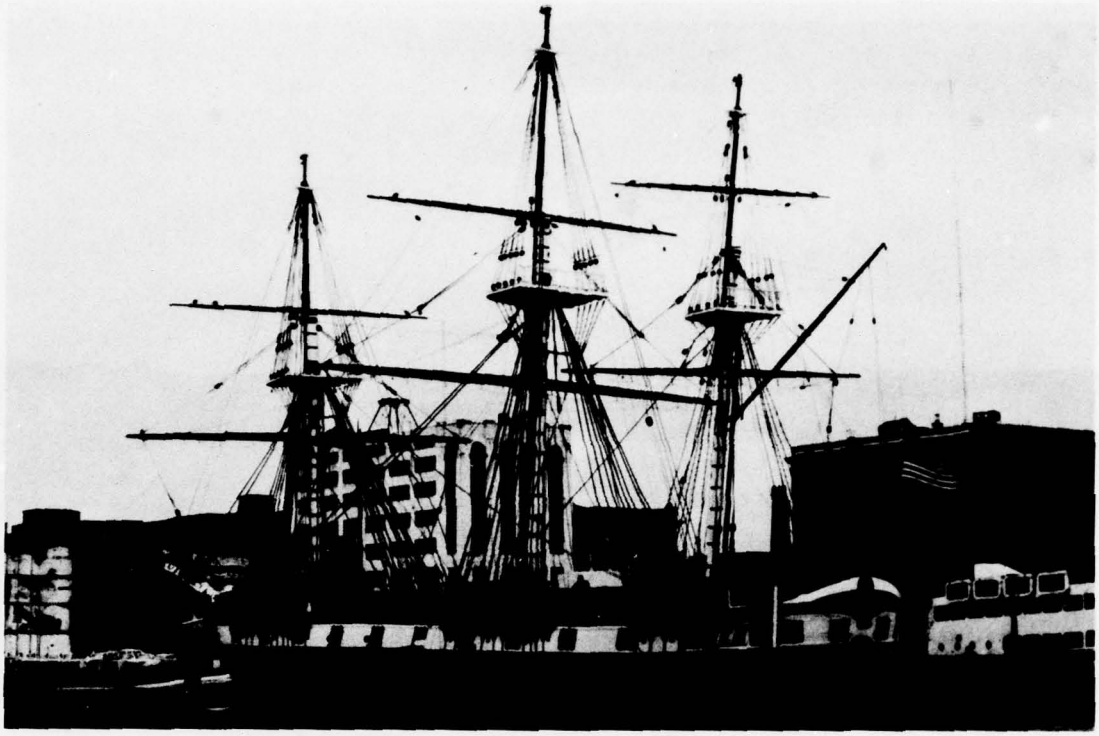
A sizeable number of forests and parks have been established throughout the Chesapeake Bay region. These natural areas are administered by either the National Park Service or a State agency. The National Park Service, under the Department of the Interior, develops management plans for, constructs facilities in, and staffs the areas under its jurisdiction. Generally, these areas are of either natural, historic, recreational, or cultural significance. The National Capital Parks system, administered by the National Park Service, includes a number of parks and related areas in the District of Columbia and surrounding areas of Maryland and Virginia. In the Bay region, the National



Chesapeake Bay wetlands have few equals in their importance to fish and wildlife.



Within the Bay Region are hundreds of National Historic Sites.



U.S.F. Constellation, Nation's oldest warship.



Shad Landing is one of many State Parks within the Bay Region.

Park Service currently administers, either directly or under the auspices of the National Capital Parks system, 35 properties (as of 30 June 1974).

The Maryland Park Service administers the State's parks while the Maryland Forest Service manages its forests. Both agencies are under the Department of Natural Resources and together have jurisdiction over 34 properties within the Study Area. The Commonwealth of Virginia, in similar fashion to Maryland, has two State bodies administering its forests and parks: the Division of Forestry, which manages two State forests, and the Division of Parks which maintains control over 11 parks and related properties within the Study Area. Both are under the guidance of the Virginia Department of Conservation and Economic Development. The Delaware Division of Parks, Recreation, and Forestry under the Department of Natural Resources and Environmental Control presently administers six forests and nine parks within the State. Plates 4-13, 4-14, and 4-15 show the Federal and State forests and parks within the Chesapeake Bay region and Attachment B lists the same. A number of the region's parks and forests are located adjacent to the Bay proper or one of its tributaries. These include such properties as Fort Washington National Park and Sandy Point, Calvert Cliffs, Elk Neck, Susquehanna, Janes Island, and Point Lookout State Parks in Maryland; Theodore Roosevelt Island and East and West Potomac Parks in Washington, D. C.; and Great Falls Park, Jamestown Festival Park, and York River, Westmoreland, Mason Neck, Chippokes Plantation, and Seashore State Parks in Virginia, to name a few. The setting of these parks enhances both their esthetic value and their appeal as recreational facilities.

A number of sources of data were used in mapping and inventorying these properties. Besides those discussed above under "Descriptive Publications," others included:

National Park Service's *Parks for America (1964)*

National Park Service's *National Parks and Landmarks* (January, 1972)

FEDERAL AND STATE FISH AND WILDLIFE MANAGEMENT AREAS

Many of the same data sources cited for use in assessment of forests and parks were used to inventory national wildlife refuges and state wildlife management areas. In addition, the following provided valuable information:

U.S. Department of the Interior's *Directory of National Wildlife Refuges* (February, 1972).

Chesapeake Bay Existing Conditions Report. Appendix C – "The Bay – Processes and Resources." Chapter VI: Fish and Wildlife.

The Bay region's land and water resources together create one of the best wildlife habitats in the Nation. The U.S. Fish and Wildlife Service under the Department of the Interior has primary jurisdiction over the national wildlife refuges. At present there are 20 properties within the Study Area which qualify as national refuges or related properties (such as the Patuxent Wildlife Research Center). The primary purpose of these refuges is to protect wildlife including certain endangered and threatened species. Those refuges within the Bay region are particularly significant for use by migratory birds since the region is an important part of the Atlantic Flyway. Research is conducted at a number of the facilities while limited hunting is offered at some.

Maryland, Virginia, and Delaware all administer fish and wildlife programs. Within the Study Area there are 68 state wildlife management areas and related properties including game farms, sanctuaries, and preserves. In Maryland, the principal agency with control over these areas is the Maryland Wildlife Administration under the Department of Natural Resources. In Virginia, the Commission of Game and Inland Fisheries has primary responsibility. Delaware's Division of Fish and Wildlife, under the Department of Natural Resources and Environmental Control, maintains that State's wildlife areas. All three agencies are involved in the preservation and propagation of birds, animals, fresh water fish and other wildlife. Plates 4-16, 4-17, and 4-18 show the many Federal and State areas in the Chesapeake Bay region. Attachment C lists these properties.

The Eastern Shore, in particular, has a number of large wildlife management areas including such refuges as Blackwater, Martin, and Eastern Neck National Wildlife Refuges and Deal Island, Taylors Island, Idylwild, and Fishing Bay State Wildlife Management Areas in Maryland; Prime Hook and

Bombay Hook National Wildlife Refuges and Petersburg, Assawoman, and Little Creek State Wildlife areas in Delaware; Chincoteague and Fisherman's Island National Wildlife Refuges and Saxis and Mockhorn State Wildlife Management Areas in Virginia. In addition to the many wildlife areas on the Eastern Shore, there are a number of areas on the Western Shore. These include Mason Neck and Plum Tree Island National Wildlife Refuges and Chickahominy and Hog Island State Wildlife Management Areas in Virginia; and the Susquehanna National Wildlife Refuge in Maryland.

MAJOR MILITARY, EDUCATION, AND RESEARCH FACILITIES

Military areas, including those of the Bay region, frequently encompass very valuable environmental areas: marshes, wetlands, forests, and other ecologically significant regions. Even though these areas are not officially designated as environmental areas, they nevertheless function as such. In addition, some of the military facilities (or at least parts of them) are being considered for conversion to public lands (parks, forests, wildlife areas). Consequently, in the near future, some may be officially designated natural environmental areas. For this reason, major military areas within Chesapeake Bay region have been assessed and inventoried in this chapter. These areas include Army, Navy, Marine Corps and Air Force facilities.

Federal and State research areas are often large in geographic area and, as with military facilities, they frequently include valuable bogs, tidal wetlands, marshes, swamp forests, and other natural areas. Many times the research being carried on at these facilities is closely associated with environmental affairs. For example, the Annapolis Field Office of the Environmental Protection Agency, the Smithsonian Institution's Chesapeake Bay Center for Environmental Studies, and the Maryland Department of Natural Resources are all located in Anne Arundel County, Maryland. The U.S. Fish and Wildlife Service has a field office on the Eastern Shore in Oxford, Maryland; the University of Maryland's Chesapeake Biological Lab is located on Soloman's Island; and the Virginia Institute of Marine Science is at Gloucester Point, Virginia. Therefore, because of their nature, research facilities were included in this inventory.

Public higher education institutions should also be singled out because of the nature of work that is frequently carried on there—research associated with some aspect of the environment. Plates 4-19, 4-20, and 4-21 show the major education, research, and military areas of the Chesapeake Bay region. Attachment D lists these properties. For Maryland, the Department of State

Planning's "Public Lands Inventory" provided the necessary data. The Virginia Educational Directory put out by the State Department of Education (1974) was used to inventory institutions within the Commonwealth. For data on major research facilities within Virginia, the following State agencies were contacted:

Department of State Planning and Community Affairs

Virginia State Library

Virginia Institute of Marine Science

Department of Education

Department of Conservation and Economic Development

None of the authorities at the above agencies knew of an existing inventory of research facilities. It was possible to complete a partial list from information supplied by the above, however. The various county "Economic Data Summaries" were used to obtain data on military reservations within the Commonwealth. For Delaware, the State Department of Administrative Services, Division of Facilities Management, was contacted for information on research and education facilities. General highway maps for each of the three counties of Delaware were consulted to obtain information on military reservations.

SCENIC RIVERS

The States within the Study Area have either initiated or are moving toward initiating active programs to identify and designate certain rivers within their boundaries as scenic rivers. The Virginia Commission of Outdoor Recreation was directed by the General Assembly to study the Commonwealth's rivers for the purpose of designating certain ones as scenic to protect them for the enjoyment of present and future generations. As a result of this survey, the Commission recommended establishment of a scenic river system. The General Assembly enacted the Scenic Rivers Act in 1970 which, among other things, helps coordinate efforts between Federal and State agencies to insure comprehensive water resource planning. In addition, private as well as local and State government efforts are focused on maintaining representative rivers as natural preserves. Local and State land use controls are to be imposed along with numerous other standards to guarantee the protection of



The Pocomoke River and its adjacent land areas have been designated a scenic river system.

those rivers designated as scenic. The Maryland Legislature recognized that certain rivers within the State plus their adjacent land areas possess outstanding scenic, fish, wildlife, and other recreation values. The State, therefore, adopted a policy which protects the water quality of those rivers and fulfills vital conservation purposes by wise use of resources within the scenic river system. The program provides for the wise management of adjacent land resources and preservation of their scenic, agricultural, and wild qualities. In addition, use is limited to "horseback riding, natural and geological interpretation, scenic appreciation, and other programs by which the general public can appreciate and enjoy the value of these areas as scenic and wild rivers in a setting of natural solitude."(1)

A non-official copy of the Maryland "Wild and Scenic Rivers Act," Senate Bill 837, Chapter 612 was used to assess the scenic rivers in Maryland. The Commission of Outdoor Recreation's *Virginia Outdoors Plan* was used to map and inventory scenic rivers in Virginia.

The State of Delaware has no existing document concerning a scenic rivers program. Mr. David Hugg of the Delaware State Planning Office suggested

that three rivers within the State might be considered for designation as scenic rivers. These included Brandywine Creek, the St. Jones River, and the Nanticoke River. Nothing offical has been done to recommend these rivers for designation, however. Plates 4-22, 4-23, and 4-24 show the existing and potential scenic rivers of the Study Area. Table 4-28 lists these rivers.

TABLE 4-28

SCENIC AND POTENTIAL SCENIC RIVERS
OF THE CHESAPEAKE BAY REGION

STATE/COUNTIES	RIVER	PLATE RIVER NUMBER
MARYLAND		
Anne Arundel	Severn	1
Harford	Deer Creek	2
Prince Georges, Charles, Anne Arundel, Calvert, St. Marys, Montgomery, and Howard	Patuxent	3
Charles and St. Marys	Wicomico	4
Prince Georges	Anacostia	5
Wicomico, Worcester, and Somerset.	Pocomoke	6
Frederick and Carroll	Monocacy	7
Montgomery	Potomac	8
VIRGINIA		
Loudoun	Goose Creek	9
Stafford, Spotsylvania, King George, and Caroline	Rappahannock	10

TABLE 4-28 (Continued)

SCENIC AND POTENTIAL SCENIC RIVERS
OF THE CHESAPEAKE BAY REGION

STATE/COUNTIES	RIVER	PLATE RIVER NUMBER
Chesterfield, Dinwiddle, and City of Petersburg	Appomattox	11
Charles City and New Kent	Chickahominy	12
Isle of Wight, Surry, and Southampton	Blackwater	13
City of Chesapeake	Northwest	14
Middlesex, King and Queen, and Gloucester	Dragon Run	15
King William and King and Queen	Mattaponi	16
Dinwiddie, Greensville, and Sussex	Nottoway	17
Spotsylvania	Rapidan	18
DELAWARE		
New Castle	Brandywine	19
Kent	St. Jones	20
Sussex	Nanticoke	21

Success in establishing scenic rivers programs depends, to a large degree, upon public concern and demand. Fortunately, man is becoming increasingly aware that quality of life and quality of environment are closely aligned, thus assuring progress in achieving the goals of the scenic rivers programs. For more information on the scenic rivers programs of Maryland and Virginia, it is suggested that the Maryland Scenic and Wild Rivers Review Board and the Virginia Commission of Outdoor Recreation be contacted.

WETLANDS

The importance of wetlands has already been discussed. As varied as their use is, so too is their nature. Each of the three states within the Study Area have classified and defined wetlands differently. Maryland defines its wetlands as "all lands under the navigable water of the State below the mean high tide which is affected by the regular rise and fall of the tide."(2) Delaware's wetlands are all those lands above the mean low water elevation including any bank, marsh,swamp, meadow, flat or other land subject to tidal action and including those areas connected to tidal waters whose surface is at or below an elevation of two feet above local mean high water. Virginia defines its wetlands as "all that land lying between mean low water and an elevation above mean low water equal to the factor 1.5 times the tide range at the site of the proposed project. . ."(3)

Although each wetland type is unique and official State definitions differ, similarities are close enough to allow wetlands to be divided into three broad categories(4): coastal saline, coastal fresh, and inland fresh. Plates 4-25, 4-26, and 4-27 show the location of major wetland areas within the Chesapeake Bay region.

Coastal saline wetlands are in direct contact with or are indirectly affected by saline waters. They normally include salt meadows and both regularly and irregularly flooded salt marshes. Although salt marsh communities are characterized by a limited diversity of plant species, it is generally believed that these marshes are one of the most productive land use types. In addition, these marshes are extremely valuable for both sport and commercial fishes and as a habitat for many wildlife species.

Coastal fresh wetlands are affected by tidal fresh water and generally include coastal deep fresh marsh. Plant diversity is much greater than with coastal saline wetlands and, as a result, they provide a more valuable wildlife habitat. Inland fresh wetlands include those areas usually characterized by non-tidal

fresh water. Included are seasonally flooded basins and flats, inland fresh meadows, inland shallow fresh marsh, shrub swamp, and wooded swamp. As with the coastal fresh wetlands, the great variety of vegetation makes the inland fresh wetlands of great importance to numerous wildlife species.

For more information on wetlands, it is suggested that the reader refer to Appendix 12, Fish and Wildlife; and Appendix 15, Biota.

PRIMARY AQUATIC AREAS

The Chesapeake Bay region is undisputedly considered one of the most productive estuary areas of the world. The valuable land resources of the region have heretofore been assessed. The Bay plus its many tributary estuaries are significant as well, serving as valuable aquatic habitats. Therefore, no inventory of natural environmental areas can be complete without at least a brief assessment of primary aquatic areas. In addition, the water-related land resources which have been examined throughout this Appendix have a substantial impact on the aquatic resources of the Bay region. Consequently, it is essential to take a cursory look at some of the rich aquatic resources. Appendix 12 of the *Future Conditions Report* entitled "Fish and Wildlife" and Appendix 15 entitled "Biota" will each provide a more thorough examination of those respective resources.

The fishery resources of the Bay are large in both variety and number. The entire Bay serves as a nursery area, although only certain portions are considered spawning grounds. Generally, the largest of the major spawning areas is in the less saline waters of northern Chesapeake Bay. The fresh water areas of the Potomac, York, Rappahannock, James and Patuxent Estuaries are also important spawning grounds. These areas plus most of the Eastern Shore rivers comprise spawning areas for anadromous fish such as blueback herring, alewife, shad, and striped bass. Such fish generally leave the ocean to swim upstream to fresh water to spawn. Other finfish known as the non-anadromous fish, use the Bay and its tributaries as feeding grounds and nursery areas. Some even spawn in the Bay, but because they do not specifically enter the fresh water areas of the Bay and its tributaries to spawn, they are not classified as anadromous. Included in this non-anadromous category are menhaden, bluefish, spot, croaker, silverside, bay anchovy, puffer, hogchoker, weakfish, catfish, and flounder. Both white and yellow perch are common in the Bay and can be considered semi-anadromous in that they are indigenous to the Bay but have definite seasonal migratory patterns upstream to fresh water areas for purposes of spawning.

A variety of shellfish are found throughout the Bay region. High salinity areas such as the mouth of the Bay are the major blue crab spawning areas. Being one of the most mobile shellfish types, crabs distribute themselves throughout the Bay, particularly during the warmer months. Oysters and clams are abundant in many parts of the Bay and its sub-estuaries as well. The former shellfish has had a long history as an important species in Chesapeake Bay. Oysters require firm bottoms to prevent sinking and smothering and usually attach themselves to hard objects such as oyster bars, rocks, or reefs. A number of species of clams are found in Chesapeake Bay but many are too small to be of commercial value. Three, the soft-shelled clam, hard clam, and brackish water clam are currently harvested commercially or have potential of being harvested. Plates 4-28, 4-29, and 4-30 show the major anadromous spawning areas and shellfish production and harvest areas of Chesapeake Bay.(5)

Sport fishing is enjoyed by many throughout the Bay region while commercial fishing proves to be one of the most profitable in the nation. Plates 4-31, 4-32, and 4-33 show the major sport and commercial fishing areas in Chesapeake Bay.(6) Increased leisure time and ideal fishing conditions have brought about an increase in sport fishing in the study areas. Principal fishes caught for sport include striped bass, bluefish, weakfish, white perch, black drum, spot, cobia, and flounder. In addition, sizable quantities of Chesapeake blue crabs are harvested on a recreation basis.

The high nutrient content of the Bay's waters is responsible, to a large degree, for the high productivity of both finfish and shellfish. Production of industrial type fish, which include menhaden (which make up the overwhelming majority of the industrial fish), alewife, striped bass, shad, catfish, spot, and croaker, has approached maximum harvest capability. Edible finfish are harvested in smaller quantities than industrial fish and it is believed their maximum harvest capability level has not yet been reached. Such fish include both white and yellow perch, catfish, swellfish, weakfish, butterfish, flounder, bluefish, and spot.

As with finfish, shellfish harvests are quite important to the commercial fisherman. Millions of pounds of crabs, oysters, and clams are produced commercially each year to make the shellfish industry more important, economically speaking, than the finfish harvest.(7)

MANAGEMENT RESPONSIBILITIES

The Federal, State, and local governments have all taken steps toward the "enhancement, conservation, preservation, and restoration" of the nat-

ural environmental, archeological, and historic areas within their jurisdiction.

The Federal Government has direct development, management, and operation authority over the many national parks and seashores, wildlife refuges, and related properties. The National Park Service (NPS) administers the parks and seashores within the Study Area. Through its national and historic landmarks programs, NPS encourages the preservation of significant natural and historic values in the private sector. In addition, NPS handles the Historic Preservation Program (established by the National Historic Preservation Act of 1966) with its National Register of Historic Places and grants-in-aid. Both elements of the program encourage preservation of the continuity and drama of American history.

The program charges Federal agencies with the responsibility for planning, protection, preservation, and maintenance of unique historic districts, sites, structures, and objects in regard to Federal programs and projects.

The National Marine Fisheries Service (NMFS) under the Department of Commerce provides services and conducts research programs for both the protection and use of living marine resources for their aesthetic, economic, and recreational value.

The Department of Interior's Fish and Wildlife Service administers the national wildlife refuges and has responsibility to determine the probable effects of Federal action or sanctioned action on fish and wildlife resources and associated habitats. In addition, it recommends measures for preventing or reducing damages to and improving conditions for these resources.

Federal concern for protecting and preserving the nation's archeological, historic, and natural resources is clearly set forth in a number of basic acts. A few of those with greatest impacts are discussed below.

The National Environmental Policy Act of 1969, declares it the policy of the Federal Government to help preserve important historic, cultural, and natural aspects of the nation's heritage. The Act requires advance consideration of the impact of Federal projects and actions on the environment and provides that an environmental impact statement be submitted to assess the effects of the proposed action. The Act also established the Council on Environmental Quality to advise and assist the President in carrying out the provisions of the Act. The Fish and Wildlife Coordination Act, in similar fashion to the Environmental Policy Act, requires that the impact of

government actions on fish and wildlife be assessed, prior to the action. The Endangered Species Preservation Act of 1966 (amended in 1969) protects fish and wildlife, particularly those threatened by extinction. The Rivers and Harbors Act of 1899, Federal Water Quality Act, Water Pollution Control Act, and Water Pollution Control Act Amendments are all aimed at establishing some minimum water quality criteria. In essence, by improving the water quality, these acts are protecting marine biota (finfish, shellfish, aquatic plant life) and improving recreational and aesthetic values.

The Federal Coastal Zone Management Act, passed in 1972, provides funding to States to develop and operate a management program for their coastal zones. The Act encourages local, State, and Federal agencies to assist in the development and implementation of these programs to achieve wise use of the land and water resources of the coastal zone. Among other things, the Act requires that geographic areas of particular concern to the State be identified and inventoried. These include such historic, archeological, and natural environmental and esthetic resources as:

(1) Areas of unique, scarce, fragile, or vulnerable natural habitat, physical feature, historical significance, cultural value, and scenic importance;

(2) Areas of high natural productivity or essential habitat for living resources, including fish, wildlife, and the various trophic levels in the food web critical to their well-being;

(3) Areas of substantial recreational value and/or opportunity;

(4) Areas of significant hazard if developed, due to storms, slides, floods, and erosion; and

(5) Areas needed to protect, maintain or replenish coastal lands or resources, such areas including coastal flood plains, aquifer recharge areas, sand dunes, coral and other reefs, beaches, offshore sand deposits, and mangrove stands.

All three States within the Study Area are currently developing coastal zone management programs to meet Federal specifications and thus qualify for funding. Delaware was the first State in the nation to pass its own coastal zone act banning heavy industry and port or dock facilities within two miles of the shoreline not in existence at the time of passage of the act.

Delaware is presently expanding its program under the Federal Coastal Zone Management Program.

Maryland, Virginia, and Delaware have each enacted wetlands laws to help control and regulate the use of these valuable lands. Each law is aimed at preserving the wetlands by preventing their despoliation and destruction. Ecological, economic, and aesthetic values are all taken into account. In Virginia, a number of counties and independent cities have established wetlands boards with responsibility for granting permits for encroaching on wetlands. A State agency, the Marine Resources Commission, grants permits for those localities which do not have wetlands boards.

Maryland has several other programs designed to help control the natural environmental resources of the State. Recently passed legislation (the State land use control law) provides for the identification and designation of critical areas within the State. These critical areas are then to be incorporated in both a "State Development Plan" as well as the comprehensive plans of non-charter counties. The State also has the right to intervene in any administrative, judicial, or other proceeding concerning land use anywhere in the State. A second program, the Power Plant Siting Program, provides for such things as monitoring the operations of existing facilities to assess environmental impacts and an environmental evaluation of proposed power plant facilities.

At the local level, many counties and independent cities have passed zoning and sub-division regulations to secure and preserve recreation areas, parks, conservation areas, and certain other natural resources. Local tax policies have also been useful in encouraging specific land uses such as conservation zones. Some county and municipal governments have used public land acquisition to preserve and maintain the character of open lands and conservation areas. By the government buying or condemning the use of this land, it is possible to control development rights while permitting the owner to retain the title and actual possession of the property.

Thus there are presently a variety of Federal, State, and local programs aimed at conserving and enhancing the historic, archeological, and natural environmental areas of the Bay region. Yet with all of these programs currently in existence, the balance may still be tipped away from protection of the environment. Additional legislation may be needed to preserve these critical areas in the future. An analysis of such legislation will be made in Chapter VIII.

For more information on specific programs discussed above, it is suggested that the agency charged with responsibility in administering the program be contacted.

FUTURE RESOURCE NEEDS

FUTURE NEEDS

Forming the southern segment of "megalopolis" the Chesapeake Bay Study Area contained over 7,850,000 people in 1970.(8) At present there are large demands for recreational use of certain natural environmental areas—beaches, forests, parks, wildlife areas, and related properties. This demand is expected to increase in the future. "The incidence of outdoor activity solely for recreational purposes has undergone a phenomenal growth during the past few years and is predicted to continue doing so."(9) An increase in both population and leisure time are two of the primary factors responsible for this growth in demand of recreational facilities. These coupled with the fact that the Bay has many unusually valuable environmental areas, make the region especially attractive for recreation. Man's increasing demand for use of the ecologically sensitive environmental areas for such things as recreation has created certain conflicts which will be addressed below.

CONFLICTS INVOLVING THE REGION'S HISTORIC, ARCHEOLOGICAL, AND NATURAL ENVIRONMENTAL AREAS

EXISTING PROBLEMS AND CONFLICTS

The very fragile nature of the historic, archeological, and natural environmental resources of the Chesapeake Bay region makes them very susceptible to both man's destruction as well as that by natural forces. This section will attempt to assess a few of the human and natural forces which threaten these ecologically and historically significant areas.

As was briefly stated earlier, many of the archeological resources within the Study Area have been disturbed and even destroyed by natural forces such as erosion, flooding, and land subsidence, and by agricultural practices, construction activities (highway construction and urban development) and industrial development (pipelines, industrial parks, and extractive activities such as quarrying). The record of past human activity has often been irrevocably destroyed. To compound the situation, relic hunters and souvenir collectors have, in many cases, sufficiently disturbed or altered

archeological sites to the point where they are no longer of much value. Man's destructive impact has increased during the past 30 years. Since archeological resources are nonrenewable, the situation can only worsen unless immediate and definitive action is taken.

Urban development, including residential, commercial, industrial, and highway construction, has also been responsible for the demise of many historical buildings, structures, and objects. In such cases the developer is often unaware or unconcerned about the significance of these sites. Although many historic structures have been identified and consequently nominated to Federal or state registers of historic places, many are still undiscovered. Thus, they may yet fall prey to the developer unless positive steps can be taken to enlighten the public of their importance in American history.

Often, man's use of the land conflicts with natural environmental areas, as well. Forests, wildlife areas, and wetlands have been paved over and converted to some urban use. As man's desire to expand his cities has increased, particularly since World War II, these natural environmental areas have frequently offered the least resistance to change.

The Chesapeake Bay region's vast wetland areas, whose value to man and biota alike is difficult to estimate, have been filled, dredged, and drained in order to accommodate man. Channels have been cut, marinas built, and agricultural land created. Wildlife habitats have been replaced by residential, commercial, and industrial development. Thousands of acres of these lands were destroyed within the Estuary Area before Maryland, Delaware, and Virginia each passed legislation forbidding dredging and filling of wetlands without a permit. Such action "against nature" has been slowed but not entirely stopped. It will take stricter monitoring of the State wetlands laws to bring about a feasible and desirable cessation.

Human activity has been responsible for a decrease in certain qualities of scenic rivers within the Study Area. The growth emanating from urban centers is gradually encroaching upon these beautiful corridors with their productive wetlands, forested flood plains, aquatic life, and wildlife. Other scenic rivers are being threatened by development pressures from second homes and water-related activities. One of the greatest pressures on these rivers involves their water quality. Approaching or intensified development along certain water bodies has often accelerated water pollution problems to "crisis proportions" resulting in fish kills, shellfish bed closings, and repulsion of wildlife.

In some cases, the rivers and their adjacent shorelines have become unfit for recreational use while their overall scenic beauty and those features which distinguish them as scenic have been destroyed. Thus there exists a pressing need to preserve the precious water and land resources of a representative number of scenic rivers of the Estuary Area.

The above represent but a few of the many problems and conflicts confronting the historic, archeological, and natural environmental resources of the Study Area. With increased pressures on the land and water resources in the future, it is expected that these problems and conflicts will intensify.

FUTURE PROBLEM AREAS

Deterioration of the quality of the resource base can present serious consequences to the recreational and aesthetic values of an area. The destruction of archeological, historical, and natural environmental resources, as described above, proves to have grave repercussions on the flora and fauna of the Bay region as well. With increases in both population and urbanization projected for the Study Area, the effects wrought by certain destructive forces can expect to intensify. As man continues to build his homes, schools, shopping centers, factories, and highways, he will persist in destroying valuable woodlands and wildlife areas. As he continues to submit virgin soil to the plow he may very well destroy irreplaceable archeological resources. As he keeps tearing down the "old" to make way for the "new," he will continue to bring about the demise of valuable historical resources. As he continues to dredge and fill he will persist in destroying many of the region's wetlands. As he continues to expand his industries he will continue to pollute the scenic rivers and primary aquatic areas.

These problems will, in all likelihood, persist. Whether they will worsen remains to be seen. Much has been passed in the way of legislation to curtail certain "environmental atrocities," yet much remains to be done. In Chapter VIII, a few of the means to satisfy needs will be addressed. In addition, some possible solutions to future problem areas will be offered.

FOOTNOTES

(1) Maryland Senate Bill No. 837, Chapter 612. "Wild and Scenic Rivers" (taken from a non-official copy of Act).

(2) Maryland House Bill No. 285, Section 719(a), lines 1-4.

(3) Virginia House Bill No. 320.

(4) U.S. Department of the Interior. Fish and Wildlife Service. *Wetlands of the United States.* Circular 39, 1956 (reissued 1971).

(5) *Chesapeake Bay Existing Conditions Report.* Appendix D - "Map Folio." Plates C-VI-4, C-VI-5, C-VI-6.

(6) *Chesapeake Bay Existing Conditions Report.* Appendix D - "Map Folio." Plates C-VI-1, C-VI-3, C-VI-4, C-VI-5, C-VI-6.

(7) *Chesapeake Bay Existing Conditions Report.* Appendix C - "The Bay Processes and Resources." Chapter VI: Fish and Wildlife Resources, Table C-VI-3, Summary of Commercial Ex-Vessel Fishery Harvest.

(8) U.S. Bureau of the Census. U.S. Census of Population: 1970. *Number of Inhabitants.* Final Report PC (1)-A1 "United States Summary," Table 24 - "Population of Counties: 1970 and 1960."

(9) J.W. Shiner, "Managing Outdoor Recreation Resources," *Water Spectrum,* Volume 7, Number 3 (Fall, 1975), p. 17.

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CHAPTER VIII

MEANS TO SATISFY NEEDS

In this Chapter some of the more significant conflicts in land use between both competing activities and the natural environment will be summarized. In addition, the general broad range alternatives that could be used to meet the water-related land resources needs and to solve some of the problems and conflicts identified in the preceding chapters will be described. Finally, a brief discussion is included of the future studies needed to develop the water-related land resources portion of a management plan for Chesapeake Bay.

SUMMARY OF PROBLEMS AND CONFLICTS INVOLVING THE WATER-RELATED LAND RESOURCES

The Chesapeake Bay Study Area is a Region made up of diverse land use activities. Large urban centers located along the Fall Line of the Bay Region's Western Shore and in the Hampton Roads Area provide a distinct contrast to the more tranquil, rural nature of significant portions of the Eastern Shore, Southern Maryland, and Tidewater Virginia. The urban centers have developed into transportation hubs where dense nucleations of residential, commercial, industrial, and institutional activities prevail. Traditionally these centers have expanded outward into what was for the most part rich virgin forest lands. During the twentieth century, a number of cities of the Bay Region together with Philadelphia, New York, and other urban centers to the northeast have grown together to form almost one continuous suburb which has been termed "megalopolis" by geographer Jean Gottmann. This highly urbanized corridor has developed into the economic center of the Nation and has become one of the most densely populated and productive urban areas of the world.

While large segments of the Study Area are intensively developed, the overwhelming portion is devoted to forest and agriculture-related activity. Simultaneous to the rise of Bay Area cities has been the conversion of millions of acres of forest lands to farmlands. Excellent physical parameters such as rich soils, moderate temperature and rainfall, and relatively long growing seasons have made the Chesapeake Bay Estuary Area a most valuable farming region. The close proximity of urban markets has, in turn, brought about a large demand for the Region's agricultural products.

Presently there are millions of acres of land within the Study Area devoted to agricultural activity, commercial forest lands, or some other rural land

use. In addition, the Estuary Area contains some of the most valuable archeological and historic resources and natural environmental areas in the Nation. Considered one of the world's most productive estuaries, the Chesapeake Bay Drainage Basin contains important wetlands, saltwater and fresh water marshes, swamp forests, bogs, scenic rivers, and aquatic areas.

It is the contrast between urban and rural land uses and the sometimes fierce competition for land which has brought about many conflicts within the Estuary Area. The most well suited lands for farming and forestry are the same lands which prove attractive to urban development because they are relatively flat, fertile, and well-drained. Since urban land uses command a higher economic rent than the less intensive uses, there has been a conversion of hundreds of thousands of acres of valuable farmland, forests, and other rural areas to houses, schools, factories, shopping centers, and highways. In addition to the actual loss of forests and rich farmland, the transformation of rural land to intensive land creates serious erosion and sedimentation problems. Land, stripped of its natural vegetation to make way for such uses as parking lots, can produce and deliver many times more sediment than agricultural areas. In terms of volume, sedimentation ranks above other wastes as a major cause of water pollution.

With an expanding population, the Bay's myriad natural environmental areas have been filled, dredged, and cleared to make way for marinas, summer cottages, retirement homes, and recreational development. Frequently haphazard and poorly planned development has largely altered these environmentally fragile areas, thus upsetting their ecological balance.
In addition to the above conflicts between competing activities, a number of problems involving both intensive and rural land use activities have proven of serious consequence to the region's water resources. The more intensively urbanized areas represent the origin of most water quality problems plaguing the Bay. Such problems involve industrial effluents, oil spills, solid wastes, domestic sewerage, and storm runoff. Pollutants of this nature may be toxic enough to kill or impair both animal and plant life. In other cases, as with the discharge of sewage from treatment plants, water bodies are overenriched by nutrients. This results in eutrophication—a process whereby nutrients stimulate the excessive growth of algae and other aquatic plants. As these plants decay, larger quantities of oxygen are used than under normal conditions, thus robbing fish of the vital gas and causing fish kills.

Intense urban construction activity in the Bay region has led to the production of unusually large quantities of sediment which have fed into the Bay and its tributaries. For many decades, the siltation of waterways has proven

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a serious enough problem to bring the decline of certain ports like Joppa Town, or, as in the case of Port Tobacco, has resulted in their becoming navigationally land locked.

Water supply problems are also most acute in the more heavily populated areas where demand is great for use in domestic consumption, industrial cooling and processing, and numerous other uses.

Another point of conflict involving land use activities and the region's water resources deals with flood plains whose physical characteristics make them particularly attractive for residential and industrial development. Historical evidence shows that during flood periods, these particular land use activities are the ones likely to incur most serious damage.

Extractive activities including quarrying and open pit mining have brought about the denudation of land surfaces resulting in frequently severe sedimen-'ation of adjacent waterways. Other forms of extractive activities have proven equally as detrimental. The dredging of river bottoms for sand and gravel stirs up bottom sediments, clouds and silts-up waterways, and ultimately destroys or impairs the waterway's biota.

While water quality problems are generally less severe in rural areas, nevertheless they still exist. Soil erosion associated with farming activity is perhaps one of the most widespread and difficult problems to control. Thousands of acres of once fertile farmlands have been denuded in the Bay region causing the sedimentation and pollution of streams, rivers, and estuaries.

Agricultural land use activities are responsible for a second type of pollutant—chemical fertilizers. Such chemicals, when introduced into the Estuary's water bodies (from runoff and through percolation into ground water), add nutrients which results in eutrophication (explained above). Other chemicals used in farming include pesticides and herbicides. These insect and plant controlling chemicals can be carried by the wind or washed from sprayed cropland, producing extremely toxic conditions for plant as well as animal life. Mortality, loss of production, and changes in estuarine life can result.

Other agricultural pollution involves the processing of farm products, such as poultry. Such processing results in the discharge of organic wastes which, when introduced into a river or estuary, produce high biochemical oxygen demand (BOD) which can then result in fish kills.

Another major environmental problem involving agricultural activity is presented by livestock and poultry waste disposal. These wastes are particularly high in nitrates and, as pollutants, find their way into the adjacent waterways through runoff or seepage into the ground water.

As with agricultural activity, poor management of forest resources has proven to have adverse environmental effects. Without proper forest cover, severe erosion can occur denuding the land and silting up waterways. In addition, the processing of certain industrial wood products, such as pulp, requires the discharge of effluents which are high in BOD. Unless the assimilative capacity of the receiving stream is great enough, serious oxygen depletion will occur proving harmful to biota.

MEANS TO SATISFY NEEDS

In order to resolve some of the problems and conflicts involving the water-related land resources and to provide for the orderly development of the Chesapeake Bay Region, a certain number of measures or actions must be taken. These measures are discussed below in terms of intensive land use, agricultural lands, forest lands, and archeological, historic, and natural environmental areas.

INTENSIVE LAND USE

As discussed earlier in this Appendix, continued expansion of urban areas will likely bring about an increase in the number of conflicts between competing activities and the natural environment. Such expansion can be guided, slowed down, or even halted through the use of certain land management measures or land use controls. Federal, State, and local constraints may influence the growth of intensive land uses by:

a. guaranteeing that there is sufficient land available in certain types of use such as farming, forests, and recreation.

b. controlling development in critical environmental areas including wetlands and scenic or historic places.

c. controlling activities which may lead to adverse environmental consequences, such as pollution, erosion, or sedimentation.

More and more authorities are realizing that urban development can be directed or channelled into or away from certain areas by means of water, sewer, and transportation planning. For example, transportation systems are being designed as a positive force shaping land development in a way that supports planning objectives and community values. Zoning has been another effective technique used in reducing the rate of land consumption. Zones are established within which incompatible uses are not allowed, thereby eliminating many conflicts.

The various levels of government are continuing to expand their management responsibilities in the area of land use controls. Some of those local, state, and Federal measures which effectively direct growth while at the same time reduce pressures and conflicts between the Region's land and water resources are described below. It should be noted that while many of the land use controls discussed here apply to both urban (intensive) land uses as well as non-urban uses such as natural environmental areas, detailed discussion will not be repeated later.

LOCAL LAND USE CONTROLS

This discussion considers local land use controls in general. Therefore, since some counties and municipalities within the Chesapeake Bay Region may not employ all or any of the controls examined below, it is suggested that specific local governments be contacted concerning their respective management tools.

Zoning is designed not to alter existing land allocations directly but merely to guide future land use decisions so as to encourage those which complement each other and to preclude those which conflict. Relationships between uses are assessed to determine the location requirements of specific activities as well as the conflicts which exist between them. Thus, by segregating residential land uses from commercial and industrial ones through zoning, many counties and cities have avoided endless discord. Zoning, when employed in local land use plans, becomes a forecast of future land uses. It has been used effectively by some local jurisdictions in preserving recreational areas, parks, conservation areas, and certain other natural resources. Rural zoning, for example, provides for the preservation of open lands by restricting land use to low density, multiple-acre rural uses including agricultural activities.

Flood plain regulations are a form of zoning designed to reduce damages and loss of life from floods. This type of zoning normally consists of regulations which govern all future uses of the established flood plain. In addition, flood

plain zoning requires existing uses be brought into conformity if the structures are abandoned, destroyed or substantially repaired. In a typical zoning ordinance, the floodway is designated as a special zone where the land can be used only in such a fashion that the floodway will not be physically restricted and minimal damages will be incurred should a flood occur. Minimum flood elevations are usually established for buildings in the floodway fringe area while flood proofing measures may be required in certain zones. Most counties and cities of the Estuary Area have adopted at least some zoning regulations and/or flood plain regulations.

Another type of local control is the subdivision regulation. As the name implies, such regulations are concerned with the subdivision of parcels of land for development purposes. These regulations can be used to secure parks, playgrounds, school sites, and other public lands as well as to direct the pace and location of new development. They are particularly useful not only in dividing residential property into smaller units, but in laying out streets and in providing certain necessary services.

Subdivision regulations, in similar fashion to zoning ordinances, are considered principal tools in the development of flood plain regulations. Used in this way, they have wide potential in requiring disclosure of flood hazards and in insuring lands will be suitable for intended purposes.

A few local governments within the Study Area have attempted to curb development and thereby control land use within their jurisdiction through "sewer moratoriums." Such measures prohibit the construction of new sewer systems or the extension of existing systems. Some of these same counties and towns have effectively used the provision of water and sewer services to guide growth to areas that have been planned for development. Such measures represent primary means for a region to obtain staged growth in accord with its public service and environmental capabilities.

Tax policies have also proven useful in controlling land use development. Through preferential tax treatment, tax concessions, and deferrals, educational and religious institutions, agricultural lands, and conservation zones can be encouraged. Some county and municipal governments have used public land acquisition policies to preserve or maintain both the character and viability of such lands as open and conservation areas. Lastly, the proliferation of local housing, building, and health codes have been indirectly responsible for determining land use patterns within the Chesapeake Bay Region.

STATE LAND USE CONTROLS

The various States within the Study Area have come to recognize that local political subdivisions frequently do not have adequate jurisdiction to provide good management of resources, especially when multi-county units are involved. As a result, the States have taken certain legislative action. The Maryland State Legislature has passed a land use control law to protect areas of critical State concern. The law also provides for a "State Development Plan" to be completed by the Department of State Planning and grants that Department the authority to intervene by presenting its views on any issue concerning land use, development, or construction which is of more than local impact, and where the proposed land use action is of substantial State or regional interest. Final decisions for land use proceedings remain the discretion of the local authorities, however. Maryland is the first State within the Study Area to pass such a land use bill and one of the first in the country to do so.

The State of Maryland has also developed a data collection system with partial funding by the U.S. Department of Housing and Urban Development and the National Aeronautics and Space Administration. The system provides a quantitative framework for rapid retrieval and analysis of geographical statistical information via computer maps displaying the capability and suitability of land for various uses across the geographic extent of the State. The maps will be used in a variety of planning projects relating to the development of the State Development Plan.

Maryland exercises considerable influence over the location of major electric generating facilities through its Power Plant Siting Program. The program includes, among other things, provisions for monitoring the operations of existing facilities to assess true environmental impacts; an environmental evaluation of proposed power plant facilities directed toward a better understanding of the basic physical, chemical, and biological mechanisms important to assessing and predicting impacts; and an analysis of the socio-economic impact of generation facilities on the land uses of the State. The program also grants the Secretary of Natural Resources, upon the advice of the Secretary of Economic and Community Development, the authority to acquire a sufficient number of sites to satisfy expected power generation requirements.

Through another piece of land use legislation, the Maryland Environmental Trust, a quasi-public agency, acquires conservation easements within the State on land with some natural or ecological importance. In return for the land-

owner's agreement to keep the land in the present condition, the Trust offers various tax advantages. The Maryland Department of Agriculture has set up the Agricultural Lands Preservation Committee to study means to preserve prime agricultural lands within the State as well.

Maryland, Virginia, and Delaware have all enacted wetlands laws to help control and regulate the uses made of these valuable lands. These laws seek to preserve the wetlands and to prevent the despoliation and destruction thereof, taking ecological, economic, developmental, recreational, and aesthetic values into account. The State of Maryland seeks to preserve its wetlands through such things as:

a. Regulating the filling and dredging of wetlands.

b. Prohibiting certain activities on specified wetlands.

c. Providing for an inventory of private wetlands.

d. Providing certain protection to wetlands owners.

The Commonwealth of Virginia seeks to control its wetlands by such action as:

a. Permitting a wide variety of uses related to recreational, conservation, or economic uses which do not require construction of facilities that obstruct tidal flow, or destroy natural contours of the marsh.

b. Requiring a permit for all uses other than the ones discussed above.

In a statement of policy, Delaware declares that the development, utilization, and control of public subaqueous lands (generally land under the surface of the water) shall be directed to make the maximum contribution to the public benefit, and that the State shall control the development of subaqueous lands so as to effectuate full utilization, conservation, and protection of these resources.

FEDERAL LAND USE CONTROLS

One of the chief Federal land resource management programs is the National Oceanic and Atmospheric Administration's Coastal Zone Management Program (CZMP). Through this program, the Federal Government assists the States in developing a plan for the management of land and water areas in the coastal zone. State programs seek to achieve wise use of land and water resources of the coastal zone and must give full consideration to ecological, cultural, historic, recreational, and esthetic values as well as needs for economic development. The Federal CZMP grants to the coastal states and territories two-thirds support of the cost of developing a state program, two-thirds support of the cost of administering the program, and one-half support of the cost of acquiring, developing, and operating estuarine sanctuaries for research and educational purposes. Through this cooperative program, the Federal Government and the states hope to preserve, protect, develop, and restore the resources of the coastal zone.

The responsibility for developing the CZMP in Maryland lies with the Energy and Coastal Zone Administration of the Department of Natural Resources. Maryland's overall goal is to develop a program which will "provide for rational allocation and utilization of the State's coastal resources while protecting, enhancing, and, where desirable and feasible, restoring the biological, recreational, aesthetic, scientific, historical, and cultural resources in the State's coastal areas."(1)

The objectives of this program are:

a. To identify and protect critical coastal areas and to provide for the rational development of developmental critical areas such as waterfront cities or ports.

b. To develop guidelines to assure that the conduct of certain activities will not have adverse effects on coastal zones.

c. To guide public and private use of coastal resources in order to minimize conflicts among uses.

d. To utilize existing State and local government programs to implement the State CZMP.

e. To provide for full participation by governmental agencies, interested organizations, and the general public.

In developing its program the State of Maryland is addressing five basic elements:

a. *Program Element I: Boundaries of the Coastal Zone.* The seaward limit of Maryland's coastal zone will be the seaward limit of the State's jurisdiction, or the three mile limit. For initial planning purposes, all counties bordering on the Potomac River, the Chesapeake Bay, and the Atlantic Ocean were included in the State's coastal zone. This inland coastal zone boundary will not be finalized until the other elements of the program have been developed.

b. *Program Element II: Areas of Particular Concern/Permissible Land and Water Uses/Priority of Uses.* To meet the requirements of the Federal Coastal Zone Management Act (FCZMA) the following tasks will be accomplished as part of this program element:

(1) Determination of areas of importance because of their on-site resources, uses, or use potential.

(2) Determination of activities in the coastal area which could adversely affect the coastal zone, their existing or potential uses, or the State's coastal waters.

(3) Identification of management measures required to affect State interest in such areas and to minimize the adverse offsite impact of activities.

(4) Identification of existing programs which can be utilized to implement management objectives.

To address the requirements of the above subsections, Maryland's Coastal zone has been divided into resource protection areas such as wetlands and prime recreation areas; hazard-prone areas including those which may be subjected to shore erosion or flooding; developmental critical areas such as Baltimore harbor; Federal lands; and, offsite impact areas whose use could have adverse effects on resource protection areas or coastal waters.

c. *Program Element III. Program Management Authority and Organization.* In order to have its program approved by the Federal Government, a State must have proper organizational structure and authority. Maryland has several existing pro-

grams which can be used to implement portions of the management program. These include the wetlands and water resources regulatory programs, the State Open Space program, the Power Plant Siting and the Coastal Facilities Review programs, and the State Land Uses program.

d. *Program Element IV: Coordination with Other Governmental Agencies.* In its efforts to meet the requirements of the ECZMA, the coastal zone management staff has concentrated on familiarizing all relevant governmental units with the objectives of the Federal act and the proposed direction of Maryland's programs. Close coordination with Federal, State, and local governmental agencies will continue.

e. *Program Element V: Public Participation.* The FCZMA requires active involvement of both the public and interested organizations. Various efforts regarding public participation have and will continue to be initiated by the State.

In Virginia, the Commerce and Resources Section under the Office of the Secretary of Commerce and Resources has assumed responsibility for development of the Coastal Zone Management Program for the Commonwealth. The Virginia Staff will use existing programs to form the basis for an expanded management plan in order to qualify for Federal support under the Coastal Zone Management Act of 1972. It is hoped that through a rational management plan, better communication and working relationships can be developed between various levels of government. Furthermore, it is expected that by providing a sound and expanded data base, more rational decisions can be made with regard to the coastal zone. Presently, boundaries are expected to coincide with existing administrative boundaries. If this proposal is adopted, all of the planning districts within Virginia's Tidewater area will be included.

The staff is planning to develop a management program around approximately eleven components or subprograms which taken together would provide designated officials the desired authority for good management. Of these components, five exist satisfactorily, two are under study by the Land Use Council and four require formulation. These are described briefly below.

a. Alteration of wetlands by either private or public bodies would continue under local Wetlands Review Boards.

b. Management of State-owned subaqueous lands would remain the responsibility of the Virginia Marine Resources Commission.

c. Point Source Discharges will remain the concern of the State Water Control Board and State Health Department.

d. Erosion and Sediment Control is and would remain under local control as mandated by State law.

e. Siting decisions for key facilities such as refineries, generating plants, transportation corridors, and airports are currently made at a State level. Legislation being drafted would result in a better process for decision-making based upon better data and related to an overall State development pattern.

f. A study currently underway of "developments of greater than local significance" will examine developments whose nature, magnitude, or impact would affect the interests of more than one political jurisdiction or would affect the functioning of "key facilities" of State interest. The study will suggest supplementary authority which might be required in matters concerning these developments.

g. Areawide and Basin Water Quality Maintenance plans will develop sub-State delineation of boundaries, uses to be controlled, authorities and organizational recommendations, areas of special significance (or particular concern), and other planning which appears to be appropriate for integration with the framework CZM plan, and are being considered as components of planning to be directly incorporated and implemented.

h. A "permissible water uses" study is addressing simplification of the permit process and is coordinating responsibilities of the Virginia Marine Resources Commission, State Water Control Board and State Health Department.

i. A proposed study dealing with "geographic areas of particular concern" would analyze critical environmental areas and areas desirable for "key facilities" or national interests. The study would also recommend criteria for designating these critical areas and appropriate management guidelines and responsibilities.

j. Areas for Preservation and Conservation is a subset study of the above to receive special attention, with anticipated leadership of areawide planning agencies and scientific research groups.

k. Public access is at this time undefined but anticipates local recommendations for the State plan.

It is hoped that through development of a management program incorporating the above components, the Federal requirements for coastal zone management can be met.

Delaware was the first State in the nation to bar construction of new industry in coastal regions through its Coastal Zone Act of 1971. That Act bans all heavy industry and port or dock facilities within two miles of the shoreline not in existence at the time of passage of the Act and requires a permit from the State Planning Office for all other manufacturing uses or expansion of existing heavy industrial uses. Through its State Planning Office, Delaware is currently expanding its program under the auspices of the FCZMA. The primary goals of Delaware's program will be to preserve and improve both the quality of life and the quality of the marine and coastal environment; promote orderly growth within the State's coastal zone; and increase the opportunities and facilities in Delaware for education, training, science, and research in marine and coastal affairs.

The objectives of this program are:

a. To develop criteria for evaluation of uses of the Coastal zone.

b. To determine the compatibility and appropriate mixtures of uses of the zone.

c. To protect the in-shore and marsh areas from pollution and unwise exploitation.

d. To develop criteria for the control of land and water uses within the coastal zone.

e. To provide for a focus for coastal zone management in the executive branch of State government.

f. To establish a mechanism for interagency and intergovernmental coordination of coastal affairs.

g. To create a coastal research program to furnish scientific and technical information necessary for coastal zone management decisions.

Development of Delaware's Coastal Zone Management Program (CZMP) involves ten essential tasks designed to build an understanding of the coastal zone, develop plans for future use of the zone, and create apparatus which will provide for implementation of the management desires. The first seven tasks will provide background data for inputs to plan and program decisions. These are described briefly below.

a. Task 1 will consist of an inventory of the coastal resources, how they are being used, and what controls presently exist.

b. Task 2 involves setting boundaries for the coastal zone. It was determined that the planning boundary should be the entire State.

c. Task 3 will develop techniques for evaluating coastal resources and uses.

d. Task 4 will delineate geographic areas of particular concern.

e. Task 5 will involve determining permissible land/water uses.

f. Task 6 will project demands on coastal resources and address factors influencing growth and demand.

g. Task 7 will test alternative mixes of resources, uses, and policies within the coastal areas.

The last three tasks will provide the guidelines and management framework for achievement of the State's goals and objectives in the coastal zone. They are addressed below.

a. Task 8 will involve the designation of priorities and the actual preparation of the coastal zone plan.

b. Task 9 will develop regulatory mechanisms.

c. Task 10 will concern itself with developing the organizational mechanisms needed to administer the program.

One of the primary concerns of the Delaware State Planning Office is to assure public involvement in the CZMP. Active public participation in all aspects of the project is recognized as essential. Therefore every reasonable effort will be made to encourage involvement by both interested citizens and organizations. For more information on Delaware's CZMP, it is suggested that the Delaware State Planning Office's *Delaware Coastal Zone Management Program Application* be consulted.

There are certain other Federal Programs which either directly or indirectly address the control of land use. One such program was initiated through the National Environmental Policy Act. This Act recognizes the "profound impact of man's activity on the interrelations of all components of the natural environment" and so declares that it is the policy of the Federal Government in cooperation with State and local governments and public and private organizations to create and maintain conditions under which man and nature can live harmoniously. Under the Federal Clean Air Act of 1970, States are required to exercise certain controls when the siting of a new facility exacerbates an air quality standard violation. The Rivers and Harbors Act of 1899 makes it illegal to allow any refuse to be introduced into a navigable waterway. In essence, the Act controls the use made of land near these waters. Along these same lines, the Water Pollution Control Act Amendments of 1972 (PL 92-500), establish minimum water quality criteria. In order to meet these criteria, the government seeks to regulate the location, modification, and construction of any facility that may have discharges. This includes most industry, mining, manufacturing, municipal, and most agricultural uses.

Another major role of the Federal Government with regard to land use planning deals with transportation. The interstate highway system, which is designed to be the best form of interstate road transportation, has had a tremendous effect on adjacent land uses by raising land values and stimulating the growth of commercial and service-related businesses. The Department of Housing and Urban Development administers a number of programs that have land use implications such as the housing and urban renewal programs. Finally, the Nuclear Regulatory Commission exerts influence on land use through the licensing process for nuclear reactors. The above deals with only some of the more important Federal land use related programs.

AGRICULTURAL LANDS

The value of maintaining a strong agricultural resource base in the Estuary Area cannot be overstated. Such resources must be protected and maintained to the highest possible environmental condition so that they may respond to

the needs of the future. Like other regions, the Study Area has had a loss in productive potential due to both physical deterioration of the land as well as conversion of agricultural land to other uses. In addition, the region has certain natural features which restrict agriculture such as soil limitations. Today, with fewer people living and working on farms but more people dependent on the farmer for food and certain other raw materials, it is ever more crucial to maintain a reliable resource base. In addition, land properly used for agriculture has certain hydrologic, recreational, and esthetic values which are of benefit to everyone in the Estuary Area. To protect, enhance, and perpetuate this valuable natural resource, certain action must be taken. In this section, the physical and social and economic means available to satisfy future agricultural needs of the region will be examined.

PHYSICAL MEANS TO SATISFY NEEDS: CONSERVATION TREATMENT

Generally, conservation treatment is needed on land not yet adequately protected. Continued care is required on lands which have or are currently being treated. To assist landowners in achieving the most beneficial use and treatment of their lands, the conservation treatment needs committees have developed current State and county data on various techniques and measures to be instituted. As presented in the committees' inventories, these data recommend various actions on cropland, orchards, pasture, and open land. Included in each inventory is a breakdown of land by county according to the type of treatment required. Some of the specific recommendations are discussed below.

1. Non-Irrigated Cropland.

    a. *Residue and Annual Cover*. Crop remains including mulch, or other annual recurring measures are recommended for local use to meet conservation problems.

    b. *Sod in Rotation*. Sod in crop rotation is recommended on some levels to meet the conservation problems.

    c. *Contouring Only*. This requires that farming operations be done on the contour to control erosion when the land is in cultivated crops.

d. *Stripcropping, Terracing, Diversions.* Terraces and diversion systems for water erosion control are recommended. In addition, other measures may be used to supplement these practices when strip cropping alone is not adequate to meet conservation problems.

e. *Permanent Cover.* Land acreages unsuited for row or grain crops are recommended for a permanent cover of grass or trees.

f. *Drainage.* An adequate drainage system is suggested for the removal of excess surface or internal water. Such systems also reduce the risk of damage in flood prone areas.

2. Irrigated Cropland.

a. *Cultural Management Practices.* This technique is recommended to maintain the proper air, water, and soil relationships.

b. *Improved Irrigation Systems.* These are needed for the proper application of irrigation water and to prevent soil erosion. Systems include measures such as land leveling, drainage, and erosion control.

c. *Water Management.* Proper management is required to control soil erosion, prevent excess water losses, and to time water applications to meet crop needs.

3. Pasture.

a. *Change in Land Use.* A change to trees is recommended in the use of the land.

b. *Needs Protection.* Protection of plant cover from overgrazing is suggested.

c. *Needs Improvement.* Improvement of present plant cover is recommended. The presently inadequate forage cover can be improved by applying minerals, weed control, use of mechanical measures, and use of grazing systems.

d. *Brush Control and Improvement.* Measures include the eradication of woody plants by chemical or mechanical means followed by improvement of preferred plant cover.

e. *Reestablishment of Vegetative Cover.* In situations where the pasture is in extremely poor condition, it is suggested that the cover be completely reestablished without brush control measures.

f. *Reestablishment with Brush Control.* Recommendation includes reestablishment of pasture and brush control measures.

In addition to the above techniques and measures, the Conservation Needs Inventory Committees also recommend that areas where conservation measures are adequate be left untreated. For more information on treatment needs, it is suggested that the individual State inventories be consulted.

SOCIAL AND ECONOMIC MEANS TO SATISFY NEEDS

If agricultural lands are to be spared from unwarranted conversion to intensive land uses, stricter land use controls must be enforced on the Federal, State, and local levels. Some of these, such as zoning and tax incentives, have been discussed earlier. Because of their value in preserving open lands and natural resources, more universal adoption and administration of such controls must be encouraged.

In maintaining a stable agricultural resource base, landowners must be informed of the various incentives and services available to them. In addition, they must be encouraged to use every acre of land within its capability and treat it according to its needs. This might require the installation of protection against erosion, drainage of low lying or inundated lands, or the installation of irrigation equipment. Landowners should be informed of specific Federal and State cooperative programs to assist them in flood prevention, drainage, and watershed protection and rehabilitation. By assisting these landowners in achieving better land and water management, agricultural output can be maximized while providing optimum recreational and esthetic use of farmlands.

Continued research is needed at all levels of government to improve the management of land and water resources. Additional work is required in classify-

ing soils and interpreting the best treatment for each. Work should be accelerated in updating soil surveys. New and safer methods of insect and disease control must be found to protect crops. Effective but more environmentally safe chemical fertilizers must be developed. Stricter use controls of existing chemical fertilizers should be imposed. Better management of animal wastes is needed to reduce pollution of ground water as well as other receiving bodies of water. Sedimentation from farming needs to be reduced in some areas by adjusting rotations and/or application of appropriate erosion control practices. Finally, methods must be developed to improve the multiple uses of agricultural lands including recreation, wildlife, and water supply.

Through the combined efforts and cooperation of Federal, State, and local governments, private institutions, and individual landowners, the agricultural resource base can be maintained in order to meet the future needs of the Chesapeake Bay Region.

FOREST LANDS

The value of the Bay region's forestry resources warrants their conservation, preservation, and enhancement. In this section, the conservation treatment needs and social and economic means to satisfy forestry resource needs will be surveyed.

CONSERVATION NEEDS

The conservation needs committees provide, in their respective inventories, an analysis of the various treatment needs required of the commercial forest lands to further improve them. Woodlands are specified as either requiring establishment and reinforcement, timber stand improvement, or no treatment. If a forest is producing below its potential because of inadequate stocking, it is classified as needing establishment and reinforcement. This can be accomplished through planting or seeding. In other areas where it is biologically feasible and when it is judged that cutting to release crop trees will result in increased growth and/or quality of the remaining trees in the stand, land is designated as needing timber stand improvement. On some commercial forest lands where grazing is responsible for soil or cover deterioration, it is recommended that grazing be reduced or eliminated. Sloping, denuded woodlands, or logging roads, skid trails, and other areas in woodland on which runoff is uninhibited and erosion is occurring are designated as critical areas and stabilization is recommended. Table 4-29 shows the number of acres of commercial forest land within the Study Area designated for specific conservation treatment.

TABLE 4-29
NUMBER OF ACRES OF COMMERCIAL FOREST
LAND WITHIN THE STUDY AREA REQUIRING
CONSERVATION TREATMENT

STATE	ACREAGE AND RECOMMENDED TREATMENT		
	Establishment & Reinforcement	Timber Stand Improvement	Treatment Adequate
Delaware	13,150	271,400	94,071
Maryland	192,510	1,471,123	261,512
Virginia	204,295	1,613,897	2,574,905
TOTAL	409,955	3,356,420	2,930,488

Sources:

Delaware's Inventory of Soil and Water Conservation Needs, 1971.

Maryland Soil and Water Conservation Needs Inventory, 1971.

Virginia Conservation Needs Inventory of 1967.

By first drawing attention to areas where conservation treatment is required, the conservation needs committees hope to take a significant step in providing the kind of management needed to achieve optimum use of these valuable resources. Specific discussions of treatment needs on a county basis are included in the State conservation needs inventories.

SOCIAL AND ECONOMIC MEANS TO SATISFY NEEDS

If the forest resource is to be used to its highest multiple use potential, the small ownership group must be brought into forestry programs. Both small and large forest landowners need to be informed of the consequences of mismanagement of the forest resources. Emphasis must be placed on steps to assure prompt and effective reforestation after harvest to increase yields. An integral part of both Federal and State land management programs should include a program oriented to informing forest owners of the many services and incentives available to them.

Fire protection of the Bay region's forests has improved significantly. Nevertheless, continued progress must be made until 100 percent fire prevention is approached. Efforts are needed to improve both fire detection methods as well as fire fighting techniques and equipment.

Continued research among the responsible Federal and State agencies is required to find less expensive, effective means of reducing the danger of both insects and disease. Utilization of more than one means of control—called integrated control – should be emphasized and might involve use of chemicals to reduce insect populations and disease to low levels.

As a deterrent to conversion of valuable woodlands to other activities, forest landowners must be urged to preserve their forestry resources. This can most effectively be accomplished through economic and tax incentives, and other special administrative efforts. It is the management responsibility of Federal and State agencies to offer and inform landowners of such measures available to them. Zoning, as discussed earlier can be another effective tool in preserving forest lands.

The intensive management of forest lands for timber production as well as for such uses as wildlife and recreation will require the use of adequate measures to protect the quality of the lands involved. This will require the continuation of forestry practices currently known to be effective as well as extensive research for development of better techniques.

HISTORIC, ARCHEOLOGICAL, AND NATURAL ENVIRONMENTAL AREAS

The following discussion presents the various means available for the proper management, conservation, preservation, creation, restoration, and improvement of the Chesapeake Bay region's natural and cultural resources and ecological systems.

As discussed earlier in this Appendix, the archeological, historic, and natural environmental areas of the Chesapeake Bay region are very valuable and fragile. As a result, local, State, and Federal Governments, interested citizens, and certain private industries are becoming increasingly concerned with the present condition of the environment. Action in the form of legislation has been taken but generally tighter, more responsive, and more strictly monitored policies are required to preserve and enhance the high quality of these areas.

In addition, more closely coordinated efforts are needed at the Federal, State, and local levels.

Through land use control laws similar to that which was recently passed in Maryland, critical areas throughout the Bay region can be identified. The Virginia Division of State Planning and Community Affairs has completed a "Critical Environmental Areas" report (and update) designating certain natural and cultural areas and calling for their protection, enhancement, and management. Legislation is now required to support the recommendations of this study, thus enabling the State to effectively influence land use.

Positive action by the States in administering a wild and scenic rivers program would aid in the preservation of certain rivers and their related land resources.

Maryland, Virginia, and Delaware must each develop a comprehensive coastal zone management program to assure the beneficial use, protection, and development of the land and water resources of the coastal zone. Maryland and Virginia are currently preparing what is hoped to be an effective management program under the Federal Coastal Zone Management Act. In addition, Delaware is expanding their present program under the auspices of the Federal Act to guarantee full consideration of the ecological, cultural, historic, esthetic, and economic resources of that State's coastal zone.

One of the most important elements required in solving outdoor recreation needs in conjunction with natural environmental areas is more effective resource management. Areas such as forests must be managed to enhance their recreational values. The numerous species of game and non-game animals must also be properly managed. Such resource management should provide for the special needs of both the resources involved and the users. Along with increased use of these natural environmental areas must come certain mechanisms to prevent overuse or abuse. Such mechanisms include providing access to additional areas, imposing carrying capacities, and achieving resource use compatibility. Certain non-polluting forms of recreation should be encouraged such as canoeing and hiking. Finally, the Federal and State forests and parks, wildlife management areas and refuges, scenic rivers, wetlands, and other environmental areas should be utilized to instruct citizens of the proper use of these very precious natural resources. If and when such provisions are taken, the preservation and enhancement of the Chesapeake Bay region's natural and cultural resources can be assured.

PROSPECTIVE LAND USE CONTROLS

There are certain kinds of land use control programs being proposed for the first time which can be expected to have a tremendous effect on future development. These include Federal, State, and local government programs. Some of the more important potential programs and legislation are assessed here.

Future Federal legislation may very well be aimed at establishing a nationwide land use planning and policy process. Since 1970 (and as late as March, 1975) various land use control bills have been introduced in Congress but none have, as yet, been passed by both houses. Although each bill has been different from the others, all would have established some form of national land use policy. Each bill has been quite controversial and has met with great public opposition. If this opposition is alleviated, it is possible that a policy will be adopted which will be designed to regulate the use of the land to minimize adverse effects on the environment.

Some other possible programs which would serve to direct future growth and protect the environment include:

a. Downzoning to lower development densities to reduce the potential urbanization of certain areas.

b. Moratoriums on water as well as sewer system development in order to stop the extension of medium and high density residential areas.

c. Environmental impact statements required for all "major" public and private developments.

d. Moratoriums on all new development in certain areas until comprehensive development plans can be revised.

Recently there have been moves toward initiation of regional land use controls. Various proposals have been made for cooperation among Federal, State, local, and regional agencies in the form of interstate and regional agreements, cooperative procedures, and joint action regarding environmental problems. It is believed that through such cooperative action fragmentary planning and haphazard development of the Region can be avoided.

Positive action in planning is considered most important in determining the course and goals of future growth and guiding development towards attaining these goals. One prime requirement in the future may be to allow only that amount of growth which is compatible with the environmental limitations of an area's natural resources. Other governmental controls may decree that the rate and distribution of growth be compatible with the existence of adequate public facilities to support growth as it occurs.

REQUIRED FUTURE STUDIES

The above represent but a few of the means which can be used to help bring about the orderly development of the Chesapeake Bay Region and to solve many of the conflicts between competing activities and the natural environment.

In order to develop a truly effective water-land management program which can be used by all Bay management organizations for the development, enhancement, conservation, preservation, and restoration of the Bay resources, certain future studies are required. A few areas of study are identified below; however, this list is not intended to be exhaustive. Some studies have never been conducted to any great detail. Others are on-going studies but must be either expanded or continued to be beneficial.

Generally, specific regional studies which apply directly to the Chesapeake Bay Region are needed in order to accurately determine the overall effects of man's activities on this complex estuarine system. Of the specific studies required, one of the first and foremost is a comprehensive, basinwide land use study. The study of land use is a relatively young discipline and land use is a dynamic element. Consequently, the need for current, comprehensive, and consistent land use data is great. A basinwide land use study of the Bay Region would enable planning officials to project future land use and determine the effect which this future land use will have on water quality, water supply, shoreline erosion, flooding, sedimentation, and recreation. As a consequence, it would also be possible to determine the demands for water-related land resources, and define where future pressures on water resources are most likely to be. A regional land use study would necessitate full cooperation and input from those appropriate Federal, State, local and regional agencies with planning authorities and interest in the affairs of Chesapeake Bay. Points to be emphasized in a study of this nature include land use change, urban expansion, and rural-urban interaction. Various land use

alternatives might also be surveyed to determine optimium conditions for development.

There are a number of studies related to a basinwide land use study. One such study would include a comprehensive investigation of the various rural and urban aspects of sediment production, movement and impact. A sediment study program of this nature would involve lone-term measurement together with projection of future conditions covering the physical, economic, and environmental impacts of sediment.

A detailed study of soils would also be complimentary to a land use study by determining the best urban development sites within the Region. Such a study would also indicate areas with poor drainage, unstable soils, or areas which are erosion prone. Much has been done in this area, already; however, much still remains to be done.

Another required study might investigate ways in which land use plans could take greater account of environmental consequences related to urbanization. Programs would be developed which would allow for development of land and water resources without at the same time degrading the environment.

The National Water Commission has found a number of areas where deficiencies related to land and water resource planning exists. One important area which requires considerable study is that of finding ways to better integrate planning for water resources with planning for the land uses that water developments are expected to serve. While the interrelationships between water and land resources has long been recognized, it has only been recently that both water and land use planning needs have been developed in conjunction with each other. Thus, in some studies, Federal, State, and local authorities are investigating the use of land and water in upstream areas to try to determine the precise effects on estuaries and the coastal zone. In related studies, methods are being studied to improve both agricultural and urban runoff in an attempt to improve the water quality of adjacent streams, rivers, and estuaries. As indicated earlier in the Chapter, many coastal states, including Maryland, Delaware, and Virginia are integrating land and water plans in an attempt to develop a management program for their coastal zone. To reiterate, the purpose of these coastal zone management programs is to provide for prudent management of all resources within the coastal areas. Thus, it constitutes one of the first attempts to integrate water and land resource plans on a broad geographical basis.

Additional efforts must be focused on maintaining a land resource base which is capable of meeting future requirements. As population in the Bay Region in-

creases in the future, pressures for more agricultural commodities and timber resources will result. Studies must be oriented toward better management of both agricultural and forest lands. Ways must be found to allow more food and fiber to be produced on fewer acres of land. Studies related to more efficient farming methods should be continued and accelerated. To achieve increased productivity, crops must be improved, pests and diseases reduced, and soils must be studied in order to improve classification techniques, treatment interpretation, and soil-plant-water relationships. Along these same lines, methods of improving multiple uses of agricultural lands must be found including recreation, wildlife, and water supply.

In the area of forestry, investigation is required to find ways of improving timber production and to better protect forests and forest lands against fire, insects, disease, and erosion. Related to forestry research is the scientific study of proper watershed management which necessitates detailed planning and regulation of use and treatment to preserve productive and environmental factors. The loss of such values through unplanned urban expansion also needs to be evaluated.

It is hoped that data presented in this Appendix will be useful not only in assessing the future demands and pressures to be placed on the Estuary Area's water and related land resources but to help provide for the orderly development of the entire Chesapeake Bay region. To fully benefit from data presented here, however, there is a need for future studies to keep data current. Due to the dynamic nature of land use activities and the many and varied effects which such activities have on all water and related land resources, it is of particular importance to periodically reevaluate the findings and recommendations presented in this Appendix.

FOOTNOTES

(1) Maryland Department of Natural Resources. *Maryland Coastal Zone Management Program, Overall Program Design,* October, 1975, p. 1 (unpublished).

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GLOSSARY

Anadromous fish – fish which leave the ocean and swim upstream to fresh water to spawn in the late winter and early spring months. (Also see non-anadromous and semi-anadromous)

Archeological features – rearrangements of rocks, soil, or other natural materials by prehistoric man.

Artifacts – archeological objects modified or produced by man such as pottery and spear beads.

Capability class – a broad grouping of soils based on the risk of soil damage or limitations in use.

Capability subclass – a grouping of soils having similar kinds of limitations or hazards. In the Chesapeake Bay region, three kinds of limitations or hazards are recognized: erosion, excessive wetness, and root zone limitations.

Capability unit – a grouping of soils that have about the same hazards for use, same influence on production and response to management, and about the same adaptations to common cultivated crops, pasture plants, and trees.

Cluster development – type of urban development whereby various activities including residential, commerical, and/or industrial land uses, locate together.

Coastal saline wetlands – wetlands which are in direct contact with or are indirectly affected by saline waters. They normally include salt meadows and both regularly and irregularly flooded salt marshes. (See also coastal fresh wetlands and inland fresh wetlands).

Coastal fresh wetlands – wetlands which are affected by tidal fresh water and generally include coastal deep fresh marsh. (See also inland fresh wetlands).

Commercial forest land – forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation.

Diatomaceous earth -- commonly known as silica, this mineral is composed of minute shells of microscopic plants called diatoms.

Endangered species – those species which are in danger of extinction throughout all or a significant portion of their range. (See also threatened species).

Extractive land use activities – those operations encompassing both surface and subsurface mining operations such as sand and gravel pits, stone quarries, oil and gas wells, and metallic and non-metallic mines.

Floodway – term used in flood plain regulations to designate a zone which has special requirements and only those land uses which are not subject to damage by floodwater and will not restrict its passage are permitted.

Growing stock volume - net volume, in cubic feet, of live growing-stock trees. Net volume equals gross volume less deduction for rot.

Inland fresh wetlands – those areas which are usually characterized by nontidal fresh water. Included are seasonally flooded basins and flats, inland fresh meadows, inland shallow fresh marsh, shrub swamp, and wooded swamp.

Intensive land use activities – those land uses which are developed for urban type purposes such as residential, commercial, and industrial activities.

Kaolin – a commercial mineral more familiarly known as white clay.

Marl – a commercial mineral made up of a combination of a dark green mineral called glauconite and shells of organisms.

Megalopolis – a term used frequently to refer to the urbanized Northeastern seaboard of the United States stretching from southern New Hampshire to northern Virginia. No other area in the U.S. has such a large concentration of people with such a high average density, spread over such a large area.

National Historic Landmarks – certain historic properties selected for inclusion on the *National Register of Historic Places* because they are considered to be nationally important reminders of the Nation's heritage.

Non-anadromous fish – fish which spawn in the Bay but which do not specifically enter the fresh water areas of the Bay and its tributaries to spawn. (See also semi-anadromous fish).

OBERS projections – projections of population and economic activity prepared for the Water Resources Council by the Bureau of Economic Analysis, US Department of Commerce, the Economic Research Service, the U.S. Department of Agriculture with assistance from the Forest Service.

Private commerical forest land - commercial forest lands which are owned by companies or individuals operating wood-using plants, farmer-owned lands, and miscellaneous private lands.

Ribbon development – urban land use activities usually "strung out" in ribbon-fashion along a transportation artery. Most ribbon development refers to commercial activities.

Rural population – defined by the 1970 Census of Population as "that portion of the population not classified as urban." (See also urban population).

Semi-anadromous fish – fish which are indigenous to an estuary area (brackish water) but which have definite seasonal migratory patterns upstream to fresh water for purposes of spawning.

Stratigraphy – refers to the arrangement of the strata or layers of earth.

Subarea – a grouping of counties for discussion and projection purposes.

Subdivision regulations – regulations concerned with the subdivision of parcels of land for development purposes. They are particularly useful in laying out streets and in providing certain necessary services.

Threatened species – those species which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Urban population – defined by the 1970 Census of Population as "all persons living in – a) places of 2500 inhabitants or more incorporated as cities, villages, boroughs, (except Alaska) and towns (except in the New England States, New York, and Wisconsin), but excluding those persons living in

the rural portions of extended cities; b) unincorporated places of 2500 inhabitants or more; and c) other territory, incorporated or unincorporated included in urbanized areas."

Woodland – synonymous in this Appendix with forest land.

Zoning – the division of a geographic area into district (zones) within which permissible and compatible uses are prescribed.

ATTACHMENT A
HISTORIC SITES IN THE CHESAPEAKE BAY REGION

MARYLAND

Anne Arundel County

1. Brice House
2. Chase-Lloyd House
3. Colonial Annapolis Historic District
4. Hammond-Harwood House
5. Maryland Statehouse
6. U.S. Naval Academy
7. Whitehall
8. All Hallows' Church
9. Cedar Park
10. Tulip Hill
11. Larkin's Hill Farm
12. Larkin's Hundred
13. Mary's Mount
14. Obligation
15. Evergreen
16. The South River Club
17. London Town Publik House
18. Artisan's House
19. John Callahan House
20. Patrick Creagh House
21. Mount Moriah A.M.E. Church
22. Old City Hall & Engine House
23. Paca House and Garden
24. St. James Church
25. St. Paul's Chapel
26. Belvoir
27. Mount Airy
28. Sudley
29. Holly Hill
30. Iglehart
31. Burrages End
32. Christ Church
33. Sandy Point Farm House
34. Peggy Stewart House
35. Skidmore, Sandy Point Shoal Light

Baltimore County

36. Thomas Viaduct, B & O Railroad (extending into Howard Co.)
37. Fort Garrison
38. Hampton National Historic Site
39. Brooklandwood
40. Rockland Historic District
41. Stone Hall
42. Todd Farmhouse
43. Glyndon Historic District
44. Prospect Hill
45. Lutherville Historic District
46. Sudbrook Park
47. Baltimore County Courthouse
48. Sheppard and Enoch Pratt Hospital
49. Craighill Channel Upper Range Front Light
50. Craighill Channel Range Front Light

Baltimore City

51. Baltimore & Ohio Transportation Museum and Mount Clare Station
52. Clifton Park Valve House
53. Federal Hill Historic District
54. Fells Point Historic District
55. Fort McHenry National Monument & Historic Shrine
56. Mount Clare
57. Otterbein Church
58. Peale's Baltimore Museum
59. Roman Catholic Cathedral of Baltimore
60. Shot Tower
61. U.S.F. Constellation
62. Old Town Friends Meeting Place
63. St. Luke's Church
64. St. Paul's Church Rectory
65. St. Paul's Protestant Episcopal Church
66. American Brewery
67. Baltimore City Hall
68. Battle Monument

Baltimore City (cont'd)

69. Bolton Hill Historic District
70. Carroll Mansion
71. Carrollton Viaduct
72. Cylburn House and Park Historic District
73. Dickeyville Historic District
74. Druid Hill Park Historic District
75. Eastern Female High School
76. Emerson Bromo-Seltzer Tower
77. Engine House No. 6
79. First Presbyterian Church and Manse
80. First Unitarian Church
81. The Flag House
82. Franklin Street Presbyterian Church and Parsonage
83. Homewood
84. Howard Street Tunnel
85. Lombard Street Bridge
86. Londontown Manufacturing Company, Inc.
87. Lovely Lane Methodist Church
88. Baltimore McKim's School
89. Mother Seton House
90. Mount Royal Station
91. Mount Vernon Place Historic District
92. Mount Vernon Place United Methodist Church and Asbury House
93. Edgar Allan Poe House
94. Poole and Hunt Company Buildings
95. St. Alphonsus' Church, Rectory, Convent, and Halle
96. St. Mary's Seminary Building
97. St. Mary's Seminary Chapel
98. St. Vincent de Paul - Roman Catholic Church
99. U.S. Customs House
100. St. John's Protestant Episcopal Church
101. Davidge Hall

Calvert County

102. Maidstone
103. Taney Place
104. Cedar Hill
105. Willow Glenn
106. Cove Point Lighthouse
107. Drum Point Lighthouse
108. Grahame House
109. All Saints' Church
110. La Veille
111. Cornehill

Caroline County

112. Willow Grove (Not shown)

Carroll County

113. Union Mills Homestead Historic District
114. Uniontown Academy

Cecil County

115. Old Lock Pump House, Chesapeake and Delaware Canal
116. Cecilton
117. Principio Furnace
118. Chesapeake and Delaware Canal
119. Bohemia Farm
120. New Castle and Frenchtown Railroad Right-of-way
121. Rogers Tavern

Charles County

122. Habre-de-Venture (Thomas Stone House)
123. Rose Hill
124. Mt. Carmel Monastery

Montgomery County

153. Chesapeake & Ohio Canal, National Historic Park
154. Clara Barton House
155. Cabin John Aqueduct
156. Beall-Dawson House
157. Sandy Spring Friends Meeting House
158. Seneca Quarry
159. Milimar

Prince Georges County

160. Accokeek Creek Site
161. Piscataway Park
162. Montgelier
163. His Lordship's Kindness
164. Fort Washington
165. Belair Stables
166. Surratt House
167. Beelefields
168. Laurel Railroad Station
169. Riverdale (Calvert Mansion)
170. St. Matthews Church
171. Bowieville
172. Mount Pleasant
173. St. John's Church

Queen Annes County

174. Readbourne
175. Bloomingdale
176. Bowlingly

Somerset County

177. Sudler's Conclusion
178. Beverly
179. Teackle Mansion (Beckford Mansion)

Dorchester County

125. Friendship Hall
126. Rehoboth
127. Hooper Island Light

Harford County

128. Sophia's Diary
129. Hays-Geighe House
130. D. H. Springhouse
131. Tudor House
132. Rigbie House
133. Medical Hall Historic District
134. Wildrell (Scott House)
135. St. Mary's Church
136. Gunpowder Meeting House
137. Presbury House (Not shown)
138. St. Ignatius Church
139. Havre De Grace Light

Howard County

140. Ellicott City Station
141. Daniels Mill
142. Doughoregan Manor
143. Bollman Railroad Truss
144. Trinity Church
145. Savage Mill

Kent County

146. Chestertown Historic District
147. Denton House
148. Godlington Manor
149. Carvill Hall
150. Widehall
151. Fairlee Manor Camp House
152. Rich Hill, The Griffith House

St. Marys County

180. West Street Mary's Manor
181. Resurrection Manor
182. St. Marys City Historic District
183. Mulberry Fields
184. Ocean Hall
185. Bachelor's Hope
186. St. Francis Xavier Church and Newtown Manor House
187. Porto Bello
188. Sotterley (Bowles' Separation)
189. Tudor Hall
190. St. Andrew's Church
191. St. George's Protestant Episcopal Church
192. St. Clement's Island Historic District
193. St. George's Protestant Episcopal Church (Poplar Hill)
194. Priest House (St. Inigoes Manor House)
195. Manor House
196. Piney Point Light Station
197. Point No Point Light

Talbot County

198. Wye House
199. St. John's Chapel of St. Michael's Parish
200. Sharps Island

Wicomico County

201. Pemberton Hall
202. Grillis-Grier House
203. Poplar Hill Mansion

Worcester County

204. Genesar

ATTACHMENT A (cont'd)
HISTORIC SITES IN THE
CHESAPEAKE BAY REGION

VIRGINIA

Accomack County

205. St. James Church
206. Assateague Lighthouse
207. Wessells Root Cellar
208. Corbin Hall
209. Wharton Place
210. Bowman's Folly
211. Hopkins and Brother Store
212. Kerr Place
213. St. George's Church

Alexandria (Independent City)

214. Alexandria Historic District
215. Bank of Alexandria
216. Carlyle House
217. Christ Church
218. Gadsby's Tavern
219. The Lyceum

Arlington County

220. Fort Myer Historic District
221. The Glebe
222. Arlington House (The Robert E. Lee Memorial)

Caroline County

223. Caroline County Courthouse
224. Old Mansion
225. Port Royal Historic District
226. Camden
227. Gay Mont
228. Hazelwood

Charles City County

229. Charles City County Courthouse
230. Berkeley Plantation (Benjamin Harrison V Birthplace and Home)
231. Greenway
232. John Tyler House (Sherwood Forest)
233. Westover
234. Westover Church
235. Eppes Island
236. Shirley
237. Margots

Chesapeake (Independent City)

238. Site of Great Bridge Battle

Chesterfield County

239. Bellona Arsenal
240. Eppington
241. Swift Creek Mill

Colonial Heights (Independent City)

773. Ellerslie

Dinwiddie County

242. Dinwiddie County Courthouse
243. Burnt Quarter
244. Five Forks Battlefield
245. Mayfield Cottage
246. Petersburg National Battlefield
247. Williamson Site

Essex County

248. Blandfield
249. Brooke's Bank
250. Elmwood
251. Vauter's Church
252. Tappahannock Historic District

Fairfax County

253. Pope-Leighey House
254. Woodlawn Plantation
255. Gunston Hall
256. Huntley (Not shown)
257. Mount Vernon
258. Sully
259. Dranesville Tavern
260. Earp's Ordinary (Ratcliffe-Logan-Allison House)
261. Belvoir Site
262. Pohick Church
263. Salona
264. Fairfax County Courthouse

Falls Church (Independent City)

774. Cherry Hill
775. The Falls Church

Fredericksburg (Independent City)

776. Fredericksburg Historic District
777. Kenmore
778. Monroe Law Office
779. Rising Sun Tavern

Gloucester County

265. Gloucester County Courthouse Square Historic District
266. Abingdon Glebe House
267. Little England
268. Walter Reed Birthplace
269. Roaring Spring
270. Rosewell
271. Toddsbury
272. Ware Parish Church
273. Lowland Cottage
274. Abingdon Church
275. Fairfield Site
276. Gloucester Woman's Club

Goochland County

277. Powell's Tavern
278. Tuckahoe
279. Woodlawn

Greensville County

280. M. T. Klugel Architectural Sheet Metal Work Building

Hampton (Independent City)

281. Chesterville Plantation Site
282. Fort Monroe
283. Fort Wool
284. Hampton Institute
285. Herbert House
286. Old Point Comfort Lighthouse
287. St. John's Church

Hanover County

288. Fort Church
289. Patrick Henry House (Scotchtown)
290. Slash Church
291. Hanover County Courthouse
292. Hanover County Courthouse Historic District
293. Richmond National Battlefield Park
294. Edmund Ruffin Plantation (Marlbourne)

Henrico County

295. Henrico
296. Flood Marker of 1771
297. James River and Kanawha Canal Historic District
298. Malvern Hill
299. Woodside

Hopewell (Independent City)

780. Weston Manor
781. Appomattox Manor

Isle of Wight County

300. St. Luke's Church
301. Old Isle of Wight County Courthouse
302. Smithfield Historic District

James City County

303. Powhatan
304. Colonial National Historical Park
305. Jamestown National Historical Site
306. Pinewoods (Warburton House)
307. Hickory Neck Church
308. Stone House Site
309. Carter's Grove
310. Governor's Land Archeological District
311. Kingsmill Plantation

King and Queen County

312. Holly Hill
313. Mattaponi Church
314. Upper Church, Stratton Major Parish
315. Hillsborough

King George County

316. Marmion
317. Nanzatico (Not shown)
318. St. Paul's Church
319. Belle Grove
320. Lamb's Creek Church (Not shown)

King William County

321. King William County Courthouse
322. Mangohick Church
323. St. John's Church
324. Elsing Green
325. Chelsea

Lancaster County

326. Christ Church
327. Bell Isle
328. St. Mary's Whitechapel
329. Corotoman

Loudoun County

330. Aldie Historic District
331. Leesburg Historic District
332. Exeter
333. James Monroe House, Oak Hill
334. Waterford Historic District
335. Broad Run Bridge and Tollhouse
336. Oatlands

Mathews County

337. Cricket Hill (Fort Cricket Hill)
338. New Point Comfort Lighthouse
339. Poplar Grove Mill and House (Not shown)
340. Hesse

Middlesex County

341. Lower Church
342. Christ Church
343. Deer Chase
344. James Mills Storehouse (Old Tobacco Warehouse)
345. Rosegill

City of Suffolk (Nansemond Co.)

346. Glebe Church
347. St. John's Church
348. Riddick House

New Kent County

349. St. Peter's Church
350. Criss Cross
351. Foster's Castle
352. Hampstead

Newport News (Independent City)

353. Denbigh Plantation
354. Hilton Village
355. Matthew Jones House
356. Lee Hall

Norfolk (Independent City)

357. Allmand-Archer House
358. U.S. Custom House
359. Freemason Street Baptist Church
360. General Douglas MacArthur Memorial (Norfolk City Hall)
361. Moses Myers House
362. Norfolk Academy Building
363. St. Paul's Church
364. West Freemason Street Area Historic District
365. Whittle House
366. Willoughby-Baylor House

Northampton County

367. Hungars Church
368. Vaucluse
369. Winona
370. Custis Tombs
371. Eyre Hall
372. Northampton County Courthouse Historic District
373. Caserta
374. Pear Valley
375. Glebe of Hungar's Parish
376. Sommer's House
377. Brownsville

Petersburg (Independent City)

378. Battersea
379. Blandford Church
380. Centre Hill
381. City Market
382. Exchange Building
383. Farmers' Bank
384. McLilwaine House
385. Petersburg Courthouse

Portsmouth (Independent City)

386. Drydock No. 1
387. Portsmouth Courthouse
388. Portsmouth Naval Hospital
389. Portsmouth Olde Towne Historic District
390. Trinity Episcopal Church

Prince George County

391. Brandon
392. Merchant's Hope Church

Prince William County

393. Old Hotel
394. Manassas National Battlefield Park
395. Bel Air
396. Rockledge
397. Beverly Mill (Chapman Mill)
398. Rippon Lodge

Richmond County

399. Menokin
400. Farnham Church
401. Sabine Hall
402. Richmond County Courthouse
403. John Tayloe Plantation (Mount Airy)

Richmond (Independent City)

404. Barrett House
405. William Beers House
406. Bell Tower
407. Branch Building
408. Broad Street Station
409. Henry Coalter Cabell House
410. Confederate Memorial Chapel
411. Crozet House (Curtis Carter House)
412. Donnan-Asher Iron Front Building
413. Egyptian Building
414. First African Baptist Church
415. First Baptist Church
416. Glasgow House
417. Hancock-Wirt-Caskie House
418. Maxall House
419. Hollywood Cemetery
420. James River and Kanawha Connection Locks
421. Jefferson Hotel
422. Kent-Valentine House
423. Benjamin Watkins Leigh House
424. Leigh Street Baptist Church
425. Linden Row
426. Main Street Station
427. John Marshall House
428. Mason's Hall
429. Maupin-Maury House
430. Maymont
431. James Monroe Tomb
432. Monument Avenue Historic District
433. Monument Church
434. Morson's Row
435. Old Stone House
436. Putney Houses
437. Richmond City Hall
438. Richmond National Battlefield Park
439. St. John's Church
440. St. John's Episcopal Church
441. St. Paul's Church
442. St. Peter's Church
443. Scott-Clarke House
444. Second Presbyterian Church
445. Sheltering Arms Hospital
446. Shockoe Slip Historic District
447. Stearns Iron Front Building
448. Stewart-Lee House
449. Tredegar Ironworks
450. 2900 Block Grove Avenue Historic District
451. U.S. Post Office and Custom House
452. Valentine Museum
453. Virginia Governor's Mansion
454. Virginia State Capitol (Second Confederate Capitol)
455. West Franklin Street Historic District
456. White House of the Confederacy
457. William J. Clark Library and Barco-Stevens Hall

Southampton County

458. Belmont

Spotsylvania County

459. Fall Hill
460. Fredericksburg & Spotsylvania County Battlefields Memorial National Military Park
461. Rapidan Dam Canal of the Rappahannock Navigation (Not shown)

Stafford County

462. Potomac Creek Site
463. Carlton
464. Falmouth Historic District
465. Gari Melchers Home (Belmont)
466. Ferry Farm Site (Site of George Washington's Boyhood Home)
467. Aquia Church
468. Hunter's Iron Works

Surry County

469. Arthur Allen House (Bacon's Castle)
470. Chippokes Plantation
471. Four Mile Tree
472. Smith's Fort
473. Warren House

Sussex County

474. Fortsville
475. Chester
476. Sussex County Courthouse Historic District

Virginia Beach (Independent City)

477. Cape Henry Lighthouse
478. Keeling House
479. Old Donation Church
480. Pembroke Manor (Not shown)
481. Pleasant Hall
482. Adam Thoroughgood House
483. Wishart-Bousch House (Not shown)

Westmoreland County

484. George Washington Birthplace
485. Chantilly
486. Stratford Hall
487. Yemcomico Church
488. Spence's Point (John R. Dos Passos Farm)

Williamsburg (Independent City)

782. Bruton Parish Church
783. Peyton Randolph House
784. James Semple House
785. Williamsburg Historic District
786. Wren Building, College of William & Mary
787. Wythe House

York County

489. Lee House, Kiskiack
490. Porto Bello
491. Grace Church
492. Yorktown Wrecks
493. William Gooch Tomb and York Village Archeological Site

ATTACHMENT A (cont'd)
HISTORIC SITES IN THE
CHESAPEAKE BAY REGION

DELAWARE

Kent County

494. Camden Friends Meeting House
495. Enoch Jones House
496. Octagonal Schoolhouse
497. Bradford-Lookerman House
498. Christ Church
499. Delaware State Museum Buildings (Old Presbyterian Church Complex)
500. Eden Hill
501. The Governor's House
502. Greenwold (Manlove Hayes House)
503. Loockerman Hall
504. Old State House
505. Town Point
506. John Dickinson Mansion
507. Great Geneva
508. Tyn Head Court (Wethered Court)
509. Allee House
510. Tharp House
511. Barratt Hall
512. Barratt's Chapel
513. Bonwell House
514. Mordington
515. Cooper House
516. Aspendale
517. Ruth Mansion House
518. Snowland
519. Wheel of Fortune
520. Old Stone Tavern
521. Jehu Reed House
522. Lindale House
523. Mathew Lowber House
524. Christ Church, Milford
525. Parson Thorne Mansion
526. Belmont Hall
527. Bannister Hall and the Baynard House
528. Duck Creek Village (Not shown)
529. Ivy Dale Farm
530. Island Field Site
531. Thomas Sutton House
532. Clow's Cheyney, Rebellion (Scene of)

New Castle County

533. Old Union Methodist Church
534. Center Meeting and Schoolhouse
535. Blockhouse and Robinson House
536. Darley House
537. Robinson House (Naaman's)
538. Fort Delaware on Pea Patch Island
539. Hockessin Friends Meeting House
540. Coffee Run Mission Site (Not shown)
541. Lum's Mill House
542. McCoy House
543. Greenbank Historic Area
544. Greenlawn
545. Middletown Academy (Town Hall)
546. Cochran Grange
547. Hedgelawn
548. Naudain
549. Noxontown
550. Old St. Anne's Church
551. Strand Millas and Rock Spring
552. Glebe House
553. The Hermitage
554. Lesley-Travers Mansion
555. New Castle Historic District
556. Old Courthouse (Old Colony and State House)
557. Buena Vista
558. England House (Red Mill Farm)
559. Andrew Fisher House
560. Old College Historic District (Delaware College)

561. Rotheram Mill House
562. Welsh-Tract Baptist Church
563. Cooch's Bridge Historic District
564. Mermaid Tavern
565. Mill Creek Friends Meeting House
566. White Clay Creek Presbyterian Church
567. Red Clay Creek Presbyterian Church
568. Appoquinimink Friends Meeting House
569. Corbit-Sharp House
570. Odessa Historic District
571. Duncan Beard Site
572. Old Drawyers Church (Drawyers Church)
573. Sereck Shallcross House
574. Williams House (Woodlawn)
575. Augustine Beach Hotel
576. Dilworth House
577. Rockland
578. Sutton House
579. Clearwater Farm
580. Old Brick Store
581. Hale-Byrnes House
582. St. James Church
583. Hart House
584. Huguenot House
585. Liston House
586. Brandywine Village Historic District
587. Breck's Mill Area (Henry Clay Village)
588. Continental Army Encampment Site
589. Jacob Dingee House
590. Obadiah Dingee House
591. Zachariah Ferris House
592. Fort Christina
593. Holy Trinity (Old Swedes) Church
594. Lombardy Hall
595. Louviers (Upper Louviers and Black Gates)
596. Lower Louviers and Chicken Alley
597. Louis McLane House
598. Masonio Hall and Grand Theater
599. Captain Thomas Mendenhall House
600. Old First Presbyterian Church of Wilmington
601. Starr House
062. Walker's Mill and Walker's Banks
603. Woodstock
604. Village of Adren
605. Brandywine Manufacturers Sunday School
606. Elevtherian Mills
607. Lobdell Estate (Minquadale Home)
608. The Winterthur Museum and Gardens
609. Wooddale Bridge
610. Stonum
611. Ashland Bridge

Sussex County

612. Fisher House
613. Prince George's Chapel
614. Highball Signal
615. Old Sussex County Courthouse
616. Sussex County Courthouse and the Circle
617. Old Christ Church
618. DeVries Palisade
619. Fisher's Paradise
620. Maull House
621. Abott's Mill
622. Pagan Creek Dike
623. St. George's Chapel
624. Carey's Camp Meeting Ground
625. Draper-Adkins House
626. Hazzard House
627. Governor James Ponder House
628. Cannon's (Woodland) Ferry
629. The Delaware Breakwater
630. The Harbor of Refuge Breakwater

ATTACHMENT A (cont'd)
HISTORIC SITES IN THE
CHESAPEAKE BAY REGION

DISTRICT OF COLUMBIA

631. Administration Building, Carnegie Institute of Washington
632. American National Red Cross
633. American Security and Trust Company
634. Larz Anderson House
635. Army Medical Museum (Medical Museum)
636. Arts Club of Washington
637. Arts and Industries Building, Smithsonian Institution
638. Bank of Columbia
639. Battleground National Cemetery
640. Bayly, Mountjoy/Johnson, Miram, House
641. Joseph Bearle House
642. Perry Belmont House
643. Canadian Embassy
644. Central Public Library
645. Chapel Hall, Gallaudet College
646. Christ Church (620 G Street)
647. Christ Church (3116 O Street)
648. Church of the Epiphany
649. City Hall (District Courthouse)
650. Commandant's Office, Washington Navy Yard
651. Conduit Road Schoolhouse
652. Congressional Cemetery
653. Corcoran Gallery of Art
654. Cosmos Club
655. Customhouse and Post Office
656. Decatur House
657. District Building
658. Dumbarton Bridge (Q Street Bridge)
659. Duncanson-Cranch House
660. East and West Potomac Parks
661. Eastern Market
662. Evermay
663. Executive Office Building
664. Folger Shakespeare Library
665. Ford's Theatre National Historic Site
666. Forrest - Marbury House
667. Franklin School
668. Frederick Douglass Home
669. Freer Gallery of Art
670. Friendship House (The Maples)
671. Georgetown Historic District
672. Georgetown Market
673. Georgetown University - Astronomical Observatory
674. Godey Lime Kilns
675. Grace Protestant Episcopal Church
676. Halcyon House
677. John Stoddert Haw House
678. Healy Building, Georgetown University
679. Heurich (Christian) Mansion
680. The Highlands (Sidwell Friends School)
681. Holt House
682. Charles Evans Hughes House
683. Indonesian Embassy (Walsh-McLean House)
684. Japanese Embassy
685. Jefferson Memorial
686. Lafayette Square Historic District
687. Thomas Law House
688. Lenthall Houses
689. Edward Simon Lewis House
690. Lincoln Memorial
691. The Lindens
692. Lockkeeper's House
693. Logan Circle Historic District
694. Luther Place Memorial Church
695. McCormick Apartments
696. Main Gate, Washington Navy Yard
697. Marine Corps Commandant's House
698. Memorial Continental Hall

DISTRICT OF COLUMIBA (cont'd)

699. Meridan House
700. Metropolitan African Methodist Episcopal Church
701. The National Archives
702. National Savings and Trust Company
703. National War College
704. National Zoological Park
705. Oak Hill Cemetery Chapel
706. Octagon House
707. Old Naval Observatory
708. Old Patent Office
709. Old Post Office and Clock Tower
710. Old Stone House
711. Isaac Owens House (Grannt-Williams House)
712. Pan American Union
713. Pennsylvania Avenue National Historic Site
714. Pension Building
715. Philadelphia (gundelo)
716. Duncan Phillips House
717. Pierce Mill
718. Pierce Springhouse and Barn
719. Pierce-Lkingle Mansion
720. Prospect House
721. Quality Hill (John Thomas Mason House)
722. Quarters A, Washington Navy Yard
723. Quarters B, Washington Navy Yard
724. Renwick Museum
725. Rhodes Tavern
726. Zalmon Richards House
727. Riggs National Bank (Washington Loan and Trust Company Branch)
728. Riggs National Bank
729. Ringgold-Carroll House
730. Rosedale
731. St. Aloysius Catholic Church
732. St. John's Church
733. St. Mark's Church, Capitol Hill
734. St. Mary's Episcopal Church
735. St. Paul's Episcopal Church
736. Sewall-Belmont House
737. Smithsonian Building
738. Sulgrave Club
739. Tariff Commission Building
740. Tucker House and Myers House
741. Tudor Place
742. Union Station
743. U.S. Capitol Gatehouses and Gateposts
744. U.S. Department of the Treasury
745. U.S. Marine Barracks Buildings
746. U.S. National Arboretum
747. Vigilant Firehouse
748. Volta Bureau
749. Warder-Totten House
750. Washington Club
751. Washington Monument
752. Washington Navy Yard Historic District
753. Wheat Row
754. Whittemore House (Woman's National Democratic Club)
755. Woodrow Wilson House
756. Winder Building
757. St. Matthews Cathedral and Rectory
758. U.S. Court of Military Appeals
759. U.S. Department of Agriculture Administration Building
760. Adams Memorial
761. Adas Israel Synagogue
762. Aqueduct, MacArthur Blvd.
763. Ashburton House
764. 800 Block of F Street, N.W.
765. Howard Theatre
766. National Academy of Sciences
767. U.S. Soldier's and Airmen's Home
768. Riggs Bank
769. Julius Lansburgh Furniture Co., Inc.
770. National Bank of Washington, Washington Branch
771. National Cathedral (Cathedral Church of St. Peter & St. Paul and Chase)
772. Old Naval Hospital

ATTACHMENT B
FEDERAL AND STATE FOREST AND PARK AREAS IN THE CHESAPEAKE BAY REGION

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND			
Anne Arundel	Sandy Point State Park	36	State
	Fort Smallwood State Park	42	State
	West of Baltimore-Washington International Airport	1	State
	West of Maryland Route 3, North of New Cut Road, East of Gambrills Road	2	State
Baltimore	Soldiers Delight	3	State
Calvert	Calvert Cliffs State Park	28	State
Caroline	Martinak State Park	33	State
Cecil	Black Hill Ranger Station	4	State
	Turkey Point/Elk Neck State Park	5	State
	Elk Neck State Forest	6	State
	West/South of Mt. Pleasant, Rowlandville	7	State
	C & D Canal Lands	23	State
Charles	General Smallwood State Park	9	State
	Cedarville State Park and Forest (extends into Prince Georges)	29	State
	Doncaster State Forest	30	State
Harford	Gunpowder River Valley State Park (extends into Baltimore County)	31	State
	Susquehanna State Park	40	State
	Deer Creek State Park	41	State
	East of Rt. 590, South of Trappe Road	10	

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND (cont'd)			
Howard	Patapsco State Park (also in Anne Arundel and Baltimore Counties)	34	State
Montgomery	Seneca State Park	11	State
	George Washington Memorial Parkway	12	Federal
	C & O Canal National Historical Park	13	Federal
	Patuxent State Park	43	State
Prince Georges	Greenbelt Park	14	Federal
	Piscataway National Park (Part of National Capital Parks)	19	Federal
	Suitland Parkway	20	Federal
	Fort Washington National Park	21	Federal
	Baltimore-Washington Parkway (extends into Anne Arundel County)	22	Federal
Queen Annes	Wye Oak State Park	38	State
	Tuckahoe State Park	39	State
Somerset	Janes Island State Park	32	State
St. Marys	St. Marys State Park (East of St. Andrews Estates/Norris Road)	15	State
	Point Lookout State Park	35	State
	North/South Steerborn Neck Road, Hollywood, Md.	16	State
Talbot	Seth Demonstration Forest	17	State
Wicomico	Wicomico State Forest	37	State

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
Worcester	Assateague Island Natonal Seashore	18	Federal
	Assateague State Park	24	State
	Milburn Landing State Park	25	State
	Pocomoke State Forest	26	State
	Shad Landing State Park	27	State
WASHINGTON D.C.			
	West Potomac Park	44	Federal
	East Potomac Park	45	Federal
	The Mall	46	Federal
	Monument Grounds	47	Federal
	Anacostia Park	48	Federal
	Rock Creek Park & Piney Branch Parkway	49	Federal
	Theodore Roosevelt Island	50	Federal
	Oxon Run Parkway	51	Federal
	Fort DuPont	52	Federal
	Glover Parkway & Children's Playground	53	Federal
	President's Park*	54	Federal
	Lady Bird Johnson Park*	55	Federal
	Rock Creek & Potomac Parkway*	56	Federal
	Potomac Palisades Parkway*	57	Federal
	Shepherd Parkway*	58	Federal
	Fort Circle Park*	59	Federal
DELAWARE			
Kent	Killen Pond State Park	67	State
New Castle	Blackbird State Forest	68	State
	Brandywine Creek State Park	61	State
	White Clay Creek State Park	64	State

*Not shown on plate.

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
	Fort Delaware State Park	65	State
	Lums Pond State Park	66	State
	Red Lion State Forest	71	State
Sussex	Delaware Beach Lands	62	State
	Trap Pond State Park	63	State
	Cape Henlopen State Park	70	State
	Holts Landing State Park	69	State
	Redden State Forest	72	State
	Owens State Forest	73	State
	Appenzeller State Forest	74	State
	Ellendale State Forest	75	State
VIRGINIA			
Accomack	Parramore Island	60	Federal
Chesterfield	Richmond National Battlefield	83	Federal
	Pocahantas State Park	88	State
	Pocahantas State Forest	92	State
Fairfax	Great Falls Park	78	Federal
	Wolf Trap Farm Park	79	Federal
	Gunston Hall State Park	85	State
	George Washington's Grist Mill	90	State
	George Washington Memorial Parkway	12	Federal
James City	York River State Park	94	State
	Jamestown Festival Park	95	State
Powhatan	Mason Neck State Park	91	State
Prince George	Petersburg National Battlefield	77	Federal

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
VIRGINIA (cont'd)			
Prince William	Prince William Forest Park (National Capital Parks)	76	Federal
	Manassas National Battlefield Park	82	Federal
	Conway-Robinson Memorial State Forest	89	State
Spotsylvania	Fredericksburg-Spotsylvania National Military Park	81	Federal
Surry	Chippokes Plantation State Park	96	State
Virginia Beach	Seashore State Park	87	State
	False Cape State Park	93	State
	Cape Henry Lighthouse	8	State
Westmoreland	George Washington's Birthplace National Monument	80	Federal
	Westmoreland State Park	86	State
York	Colonial National Historical Park	84	Federal

ATTACHMENT C
FEDERAL AND STATE FISH AND WILDLIFE MANAGEMENT
AREAS IN THE CHESAPEAKE BAY REGION

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND			
Baltimore	Gwynbrook State Game Farm	1	State
Caroline	Idylwild Wildlife Management Area	43	State
Carroll	Deep Run Wildlife Management Area	47	State
Cecil	Cecil Wildlife Management Area	3	State
	Private Whitaker Wildlife Management Area	48	State
	Earleville Wildlife Management Area	49	State
	Southwest of Hack Pt. North/South of Veaseys Neck Road	2	State
Charles	Myrtle Grove Wildlife Management Area	39	State
	Doncaster Wildlife Management Area	40	State
	Zekiak Swamp Wildlife Management Area	41	State
	Cedarville Swamp Wildlife Management Area	42	State
Dorchester	Bloodsworth Island	7	Federal
	Blackwater National Wildlife Refuge	18	Federal
	Linkwood Wildlife Management Area	19	State

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND (cont'd)			
	Taylors Island Wildlife Management Area	20	State
	Le Compte Wildlife Management Area	21	State
	Fishing Bay Wildlife Management Area	22	State
	West of Cow Creek	4	State
	East of Fishing Bay, East/South McCready's Cove, South of Elliott	5	State
	East/South Cow Creek West/South Nanticoke River	6	State
Harford	Susquehanna National Wildlife Refuge	17	Federal
Howard	Hugg Thomas Wildlife Management Area	34	State
Kent	Eastern Neck National Wildlife Refuge	24	Federal
	Millington Wildlife Management Area	8	State
	Black Bottom Road, South of Gulte (extends into Delaware)	25	State
Montgomery	Strider Wildlife Management Area	36	State
	McKee Beshers Wildlife Management Area	37	State
	Dierssen Wildlife Management Area	38	State
Prince Georges	Patuxent National Wildlife Research Center	26	Federal
	Bowen Wildlife Management Area	27	State

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND (cont'd)			
	West of Patuxent River, near Calvert & Anne Arundel Counties	27	State
Somerset	Martin National Wildlife Refuge	28	Federal
	Fairmount Wildlife Management Area	29	State
	Pocomoke Sound Wildlife Management Area	30	State
	Cedar Island Wildlife Management Area	31	State
	Deal Island Wildlife Management Area	32	State
	South of Shelltown Road	11	State
	South of Dublin Road, near Arden	12	State
St. Marys	St. Clements Island Wildlife Management Area	44	State
Wicomico	East/South of Mt. Olive Road, Rt. 240	13	State
	Ellis Bay Wildlife Management Area	23	State
Worcester	Pocomoke River Wildlife Management Area	14	State
	Chincoteague National Wildlife Refuge	16	Federal
	Foster Wildlife Management Area	33	State
	E. A. Vaughn Wildlife Management Area	45	State
	Sinepuxent Wildlife Management Area	46	State

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
DELAWARE			
Kent	Bombay Hook National Wildlife Refuge	50	Federal
	Woodland Beach	53	State
	Little Creek Wildlife Area	54	State
	Petersburg Wildlife Area	55	State
	Milford Neck Wildlife Area	56	State
	Blackiston Wildlife Area	9	State
New Castle	Augustine Beach Wildlife Area	52	State
	Canal Land Wildlife Management Area	35	State
	Reedy Island Wildlife Management Area	59	State
	Reedy Point Wildlife Management Area	60	State
	Appoquinimink	61	State
	Killcohook National Wildlife Refuge**	10	Federal
Sussex	Primehook National Wildlife Refuge	51	Federal
	Assawoman Wildlife Area	57	State
	Nanticoke Wildlife Area	58	State
	Gordon Pond Wildlife Management Area	62	State
VIRGINIA			
Accomack	Chincoteague National Wildlife Refuge	16	Federal
	Parkers Marsh National Area	70	State
	Saxis Wildlife Management Area (Michael's Marsh)	78	State
	Wallops Island National Wildlife Refuge	68	Federal

** Only a portion of this National Wildlife Refuge lies within Delaware. The remainder is in New Jersey.

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
VIRGINIA (cont'd)			
Charles City	Chickahominy Wildlife Management Area	81	State
	Harrison Lake National Fish Hatchery	79	Federal
Chesterfield	Presquile National Wildlife Refuge	63	Federal
Fairfax	Mason Neck National Wildlife Refuge	65	Federal
	Fraser Preserve	85	State
	Great Falls	86	State
King George	Lands End Refuge Wildlife Management Area	73	State
	Motts Run Public Access Area*	74	State
Loudoun	Furnace Mountain	84	State
New Kent	Game Farms Marsh Wildlife Area	75	State
Northampton	Fisherman's Island National Wildlife Refuge	67	Federal
	Wreck and Bone Islands Natural Area	71	State
	Mockhorn Island Refuge Wildlife Management Area	72	State
	Barrier Islands	15	State
	Cape Charles	82	State
Powhatan	Pocahantas Wildlife Management Area*	80	State
Spotsylvania	Alexander Berger Memorial Sanctuary	87	State

* Not shown on plate.

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
Suffolk	Dismal Swamp National Wildlife Refuge (extends into City of Chesapeake)	83	Federal
Surry	Hog Island Refuge Wildlife Management Area	77	State
Virginia Beach	Back Bay Migratory Waterfowl National Wildlife Refuge	64	Federal
	Mackay Island National Wildlife Refuge	66	Federal
	Trojan Wildlife Management Area	76	State
York	Plumtree Island National Wildlife Refuge	69	Federal

* Not shown on plate.

ATTACHMENT D
MAJOR EDUCATION, RESEARCH, AND MILITARY
AREAS OF THE CHESAPEAKE BAY REGION

PUBLIC EDUCATION

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND			
Anne Arundel	U.S. Naval Academy Dairy Farm	1	Federal
	U.S. Naval Academy (Annapolis)	2	Federal
	District Training School	3	Federal
Baltimore City	Morgan State University	7	State
	Coppin State College	109	State
Baltimore	University of Maryland	4	State
	Towson State University	5	State
	Maryland Training School for Boys	6	State
Caroline	Southeast/South of Todd Road in Smithville Lake Area	8	State
Howard	University of Maryland Experimental Farm	9	State
	Experimental Farm, northwest of Columbia	10	State
Montgomery	University of Maryland Research Farms	11	State
Prince Georges	Regents of the University of Maryland, Tobacco Farm	12	State
	Bowie State College	13	State
	University of Maryland (College Park)	14	State

PUBLIC EDUCATION
(cont'd)

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND (cont'd)			
Queen Anne's	Chesapeake College	15	State
	Wye Institute (University of Maryland)	16	State
Saint Marys	St. Marys College	17	State
Somerset	University of Maryland (Eastern Shore)	18	State
Wicomico	Salisbury State College	110	State
VIRGINIA			
Accomack	University of Virginia (Wallops Island)	111	State
Fairfax	George Mason University	58	State
City of Newport News	Christopher Newport College (College of William & Mary)	57	State
City of Norfolk	Old Dominion University	60	State
	Norfolk State College	61	State
City of Peters-burg	Virginia State College	63	State
	Richard Bland College	138	State
City of Richmond	Virginia Commonwealth University	62	State
Spotsylvania	Mary Washington College	59	State
York	College of William and Mary	56	State

PUBLIC EDUCATION
(cont'd)

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
DELAWARE			
New Castle	University of Delaware (Newark)	112	State
Kent	Delaware State College (Dover)	113	State
Sussex	University of Delaware Experiment Station (Agriculture Sub-Station)	117	State
	College of Marine Sciences (Lewes)	123	State
DISTRICT OF COLUMBIA			
	District of Columbia Teachers College	114	Municipal
	Federal City College	115	Municipal
	U.S. Department of Agriculture (Graduate School)	116	Federal

RESEARCH

MARYLAND			
Anne Arundel	Environmental Protection Agency (Annapolis Field Office)	95	Federal
	Maryland Department of Water Resources	96	State
	Smithsonian Institution (Chesapeake Bay Center for Environmental Studies - Edgewater)	97	Federal

RESEARCH
(cont'd)

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND (cont'd)			
Baltimore City	Maryland Department of Health and Mental Hygiene	92	State
	Baltimore District U.S. Army Corps of Engineers	93	Federal
	Maryland Environmental Service	94	State
	University of Maryland	102	State
Calvert	Chesapeake Biological Lab (Solomon's Island)	47	State
Howard	East of Route 1, West of Route 175	48	State
Montgomery	National Institute of Health	49	Federal
	National Institute of Health (Oakmont)	50	Federal
	U.S. Bureau of Standards	89	Federal
	Energy Research and Development Administration (ERDA)	90	Federal
	National Ocean Survey	91	Federal
Prince Georges	National Agricultural Research Center	51	Federal
	U.S. Bureau of Plant Industries	52	Federal
	Goddard Space Flight Center	53	Federal
	U.S. Naval Oceanographic Office	98	Federal
Talbot	U.S. Fish and Wildlife Service (Oxford)	54	Federal
	National Oceanic and Atmospheric Administration (Oxford)	55	Federal

RESEARCH
(cont'd)

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
VIRGINIA			
Fairfax	Fairbanks Highway Research Center	120	Federal
	U.S. Geological Survey	99	Federal
Gloucester	Virginia Institute of Marine Science	101	State
Loudoun	Sterling Research and Development Center (Weather Bureau)*	121	Federal
City of Newport	Virginia Associated Research Center	140	State
Prince William	Harry Diamond Labs (Woodbridge)	122	Federal
City of Richmond	State Water Control Board	100	State
DISTRICT OF COLUMBIA			
	Smithsonian Institution	124	Federal
	National Arboretum	125	Federal
	National Zoo	126	Federal

MILITARY

MARYLAND			
Anne Arundel	Ft. George G. Meade	19	Federal
	U.S. Naval Ship Research and Development Center	20	Federal

* Not shown on plate.

MILITARY
(cont'd)

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND (cont'd)			
	U.S. Coast Guard Depot	21	Federal
	U.S. Air Force Transmitter Station	22	Federal
Baltimore Ctiy	Ft. Holabird	24	Federal
Calvert	Naval Testing Center (Solomon's Island)	25	Federal
	Naval Research Lab (Randall Cliff Beach)	26	Federal
Cecil	Naval Training Center (Bainbridge)	27	Federal
	U.S. Reservation (Veazy Cove)	28	Federal
	U.S. Reservation (C & D Canal)	29	Federal
	C & D Disposal Area (Sassafras River)	30	Federal
	C & D Disposal Area (Elk River near Port Herman)	31	Federal
	C & D Disposal Area (West View Shores)	32	Federal
Charles	East Coast Radio Receiving Station (La Plata)	33	Federal
	Naval Ordnance Station and Research Lab (Indian Head)	34	Federal
	Blossom Proving Grounds (Upper Cedar Point)	35	Federal
Harford	Aberdeen Proving Grounds	23	Federal
	Edgewater Arsenal	36	Federal

MILITARY
(cont'd)

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
MARYLAND (cont'd)			
Montgomery	National Naval Medical Center	37	Federal
	Naval Ship Research and Development Center	38	Federal
	Walter Reed Army Medical Center	39	Federal
	Naval Ordnance Lab	40	Federal
Prince Georges	Andrews Air Force Base	41	Federal
	U.S. Military Reservation (Globecom)	42	Federal
	Reconnaisance and Technical Support Center	43	Federal
	Naval Reservation Radio Station	44	Federal
St. Marys	Patuxent Naval Air Test Center	45	Federal
	Webster Field (Electronic Systems Test and Evaluation Center)	46	Federal
VIRGINIA			
Accomack	National Aeronautics and Space Administration (Wallops Island)	103	Federal
City of Alexandria	Cameron Station Military Supply Depot	137	Federal
	Battery Cove Military Reservation	146	Federal
Arlington	Pentagon	141	Federal
	Ft. Myer	142	Federal

MILITARY
(cont'd)

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
VIRGINIA (cont'd)			
	Navy Annex	143	Federal
	Arlington Hall Reservation (Signal Corps)	144	Federal
Caroline	A.P. Hill Military Reservation	67	Federal
City of Chesapeake	U.S. Naval Reservation (Fentress Landing Field)	87	Federal
	U.S. Naval Reservation (Northwest Radio Station)	147	Federal
Chesterfield	Defense General Supply Center	136	Federal
Dinwiddie	Camp Picket*	139	Federal
Fairfax	Ft. Belvoir Military Reservation	65	Federal
City of Hampton	Langley Air Force Base	64	Federal
	Ft. Monroe Military Reservation	75	Federal
Isle of Wight	U.S. Military Reservation	76	Federal
James City	Camp Wallace Military Reservation	69	Federal
King George	U.S. Naval Reservation (Dahlgren Weapons Lab)	78	Federal
City of Newport News	Ft. Eustis Military Reservation	70	Federal
	U.S. Military Reservation	73	Feceral
	Big Bethel Reservation	74	Federal

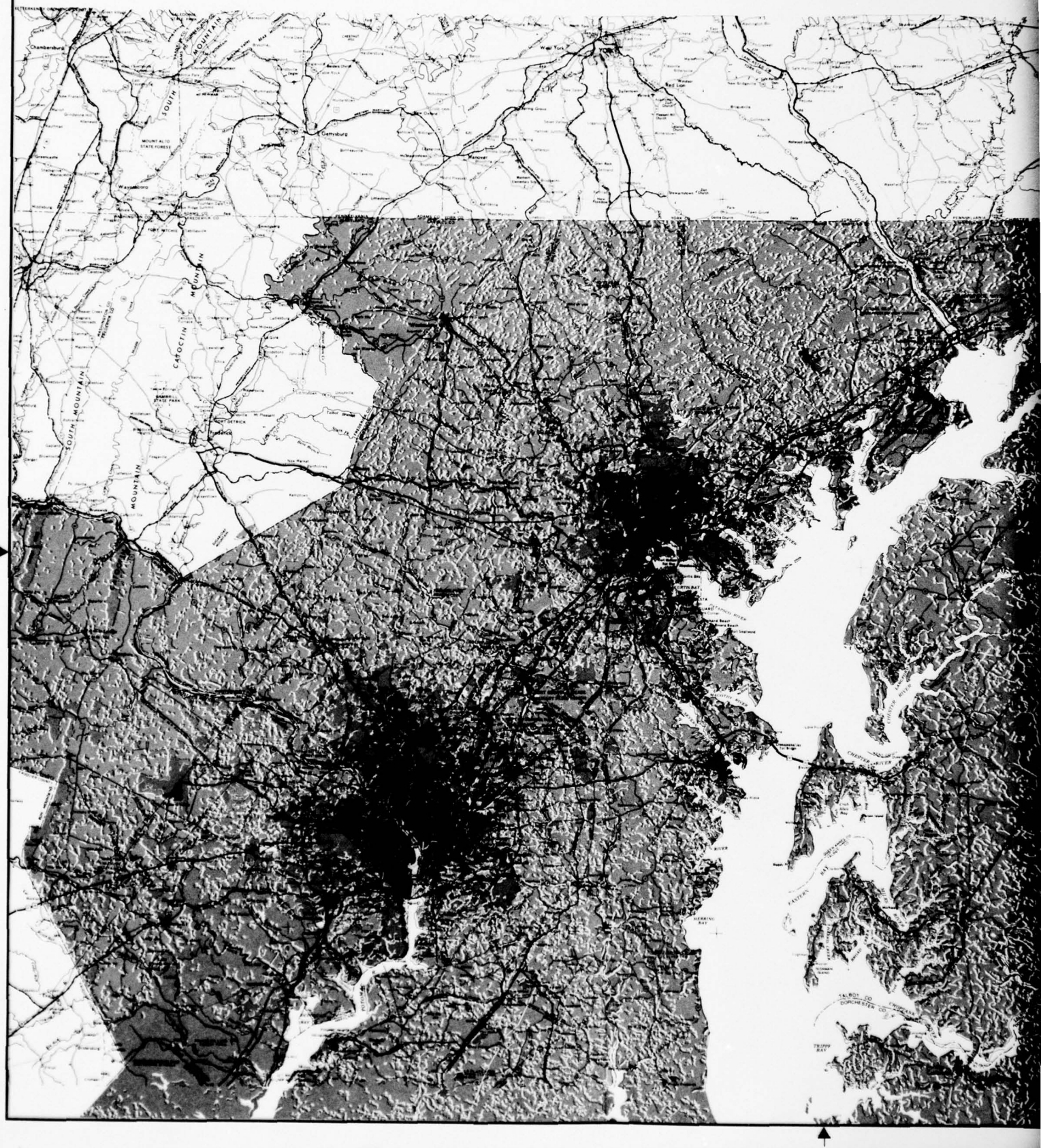
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MILITARY
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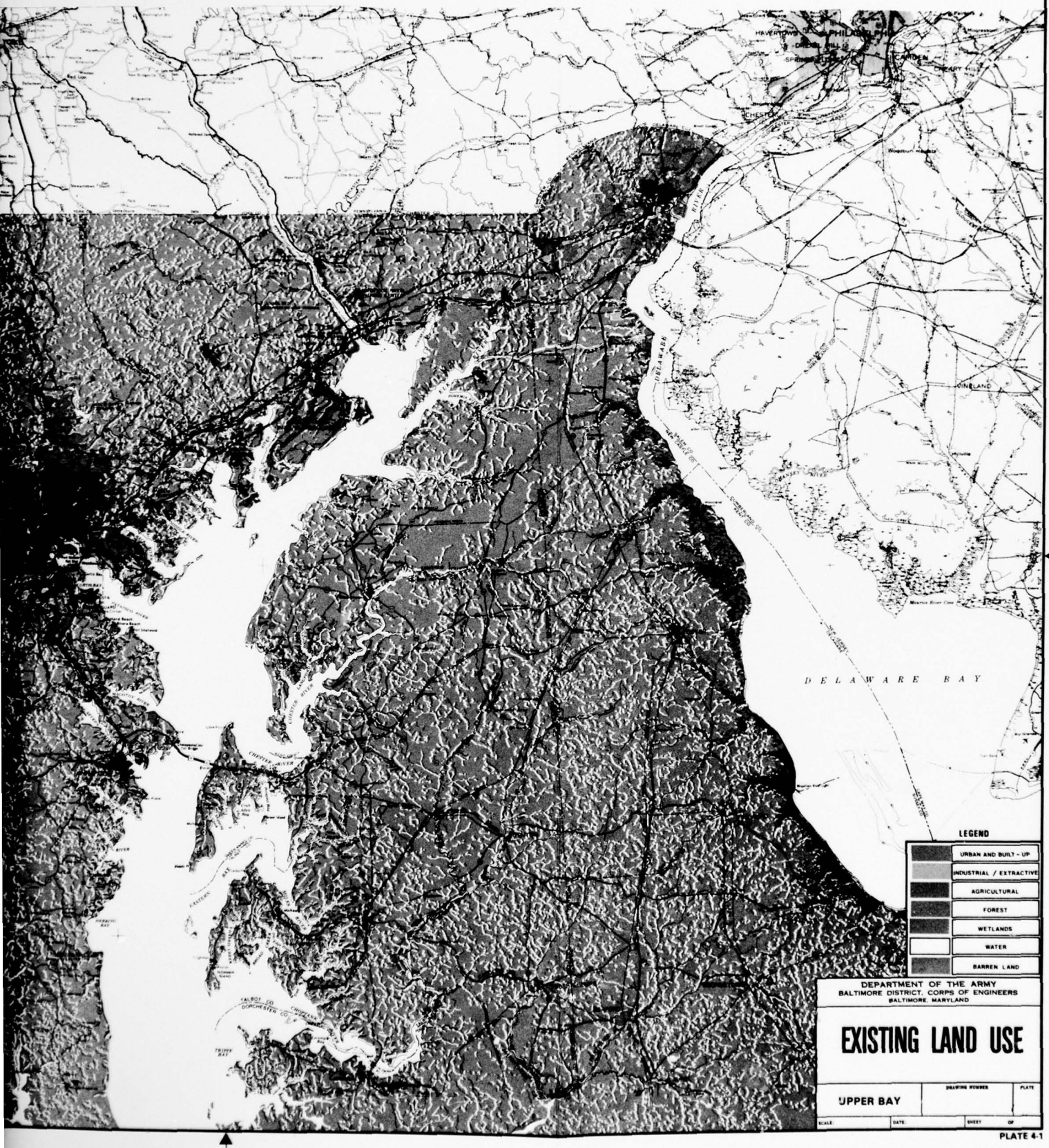
STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
VIRGINIA (cont'd)			
Northampton	U.S. Military Reservation	72	Federal
	Cape Charles Air Force Base	106	Federal
City of Portsmouth	Craney Island Disposal Area	83	Federal
Prince George	Ft. Lee Military Reservation	68	Federal
	U.S. Coast Guard Station	88	Federal
Prince William	U.S. Military Reservation	66	Federal
	Quantico Marine Corps School (extending into Stafford County)	82	Federal
City of Suffolk	U.S. Naval Transmitter Station	86	Federal
City of Virginia Beach	Ft. Story Military Reservation	77	Federal
	U.S. Naval Reservation (Little Creek Amphibious Base)	84	Federal
	Oceana Naval Air Station	85	Federal
	Dam Neck Naval Base	107	Federal
	Coast Guard Communication Station	108	Federal
York	U.S. Military Reservation (Plum Tree Island Bombing Range)	71	Federal
	Camp Peary Naval Reservation	79	Federal
	Naval Supply Center	80	Federal
	U.S. Naval Weapons Station	81	Federal
	Cheatham Annex Naval Supply Depot	104	Federal
	Yorktown Naval Weapons Station	105	Federal

STATE/COUNTIES	PROPERTY TITLE OR DESCRIPTION	PLATE PROPERTY NUMBER	OWNER-SHIP
DELAWARE			
Kent	Dover Air Force Base	119	Federal
Sussex	U.S. Military Reservation	118	Federal
DISTRICT OF COLUMBIA			
	Naval Research Lab	127	Federal
	Bolling Air Force Base	128	Federal
	U.S. Naval Station	129	Federal
	Washington Navy Yard	130	Federal
	U.S. Soldiers and Airmen's Home	131	Federal
	Walter Reed Army Medical Center	132	Federal
	U.S. Naval Observatory	133	Federal
	Ft. McNair	134	Federal
	Naval Communications Annex	135	Federal

CORPS OF ENGINEERS



U. S. ARMY



DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

EXISTING LAND USE

UPPER BAY

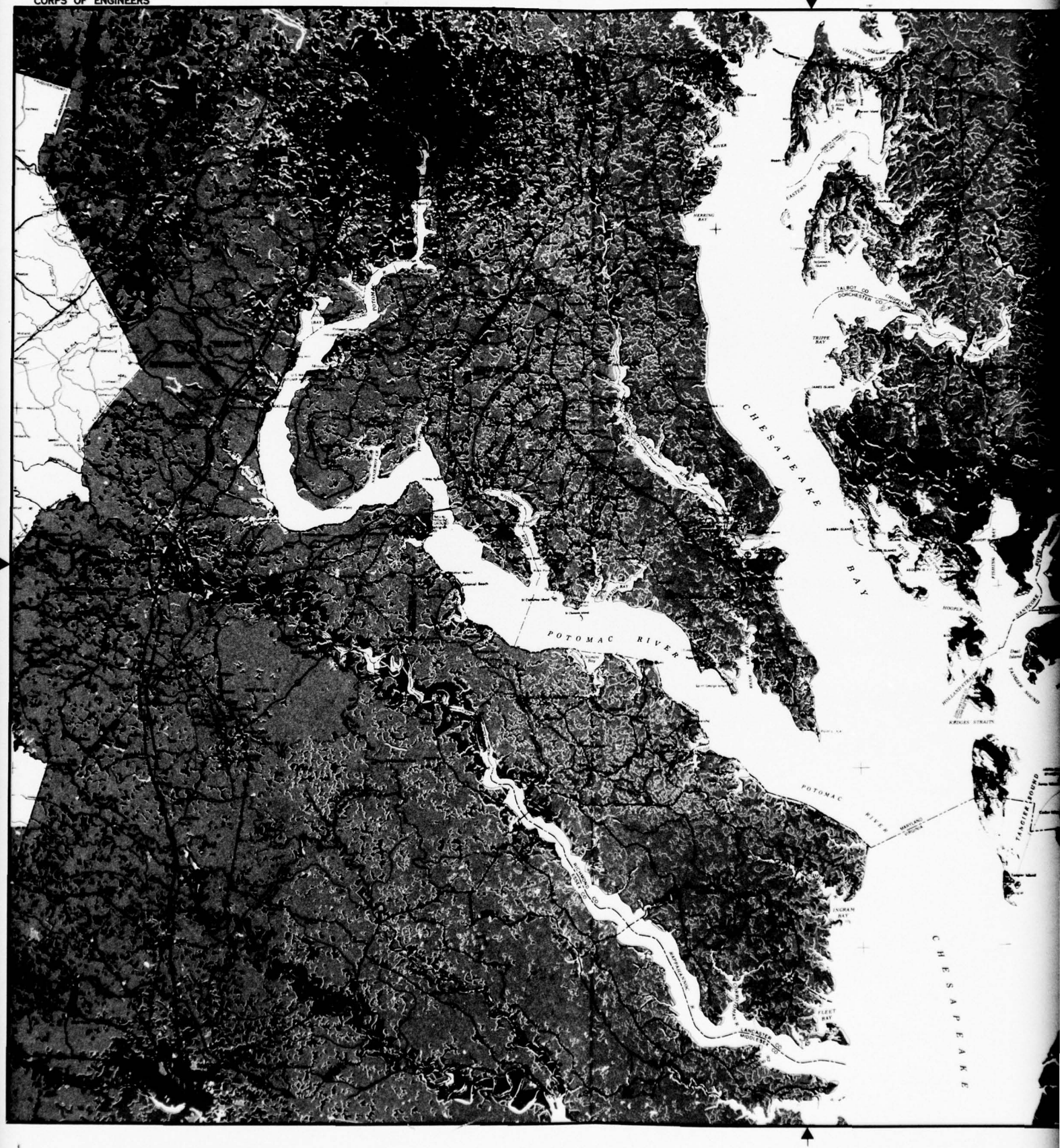
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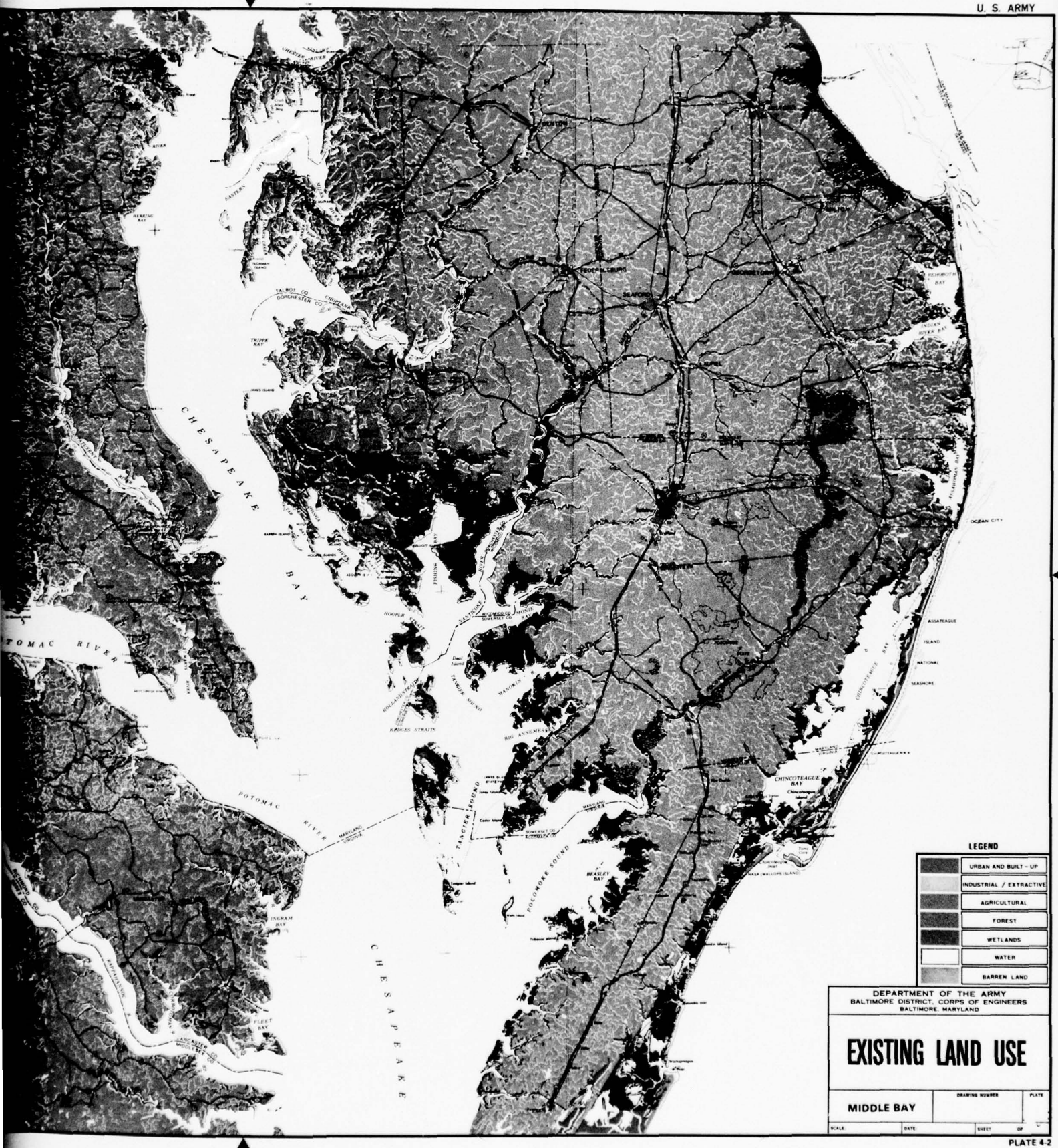
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PLATE 4-1

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CORPS OF ENGINEERS




U. S. ARMY
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POTOMAC RIVER
CHESAPEAKE
LEGEND
URBAN AND BUILT - UP
INDUSTRIAL / EXTRACTIVE
AGRICULTURAL
FOREST
WETLANDS
WATER
BARREN LAND
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND
EXISTING LAND USE
MIDDLE BAY
DRAWING NUMBER
PLATE
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OF
PLATE 4-2

POTOMAC
RIVER
CHESAPEAKE BAY
JAMES
RIVER
NEWPORT NEWS

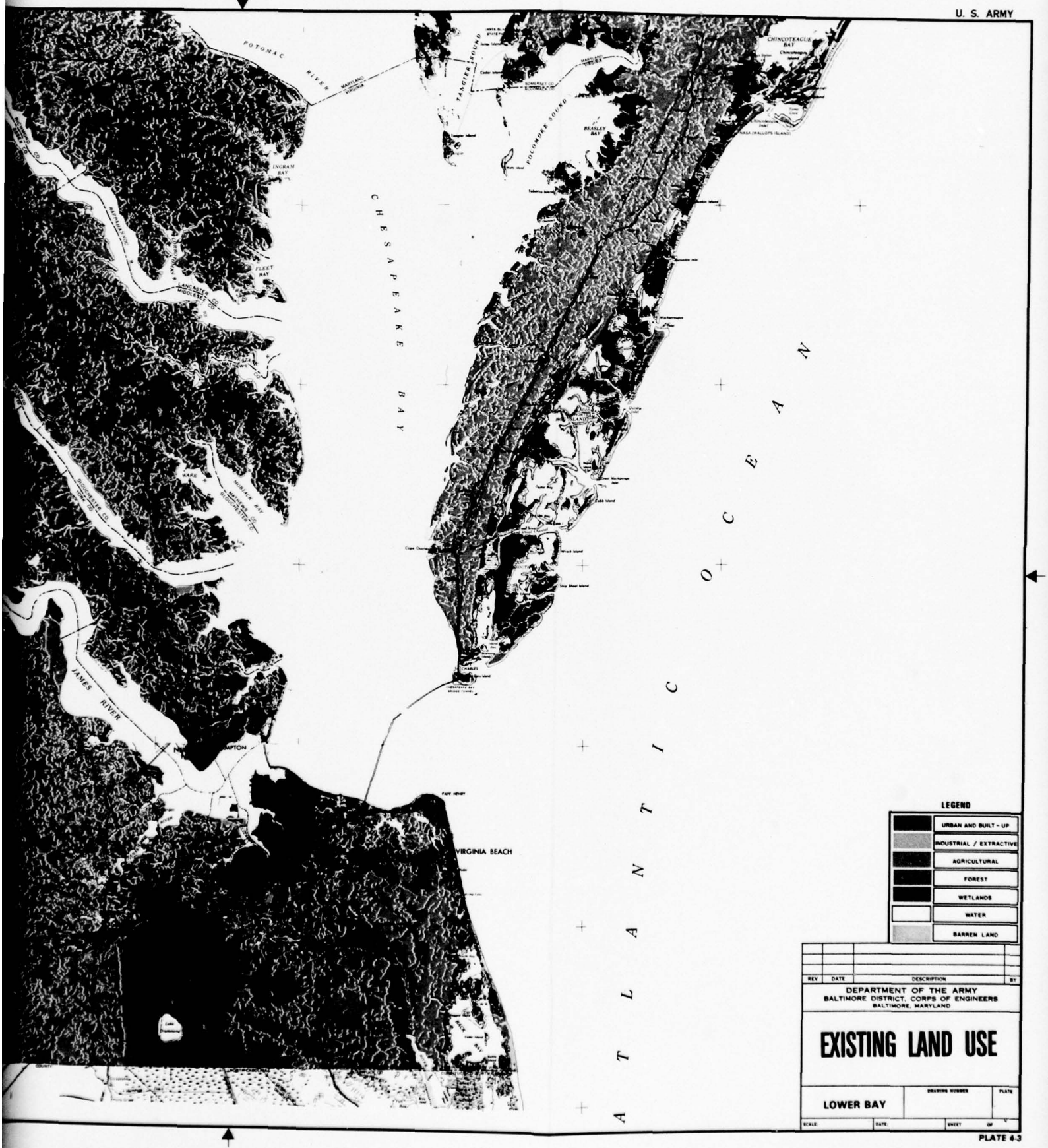
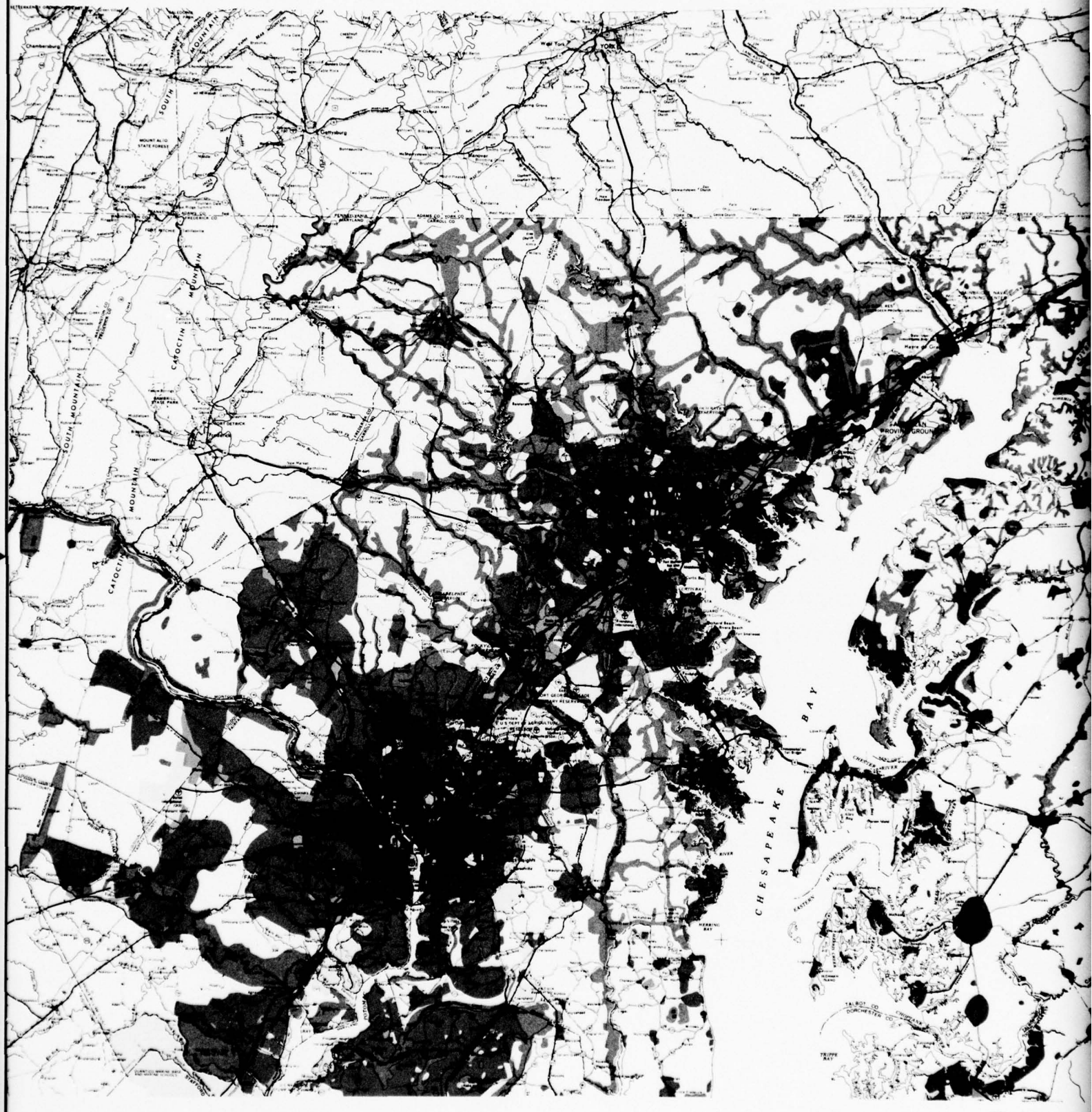

U. S. ARMY
POTOMAC RIVER
MARYLAND
VIRGINIA
TANGIER SOUND
POCOMOKE SOUND
CHINCOTEAGUE BAY
BEASLEY BAY
INGRAM BAY
FLEET BAY
CHESAPEAKE BAY
ATLANTIC OCEAN
JAMES RIVER
VIRGINIA BEACH
CAPE HENRY
LEGEND
URBAN AND BUILT - UP
INDUSTRIAL / EXTRACTIVE
AGRICULTURAL
FOREST
WETLANDS
WATER
BARREN LAND
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BY
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND
EXISTING LAND USE
LOWER BAY
DRAWING NUMBER
PLATE
SCALE:
DATE:
SHEET
OF

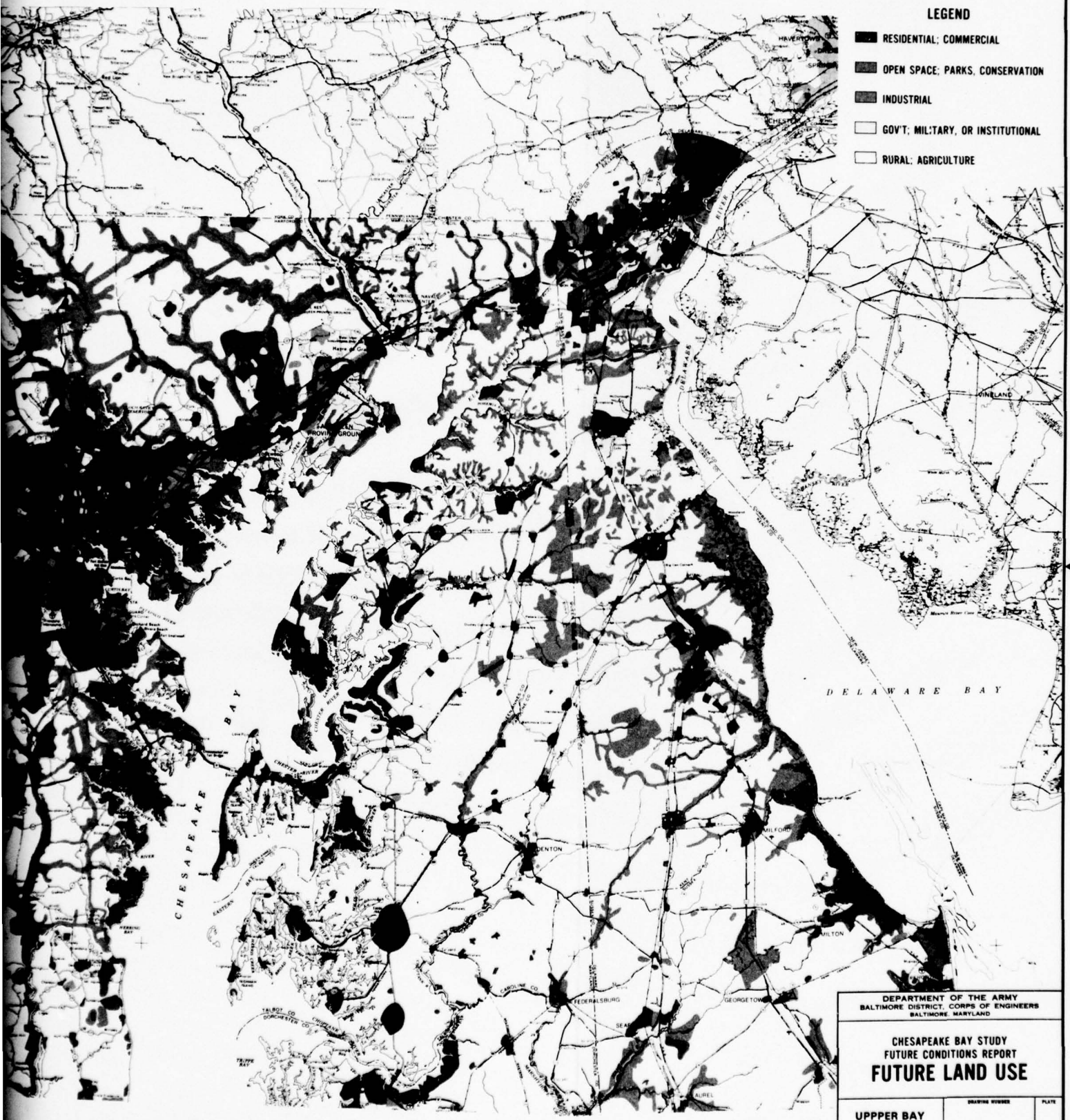
PLATE 4-3

CORPS OF ENGINEERS



NOTE: DATA WAS CO

U. S. ARMY



NOTE: DATA WAS COMPILED FROM LOCAL AND REGIONAL PLANNING AGENCIES PROJECTIONS

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

FUTURE LAND USE

UPPPER BAY

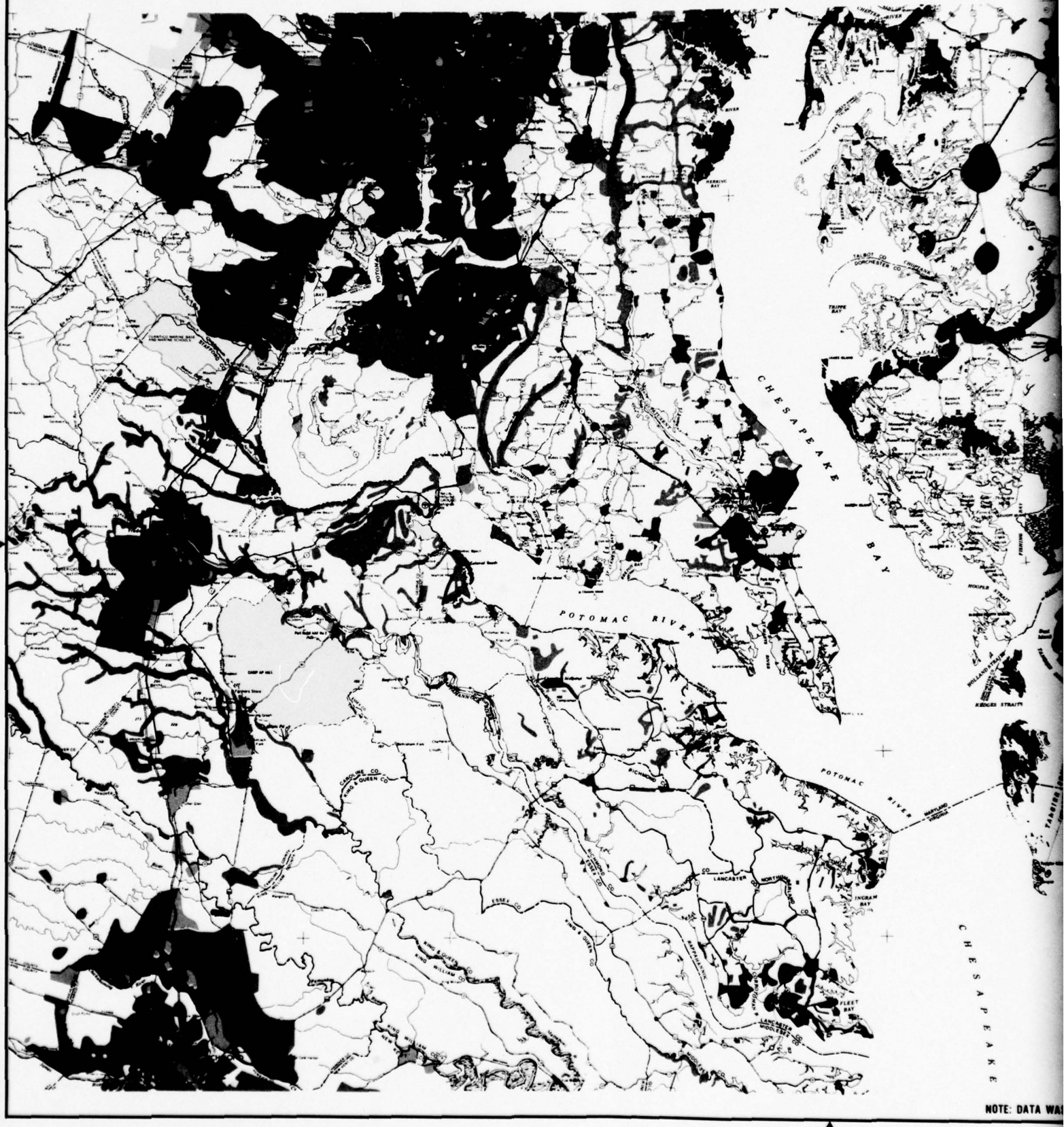
DRAWING NUMBER | PLATE

SCALE: | DATE: | SHEET 1 OF 3

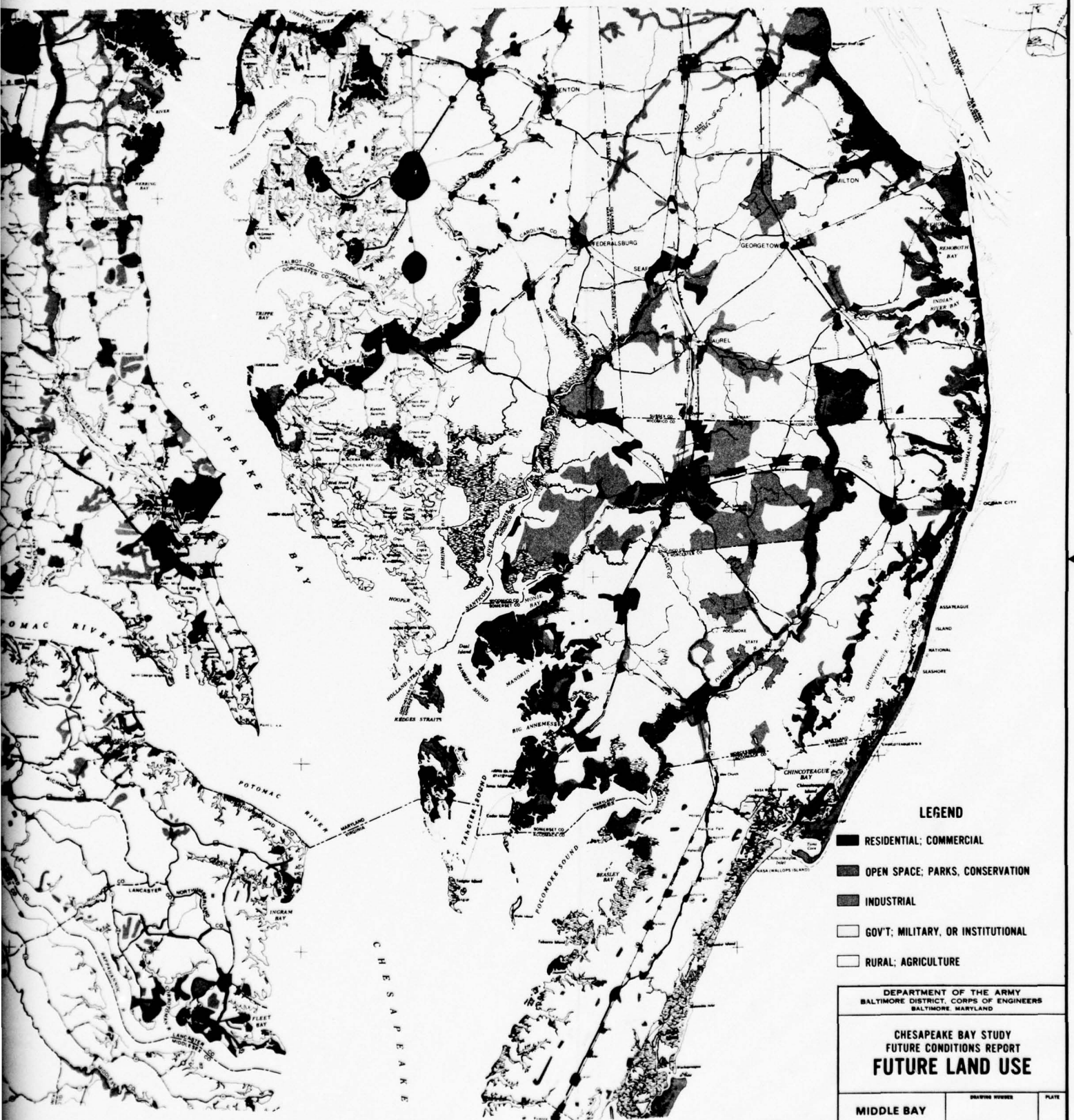
PLATE 4-4

2

CORPS OF ENGINEERS



NOTE: DATA WAS



LEGEND

- RESIDENTIAL; COMMERCIAL
- OPEN SPACE; PARKS, CONSERVATION
- INDUSTRIAL
- GOV'T; MILITARY, OR INSTITUTIONAL
- RURAL; AGRICULTURE

NOTE: DATA WAS COMPILED FROM LOCAL AND REGIONAL PLANNING AGENCIES PROJECTIONS

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

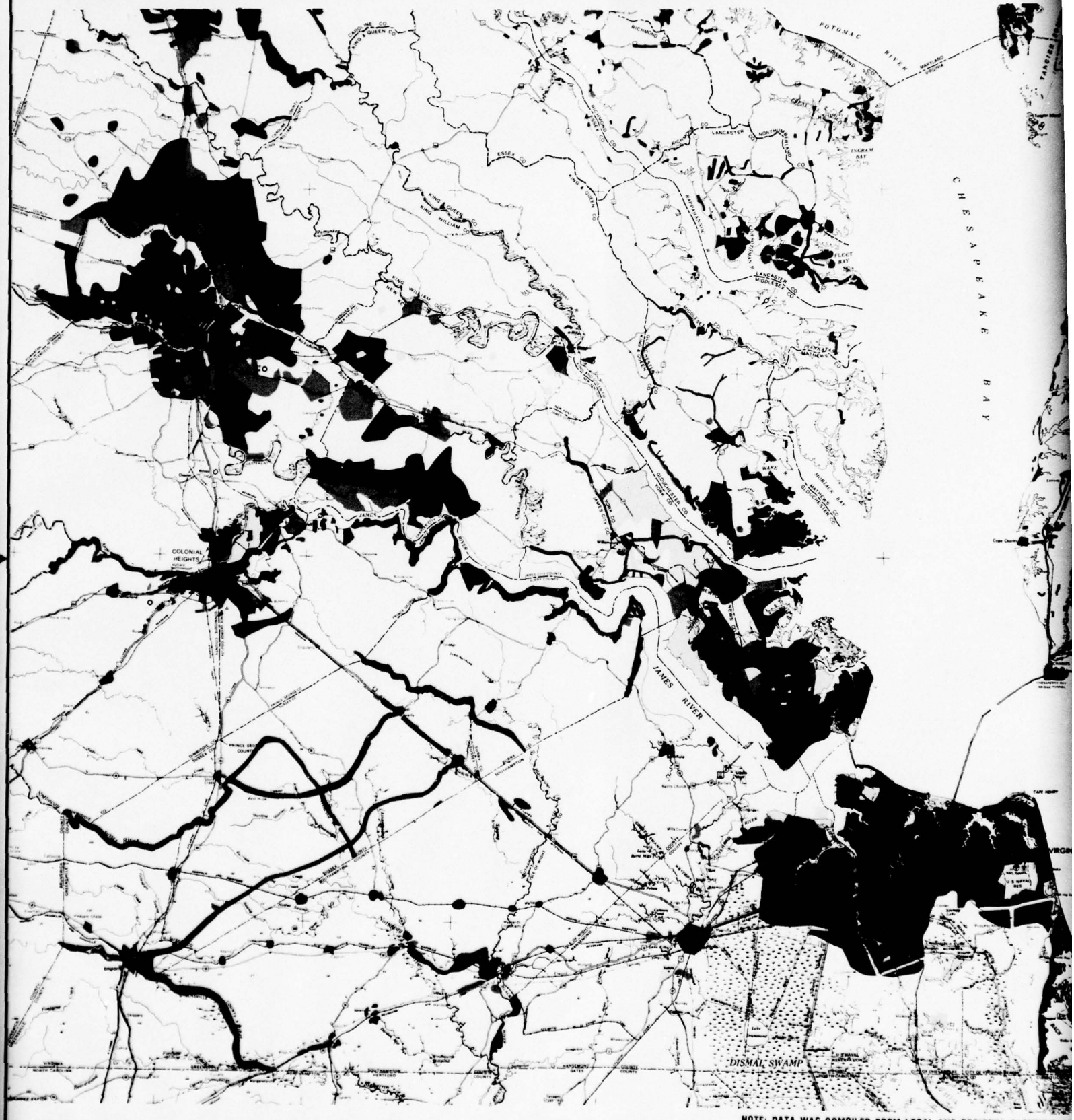
CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

FUTURE LAND USE

MIDDLE BAY	DRAWING NUMBER	PLATE
SCALE:	DATE:	SHEET 2 OF 3

PLATE 4-5

CORPS OF ENGINEERS



NOTE: DATA WAS COMPILED FROM LOCAL AND REGIONAL PLANNING AG

U. S. ARMY



NOTE: EXISTING LAND USE DATA WAS USED FOR THE FOLLOWING COUNTIES SINCE FUTURE LAND USE DATA WAS NOT AVAILABLE AT TIME OF PRINTING:
ACCOMACK COUNTY, VIRGINIA
ESSEX COUNTY, VIRGINIA
KING AND QUEEN COUNTY, VIRGINIA
KING WILLIAM COUNTY, VIRGINIA
MATHEWS COUNTY, VIRGINIA
MIDDLESEX COUNTY, VIRGINIA
NORTHAMPTON COUNTY, VIRGINIA

LEGEND

- RESIDENTIAL; COMMERCIAL
- OPEN SPACE; PARKS, CONSERVATION
- INDUSTRIAL
- GOV'T; MILITARY, OR INSTITUTIONAL
- RURAL; AGRICULTURE

REV	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

FUTURE LAND USE

LOWER BAY

DRAWING NUMBER

PLATE

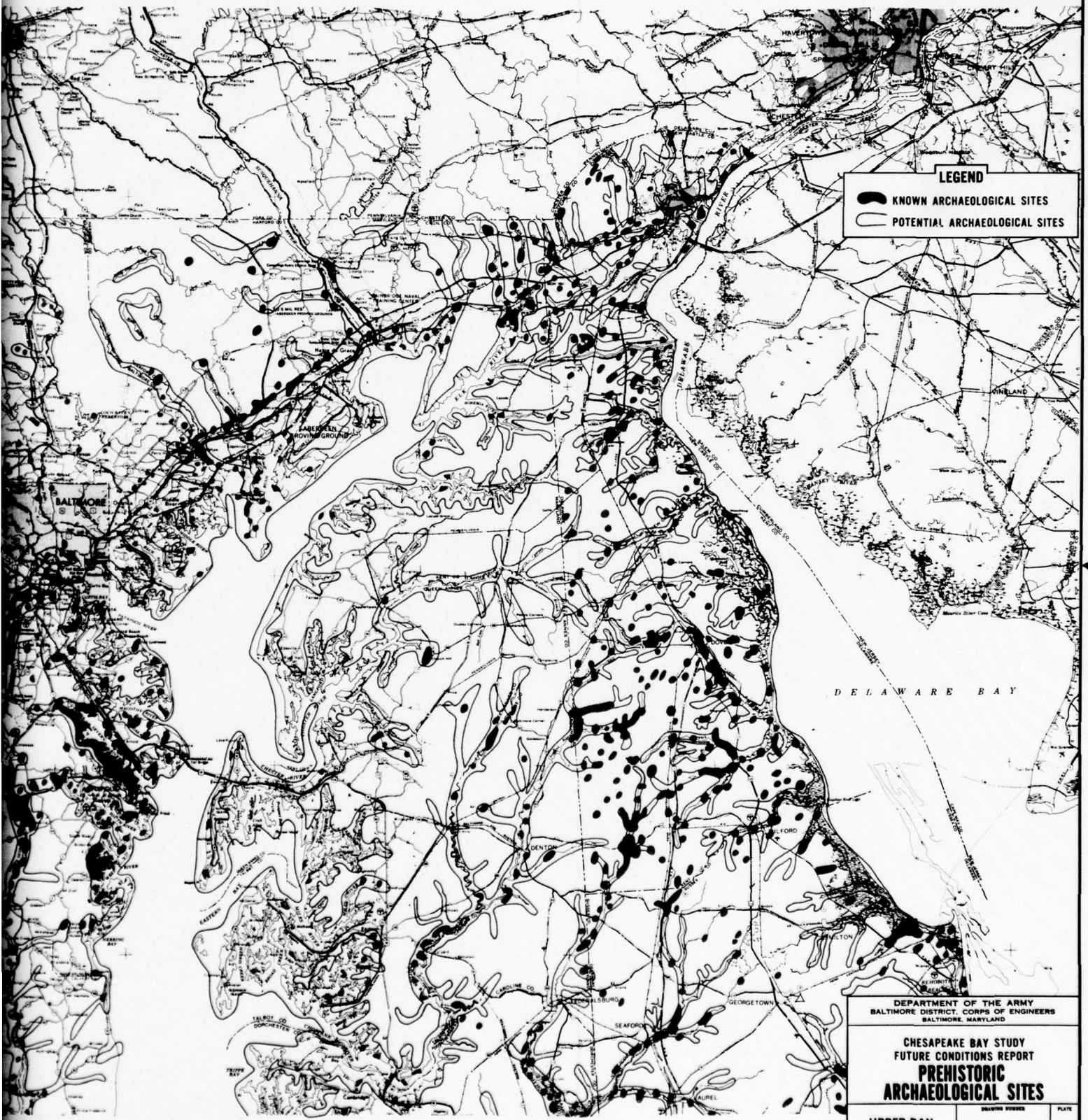
SCALE: DATE: SHEET 3 OF 3

NOTE: DATA WAS COMPILED FROM LOCAL AND REGIONAL PLANNING AGENCIES PROJECTIONS

PLATE 4-6

2


SOUTH MOUNTAIN
CATOCTIN MOUNTAIN
MOUNT ALTO STATE FOREST
Gettysburg
ADAMS CO
YORK CO
CARROLL CO
HARFORD CO
ABERDEEN PROVING GROUND
BALTIMORE
MD
Rockville
ARLINGTON
WASHINGTON
FAIRFAX
ALEXANDRIA
CHESTER RIVER
EASTERN BAY
TALBOT CO
DORCHESTER CO
TRIPPE BAY



DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

PREHISTORIC ARCHAEOLOGICAL SITES

UPPER BAY

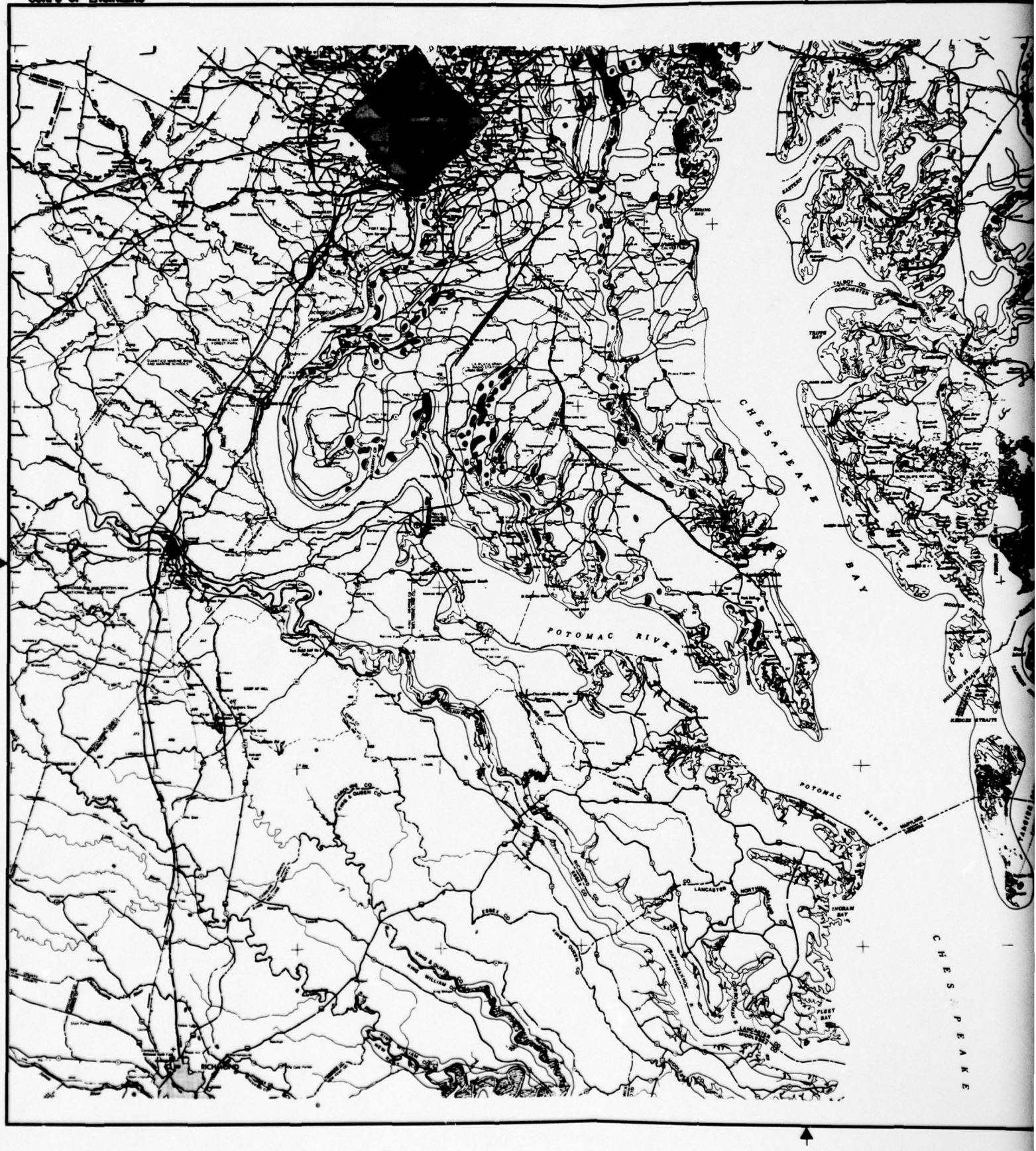
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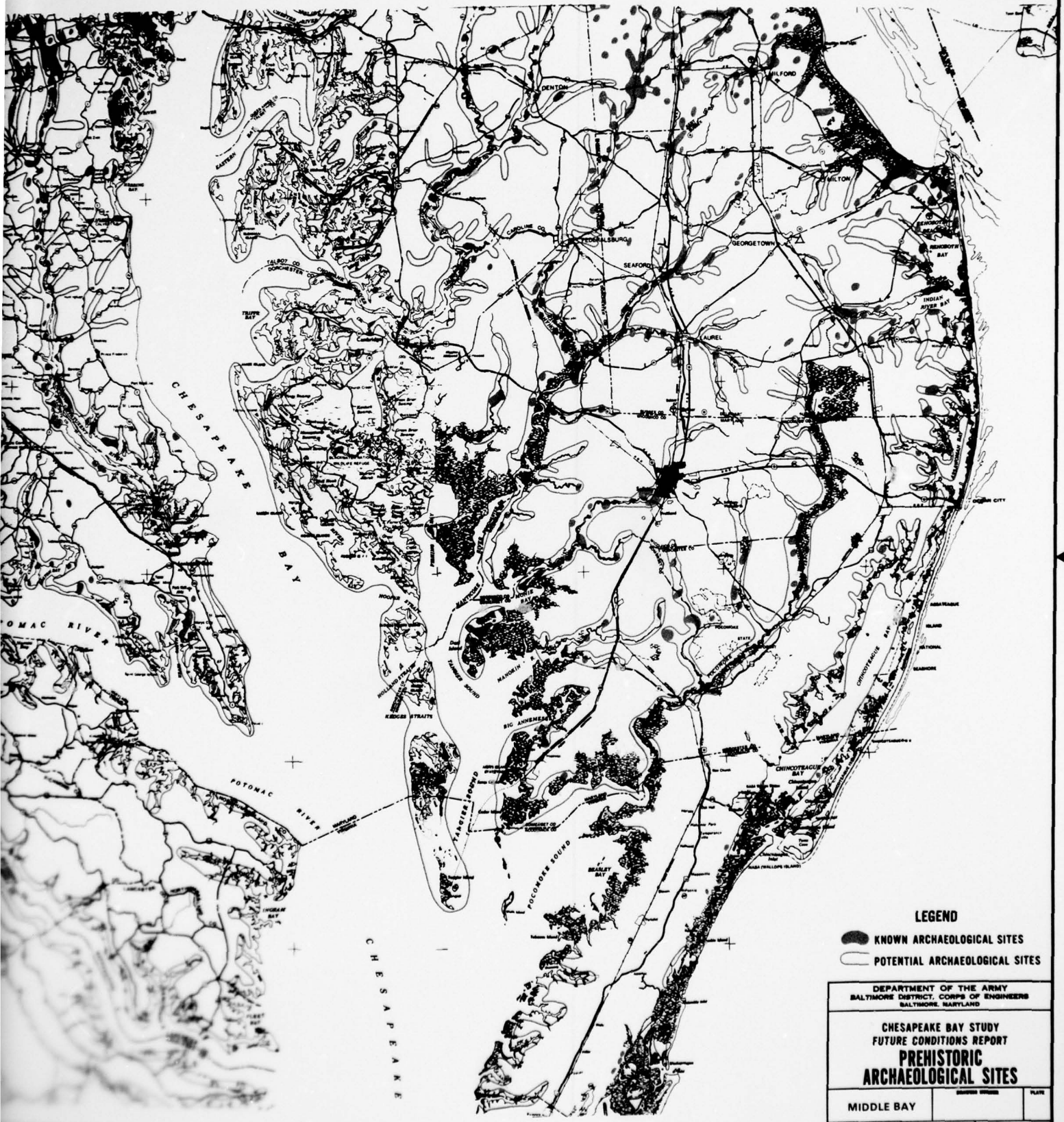
SCALE: | DATE: | SHEET 1 OF 3

PLATE 4-7

2

CORPS OF ENGINEERS





LEGEND

KNOWN ARCHAEOLOGICAL SITES

POTENTIAL ARCHAEOLOGICAL SITES

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

PREHISTORIC ARCHAEOLOGICAL SITES

MIDDLE BAY

PLATE

SCALE: DATE: SHEET 2 OF 3

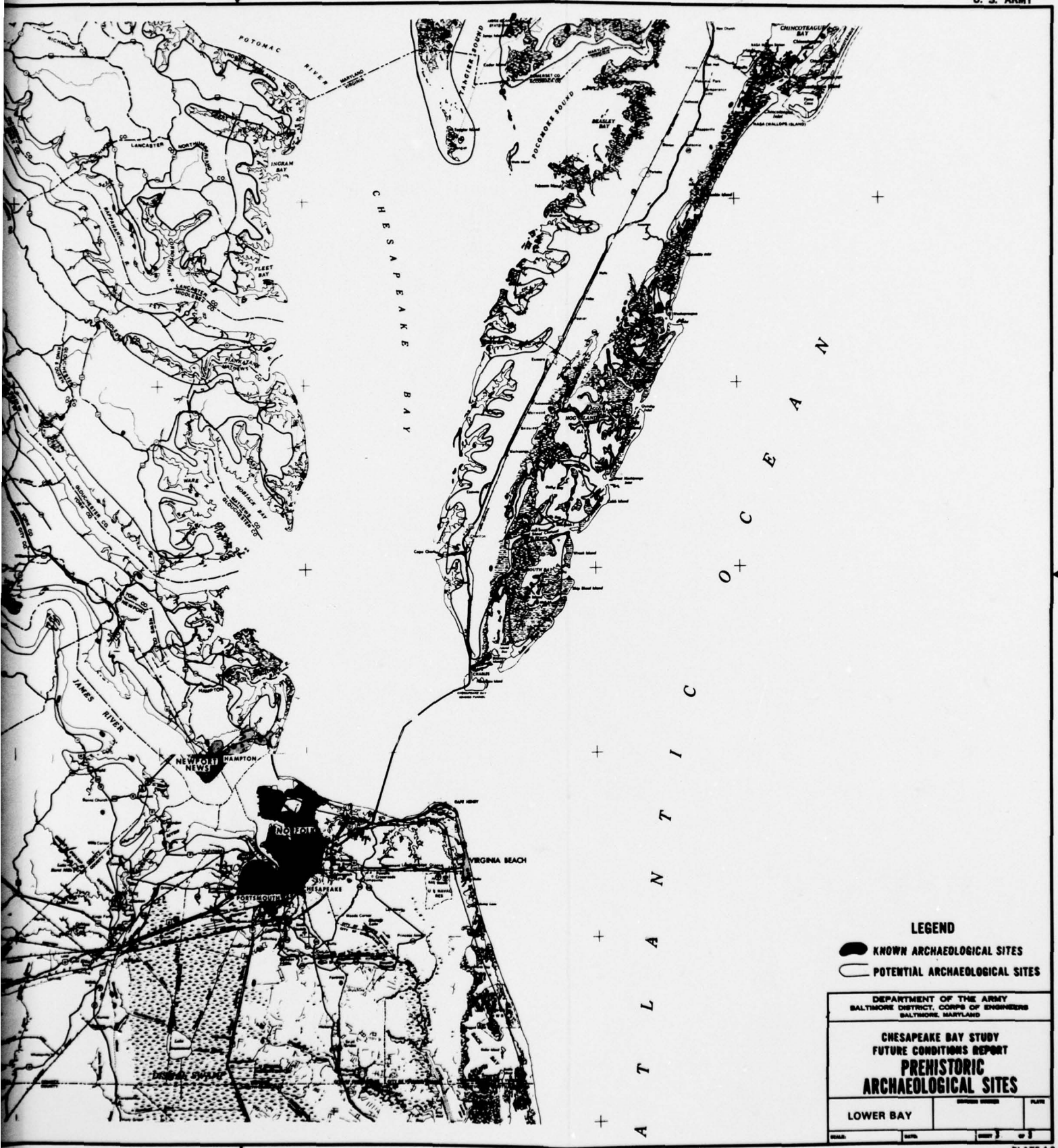
PLATE 4-8

2

CORPS OF ENGINEERS



U. S. ARMY



LEGEND

- KNOWN ARCHAEOLOGICAL SITES
- POTENTIAL ARCHAEOLOGICAL SITES

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

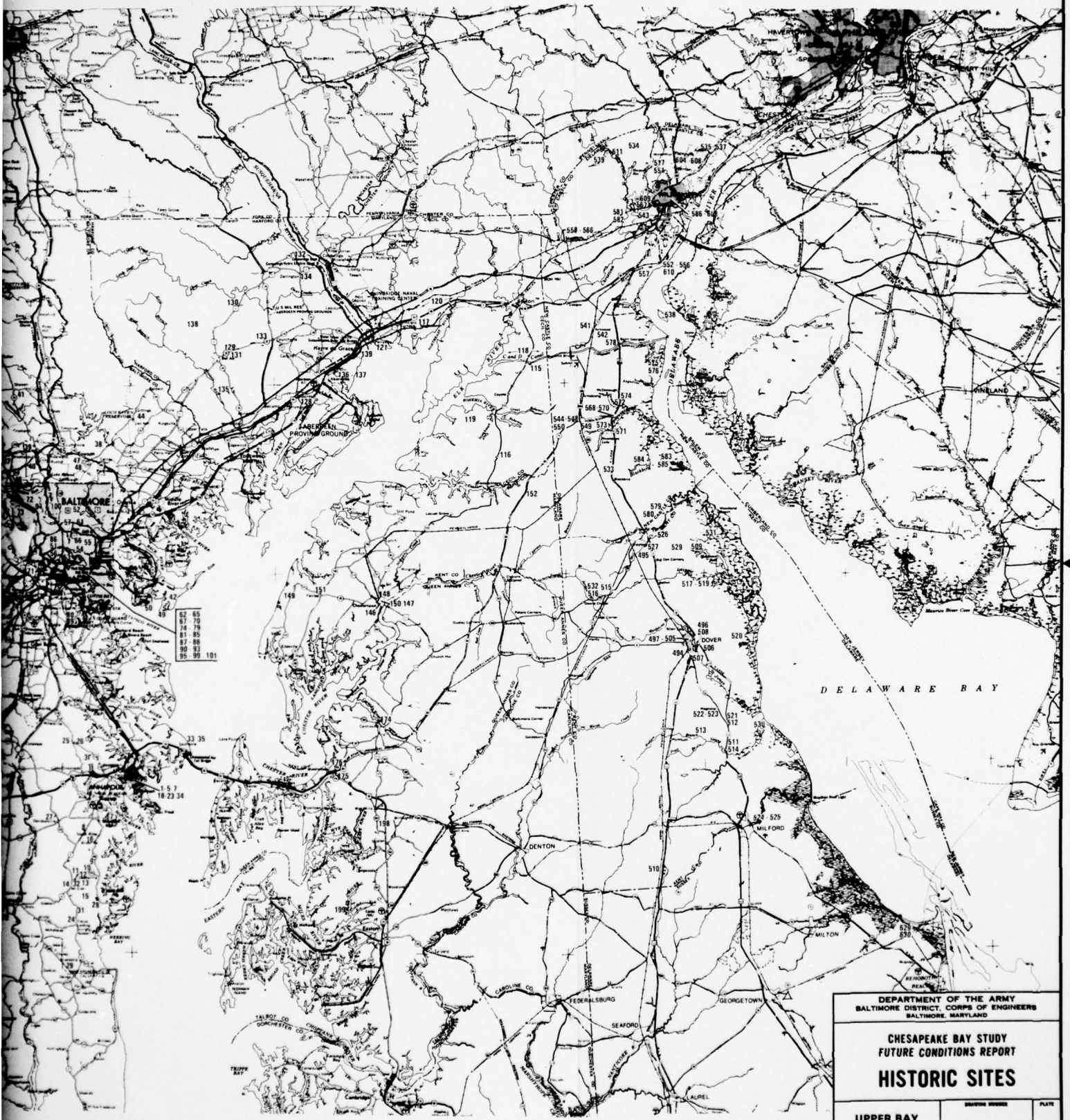
PREHISTORIC ARCHAEOLOGICAL SITES

LOWER BAY

PLATE 4-9

2


SOUTH MOUNTAIN
CATOCTIN MOUNTAIN
MOUNT ALTO STATE FOREST
CATOCTIN MOUNTAIN PARK
FORT DETRICK
BALTIMORE
ABERDEEN PROVING GROUND
ARLINGTON
ALEXANDRIA
FAIRFAX
QUANTICO
62 65
67 70
74 79
81 85
87 88
90 93
95 99 101



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BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

HISTORIC SITES

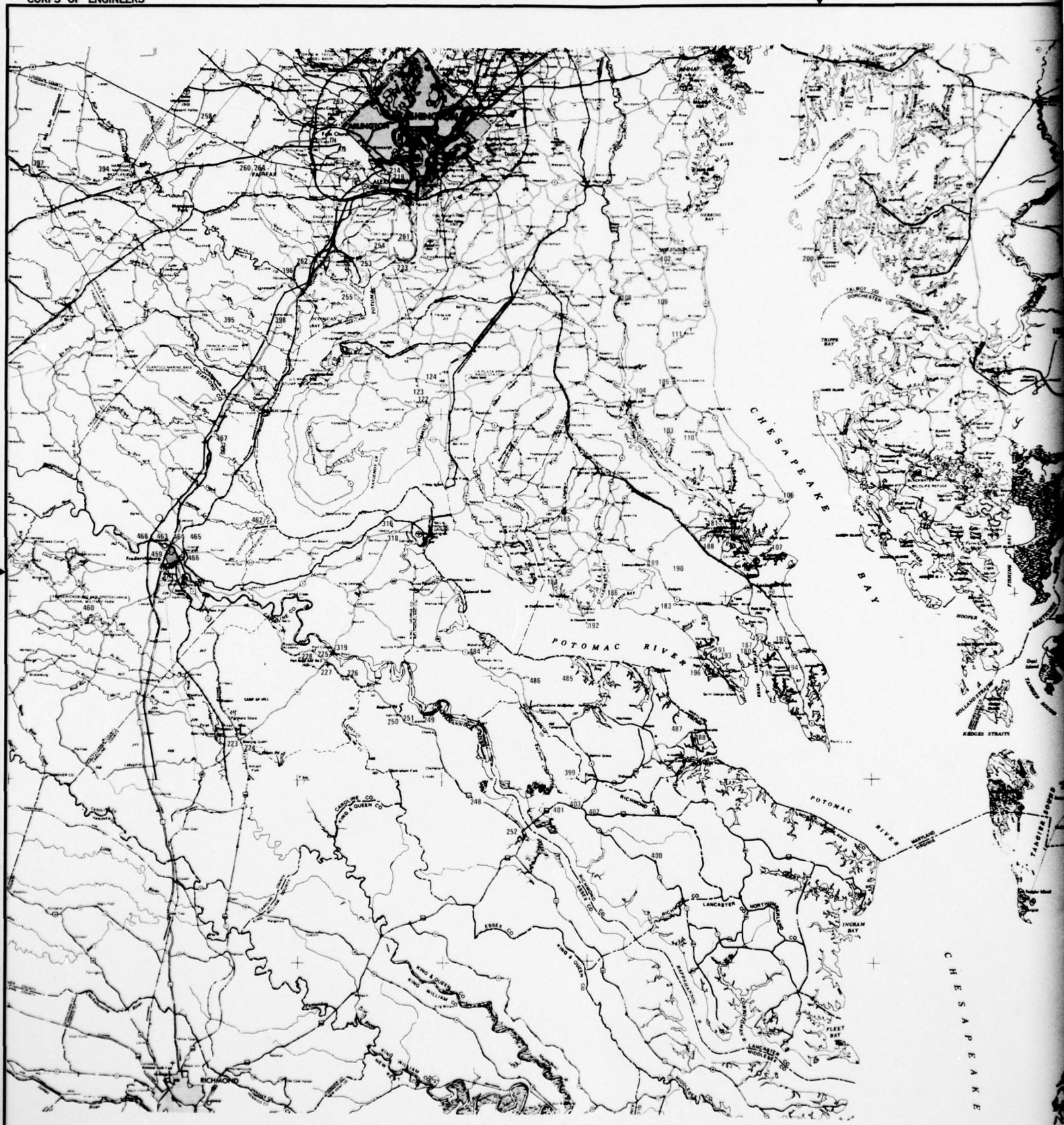
UPPER BAY

DRAWING NUMBER | PLATE

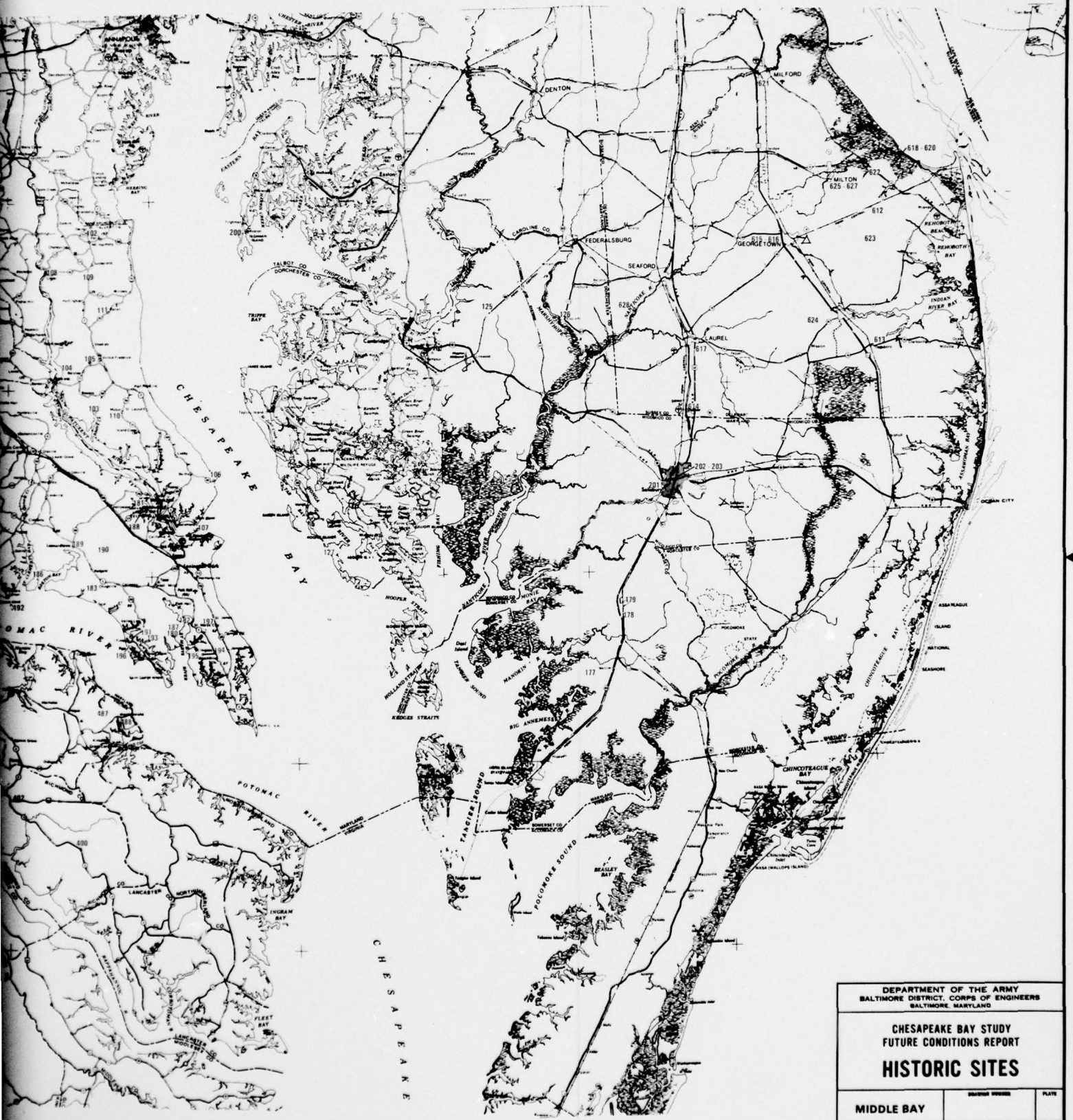
SCALE: | DATE: | SHEET 1 OF 3

PLATE 4-10

CORPS OF ENGINEERS



U. S. ARMY



DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

HISTORIC SITES

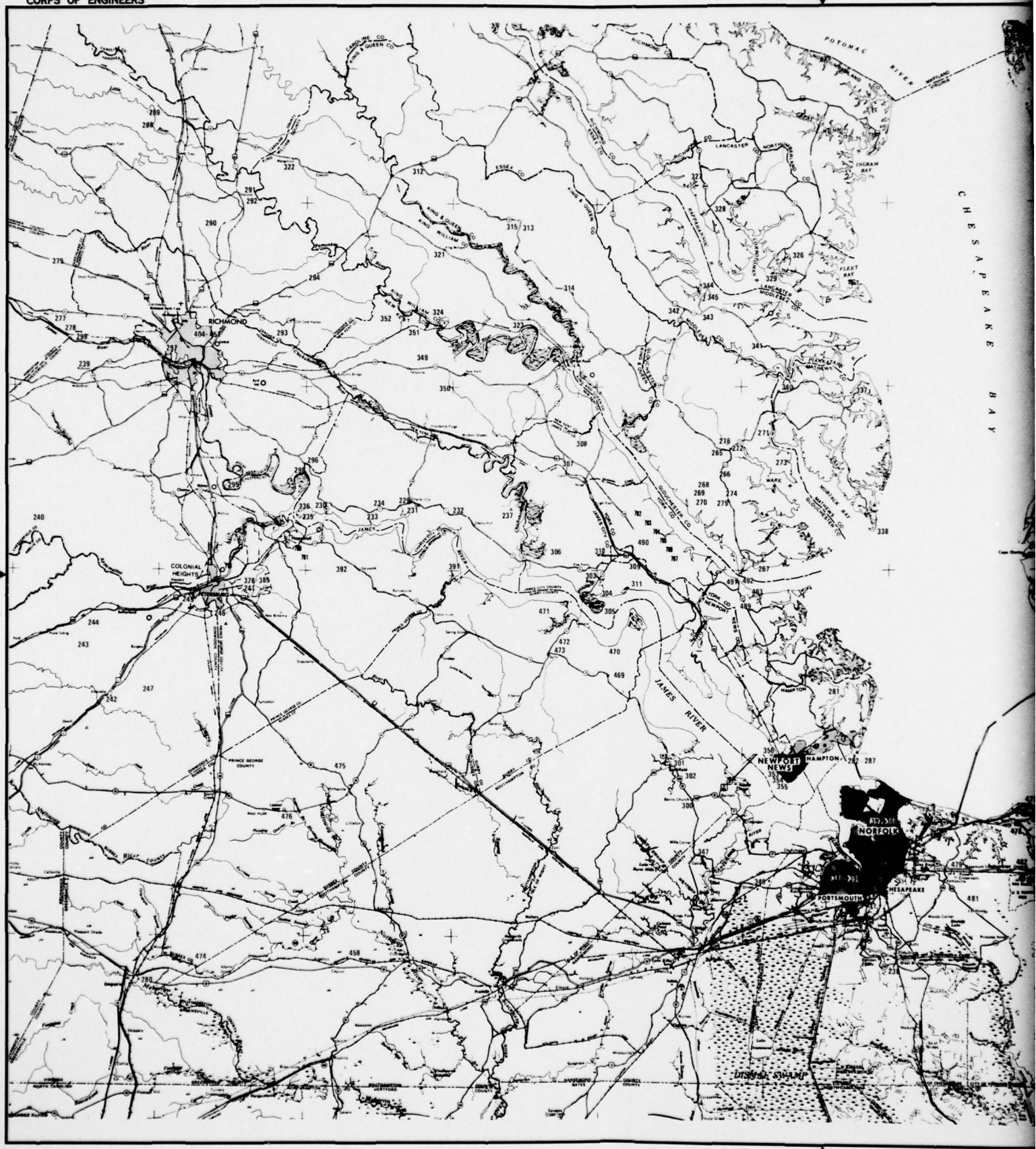
MIDDLE BAY

DRAWING NUMBER | PLATE

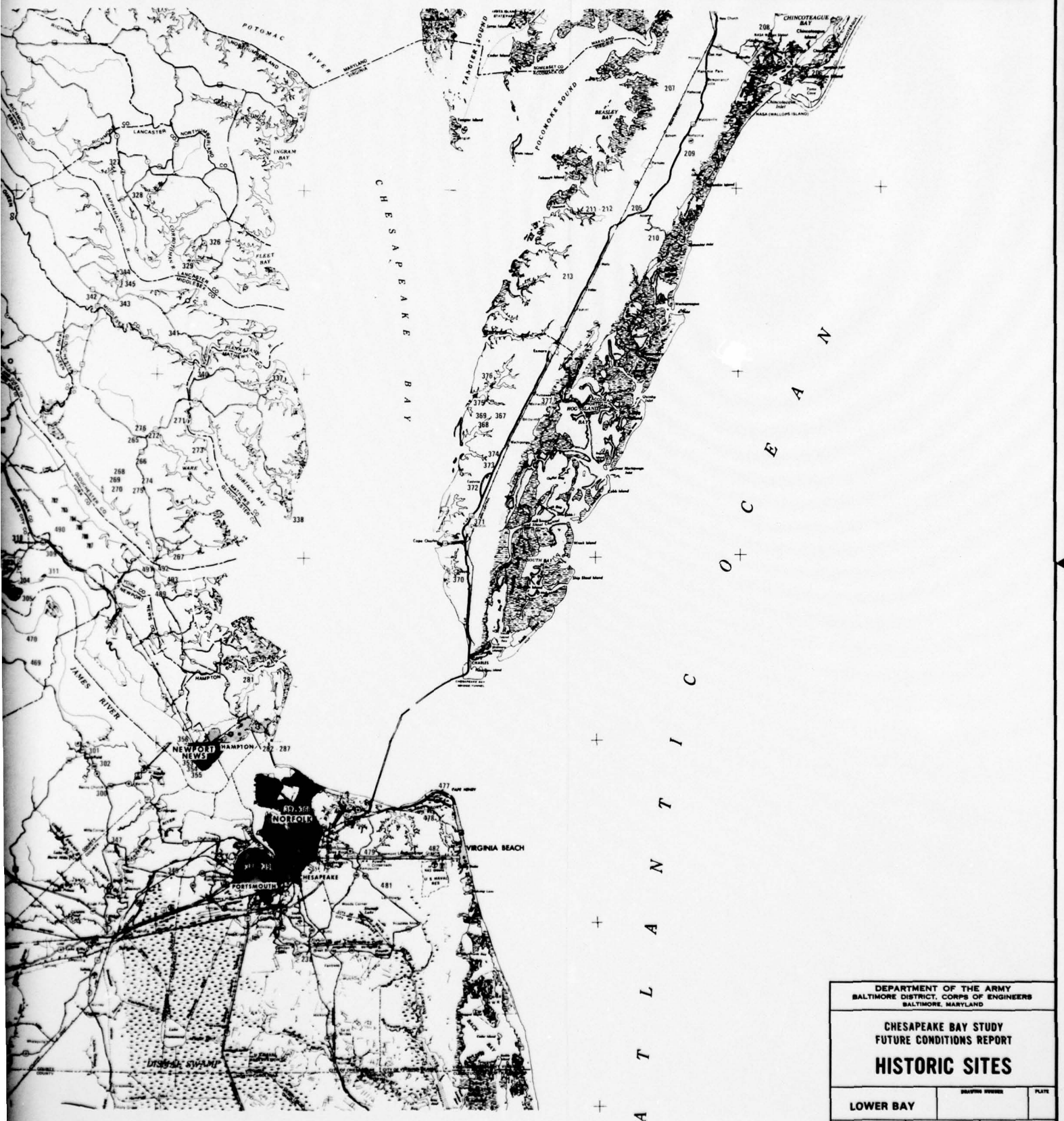
SCALE: | DATE: | SHEET 2 OF 3

PLATE 4-11

2


RICHMOND
COLONIAL HEIGHTS
PETERSBURG
HOPEWELL
PRINCE GEORGE COUNTY
NEWPORT NEWS
HAMPTON
NORFOLK
PORTSMOUTH
CHESAPEAKE
JAMES RIVER
CHESAPEAKE BAY
POTOMAC RIVER
DISMAL SWAMP

U. S. ARMY



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BALTIMORE DISTRICT, CORPS OF ENGINEERS
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CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

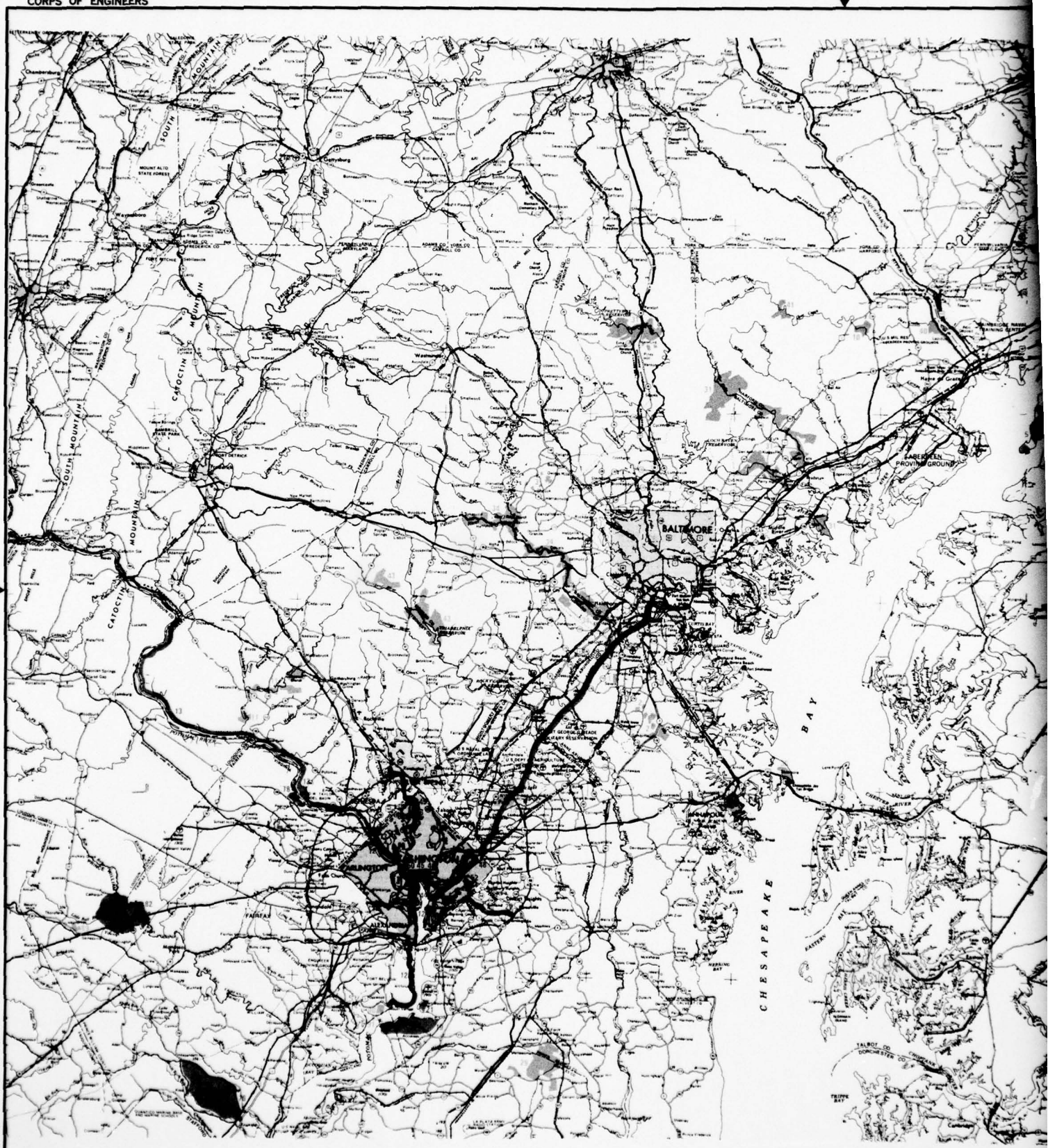
HISTORIC SITES

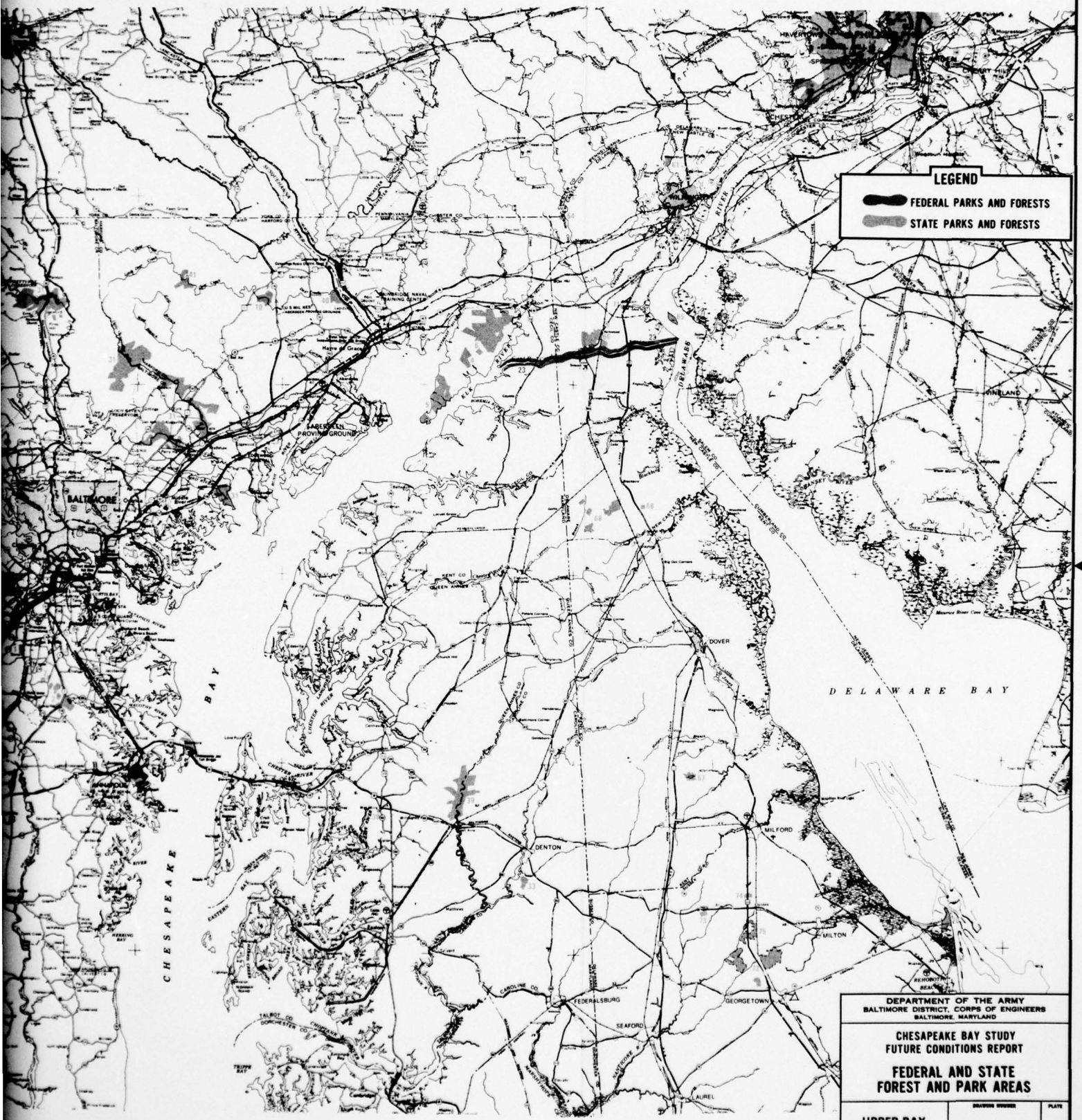
LOWER BAY	DRAWING NUMBER	PLATE
SCALE:	DATE:	SHEET 3 OF 3

PLATE 4-12

2

CORPS OF ENGINEERS





DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

FEDERAL AND STATE FOREST AND PARK AREAS

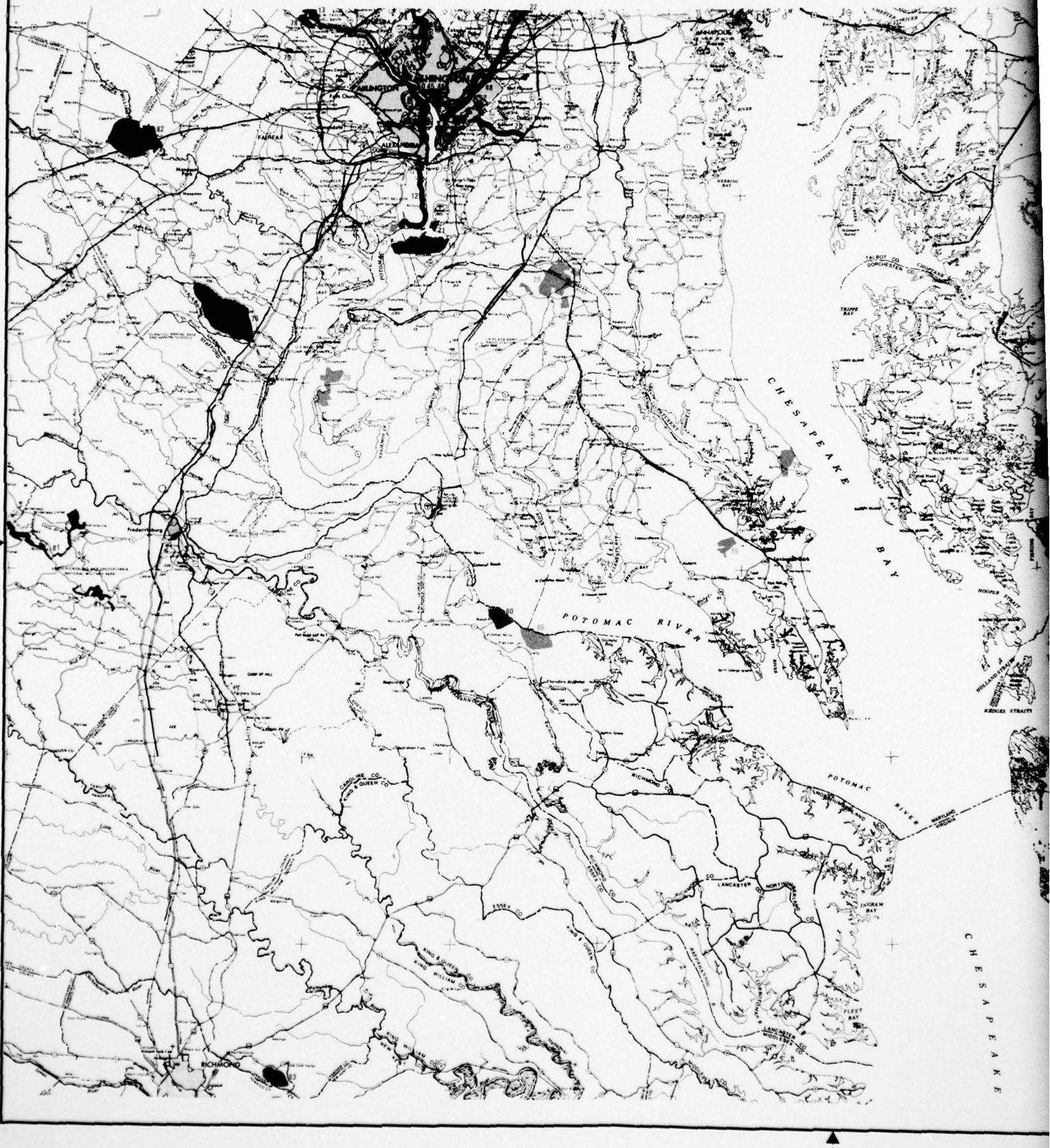
UPPER BAY

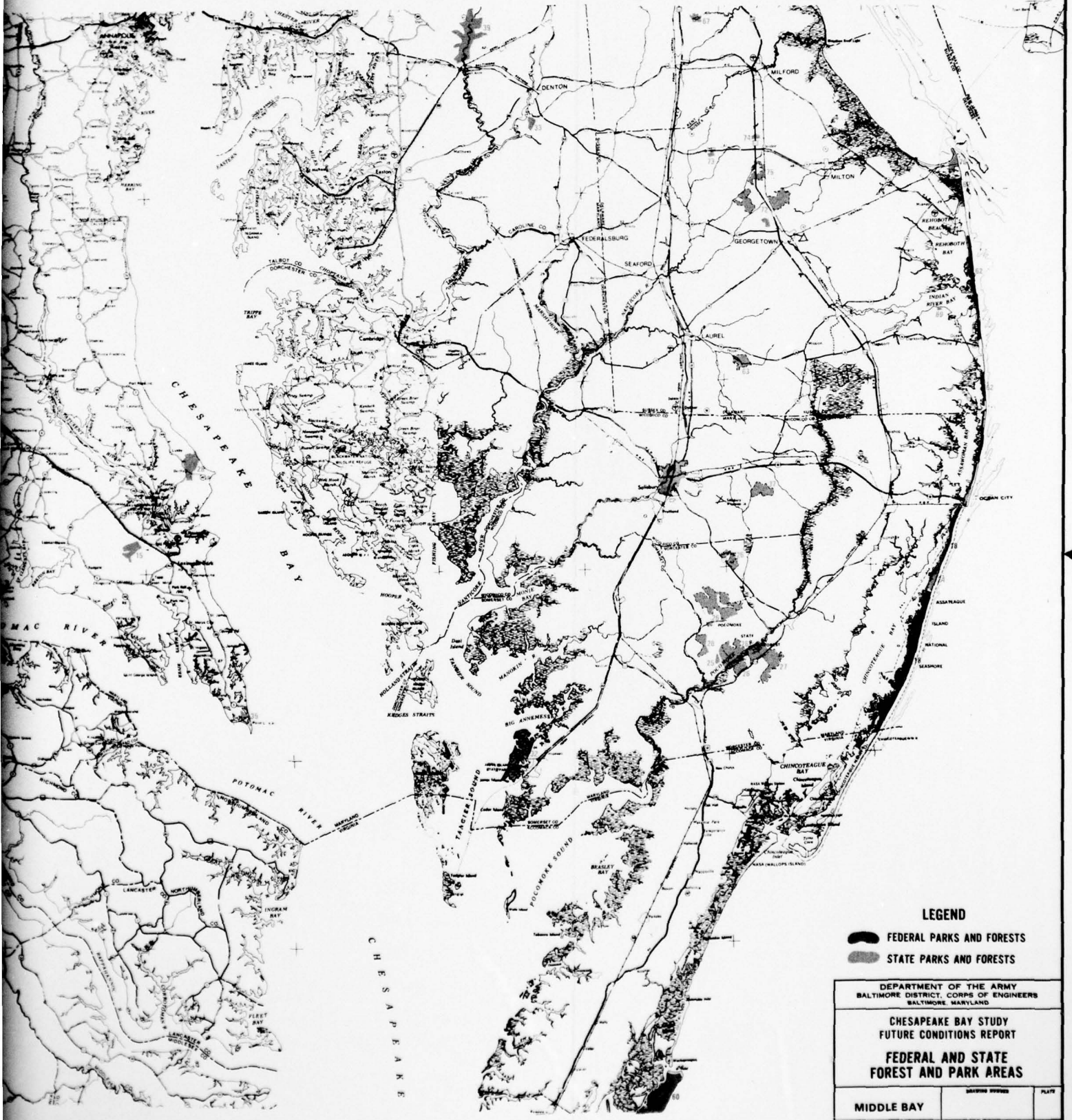
DRAWING NUMBER | PLATE

SCALE: | DATE: | SHEET 1 OF 3

PLATE 4-13

CORPS OF ENGINEERS





LEGEND

- FEDERAL PARKS AND FORESTS
- STATE PARKS AND FORESTS

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

FEDERAL AND STATE FOREST AND PARK AREAS

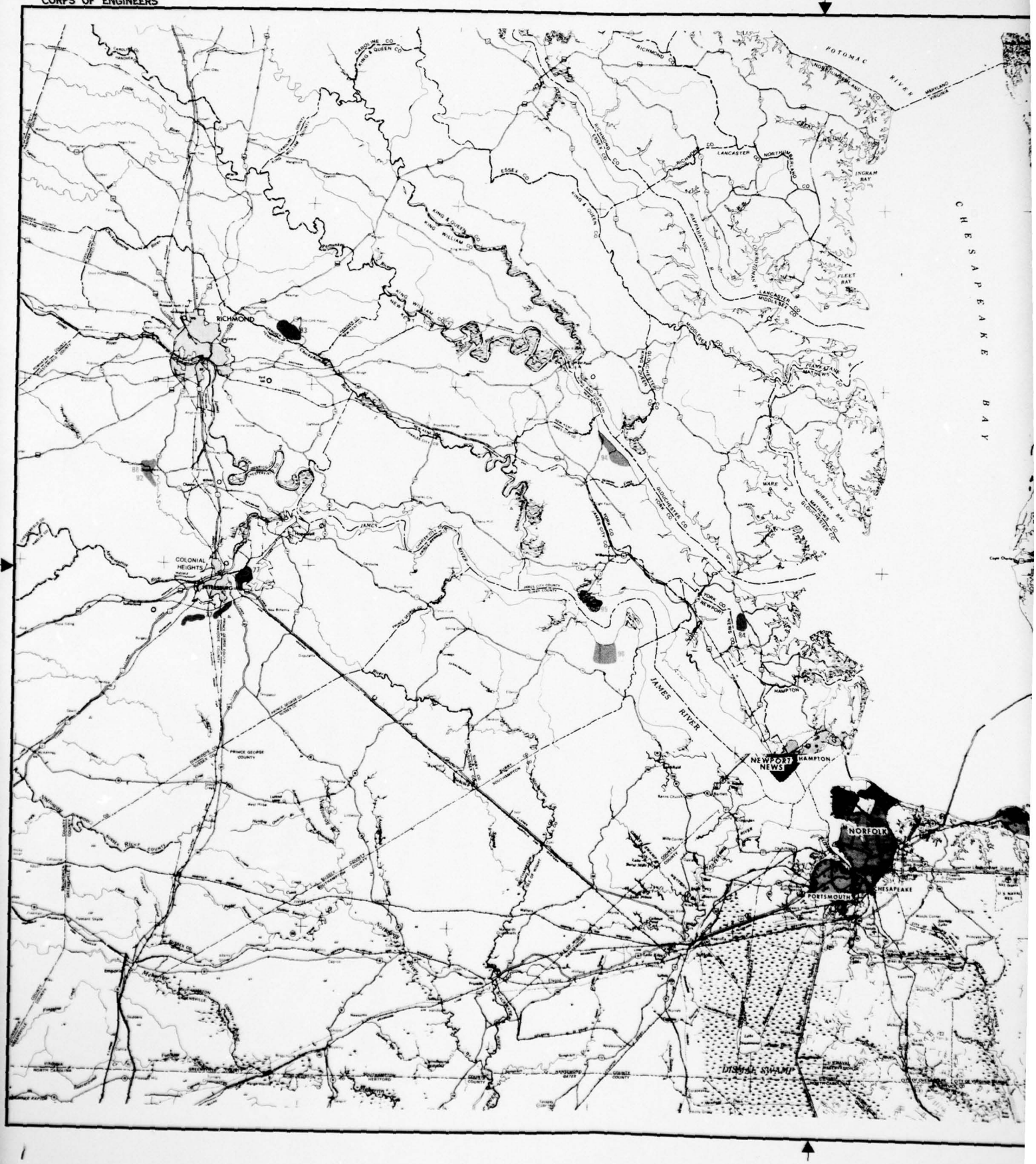
MIDDLE BAY | DRAWING NUMBER | PLATE

SCALE: | DATE: | SHEET 2 OF 3

PLATE 4-14

2

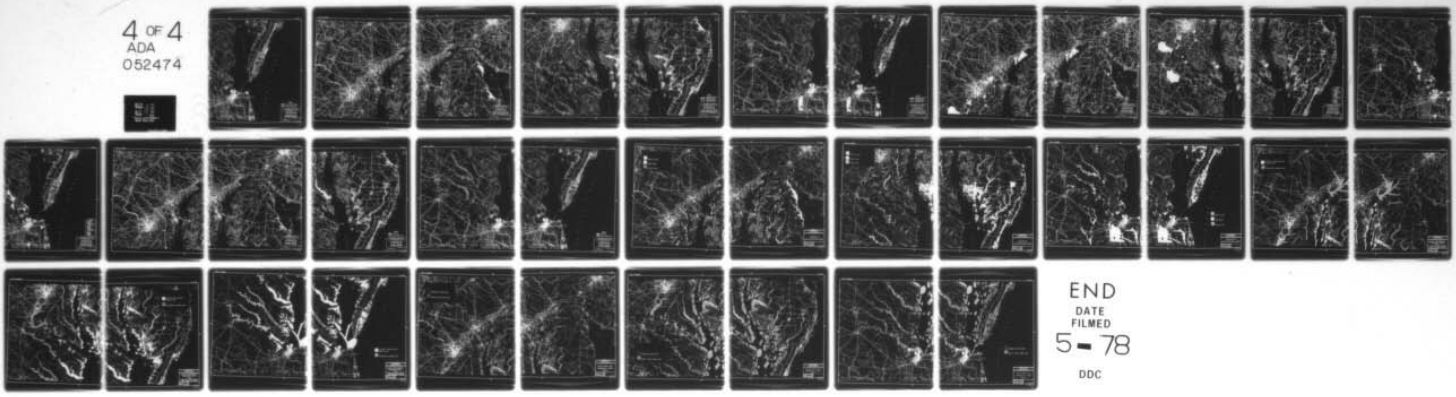
CORPS OF ENGINEERS



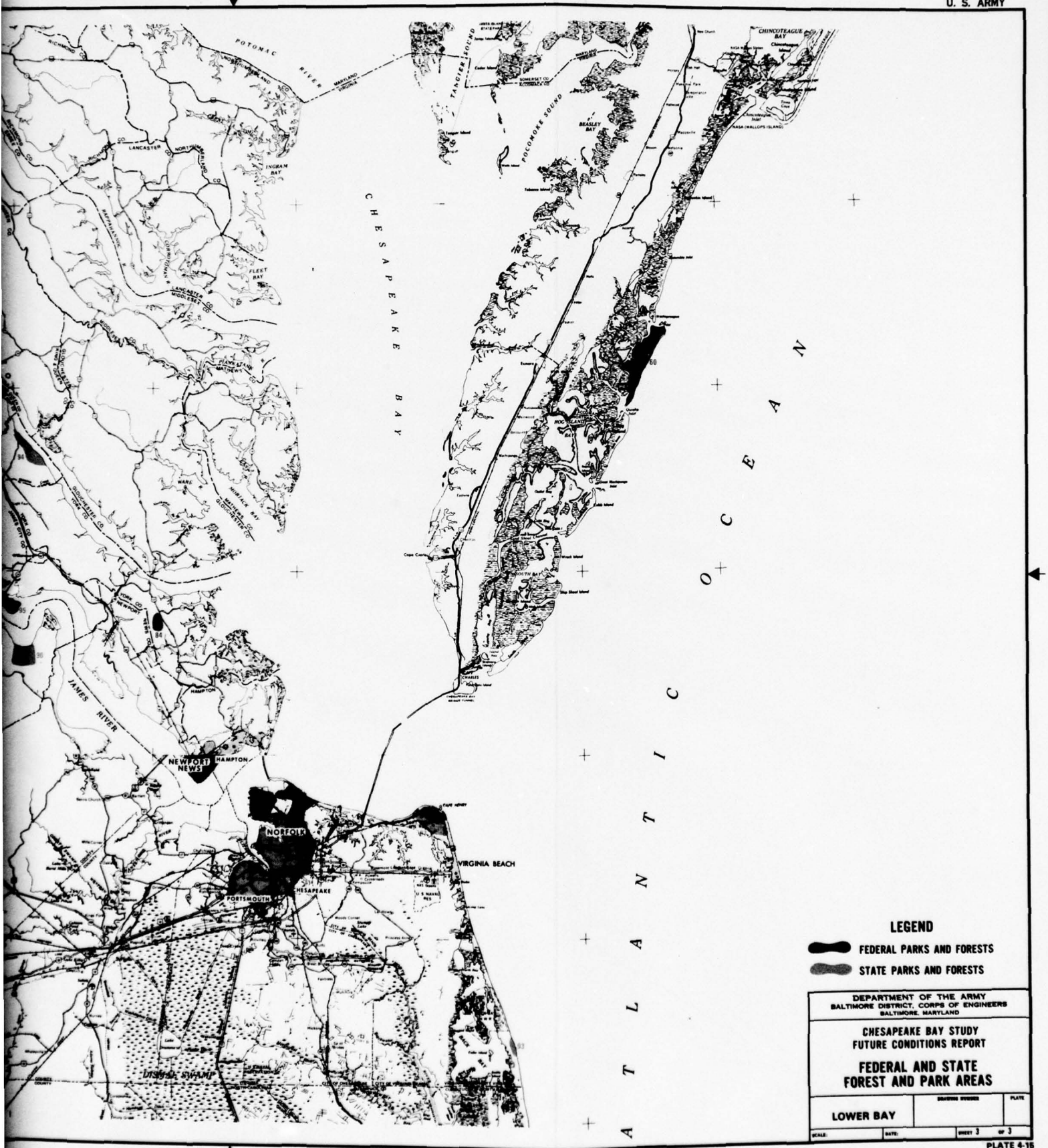
AD-A052 474 CORPS OF ENGINEERS BALTIMORE MD BALTIMORE DISTRICT F/G 6/6
CHESAPEAKE BAY FUTURE CONDITIONS REPORT. VOLUME IV. WATER RELAT--ETC(U)
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BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

FEDERAL AND STATE FOREST AND PARK AREAS

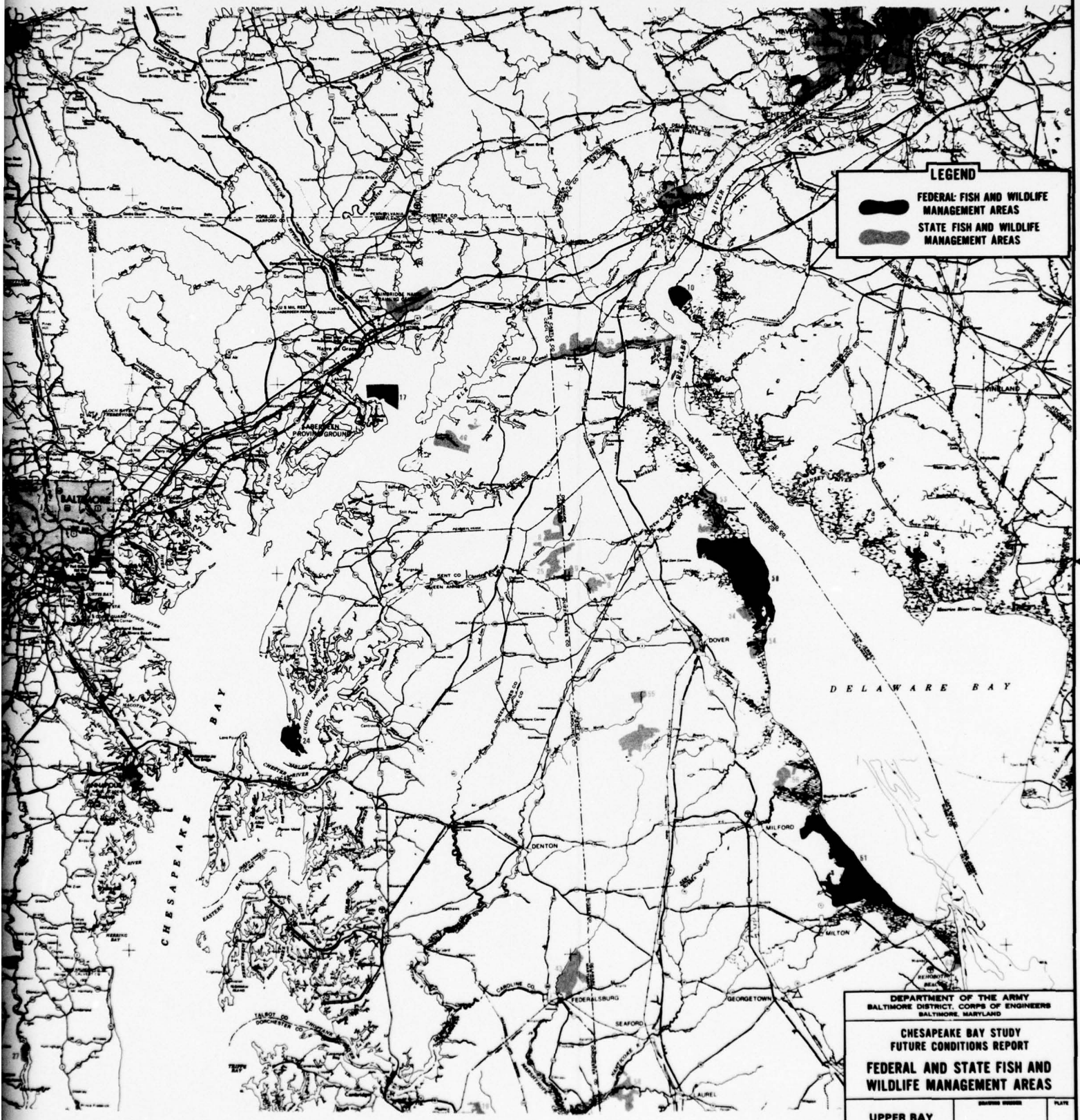
LOWER BAY

DRAWING NUMBER | PLATE

SCALE: | DATE: | SHEET 3 OF 3

PLATE 4-15


SOUTH MOUNTAIN
CATOCTIN MOUNTAIN
BALTIMORE
ABERDEEN PROVING GROUND
CHESAPEAKE BAY
ARLINGTON
POTOMAC RIVER



DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

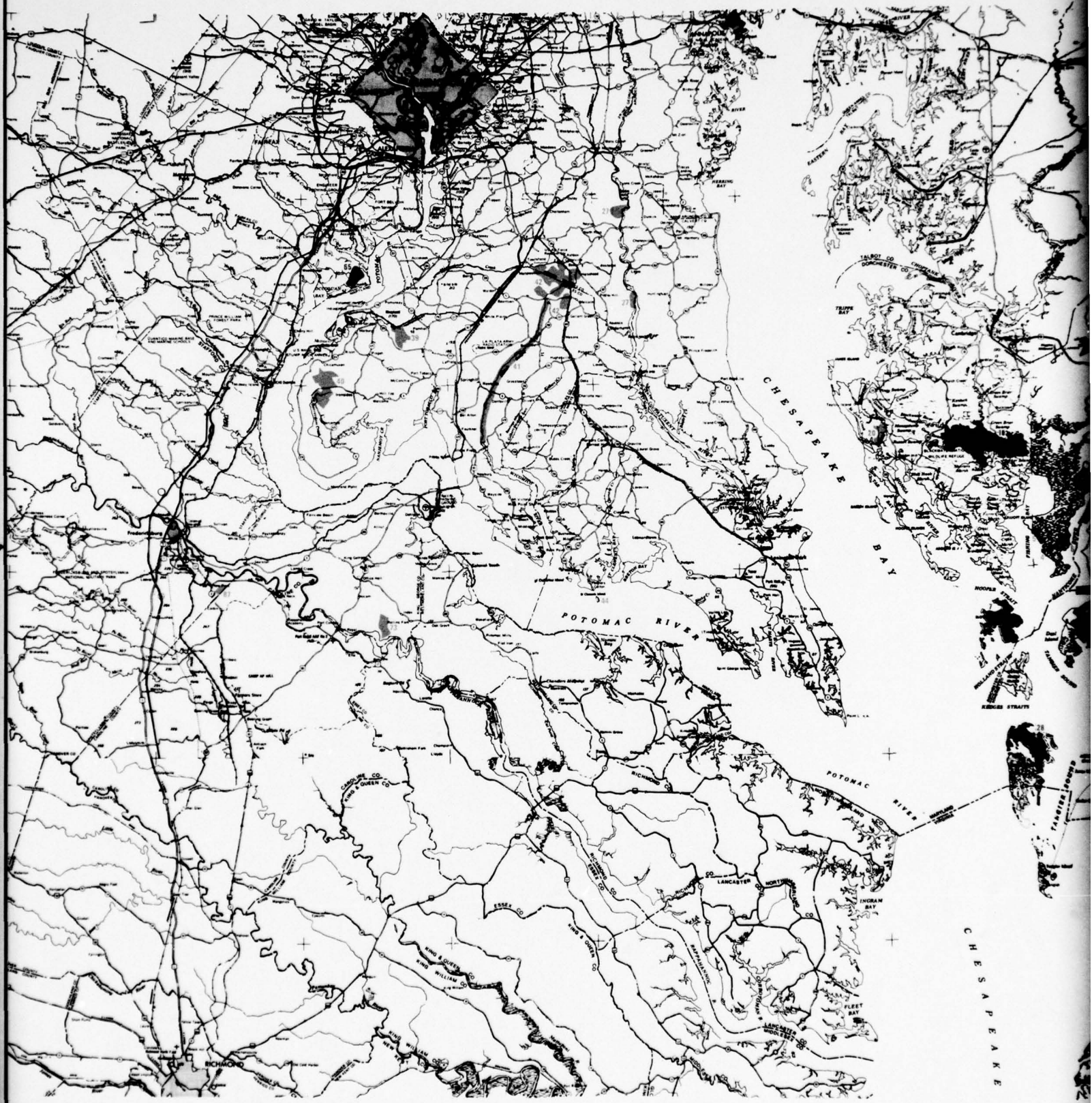
FEDERAL AND STATE FISH AND WILDLIFE MANAGEMENT AREAS

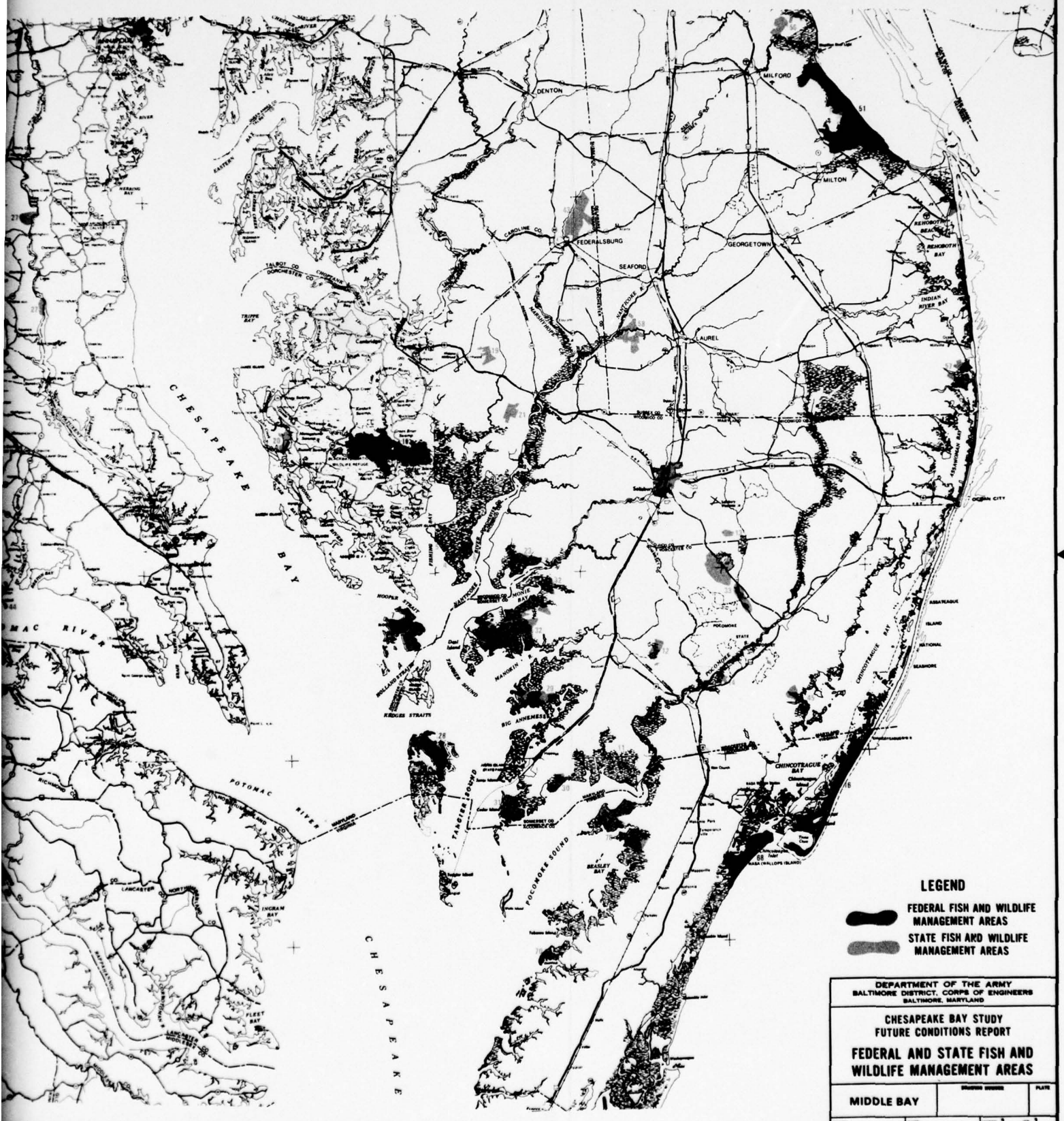
UPPER BAY

PLATE

SCALE: | DATE: | SHEET 1 OF 3

PLATE 4-16


CHESAPEAKE BAY
POTOMAC RIVER
POTOMAC RIVER
CHESAPEAKE
RICHMOND
RICHMOND
TALBOT CO
DORCHESTER
TRIPPE BAY
HOOPER STRAIT
KEDGES STRAITS
TANGIER SOUND
CAROLINE CO
KING & QUEEN CO
KING WILLIAM CO
ESSEX CO
LANCASTER CO
NORTHUMBERLAND
INGRAM BAY
FLEET BAY
RAPPAHANNOCK



LEGEND

- FEDERAL FISH AND WILDLIFE MANAGEMENT AREAS
- STATE FISH AND WILDLIFE MANAGEMENT AREAS

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

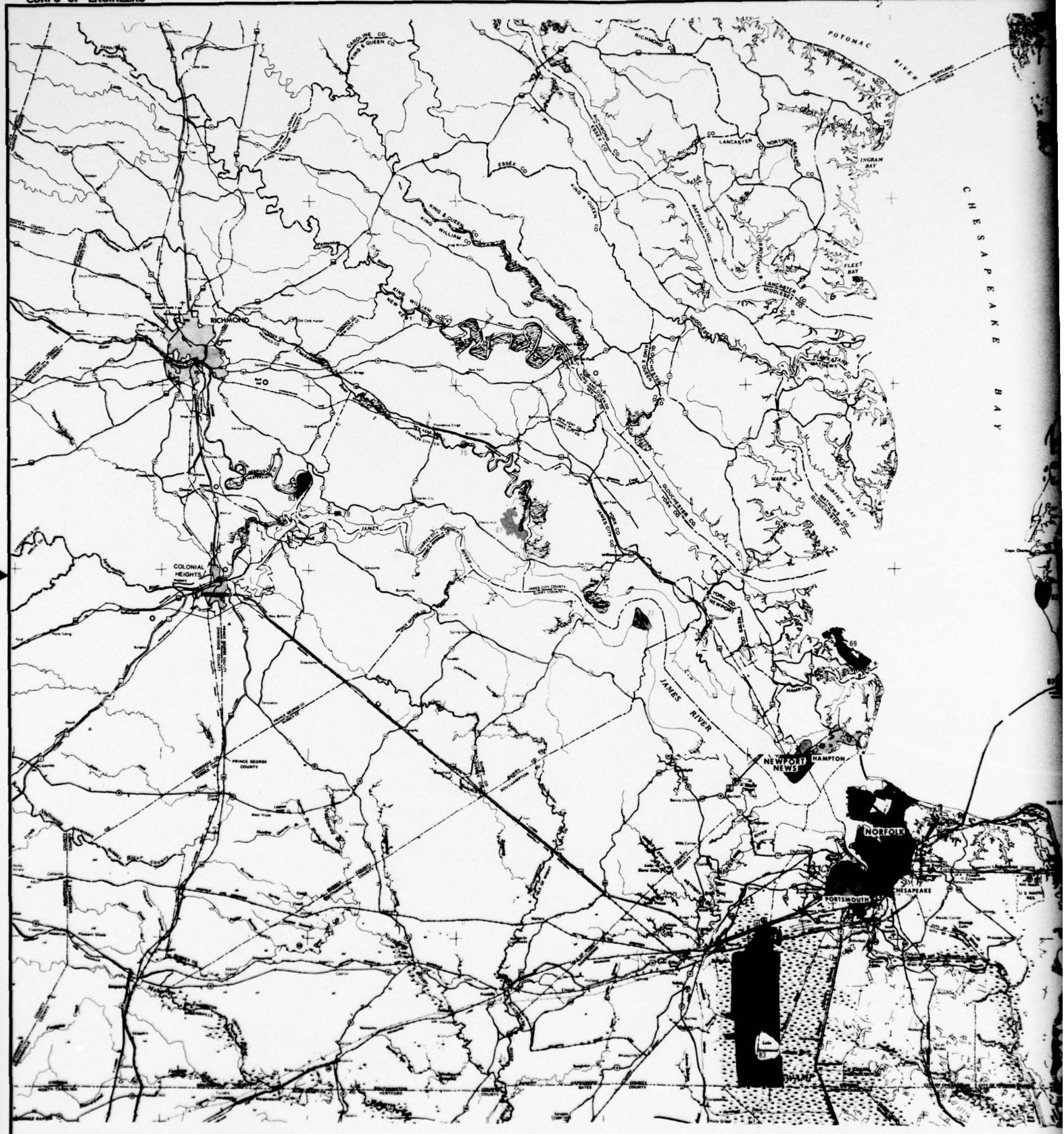
FEDERAL AND STATE FISH AND WILDLIFE MANAGEMENT AREAS

MIDDLE BAY

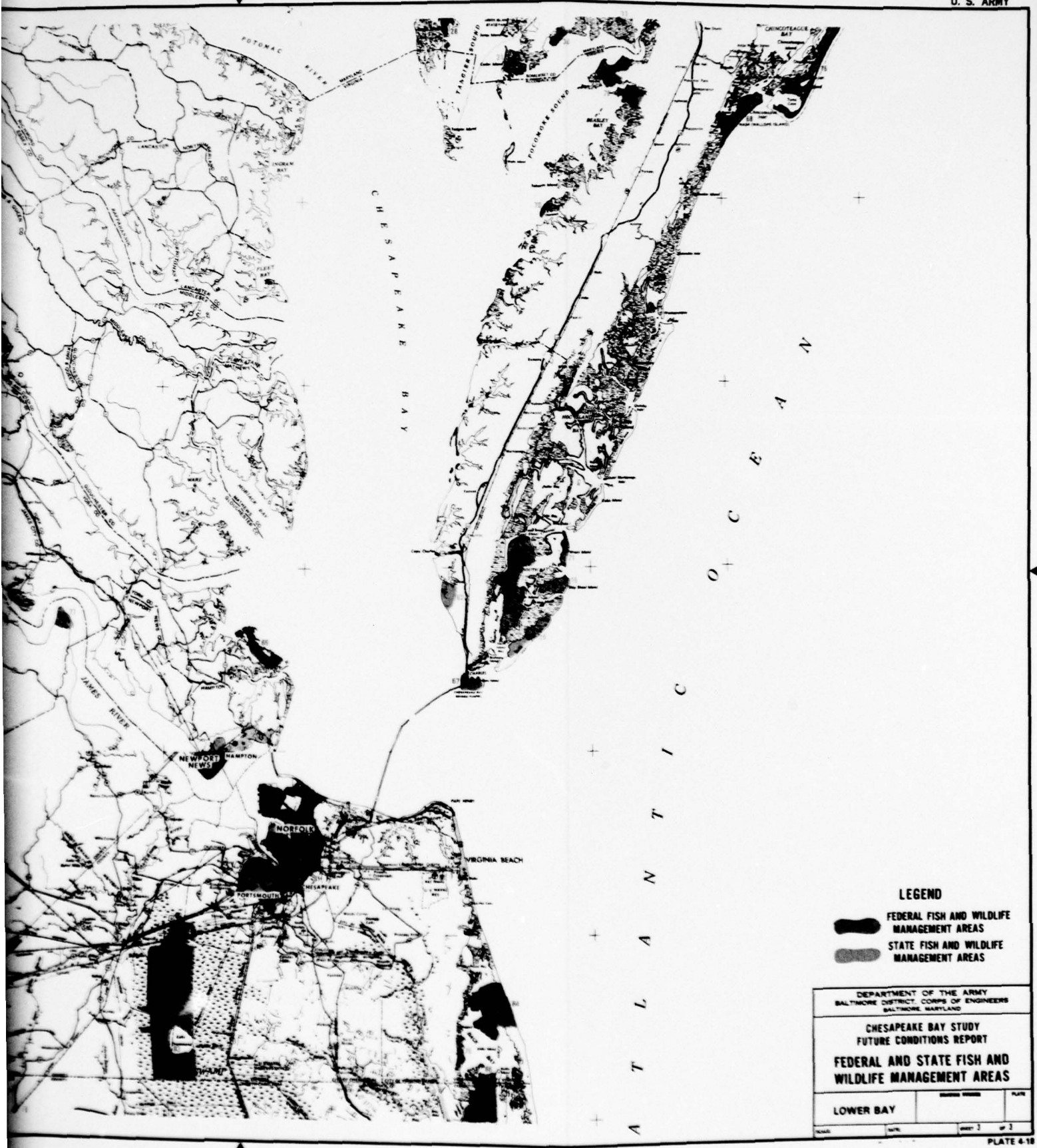
PLATE 4-17

2

CORPS OF ENGINEERS



U. S. ARMY



LEGEND

- FEDERAL FISH AND WILDLIFE MANAGEMENT AREAS
- STATE FISH AND WILDLIFE MANAGEMENT AREAS

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

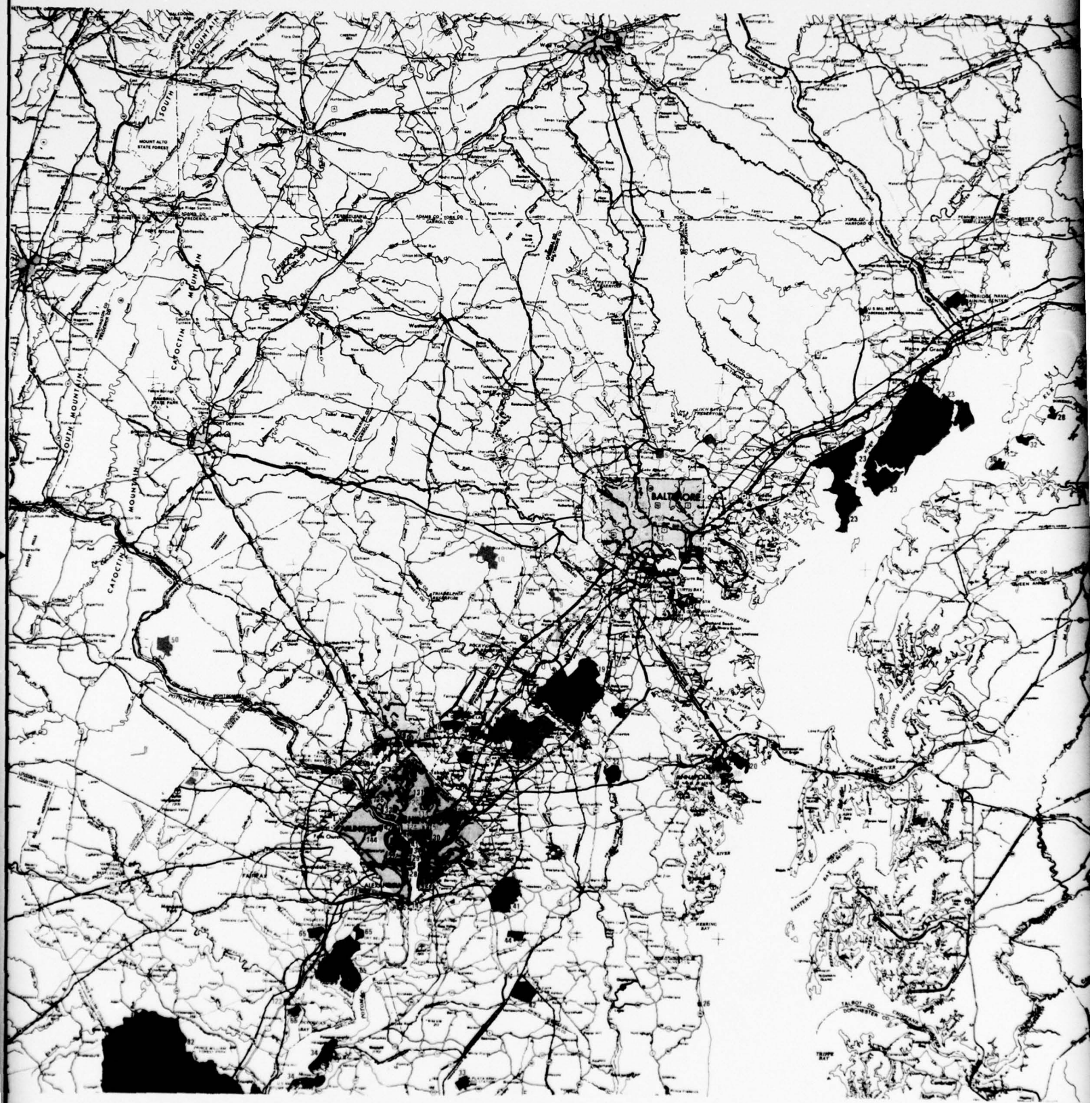
FEDERAL AND STATE FISH AND WILDLIFE MANAGEMENT AREAS

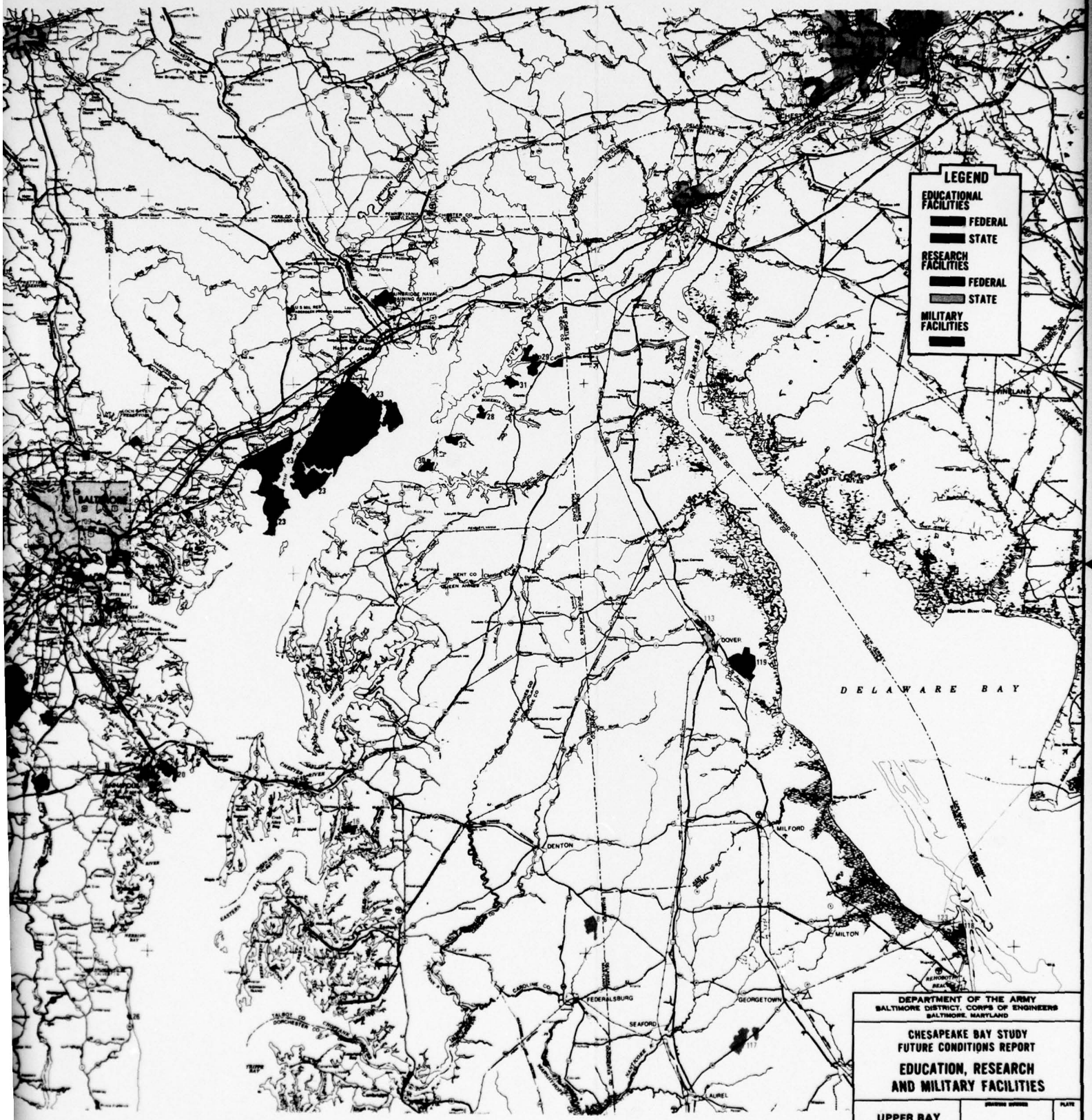
LOWER BAY

PLATE 4-18

2

CORPS OF ENGINEERS





DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

EDUCATION, RESEARCH AND MILITARY FACILITIES

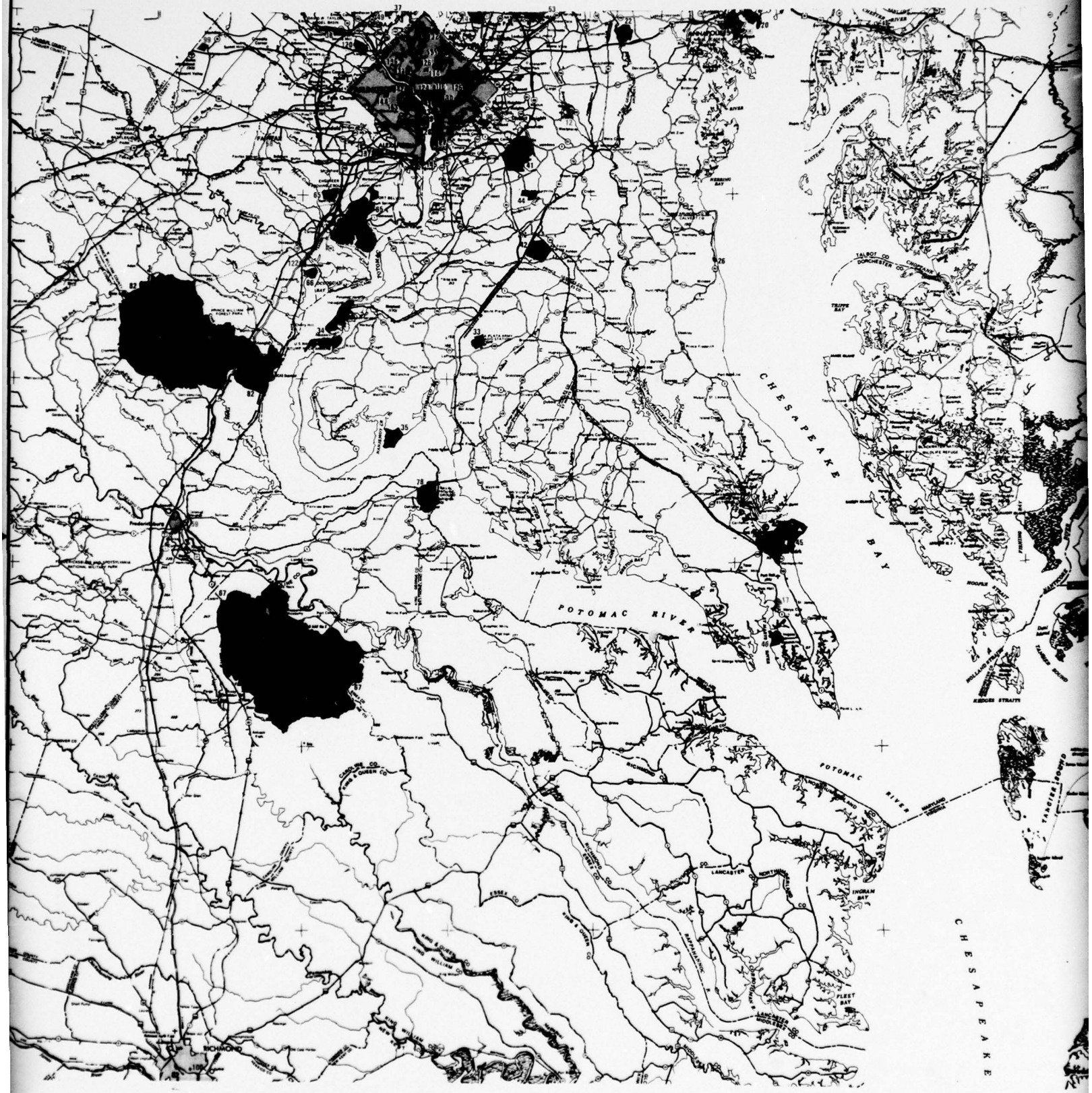
UPPER BAY

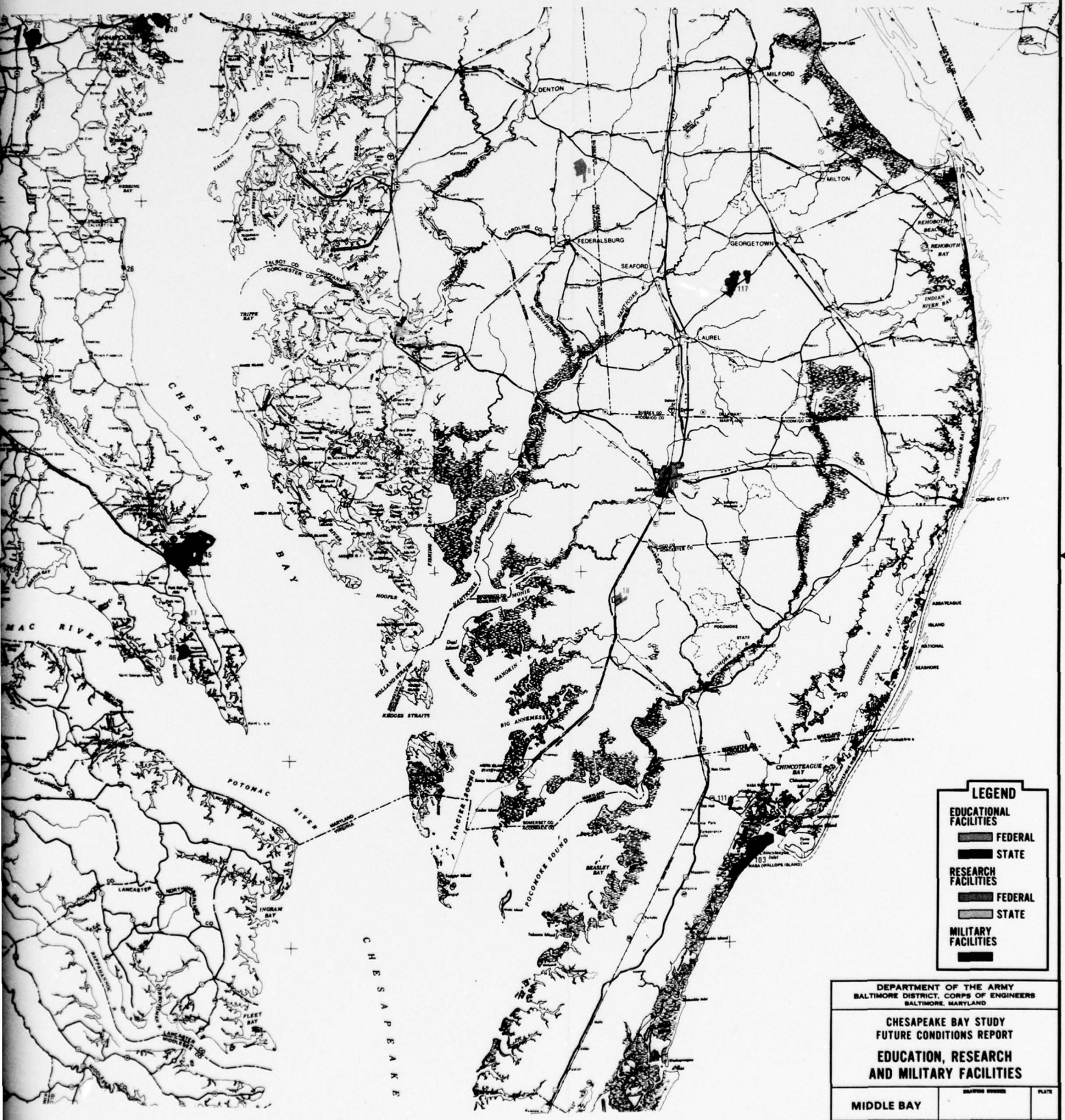
PLATE

SCALE: DATE: SHEET 1 OF 3

PLATE 4-19

2


CHESAPEAKE BAY
POTOMAC RIVER
POTOMAC RIVER
CHESAPEAKE
RICHMOND
TALBOT CO
DORCHESTER CO
KENT CO
QUEEN ANNE'S CO
CAROLINE CO
KING & QUEEN CO
KING WILLIAM CO
ESSEX CO
RICHMOND CO
LANCASTER CO
NORTHUMBERLAND CO
WESTMORELAND CO
KING GEORGE CO
STAFFORD CO
SPOTSYLVANIA CO
ORANGE CO
FAUQUIER CO
PRINCE WILLIAM CO
PRINCE WILLIAM FOREST PARK
ACCOKEEK CREEK
TRIPPE BAY
EASTERN BAY
HOOPER STRAIT
KEDGES STRAITS
TANGIER SOUND
INGRAM BAY
FLEET BAY
MARYLAND
VIRGINIA



LEGEND

EDUCATIONAL FACILITIES
- FEDERAL
- STATE

RESEARCH FACILITIES
- FEDERAL
- STATE

MILITARY FACILITIES

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

EDUCATION, RESEARCH AND MILITARY FACILITIES

MIDDLE BAY

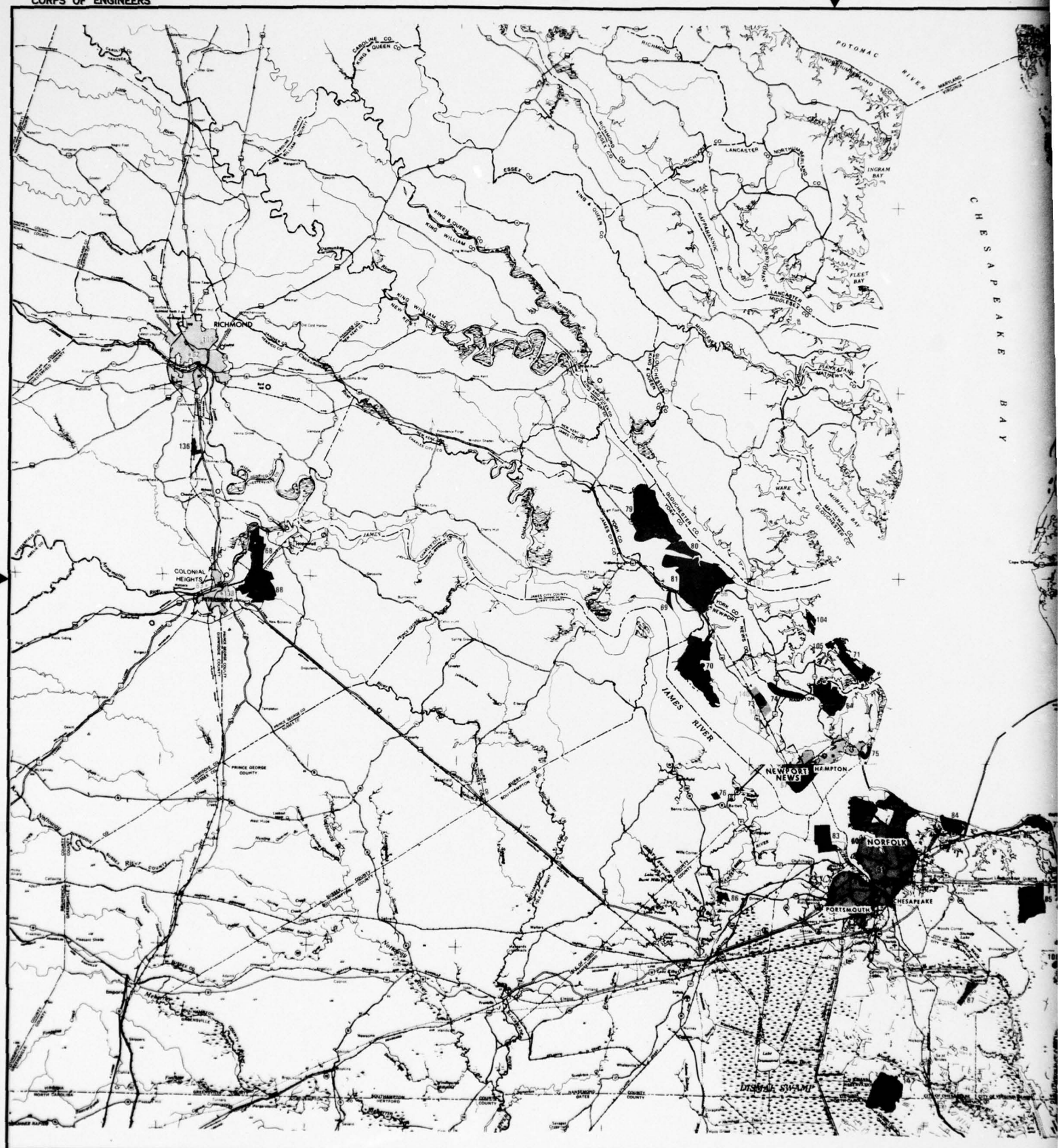
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SCALE: | DATE: | SHEET 2 OF 3

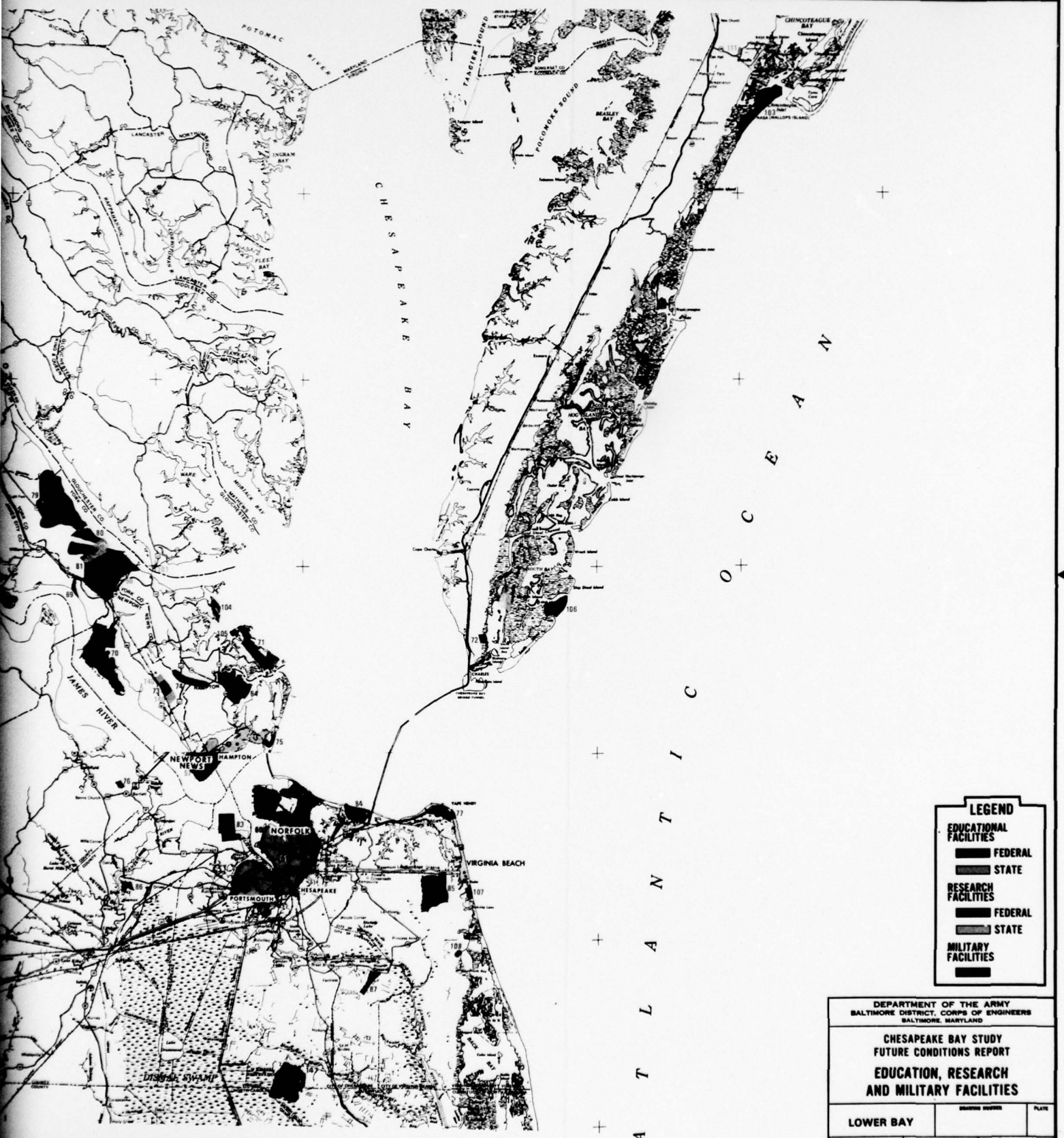
PLATE 4-20

2

CORPS OF ENGINEERS



U. S. ARMY



DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

EDUCATION, RESEARCH AND MILITARY FACILITIES

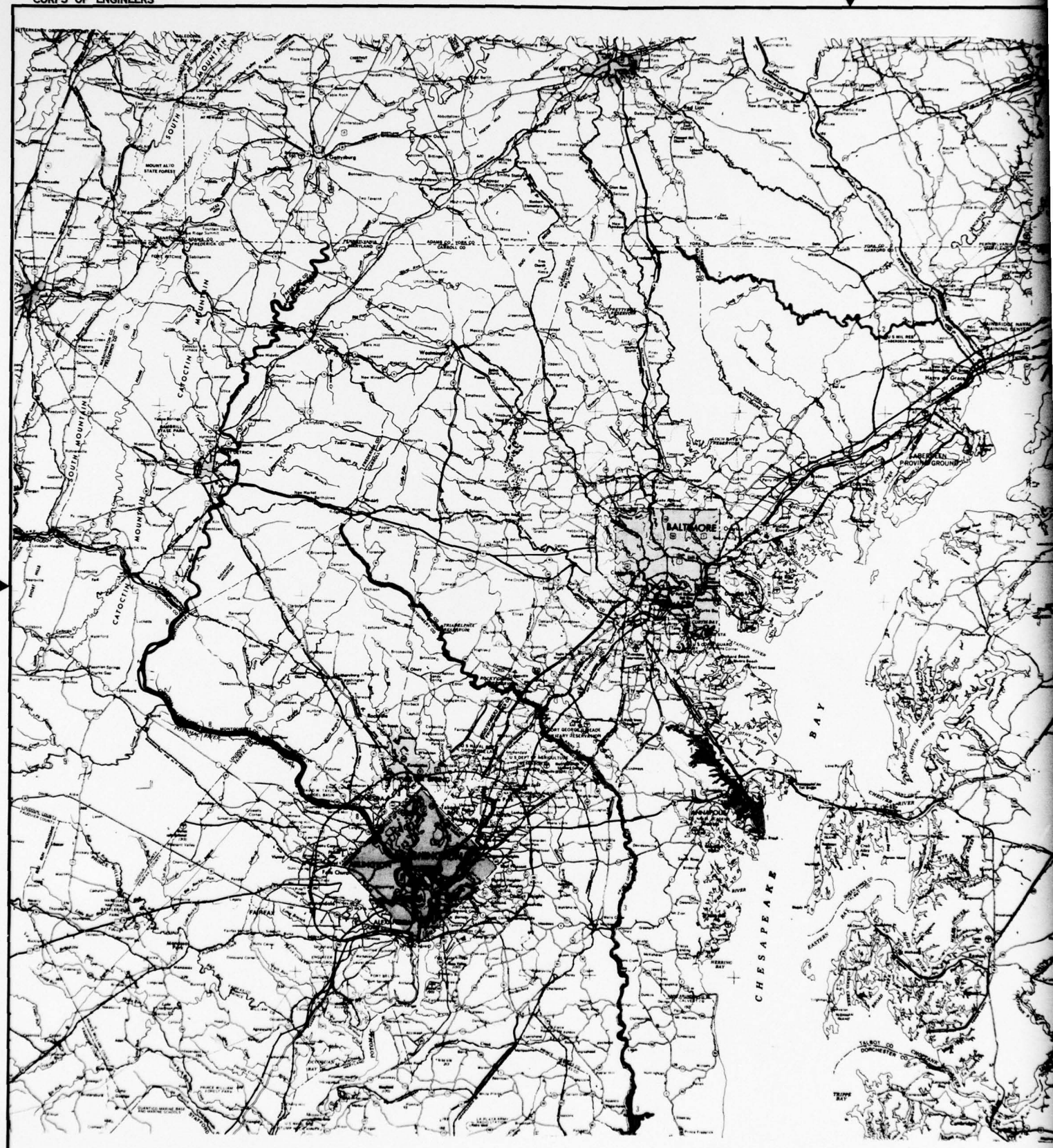
LOWER BAY

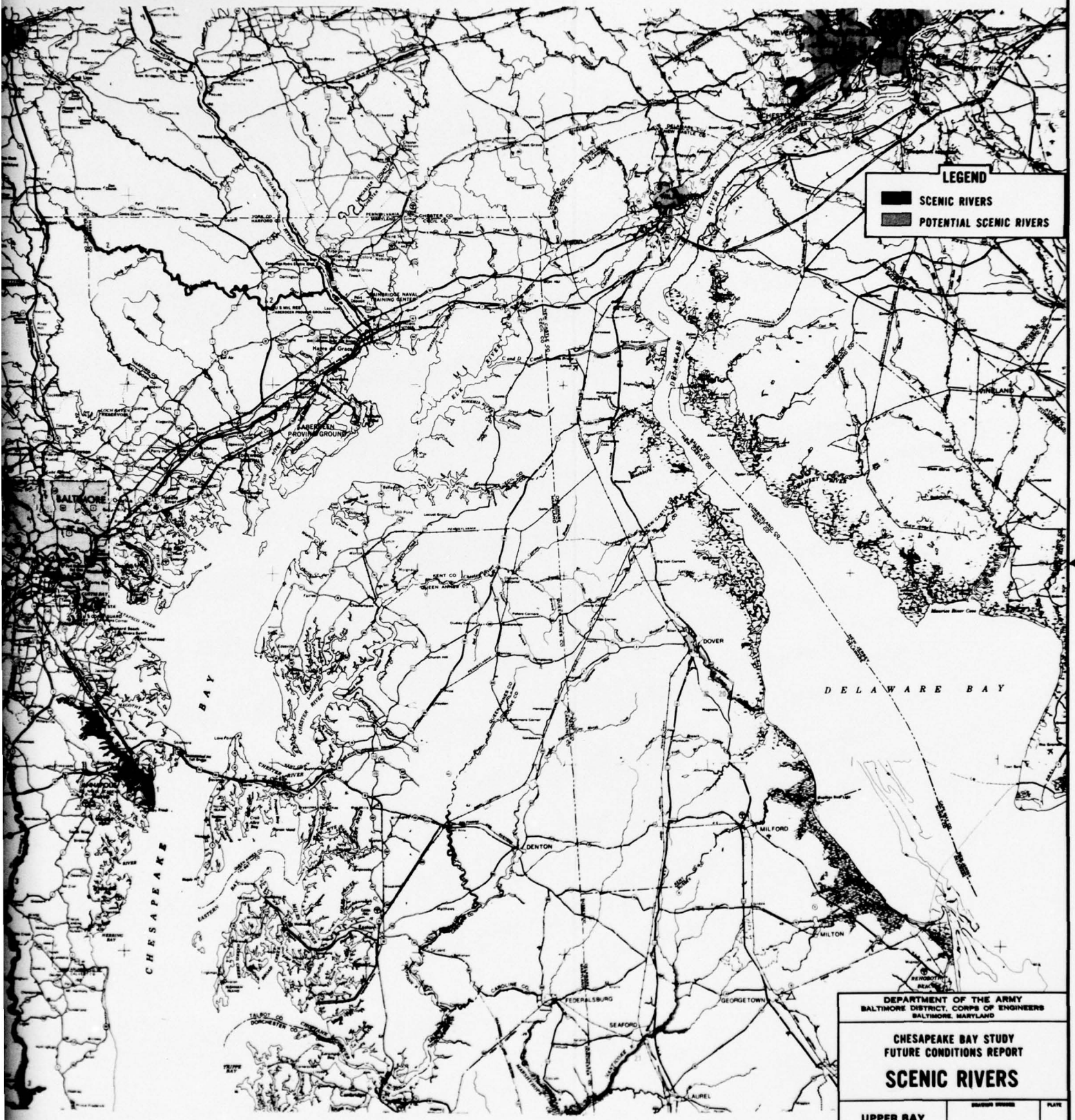
DRAWING NUMBER | PLATE

SCALE: | DATE: | SHEET 3 OF 3

PLATE 4-21

2


BALTIMORE
CHESAPEAKE BAY
SOUTH MOUNTAIN
CATOCTIN MOUNTAIN
MOUNT ALTO STATE FOREST
GAMBRILL STATE PARK
FORT DETRICK
ABERDEEN PROVING GROUND
EDGEWOOD ARSENAL
FORT GEORGE G. MEADE
PATUXENT RIVER NAVAL AIR TEST CENTER
PATUXENT RIVER
CHESTER RIVER
EASTERN BAY
TRIPPE BAY
DORCHESTER
TALBOT CO
CARROLL CO
FREDERICK CO
ADAMS CO
FRANKLIN CO
PENNSYLVANIA
MARYLAND



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CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

SCENIC RIVERS

UPPER BAY

PLATE

SCALE: DATE: SHEET 1 OF 3

PLATE 4-22

U. S. ARMY

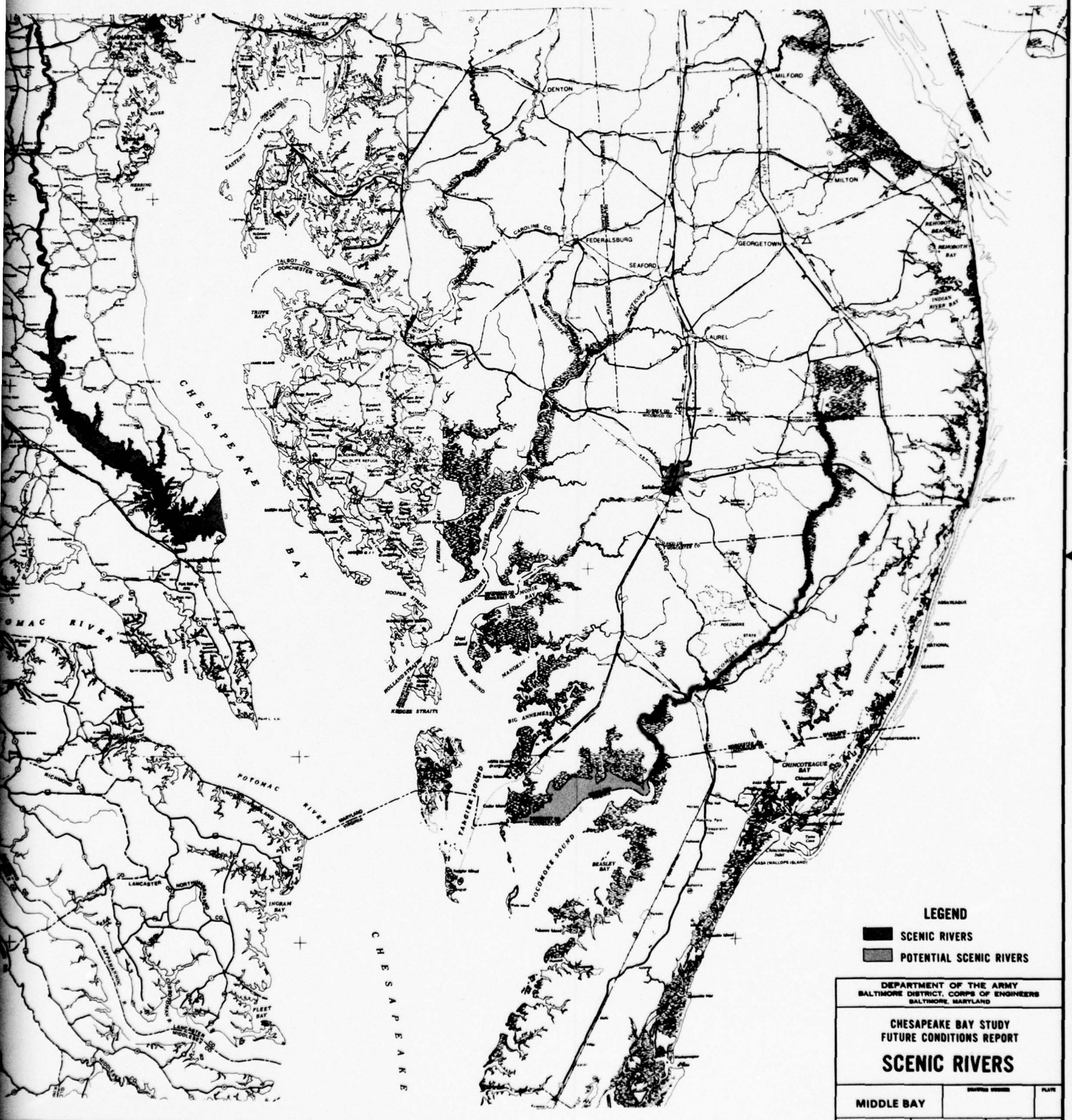
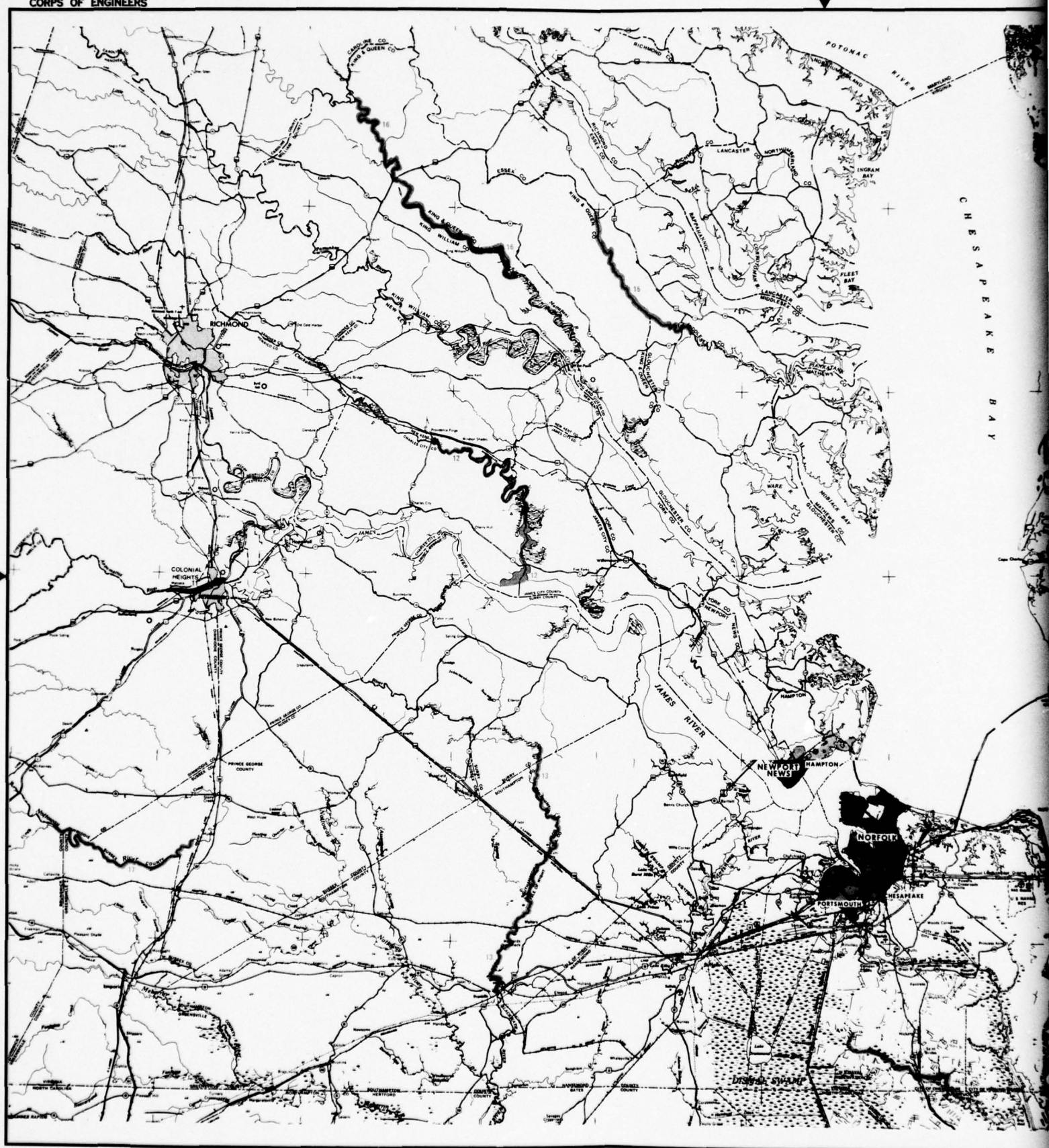
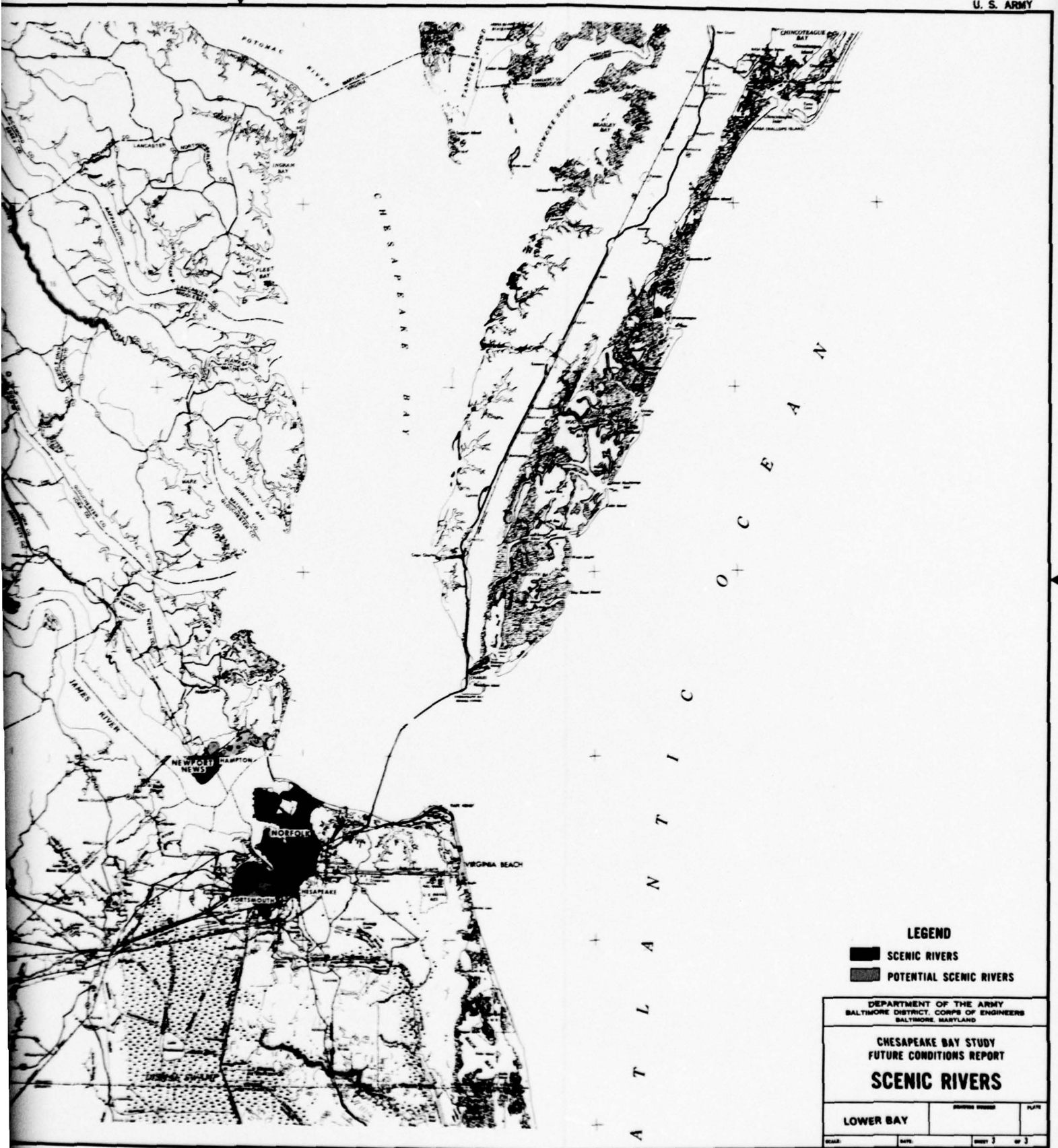


PLATE 4-23

2

CORPS OF ENGINEERS





DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND

CHESAPEAKE BAY STUDY
FUTURE CONDITIONS REPORT

SCENIC RIVERS

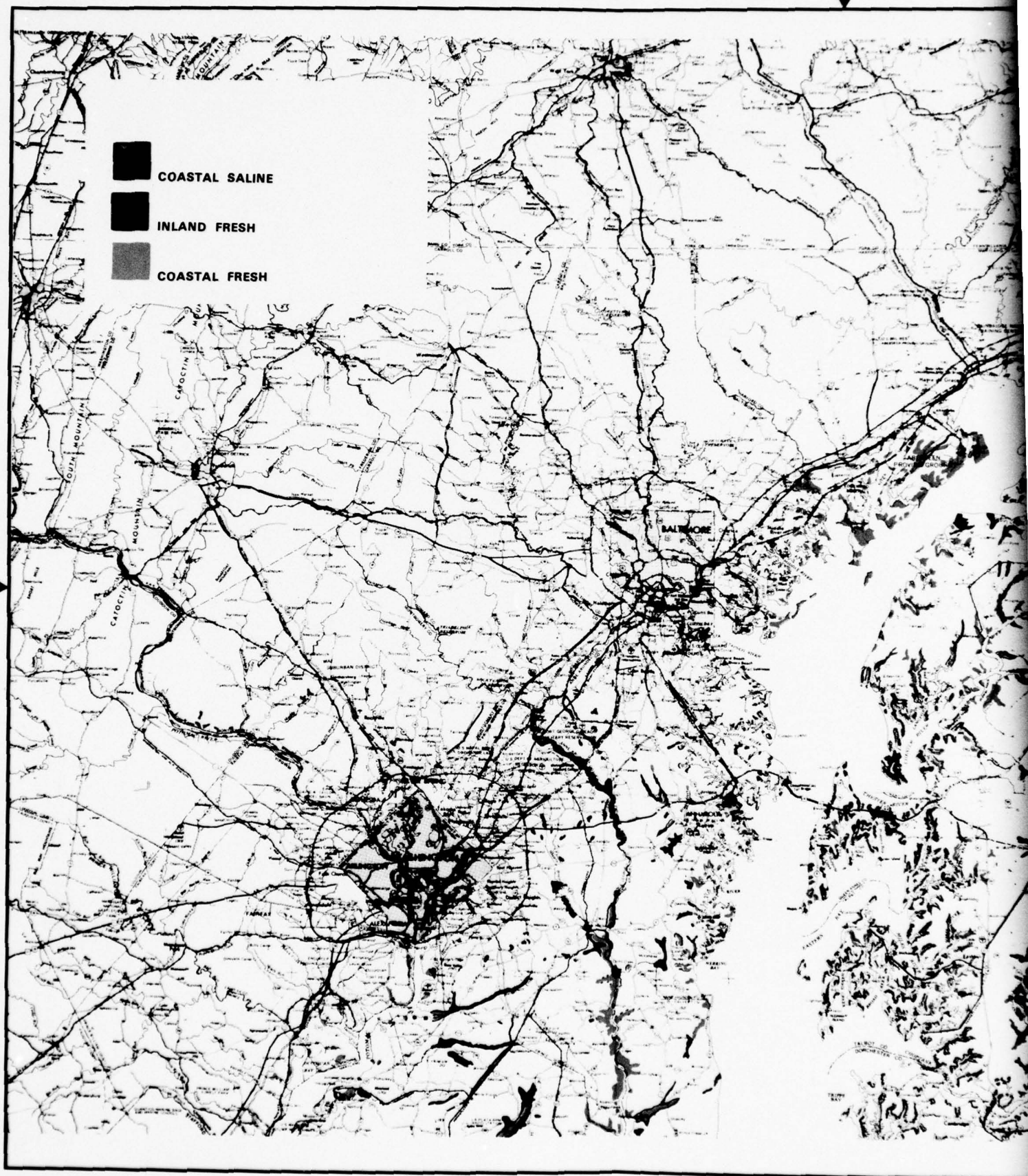
LOWER BAY

PLATE

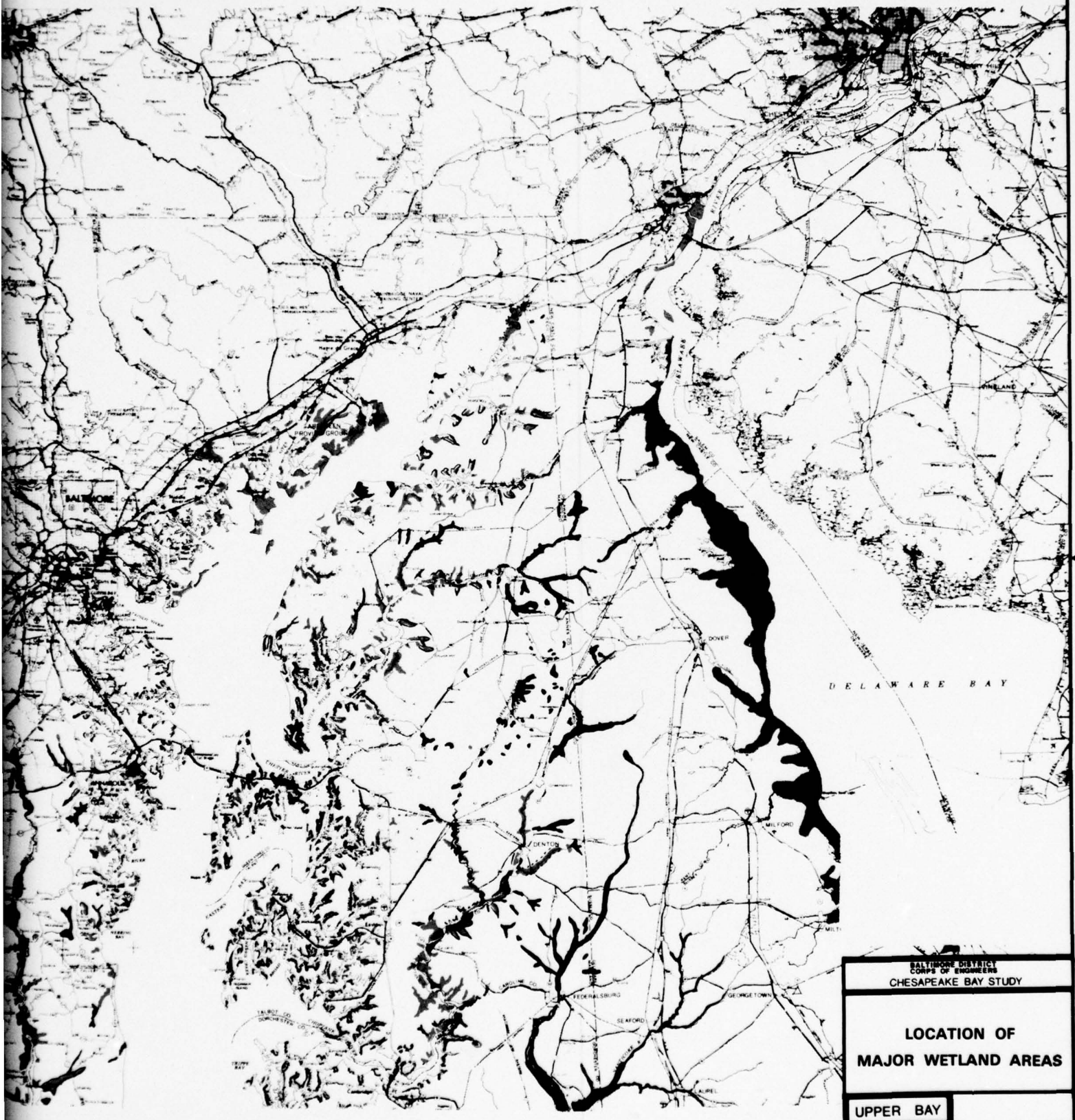
SCALE: DATE: SHEET 3 OF 3

PLATE 4-24

2


COASTAL SALINE
INLAND FRESH
COASTAL FRESH
BALTIMORE

U. S. ARMY



BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

LOCATION OF MAJOR WETLAND AREAS

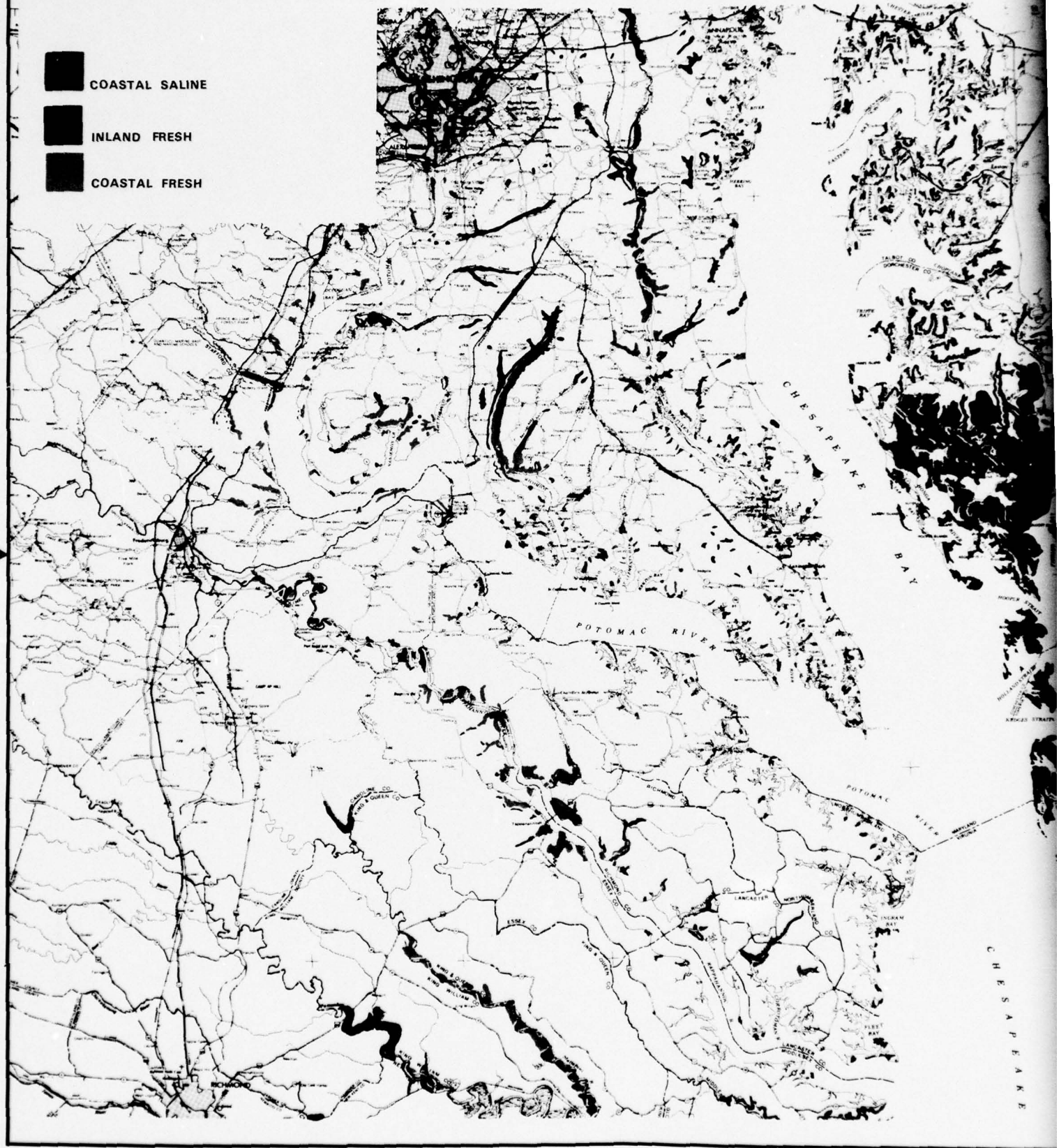
UPPER BAY

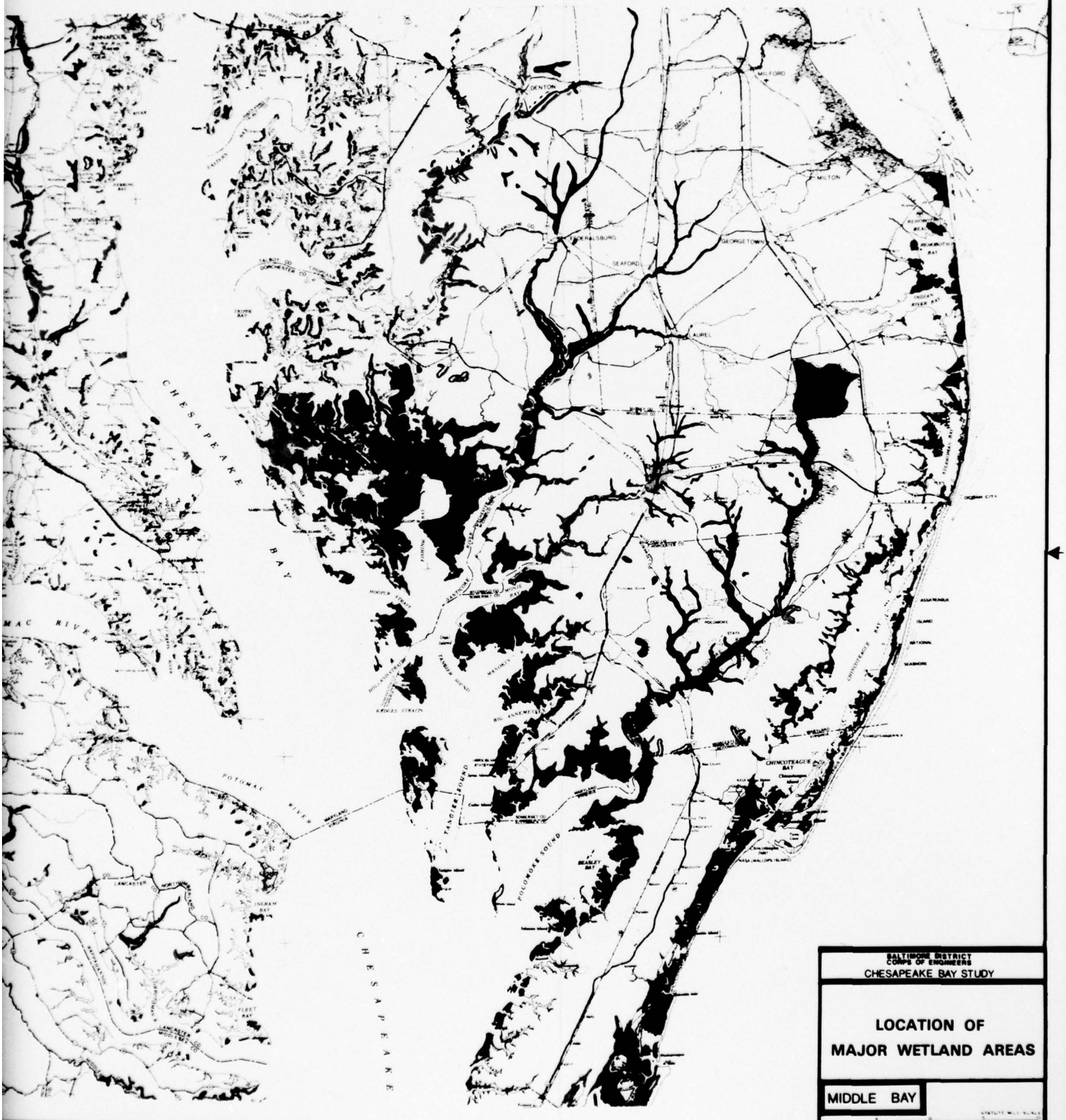
STATUTE MILE SCALE

PLATE 4-25

2

CORPS OF ENGINEERS





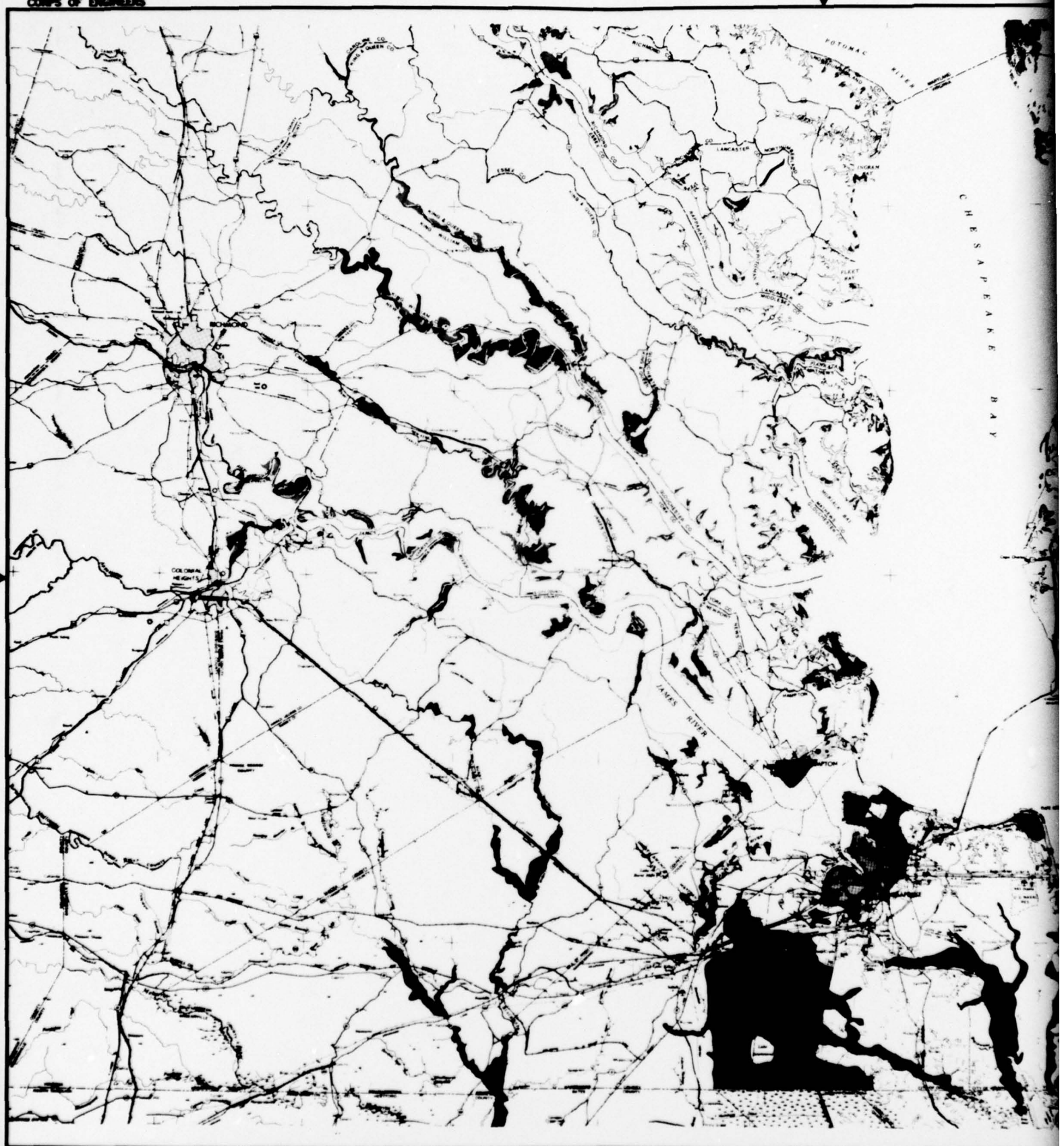
BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

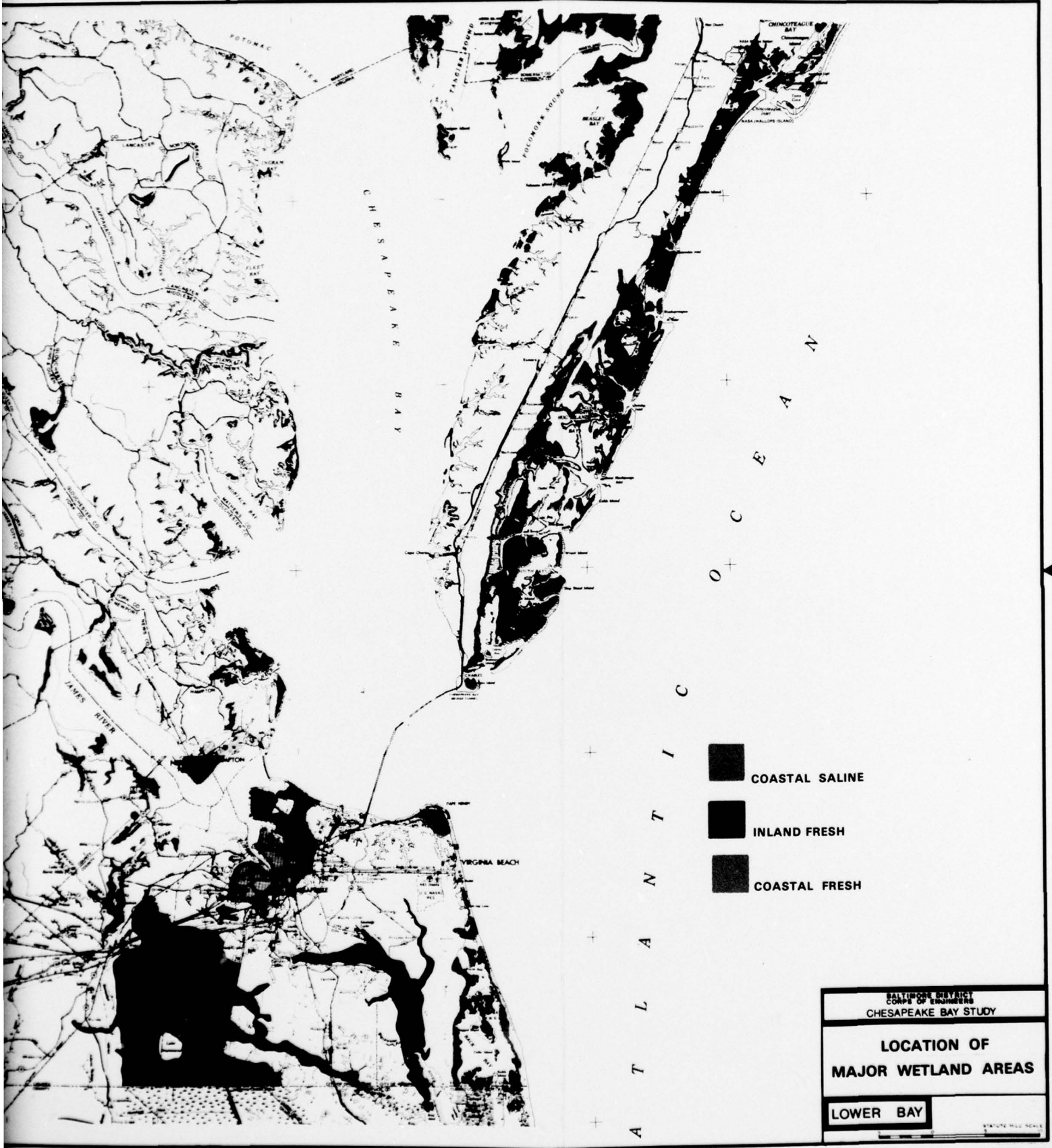
LOCATION OF MAJOR WETLAND AREAS

MIDDLE BAY

PLATE 4-26

2


POTOMAC
RIVER
CHESAPEAKE BAY
JAMES RIVER



BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

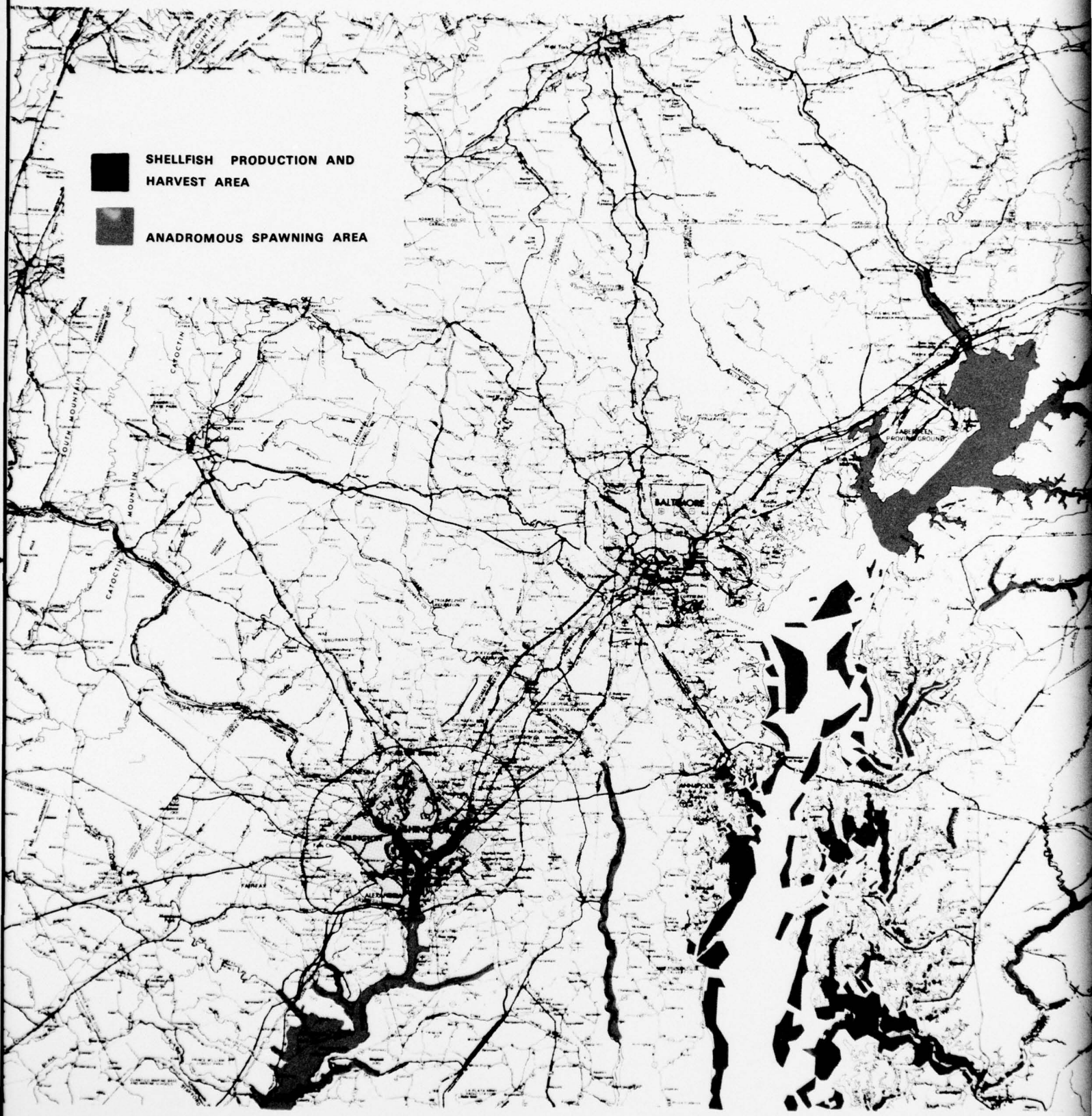
LOCATION OF MAJOR WETLAND AREAS

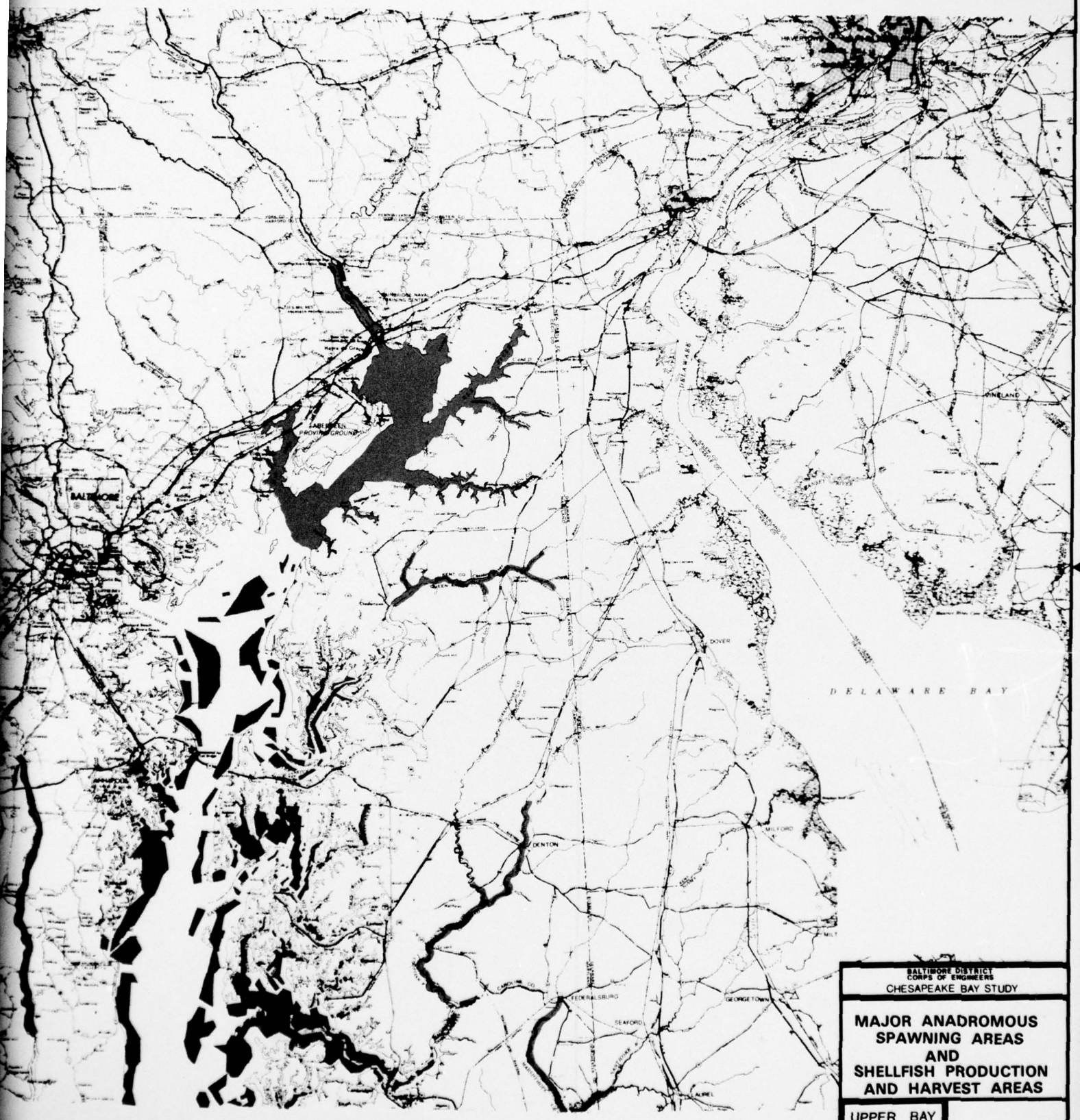
LOWER BAY

STATUTE MILE SCALE

PLATE 4-27

2


SHELLFISH PRODUCTION AND HARVEST AREA
ANADROMOUS SPAWNING AREA
SOUTH MOUNTAIN
CATOCTIN MOUNTAIN
CATOCTIN
BALTIMORE
ABERDEEN PROVING GROUND



BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

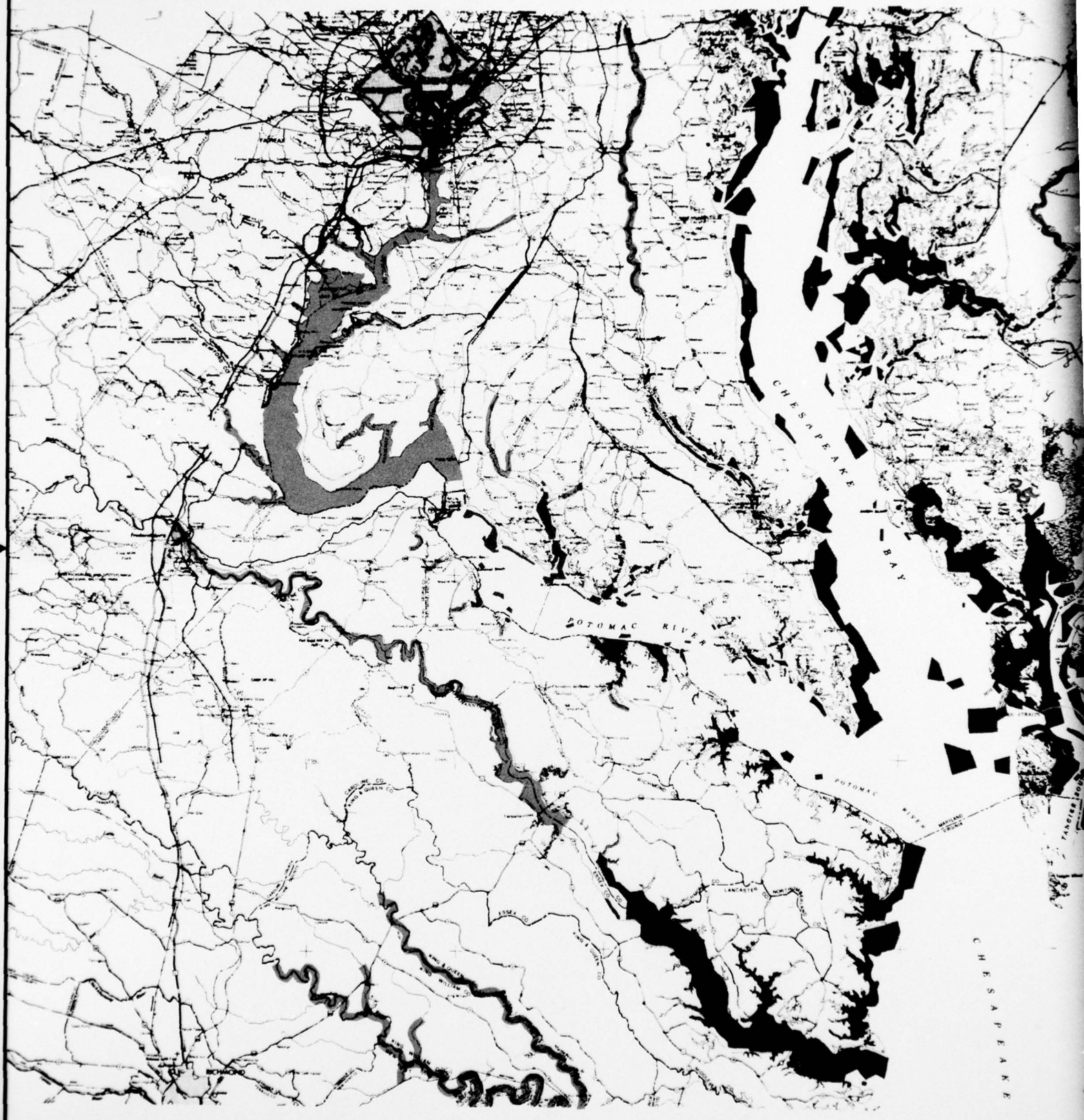
MAJOR ANADROMOUS SPAWNING AREAS AND SHELLFISH PRODUCTION AND HARVEST AREAS

UPPER BAY

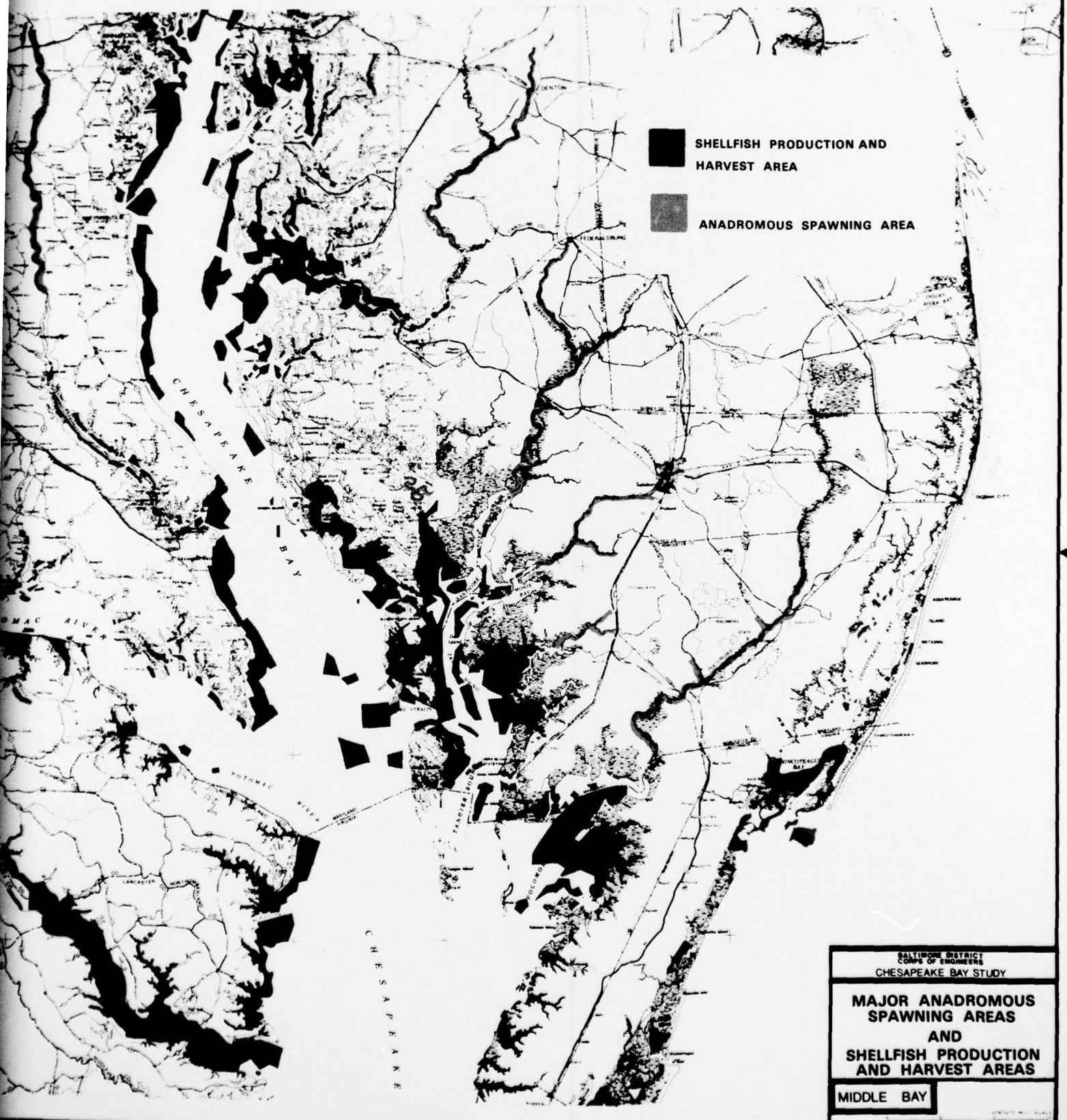
STATUTE MILE SCALE

PLATE 4-28

CORPS OF ENGINEERS



U. S. ARMY



BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

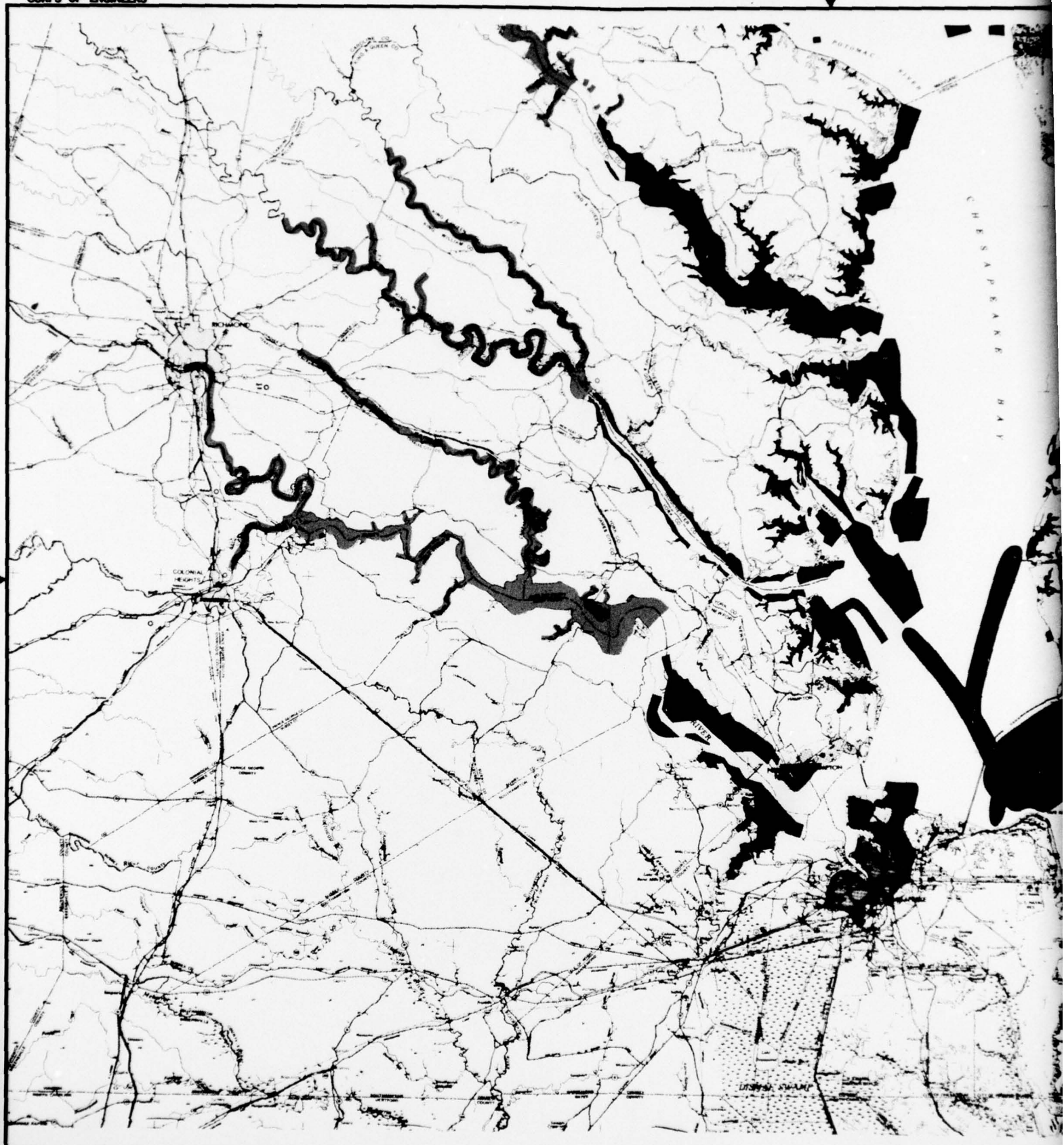
MAJOR ANADROMOUS SPAWNING AREAS AND SHELLFISH PRODUCTION AND HARVEST AREAS

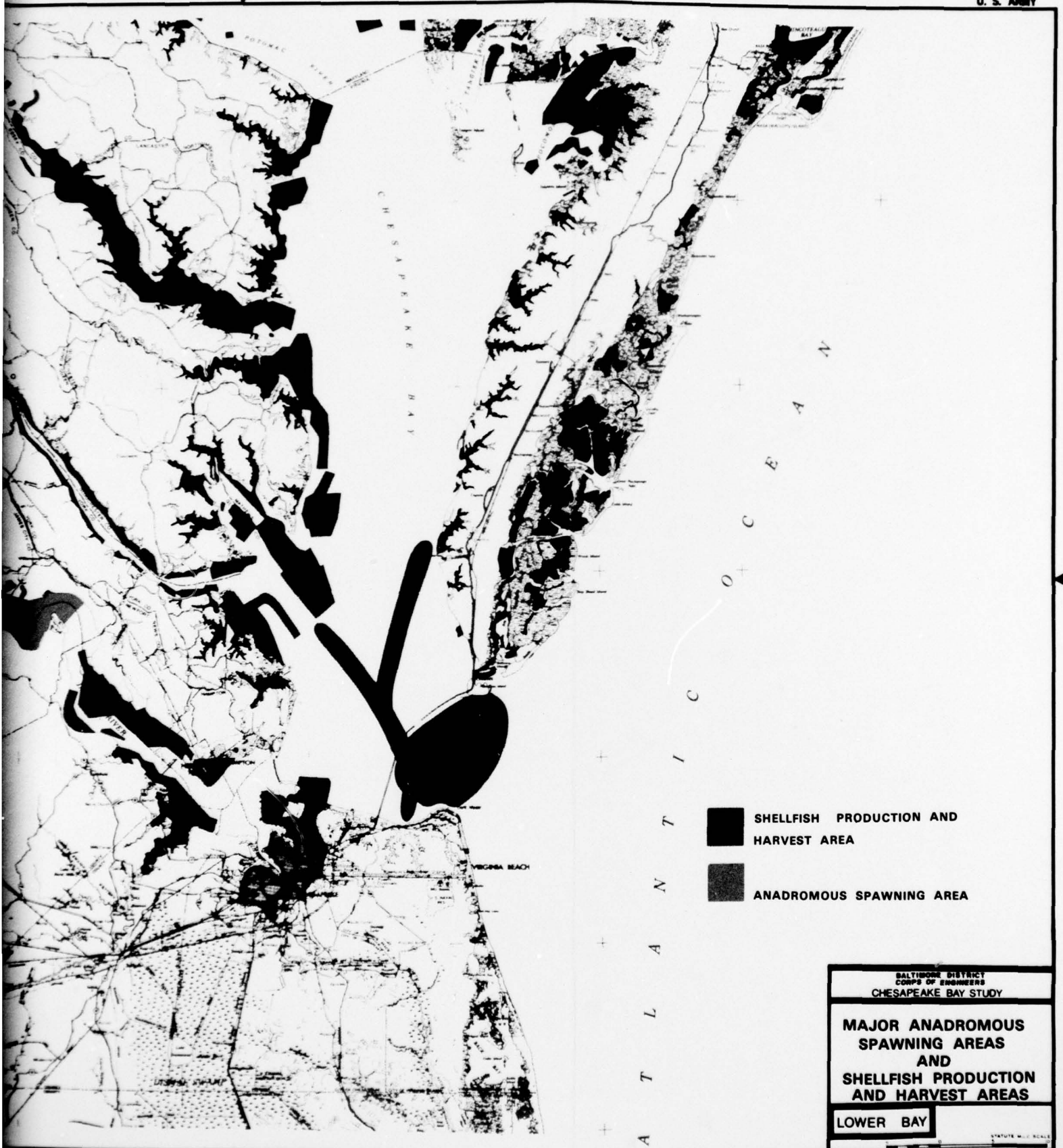
MIDDLE BAY

PLATE 4-29

2

CORPS OF ENGINEERS



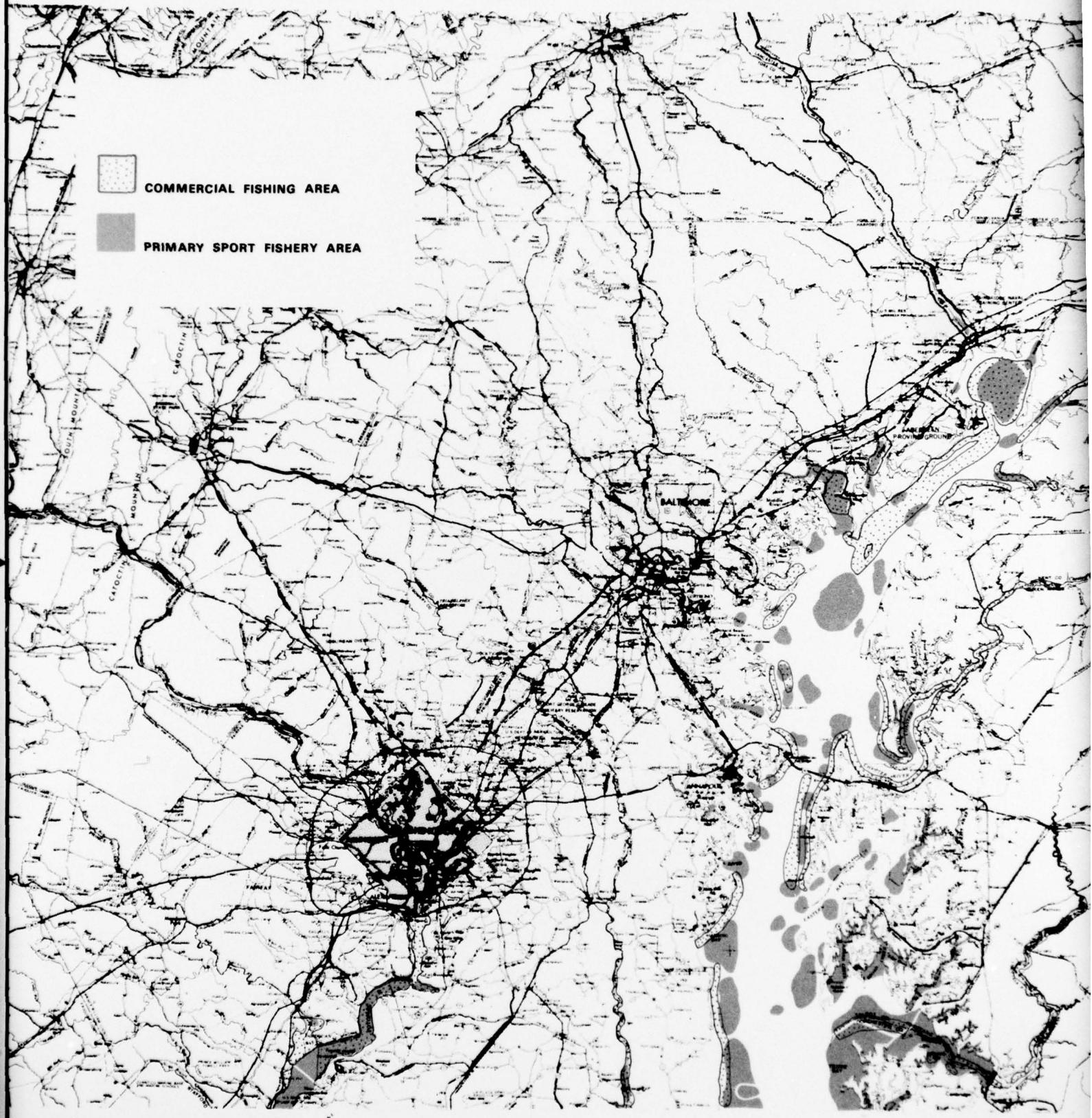


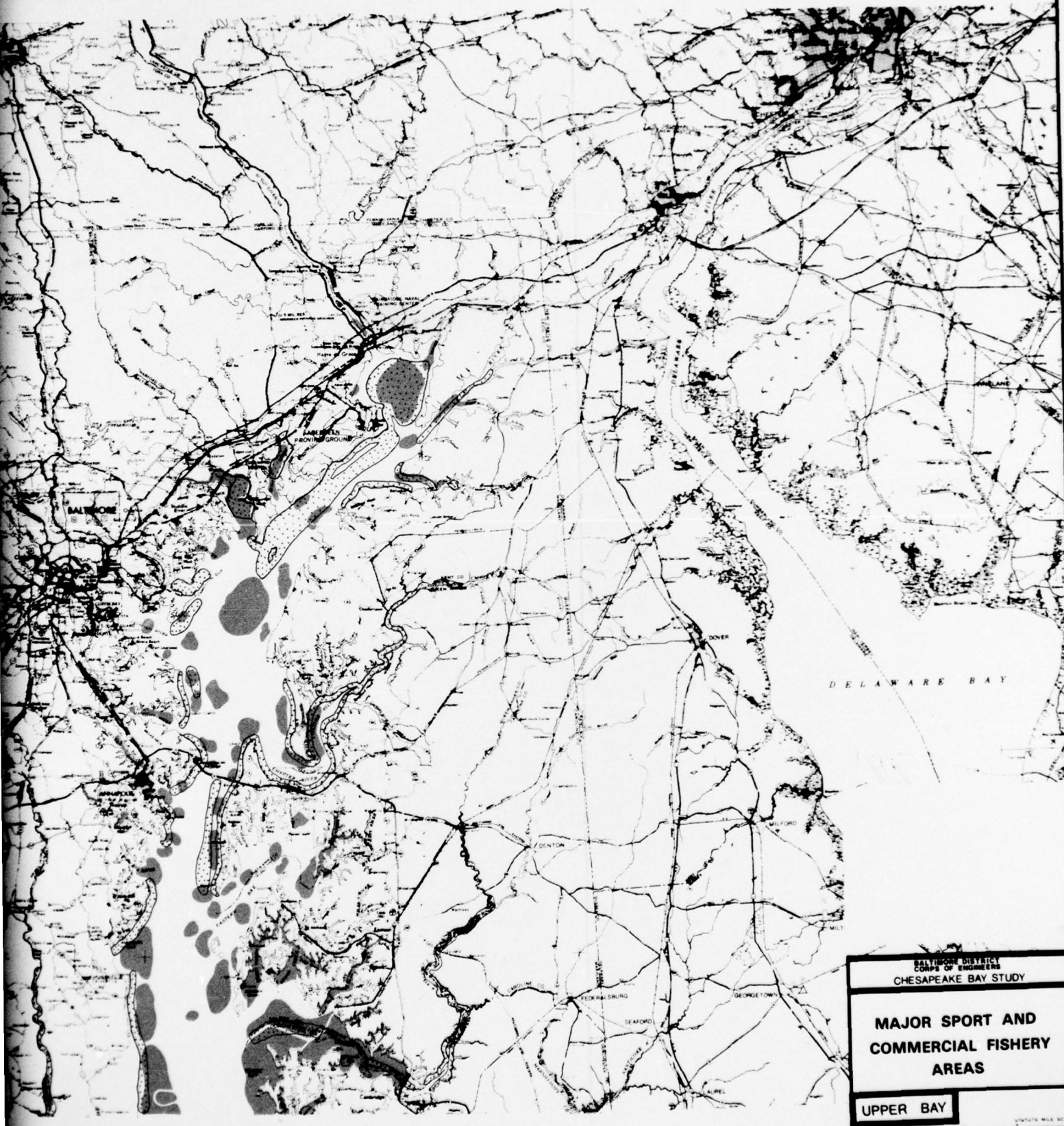
BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

MAJOR ANADROMOUS SPAWNING AREAS AND SHELLFISH PRODUCTION AND HARVEST AREAS

LOWER BAY

STATUTE MILE SCALE


COMMERCIAL FISHING AREA
PRIMARY SPORT FISHERY AREA
CATOCTIN MOUNTAIN
BALTIMORE



BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

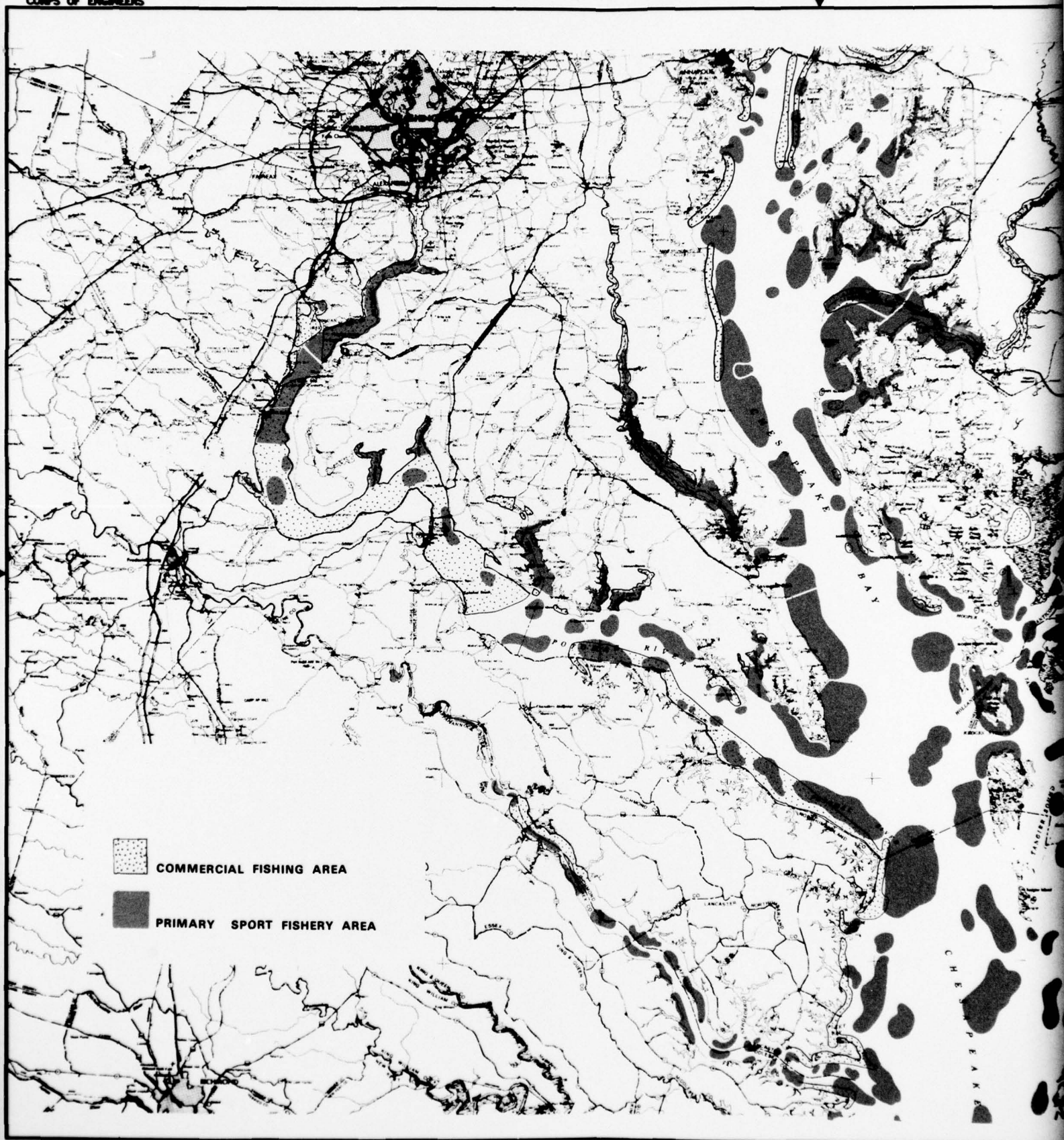
MAJOR SPORT AND COMMERCIAL FISHERY AREAS

UPPER BAY

STATUTE MILE SCALE

PLATE 4-31

2


COMMERCIAL FISHING AREA
PRIMARY SPORT FISHERY AREA

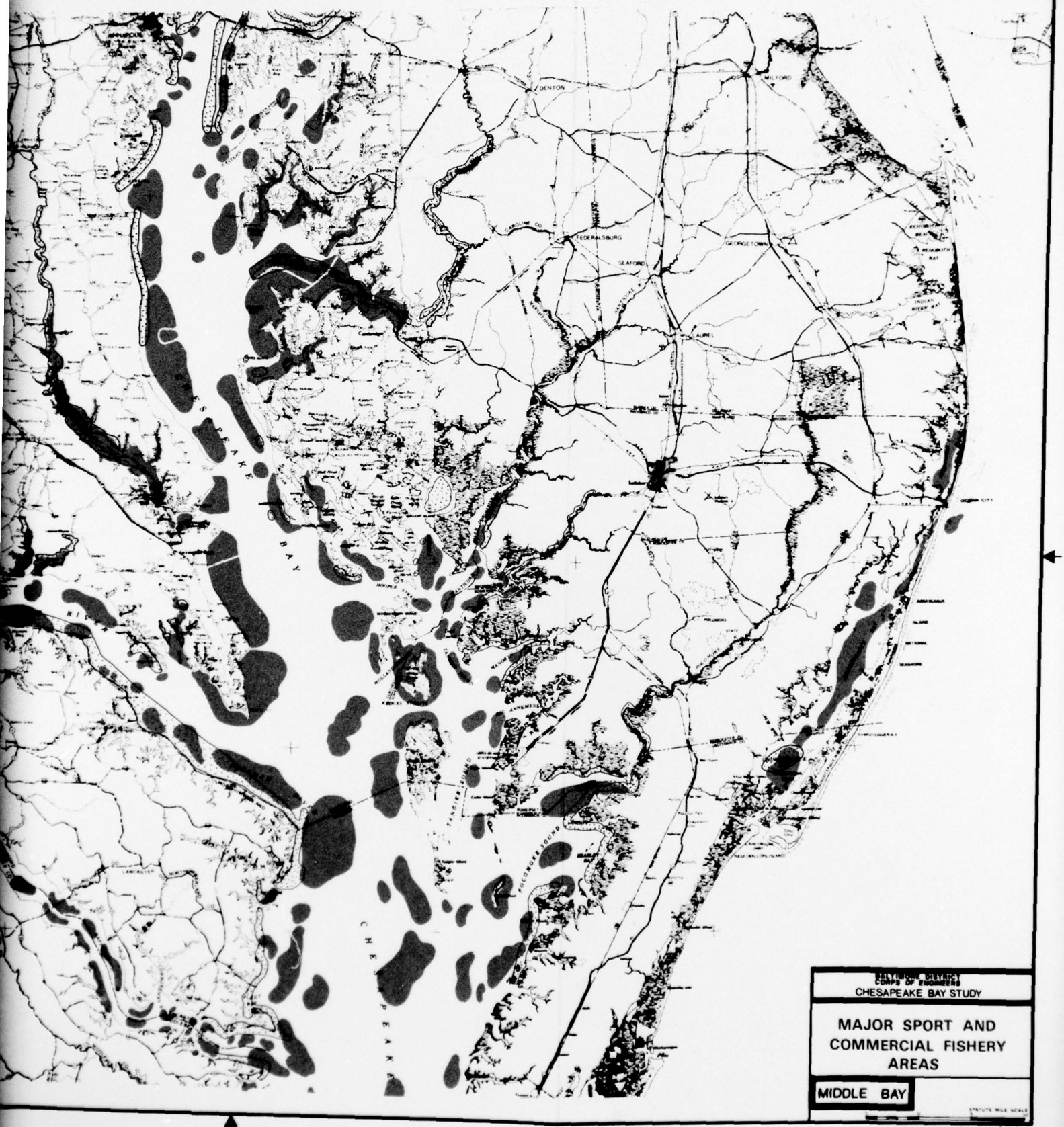
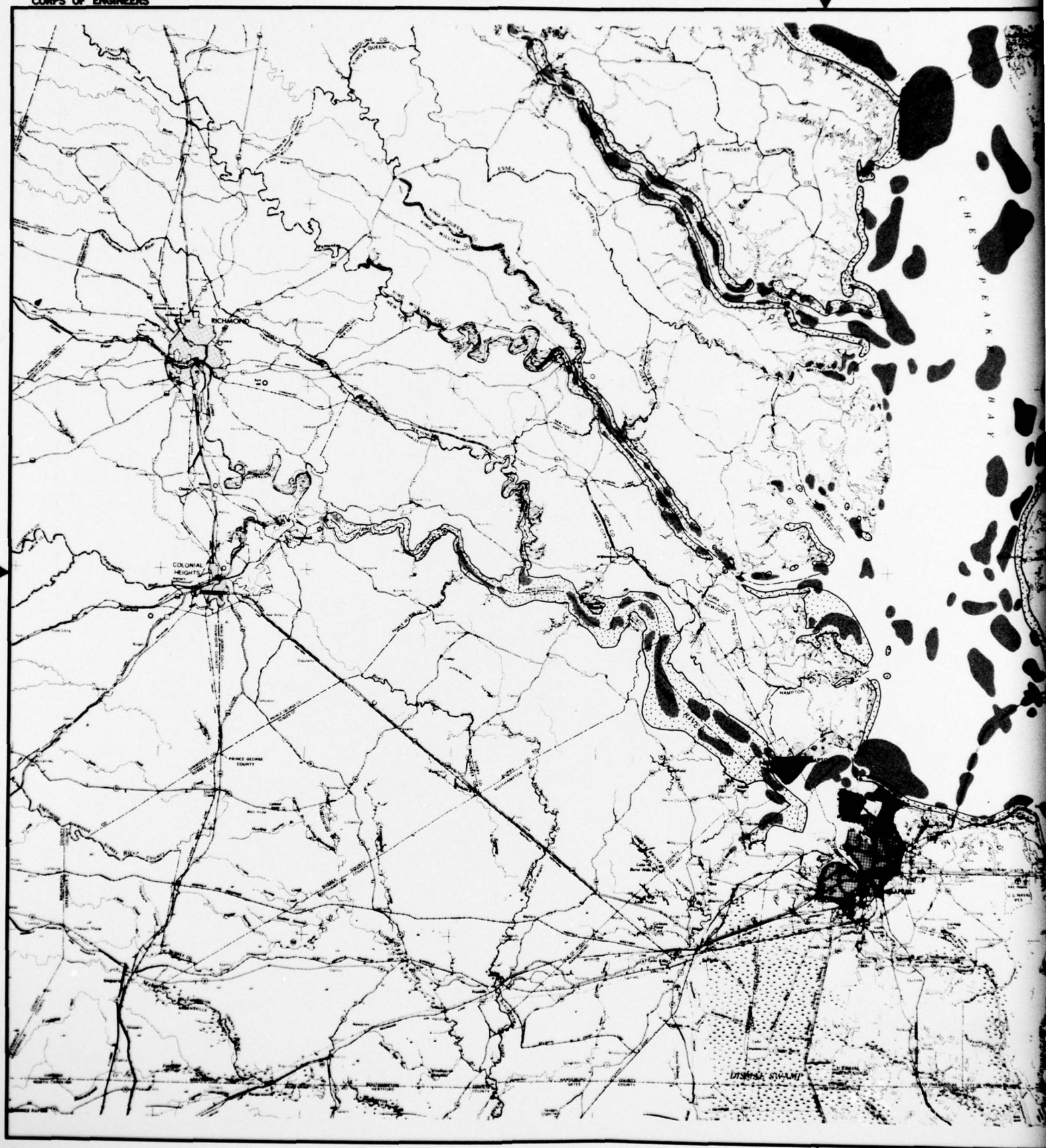
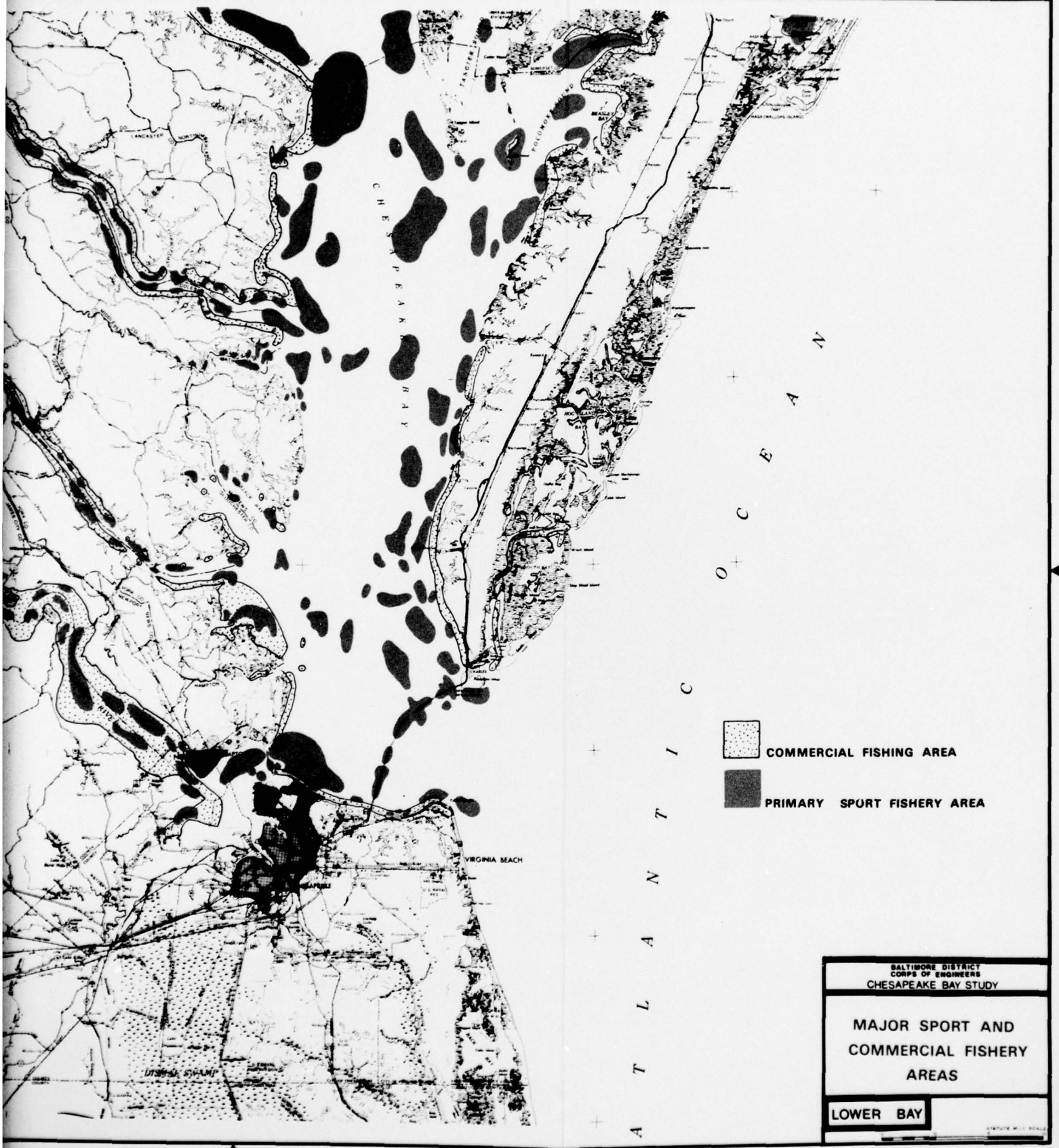

DENTON
MILFORD
MILTON
FEDERALSBURG
GEORGETOWN
SEAFORD
CHESAPEAKE BAY
POCOMOKE SOUND
BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY
MAJOR SPORT AND COMMERCIAL FISHERY AREAS
MIDDLE BAY
STATUTE MILE SCALE

PLATE 4-32

2

CORPS OF ENGINEERS





BALTIMORE DISTRICT
CORPS OF ENGINEERS
CHESAPEAKE BAY STUDY

MAJOR SPORT AND COMMERCIAL FISHERY AREAS

LOWER BAY

PLATE 4-33

2