United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Virginia Polytechnic
Institute and
State University

Soil Survey of Northampton County, Virginia

How To Use This Soil Survey

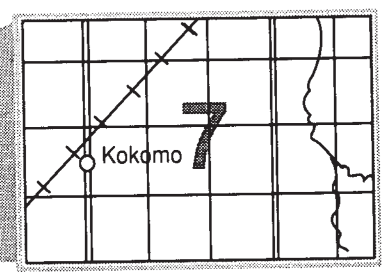
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

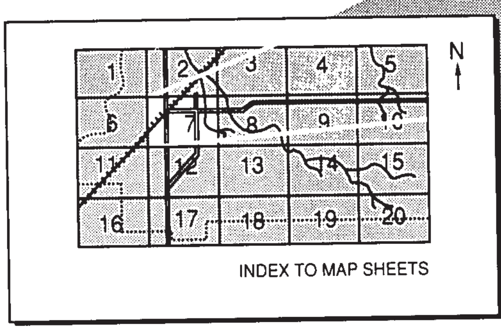
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



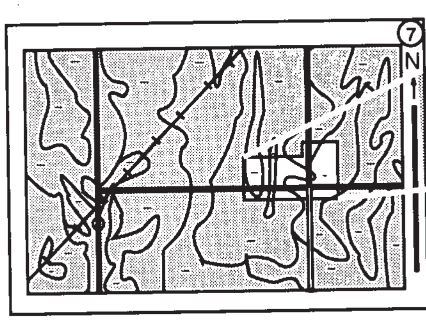
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

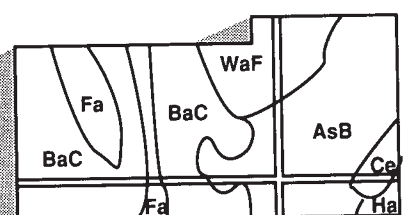


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Soil Conservation Service and the Virginia Polytechnic Institute and State University. The survey is part of the technical assistance furnished to the Eastern Shore Soil and Water Conservation District. The survey was financed in part by the Virginia Department of Conservation and Recreation and the Northampton County Board of Supervisors.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Irish potatoes on Bojac sandy loam, 0 to 2 percent slopes.

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Issued August 1989

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Foreword

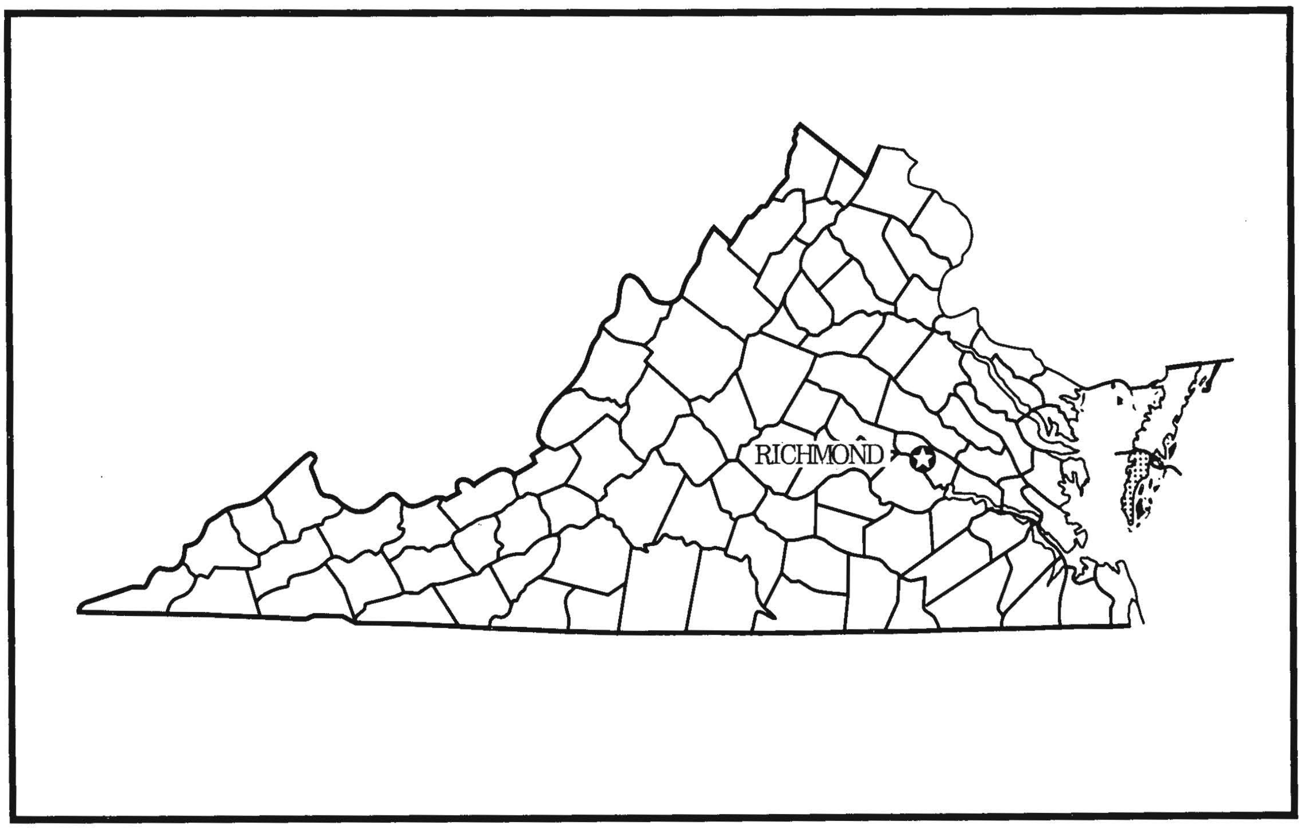
This soil survey contains information that can be used in land-planning programs in Northampton County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Norris
State Conservationist
Soil Conservation Service



Location of Northampton County in Virginia.

Soil Survey of
Northampton County, Virginia

By Phillip R. Cobb and David W. Smith, Virginia Polytechnic Institute and State University

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
Virginia Polytechnic Institute and State University

NORTHAMPTON COUNTY covers the easternmost part of Virginia and the southern tip of the Delmarva Peninsula (see facing page). The county is 227,300 acres, or 325 square miles, about one third of which is marsh and saltwater. Cape Charles, with a population of about 1,500, is the largest town in the county. The county's main automotive route is U.S. Route 13, which runs the length of the county. The county has rail service and has maintained harbors at Cape Charles and Willis Wharf.

Farming and its related industries and the seafood industry are the major enterprises in the county. The major crops are vegetables, soybeans, small grains, and ornamental trees and shrubs.

This soil survey is an update of a soil survey of Northampton County that was published in 1920 *(6)*, and shows the soils in greater detail while providing additional information. Most of the differences from the older survey are the results of additional information, the use of aerial photography, and increases in the intensity of mapping.

General Nature of the Survey Area

This section describes some of the natural and cultural influences on the use of the soils and land in the county.

History

Between 1570 and the early 1600's, the Spanish and other Europeans explored the area of the county. In 1608, Captain John Smith explored the area and, with land obtained from the Indians in 1614, the English established Accomack Plantation in 1619. Later, in 1643, it was renamed Northampton, and in 1663 the Eastern Shore was divided into two counties, Accomack to the north and Northampton to the south. Eastville has been the county seat of Northampton County since 1680.

Separated from the mainland by the Chesapeake Bay, Northampton County is mainly rural. The county's direct access to the mainland is the Chesapeake Bay Bridge-Tunnel, completed in 1964.

Until 1980, most of the recent population data for the county showed a downward trend. The 1980 census, however, showed a total population of 14,625, a slight increase over the total in the 1970 census.

Climate

Prepared by the Virginia Polytechnic Institute and State University.

The climate of Northampton County is mild in winter and hot and humid in summer. The winds from the Atlantic Ocean and the Chesapeake Bay provide some relief from the summer heat and intensify the cold of winter, although extended periods of bitter cold are rare. Light snows are occasional in winter, but snow cover for extended periods is uncommon. Precipitation is well distributed throughout the year and generally is adequate for most of the common crops.

The southern end of the county is narrower than the northern end and thus is more subject to the moderating influences of the ocean and the bay and their effects on the growing season. Farmers in the southern part can plant, for example, Irish potatoes about two weeks earlier than can their counterparts in the northern part.

The county is subject to frequent steady storms in winter, fall, and spring. These storms produce local flooding and severe shoreline erosion. Though north of the usual track of hurricanes and tropical storms, the county has been struck. A hurricane in 1933 caused extensive damage and some loss of life on the mainland while decimating settlements on the barrier islands.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Cheriton from 1949 to 1976 and at Painter from 1956 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring, and table 3 provides data on the length of the growing season.

At Cheriton, the average temperature in winter is 40.5 degrees F and the average daily minimum temperature is 31.9 degrees F. The lowest temperature on record at Cheriton, which occurred on January 22, 1970, is 5 degrees F. In summer the average temperature is 76 degrees F and the average daily maximum temperature is 84.5 degrees F. The highest temperature recorded at Cheriton was 102 degrees F on July 23, 1952.

At Painter, the average temperature in winter is 39.1 degrees F and the average daily minimum temperature is 30 degrees F. The lowest temperature recorded at Painter was -5 degrees F on January 17, 1965. In summer the average temperature at Painter is 75 degrees F and the average daily maximum temperature is 84.4 degrees F. The highest temperature recorded at Painter was 98 degrees F on June 10, 1965.

Growing degree days, shown in table 2, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation at Cheriton is 40.8 inches. Of this, 21.1 inches, or 52 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 9.2 inches at Cheriton on August 13, 1955. Thunderstorms occur on an average of about 5 days per year, and most occur in summer.

The total annual precipitation at Painter is 42.7 inches. Of this, 21.5 inches, or 50 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 23.7 inches. The heaviest 1-day rainfall during the period of record was 6.18 inches at Painter on August 4, 1958. Thunderstorms occur on an average of about 5 days per year, and most occur in summer.

The average seasonal snowfall in Northampton County is about 6 inches. The greatest snow depth at any one time during the periods of record was 13 inches. On the average, 2 days of the year have at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time in summer and about 55 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 20 miles per hour, in March.

Physiography, Relief, and Drainage

Northampton County is in the Tidewater region of the Atlantic Coastal Plain and is on three major landforms: terrace, tidal marsh, and barrier island.

The terrace is divided into a lower terrace and an upper terrace, both extending the length of the county (fig. 1). These terraces are separated by a discontinuous escarpment with an elevation of 25 feet above sea level.

The lower terrace is generally west of U.S. Route 13 and comprises about half of the mainland. It consists of broad flats broken by large meandering tidal creeks bordered by sloping to steep side slopes. These creeks helped form the long, irregularly shaped necks, or peninsulas, that are characteristic of areas bordering the Chesapeake Bay. South of Mattawoman Creek, gently sloping to steep sand dunes are in some areas that border the Chesapeake Bay. Some of the dunes approach 55 feet in elevation and are the highest points in the county. Another lower terrace is on the extreme eastern edge of the mainland. This terrace consists of broad to narrow flats bordered by tidal marshes on the east and a discontinuous escarpment on the west.

The upper terrace, or upland, ranges in elevation from about 25 to 40 feet above sea level. The topography, more complex than that of the low terrace, is level to very gently undulating and is characterized by shallow depressions and gently sloping elliptical ridges locally known as whale wallows or Carolina bays. Steep slopes are along most drainageways. The soils on this terrace generally are in a more complex pattern than

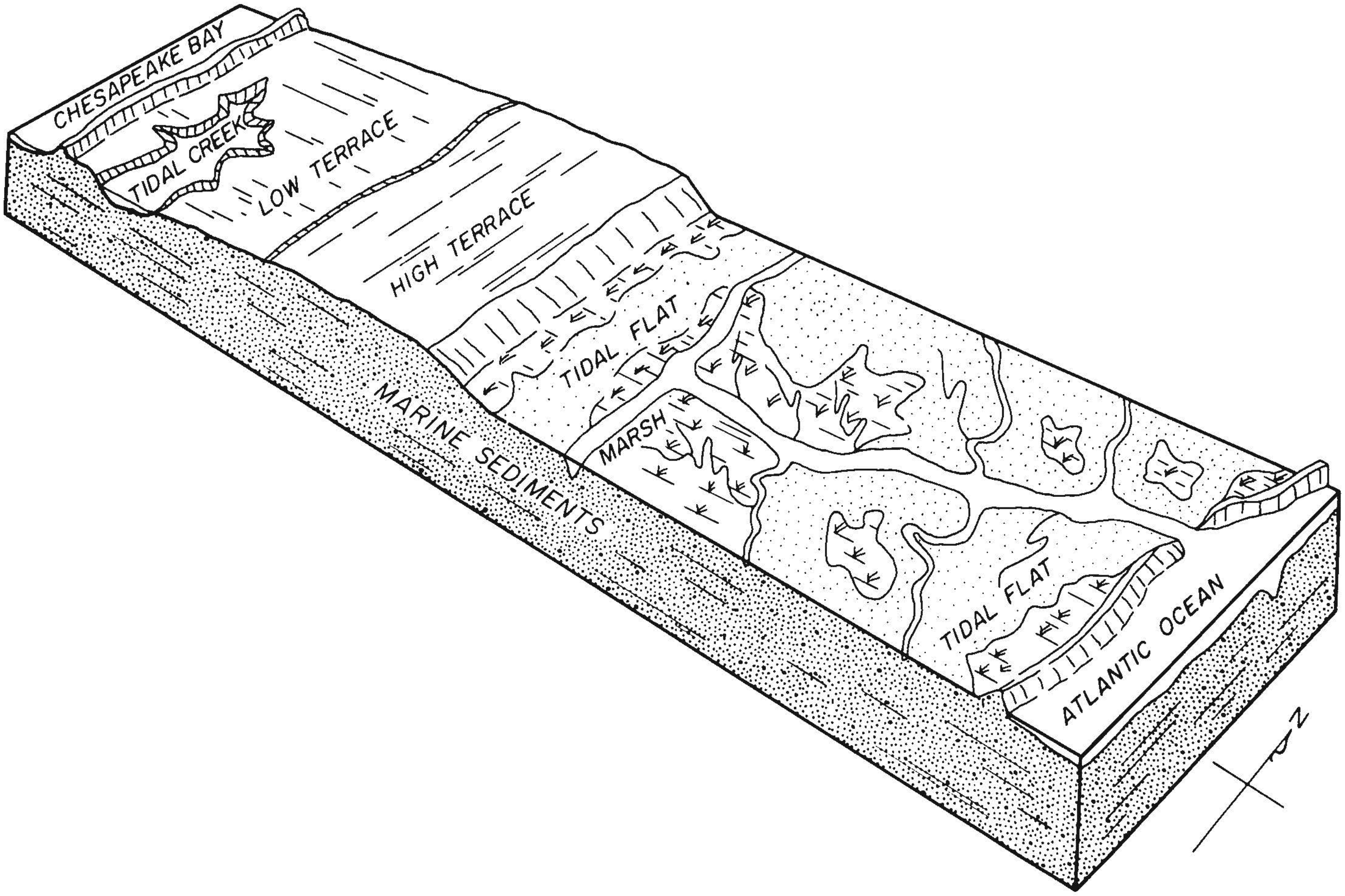


Figure 1.—The typical mainland landscape in Northampton County.

those on the low terrace. The high terrace is drained by tidal creeks that narrow into small freshwater streams beyond tidal influence.

Between the mainland and the barrier islands are extensive areas of vegetated tidal marshes, and a few narrow fringe tidal marshes are along the Chesapeake Bay and its tributaries *(7)*. These tidal marshes are flooded regularly by saltwater and are drained by an extensive system of meandering creeks. The soils in these marshes are immature. Extensive areas of barren tidal flats, commonly exposed at low tide, are prominent.

The barrier islands form a chain broken by inlets, such as Smith Island Inlet, Ship Shoal Inlet, and Great Machipongo Inlet. The islands are roughly parallel to the mainland, are generally less than 10 feet above sea level, and are nearly level to steep. The soils are immature and very poorly drained to excessively drained. Tidal drainageways extend into the interior of some of the larger islands, and freshwater is scarce.

Industry

The economy of the county is based on agriculture. The census of 1980 shows 237 farms in the county with an average size of 261 acres. For several decades Northampton County has been a leading producer of vegetables, especially Irish potatoes (fig. 2). The trend in farming, however, has been toward growing fewer vegetables and more soybeans and small grains, and the county has become one of Virginia's largest producers of soybeans and small grains.

A few nurseries in the county produce ornamental plants and shrubs, and much of the vegetable harvest is processed at several in-county packing facilities and one cannery. The seafood industry, centered at Cape

Figure 2.—Harvesting Irish potatoes on Bojac fine sandy loam, 0 to 2 percent slopes.

Charles and Willis Wharf, consists mainly of harvesting and processing blue crabs, oysters, hard clams, sea clams, and several species of finfish. Sport fishing, waterfowl hunting, camping, and water sports are major parts of the recreation and tourist industries.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material has few or no roots or other living organisms and has been changed very little by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Bojac-Munden-Molena

Nearly level to steep, moderately well drained to somewhat excessively drained, loamy and sandy soils; on broad flats, side slopes, and escarpments

This unit is throughout the county but is mainly on the necks along the Chesapeake Bay. The elevation of the unit ranges from about 5 to 40 feet above sea level, and the native vegetation is hardwoods and pines. The landscape consists of nearly level flats broken by gently sloping ridges and nearly level to steep slopes along drainageways. Most of the acreage on the flats has a seasonal high water table.

This unit makes up about 52 percent of the county. The unit is about 76 percent Bojac soils, 9 percent Munden soils, 5 percent Molena soils, and 10 percent soils of minor extent.

Most of this unit is used for cultivated crops. The uncleared acreage is on the nearly level to steep side slopes and in areas used for commercial woodland or esthetics.

The Bojac soils are nearly level to gently sloping. They are on broad flats, side slopes, and escarpments. They are well drained and have a loamy subsoil and a sandy substratum.

The Munden soils are nearly level. They are on broad flats and in depressions. They are moderately well drained and have a loamy subsoil and a sandy substratum.

The Molena soils are nearly level to steep. They are on the side slopes and escarpments. They are somewhat excessively drained and are sandy throughout.

Of minor extent are very poorly drained Chincoteague soils along tidal creeks, poorly drained Nimmo soils and somewhat poorly drained Dragston soils in depressions and on broad flats, very poorly drained Polawana soils in drainageways, and excessively drained Assateague soils on dunes.

The nearly level to gently sloping soils in this unit are suited to and used for vegetables, soybeans, small grains, and ornamental trees and shrubs. Increasing the organic matter content of the soils, using lime and fertilizer to offset acidity and low natural fertility, and reducing the hazard of wind erosion are the main management needs. The hazard of water erosion is a concern on the gently sloping soils. Slope and a severe erosion hazard limit the nearly level to steep areas for most uses other than woodland.

The soils in this unit are suited to trees. The soils are managed for pines and hardwoods, and productivity is moderately high to high. Seasonal wetness in the moderately well drained soils limits the use of logging equipment, and slope and erosion are major concerns on the nearly level to steep soils.

This unit has few limitations for community development. The main ones are the seasonal high water table in the moderately well drained soils and slope and seepage in the nearly level to steep soils. Rapid permeability in the sandy substrata causes a hazard of ground-water pollution in areas used for waste disposal.

2. Nimmo-Munden-Dragston

Nearly level, moderately well drained to poorly drained, loamy soils; on broad flats and in depressions

Most of the acreage of this unit is in a northeast-southwest pattern along U.S. Highway 13, on Occohannock Neck and Savage Neck, and along the eastern edge of the mainland. The landscape consists of nearly level flats and many small to large shallow depressions. Most of the soils have a seasonal high water table, and the native vegetation is pines and hardwoods.

This unit makes up about 16 percent of the county. The unit is about 52 percent Nimmo soils, 32 percent Munden soils, 7 percent Dragston soils, and 9 percent soils of minor extent.

About half of the acreage of this unit is used for cultivated crops. Most of the rest is wet areas of pines and hardwoods.

The Nimmo soils are poorly drained, the Munden soils are moderately well drained, and the Dragston soils are somewhat poorly drained. All three soils have a loamy subsoil and a sandy substratum.

Of minor extent are well drained Bojac soils on narrow elliptical ridges and broad flats, moderately well drained Seabrook soils along the base of the escarpments, and poorly drained Magotha soils and very poorly drained Chincoteague soils in tidal marshes bordering the east side of the mainland.

The moderately well drained soils in this unit are suited to and used for vegetables, soybeans, small grains, ornamental shrubs and trees, and hay and pasture. If drained, the somewhat poorly drained and poorly drained soils also are generally well suited to those uses. Besides providing drainage, the major management concerns are increasing organic matter content and using lime and fertilizer.

The soils are suited to trees and are managed for pines and hardwoods. Productivity is high. Seasonal wetness limits the use of logging equipment.

Seasonal wetness is the main limitation of the soils for community development. Rapid permeability in the sandy substrata causes a hazard of ground-water pollution in areas used for waste disposal.

3. Chincoteague-Magotha

Nearly level, very poorly drained and poorly drained, silty and loamy soils; in tidal marshes

This unit is between the mainland and the barrier islands in the zone between low tide and the lines of the spring and storm tides. Saltwater frequently floods the soils. The landscape consists of broad and narrow flats dissected by meandering creeks. The main types of native vegetation are salt-tolerant species.

This unit makes up about 28 percent of the county. The unit is about 81 percent Chincoteague soils, 4 percent Magotha soils, and 15 percent soils of minor extent.

Most of this unit provides habitat for marine and wetland wildlife and serves as a buffer against shoreline erosion and flooding. Daily tidal flooding and salt in the soil make this unit generally unsuited to or limited for most other uses.

The Chincoteague soils are in broad tidal marshes that are flooded daily. They are very poorly drained and have a silty substratum.

The Magotha soils are in long, narrow higher marshes bordering the mainland that are intermittently flooded. They have a loamy subsoil and a sandy substratum.

Of minor extent are poorly drained Nimmo soils in mainland areas that border the marshes, poorly drained Camocca soils and moderately well drained Fisherman soils on the barrier islands, and very poorly drained Polawana soils in areas where freshwater streams empty into the marshes. The unit also contains a few areas of dredge spoil, oyster reefs, and barren tidal flats.

4. Fisherman-Beaches-Camocca

Nearly level to sloping, moderately well drained and poorly drained, sandy soils and beaches; on flats and low dunes and in depressions

This unit is on the barrier islands and the southern tip of the mainland. The landscape consists of dunes, flats, depressions, and beaches broken by narrow ocean inlets. The native vegetation mainly is salt-tolerant grasses and shrubs, especially near the shore, but coniferous and deciduous trees are common inland. Most of this unit provides habitat for shorebirds and other wildlife. Some areas are used for recreation.

This unit makes up about 4 percent of the county. The unit is about 41 percent Fisherman soils, 29 percent Beaches, 27 percent Camocca soils, and 3 percent soils of minor extent.

The Fisherman soils are nearly level and gently sloping. They are on flats and dunes and in depressions and are moderately well drained and sandy throughout.

The Beaches are nearly level to sloping and are adjacent to the ocean. They consist of sandy material subject to erosion and accretion.

The Camocca soils are nearly level. They are on flats and in depressions and are poorly drained and sandy throughout.

Of minor extent are moderately sloping to steep, excessively drained Assateague soils on dunes and very poorly drained Chincoteague soils in tidal marshes.

The soils in this unit are generally unsuited to farming or woodland because of flooding, wetness, very low available water capacity, sandy texture, and a severe hazard of wind erosion.

Flooding, wetness, seepage, rapid permeability, and instability limit the soils for community development.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Bojac loamy sand, 2 to 6 percent slopes, is one of several phases in the Bojac series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Fisherman-Camocca complex, 0 to 6 percent slopes, frequently flooded, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Udorthents and Udipsamments soils, 0 to 30 percent slopes, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Beaches is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AsE—Assateague sand, 2 to 50 percent slopes. This soil is gently sloping to very steep, very deep, and excessively drained. It is on and between dunes along the Chesapeake Bay, mainly on Savage Neck, Butlers Bluff, and Picketts Harbor. The areas range from about 5 to 150 acres.

Typically, the surface layer is grayish brown sand about 4 inches thick. The substratum extends to a depth of at least 85 inches. The upper part is pale brown sand about 32 inches thick. Below that is very pale brown sand.

Included with this soil in mapping are small areas of well drained Bojac soils, moderately well drained Munden soils, and poorly drained Nimmo soils, all on flats and in depressions mainly along the boundaries of the unit. Included soils make up about 20 percent of the unit.

Permeability in this Assateague soil is very rapid. Available water capacity is very low. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is extremely acid to mildly alkaline.

This soil is used mainly for wildlife habitat and as a recreation area.

This soil is generally unsuited to cultivated crops or pasture grasses. The available water capacity and a severe erosion hazard by wind are the major limitations, and slope is an additional limitation for cultivated crops.

The potential productivity for loblolly pine on this soil is moderately high, and the estimated production of wood per acre is 65 cubic feet. Moisture stress limits seedling survival. The sandy texture and the slope limit the use of equipment for managing timber.

The permeability, the slope, droughtiness, the sandy texture, and the hazards of seepage and instability limit this soil for community development. The permeability in the substratum causes a hazard of pollution to ground water in areas used as sites for septic tanks, sewage lagoons, and sanitary landfills. The instability limits the soil as a site for shallow excavations. This soil is a probable source of sand for construction material.

Capability subclass is VIIs.

AtD—Assateague fine sand, 2 to 35 percent slopes, rarely flooded. This soil is gently sloping to steep, very deep, and excessively drained. It is on and between dunes mainly on Cobb, Smith, Hog, and Myrtle Islands. The areas range from about 5 to 50 acres. They are flooded by storm tides.

Typically, the surface layer is dark grayish brown fine sand about 4 inches thick. The substratum extends to a depth of 85 inches or more. The upper part is pale brown fine sand about 32 inches thick. Below that is very pale brown fine sand.

Included with this soil in mapping are small areas of poorly drained Camocca soils, moderately well drained Fisherman soils, and very poorly drained Chincoteague soils, all in depressions, sloughs, and marshes. Beaches are in some units. Included areas make up about 20 percent of this map unit.

Permeability in this Assateague soil is very rapid. Available water capacity is very low. Surface runoff is slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is extremely acid to mildly alkaline.

This soil is used mainly for wildlife habitat and as a recreation area.

This soil is generally unsuited to cultivated crops or pasture grasses and legumes. The main limitations are the available water capacity and a severe hazard of erosion by wind. Slope is an additional limitation for cultivated crops.

The potential productivity for loblolly pine on this soil is moderately high, and the estimated production of wood per acre is 65 cubic feet. The available water capacity is a limitation, and moisture stress limits seedling survival. The sandy texture and the slope limit the use of equipment for managing timber.

The flooding, permeability, slope, the sandy texture, droughtiness, and the hazards of seepage and instability limit this soil for community development. The permeability in the substratum causes a hazard of pollution to ground water in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The instability limits the soil as a site for shallow excavations. This soil is a probable source of sand for construction material.

Capability subclass is VIIs.

BeB—Beaches, 0 to 10 percent slopes. This unit consists of nearly level to moderately sloping sandy marine sediments deposited by wave action (fig. 3). It is mainly on the barrier islands. The areas range from 5 to 350 acres.

Included with this unit in mapping are small areas of excessively drained Assateague soils, poorly drained Camocca soils, and moderately well drained Fisherman soils, all on dunes and flats and in depressions and sloughs. Included areas make up about 25 percent of this unit.

This unit is used mainly for wildlife habitat and as a recreation area. Tidal flooding, severe erosion, and accretion of sediments limit most other uses.

Capability subclass is VIIIw.

Figure 3.—An area of Beaches, 0 to 10 percent slopes, with the Chesapeake Bay Bridge-Tunnel in the background.

BhB—Bojac loamy sand, 2 to 6 percent slopes. This soil is gently sloping, very deep, and well drained. It is on side slopes; escarpments; rims of Carolina bays, locally known as whale wallows; and undulating upland areas mainly on Wilsonia, Elliotts, and Wellington Necks. The areas range from 5 to 175 acres.

Typically, the surface layer is dark grayish brown loamy sand 6 inches thick. The subsoil is strong brown and is 32 inches thick. The upper 19 inches of the subsoil is sandy loam, and the lower 13 inches is loamy sand. The substratum is brownish yellow sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of somewhat poorly drained Dragston soils, poorly drained Nimmo soils, and moderately well drained Seabrook soils, all in depressions and on flats. Included soils make up about 20 percent of this unit.

Permeability in this Bojac soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is low. Surface runoff is medium. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to slightly acid. The seasonal high water table is more than 4 feet below the surface.

This soil is used mainly for cultivated crops. Some areas are in woodland.

This soil is moderately well suited to cultivated crops, especially soybeans, small grains, vegetables, and ornamentals. Crop production is limited by the available water capacity. The erosion hazard is moderate by water and severe by wind. Tilth is good. Crops respond well if lime and fertilizer are applied to the soil. Applications of fertilizer and lime and seasonal moisture changes produce fluctuations in available plant nutrients in the surface layer. Thus, fertilizers, particularly nitrogen, are more effective if applied as needed during the growing season rather than as a single early-spring application. The levels of calcium and magnesium in the soil fluctuate widely, making small, yearly or biyearly applications of lime necessary. Cover crops reduce wind and water erosion.

Pasture grasses and legumes are moderately well suited to this soil. The available water capacity is a limitation. The main pasture management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer.

The potential productivity for loblolly pine on this soil is high, and the estimated production of wood per acre is 110 cubic feet. Seedling survival is limited by moisture stress during periods of drought.

Community development on this soil is limited by rapid permeability and instability of the soil. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The instability limits the soil as a site for shallow excavations. The soil is a good source of material for roadfill.

Capability subclass is IIe.

BkA—Bojac sandy loam, 0 to 2 percent slopes. This soil is nearly level, very deep, and well drained. It is on broad flats on uplands, generally at an elevation of more than 25 feet above sea level. The areas range from 5 to 1,200 acres.

Typically, the surface layer is dark grayish brown sandy loam 8 inches thick. The subsurface layer is yellowish brown sandy loam 5 inches thick. The subsoil is strong brown and is 33 inches thick. The upper 25 inches of the subsoil is sandy loam, and the lower 8 inches is loamy sand. The substratum is brownish yellow sand to a depth of 60 inches or more.

Included with this soil in depressions are small areas of somewhat poorly drained Dragston soils, poorly drained Nimmo soils, and moderately well drained Seabrook soils. Included soils make up about 20 percent of this unit.

Permeability in this Bojac soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is moderate. Surface runoff is slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to slightly acid. The seasonal high water table is more than 4 feet below the surface.

This soil is used mainly for cultivated crops. Some areas are in woodland.

This soil is well suited to cultivated crops, especially soybeans, small grains, vegetables, and ornamentals (fig. 4). The erosion hazard is slight by water and moderate by wind. The tilth is good. Crops respond well if lime and fertilizer are applied to the soil. Cover crops help to reduce wind erosion.

Pasture grasses and legumes are well suited to this soil. The main pasture management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer.

The potential productivity for loblolly pine on this soil is high, and the estimated production of wood per acre is 110 cubic feet. This soil is easily managed for woodland. Seedling survival is limited by plant competition.

Community development on this soil is limited by rapid permeability and instability of the soil. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The instability limits the soil as a site for shallow excavations. The soil is a good source of material for roadfill.

Capability class is I.

BoA—Bojac fine sandy loam, 0 to 2 percent slopes. This soil is nearly level, very deep, and well drained. It is on broad flats on the low terraces, generally at an elevation of less than 25 feet above sea level. These areas are locally known as necks and are mainly along U.S. Route 13. The areas range from 5 to 1,300 acres.

Typically, the surface layer is dark brown fine sandy loam 9 inches thick. The subsoil is strong brown and is 33 inches thick. The upper 23 inches of the subsoil is fine sandy loam, and the lower 10 inches is loamy fine sand. The substratum is light yellowish brown fine sand to a depth of 80 inches or more.

Included with this soil in mapping are small areas of somewhat poorly drained Dragston soils, poorly drained Nimmo soils, and very poorly drained Polawana soils. They are in depressions and along drainageways. Included soils make up about 15 percent of this unit.

Permeability in this Bojac soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is moderate. Surface runoff is slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to slightly acid. The seasonal high water table is more than 4 feet below the surface.

Figure 4.—Cabbage plants on Bojac sandy loam, 0 to 2 percent slopes.

This soil is used mainly for cultivated crops. Some areas are in woodland.

This soil is well suited to cultivated crops, especially soybeans, small grains, vegetables, and ornamentals. The erosion hazard is slight by water and moderate by wind. The tilth is good. Crops respond well if lime and fertilizer are applied to the soil. Cover crops help to reduce wind erosion.

Pasture grasses and legumes are well suited to this soil. The main pasture management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer.

The potential productivity for loblolly pine on this soil is high, and the estimated production of wood per acre is 110 cubic feet. This soil is easily managed for woodland. Seedling survival is limited by plant competition.

Community development on this soil is limited by rapid permeability and instability of the soil. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The instability limits the soil as a site for shallow excavations. The soil is a good source of material for roadfill.

Capability class is I.

CaA—Camocca fine sand, 0 to 2 percent slopes, frequently flooded. This soil is nearly level, very deep, and poorly drained. It is in depressions and on flats on dunes and tidal marshes mainly on Fisherman, Smith, Ship Shoal, Myrtle, Cobb, and Hog Islands and Wise Point. The areas range from 5 to 200 acres.

Typically, the surface layer is very dark gray fine sand 7 inches thick. The substratum is dark gray and gray fine sand to a depth of 85 inches or more.

Included with this soil in mapping are small areas of excessively drained Assateague soils, moderately well drained Fisherman soils, and very poorly drained Chincoteague soils, all on dunes and in marshes. Beaches are in some units. Included soils make up about 25 percent of this unit.

Permeability in this Camocca soil is very rapid. The available water capacity is very low. Surface runoff is very slow. Natural fertility and shrink-swell potential are low. Organic matter content is moderate. The root zone extends to a depth of at least 60 inches. Reaction is extremely acid to moderately alkaline. The seasonal high water table is between the surface and a depth of 1 foot.

This soil is used mainly for wildlife habitat and recreation. Some areas are in woodland.

This soil is generally unsuited to cultivated crops or pasture grasses and legumes. Tidal flooding, the available water capacity, and the seasonal high water table are major limitations. A severe erosion hazard by wind is an additional limitation for cultivated crops.

Timber is poorly suited to this soil. Tidal flooding, the seasonal high water table, and salt in the soil are the main limitations. The sandy texture and the seasonal high water table limit the use of equipment for managing timber.

The seasonal high water table, the flooding, the sandy texture, and a hazard of instability limit this soil for community development. This soil is a probable source of sand for construction material.

Capability subclass is VIIIw.

ChA—Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded. This soil is nearly level, very deep, and very poorly drained. It is in tidal marshes. The areas range from about 5 to 4,000 acres.

Typically, the surface layer is dark gray silt loam 6 inches thick. The substratum is dark gray silt loam and silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of poorly drained Camocca, Magotha, and Nimmo soils, all on flats. Barren tidal flats are in some units. Included soils make up about 15 percent of this unit.

Permeability of this Chincoteague soil is moderate to moderately slow in the upper part of the substratum and rapid in the lower part. Available water capacity is very high for salt-tolerant plants. Natural fertility and shrink-swell potential are moderate. Organic matter content is moderate to high. The root zone extends to a depth of at least 60 inches for salt-tolerant plants. Reaction is slightly acid to mildly alkaline. The water table is between the surface and a depth of 3 feet. The soil is saline.

This soil is used for wetland wildlife habitat and as spawning grounds for shellfish and finfish.

This soil is generally unsuited to cultivated crops, to pasture grasses and legumes, and to timber. Tidal flooding, the high water table, and salt in the soil are major limitations.

Tidal flooding, the seasonal high water table, ponding, low strength, and salt in the soil are major limitations for community development.

Capability subclass is VIIIw.

DrA—Dragston fine sandy loam, 0 to 2 percent slopes. This soil is nearly level, very deep, and somewhat poorly drained. It is on flats and in depressions on uplands. The areas range from 5 to 150 acres.

Typically, the surface layer is dark grayish brown fine sandy loam 2 inches thick. The subsurface layer is light yellowish brown fine sandy loam 4 inches thick. The subsoil is 39 inches thick. The upper 12 inches of the subsoil is yellowish brown loam mottled with light gray. The next 21 inches is light brownish gray loam mottled with yellowish brown. The lower 6 inches is light brownish gray fine sandy loam mottled with yellowish brown and olive brown. The substratum is mottled light gray and yellowish brown fine sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Bojac soils, very poorly drained Polawana soils, and moderately well drained Seabrook soils. The Bojac soils are on broad flats. The Polawana soils are along drainageways. The Seabrook soils are on flats and in depressions and are sandy throughout. Included soils make up about 20 percent of this unit.

Permeability in this Dragston soil is moderately rapid in the subsoil and rapid in the substratum. Available water capacity is moderate. Surface runoff is very slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to slightly acid. The seasonal high water table is 1 foot to 1.5 feet below the surface.

This soil is used mainly for cultivated crops. Some areas are in woodland.

Cultivated crops are moderately well suited to this soil. Soybeans, small grains, vegetables, and ornamentals are well suited to drained areas of this soil. The instability of the substratum, however, is a limitation for open-ditch drainage systems, and sedimentation is a limitation for tile systems. The erosion hazard is slight by water and moderate by wind. Tilth is good. Crops respond well if lime and fertilizer are applied to the soil. Cover crops help reduce wind erosion.

Pasture grasses and legumes are well suited to this soil. The main pasture management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer. Grazing during periods of seasonal wetness cuts and compacts the surface layer.

The potential productivity for loblolly pine on this soil is very high, and the estimated production of wood per acre is 135 cubic feet. Seedling survival is limited by plant competition. Wetness limits the use of equipment for managing timber.

The seasonal high water table, the rapid permeability in the substratum, poor filtering capacity, and the hazards of seepage and instability limit this soil for community development. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The seasonal high water table is also a limitation for those uses, as well as for local roads and streets. The instability limits the soil as a site for shallow excavations. This soil is a source of roadfill material.

Capability subclass is IIIw undrained and IIw drained.

FhB—Fisherman fine sand, 0 to 6 percent slopes, occasionally flooded. This soil is nearly level and gently sloping, very deep, and moderately well drained. It is in depressions and on undulating areas near dunes and tidal marshes primarily on Fisherman, Smith, Ship Shoal, Myrtle, Wreck, Cobb, and Hog Islands and Wise Point. The areas range from 5 to 250 acres.

Typically, the surface layer is grayish brown fine sand 6 inches thick. The substratum extends to a depth of 85 inches or more. The upper 19 inches is light yellowish brown fine sand. Below that is grayish brown sand mottled with yellowish brown.

Included with this soil in mapping are small areas of excessively drained Assateague soils, poorly drained Camocca soils, and very poorly drained Chincoteague soils. The Assateague soils are on higher dunes. The Camocca soils are in depressions between dunes. The Chincoteague soils are in tidal marshes and are saline. Beaches are in some units. Included soils make up about 25 percent of this unit.

Permeability in this Fisherman soil is very rapid, and available water capacity is very low. Surface runoff is very slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to mildly alkaline. A seasonal high water table is 1.5 to 3.0 feet below the surface.

This soil is used mainly for wildlife habitat and recreation. Some areas are in woodland.

This soil is generally unsuited to cultivated crops or pasture grasses and legumes. Tidal flooding, the seasonal high water table, and the available water capacity are the main limitations. A severe hazard of erosion by wind is an additional limitation for cultivated crops.

The potential productivity for loblolly pine on this soil is moderately high, and the estimated production of wood per acre is 65 cubic feet. Tidal flooding, the seasonal high water table, and the available water capacity are limitations. The sandy texture and the seasonal high water table limit the use of equipment for managing timber. Seedling survival is limited by windblown sand.

The seasonal high water table, the flooding, droughtiness, seepage, a poor filtering capacity, the sandy texture, and the instability of the soil are the main limitations for community development. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The seasonal high water table is also a limitation for those uses. The instability limits the soil as a site for shallow excavations.

Capability subclass is VIs.

FmD—Fisherman-Assateague complex, 0 to 35 percent slopes, rarely flooded. This unit consists of nearly level to steep, very deep soils. The soils are in depressions and on dunes primarily on Fisherman, Smith, Myrtle, Cobb, and Hog Islands. The areas range from 5 to 100 acres. Slopes range from 0 to 6 percent on the Fisherman soils and from 2 to 35 percent on the Assateague soils. This unit is about 45 percent moderately well drained Fisherman soils, 40 percent excessively drained Assateague soils, and 15 percent other soils. These soils are so intermingled that it was not practical to map them separately.

Typically, the Fisherman soils have a surface layer of grayish brown fine sand 6 inches thick. The substratum extends to a depth of 60 inches or more. The upper part of the substratum is light yellowish brown fine sand

19 inches thick. The lower part is grayish brown sand mottled with yellowish brown.

Typically, the Assateague soils have a surface layer of dark grayish brown fine sand 4 inches thick. The substratum extends to a depth of 85 inches or more. The upper part is pale brown fine sand 32 inches thick. The lower part is very pale brown fine sand.

Included with this unit in mapping are small areas of poorly drained Camocca soils and very poorly drained Chincoteague soils. These soils are in depressions, sloughs, and marshes. Beaches are in some units.

Permeability in these Fisherman and Assateague soils is very rapid. Available water capacity is very low. Surface runoff is slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. The Fisherman soils are very strongly acid to mildly alkaline. The Assateague soils are extremely acid to mildly alkaline. The seasonal high water table is 1.5 to 3.0 feet below the surface in the Fisherman soils and more than 6 feet below the surface in the Assateague soils.

These soils are used mainly for wildlife habitat and recreation.

These soils are generally unsuited to cultivated crops or pasture grasses and legumes. Flooding and the available water capacity are major limitations. Slope and a severe hazard of erosion by wind are additional major limitations for cultivated crops.

The potential productivity for loblolly pine on this unit is moderately high, and the estimated production of wood per acre is 65 cubic feet. Flooding and the available water capacity are limitations. Seedling survival is limited by moisture stress. The sandy texture of these soils and the slope limit the use of equipment for managing timber.

Flooding, seepage, slope, poor filtering capacity, the sandy texture, the permeability, droughtiness, and instability are the main limitations of the soils for community development. The very rapid permeability in the substratum of these soils causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The seasonal high water table in the Fisherman soils is also a limitation for those uses, as well as for local roads and streets. The instability limits the soils as sites for shallow excavations. These soils are a source of sand for construction material.

Capability subclass is unassigned.

FrB—Fisherman-Camocca complex, 0 to 6 percent slopes, frequently flooded. This unit consists of nearly level and gently sloping, very deep soils. The soils are in depressions, in sloughs, on flats, and on low dunes primarily on Fisherman, Smith, Ship Shoal, Myrtle, Cobb, and Hog Islands. The areas range from 5 to 300 acres. Slopes range from 0 to 6 percent on the Fisherman soils and from 0 to 2 percent on the Camocca soils. This unit is about 45 percent moderately well drained Fisherman soils, about 35 percent poorly drained Camocca soils, and about 20 percent other soils. These soils are so intermingled that it was not practical to map them separately.

Typically, the Fisherman soils have a surface layer of grayish brown fine sand 6 inches thick. The substratum extends to a depth of 85 inches or more. The upper 19 inches is light yellowish brown fine sand. The lower part is grayish brown sand mottled with yellowish brown.

Typically, the Camocca soils have a surface layer of very dark gray fine sand 7 inches thick. The substratum is dark gray and gray fine sand to a depth of 85 inches or more.

Included with this unit in mapping are small areas of excessively drained Assateague soils and very poorly drained Chincoteague soils. The Assateague soils are on higher dunes. The Chincoteague soils are in tidal marshes. Beaches are in some units.

Permeability in these Fisherman and Camocca soils is very rapid. The available water capacity is low. Surface runoff is very slow and slow. Natural fertility is low. Organic matter content is low in the Fisherman soils and moderate in the Camocca soils. Shrink-swell potential is low. The root zone extends to a depth of 60 inches or more. Reaction is very strongly acid to mildly alkaline in the Fisherman soils and extremely acid to moderately alkaline in the Camocca soils. The seasonal high water table is 1.5 to 3.0 feet below the surface in the Fisherman soils and between the surface and a depth of 1 foot in the Camocca soils.

These soils are used mainly for wildlife habitat and recreation. Some areas of Fisherman soils are in woodland.

These soils are generally unsuited to cultivated crops or pasture grasses and legumes. Flooding by saltwater, the seasonal high water table, and the available water capacity are limitations. A severe erosion hazard by wind is an additional limitation for cultivated crops.

The potential productivity for loblolly pine on the Fisherman soils is moderately high, and the estimated production of wood per acre is 65 cubic feet. Flooding by saltwater, the seasonal high water table, and the available water capacity are limitations. The sandy texture and the seasonal high water table limit the use of equipment for managing timber on the Fisherman soils. Flooding by saltwater, the seasonal high water table, and excess salt make the Camocca soils poorly suited to timber.

The seasonal high water table, flooding, seepage, poor filtering capacity, the sandy texture, droughtiness, the permeability, and instability limit these soils for community development. The very rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The seasonal high water table is also a limitation for those uses. The instability limits the soils as sites for shallow excavations. These soils are a probable source of sand for construction material.

Capability subclass is unassigned.

MaA—Magotha fine sandy loam, 0 to 2 percent slopes, frequently flooded. This soil is nearly level, very deep, and poorly drained. It is in higher landscape positions in tidal marshes. The areas range from 5 to 100 acres.

Typically, the surface layer is gray fine sandy loam 5 inches thick. The subsoil is light gray loam mottled with brownish yellow and is 40 inches thick. The substratum is gray sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of very poorly drained Chincoteague soils, moderately well drained Munden soils, and poorly drained Nimmo soils. The Chincoteague soils are in lower tidal marshes. The Munden and Nimmo soils are on higher areas adjacent to the mainland. Also included are small barren areas of soils that contain large amounts of salt and small areas of dredge spoil. Included soils make up about 25 percent of this unit.

Permeability in this Magotha soil is moderate in the subsoil and rapid in the substratum. Available water capacity is moderate. Surface runoff is slow. Natural fertility is high. Organic matter content is medium. Shrink-swell potential is low. The root zone extends to a depth of at least 60 inches. Reaction is extremely acid to neutral. The seasonal high water table is between the surface and a depth of 1 foot.

This soil is used for wetland wildlife habitat. Flooding by saltwater, the seasonal high water table, and the salt content in the soil make this soil generally unsuited to cultivated crops, to timber, and to pasture grasses and legumes (fig. 5). Native saltgrasses, however, are used for pasture in some areas.

Flooding, the seasonal high water table, wetness, poor filtering capacity, instability of the soil, and the salt content limit this soil for most types of community development.

Capability subclass is VIIIw.

MoD—Molena loamy sand, 6 to 35 percent slopes. This soil is moderately sloping to steep, very deep, and somewhat excessively drained. It is on side slopes and escarpments on uplands. The areas range from 2 to 50 acres.

Typically, the surface layer is very dark grayish brown loamy sand 5 inches thick. The subsurface layer is light yellowish brown loamy sand 13 inches thick. The subsoil is strong brown loamy sand 28 inches thick. The substratum is strong brown sand to a depth of 72 inches or more.

Included with this soil in mapping are small areas of moderately well drained Munden soils and very poorly drained Polawana soils. The Munden soils are on broad flats. The Polawana soils are along drainageways. Included soils make up about 15 percent of this unit.

Permeability in this Molena soil is rapid, and available water capacity is low. Surface runoff is slow to medium. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction in unlimed areas is very strongly acid to moderately acid.

This soil is unsuited to cultivated crops. Slope and the available water capacity are limitations. The erosion hazard is severe.

Pasture grasses and legumes are poorly suited to this soil. If these soils are pastured, the main management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer.

Most areas of this soil are wooded. The potential productivity for loblolly pine is high, and the estimated production of wood per acre is 110 cubic feet. The available water capacity is a limitation. Slope limits use of equipment for managing timber.

Slope, the permeability, the sandy texture, instability of the soil, droughtiness, and seepage limit this soil for community development. The permeability causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The instability limits the soil as a site for shallow excavations.

Capability subclass is VIIs.

MuA—Munden sandy loam, 0 to 2 percent slopes. This soil is nearly level, very deep, and moderately well drained. It is on broad flats and in depressions on low terraces. The areas range from 5 to 300 acres.

Typically, the surface layer is very dark grayish brown sandy loam 3 inches thick. The subsurface layer is pale brown sandy loam with yellowish brown mottles

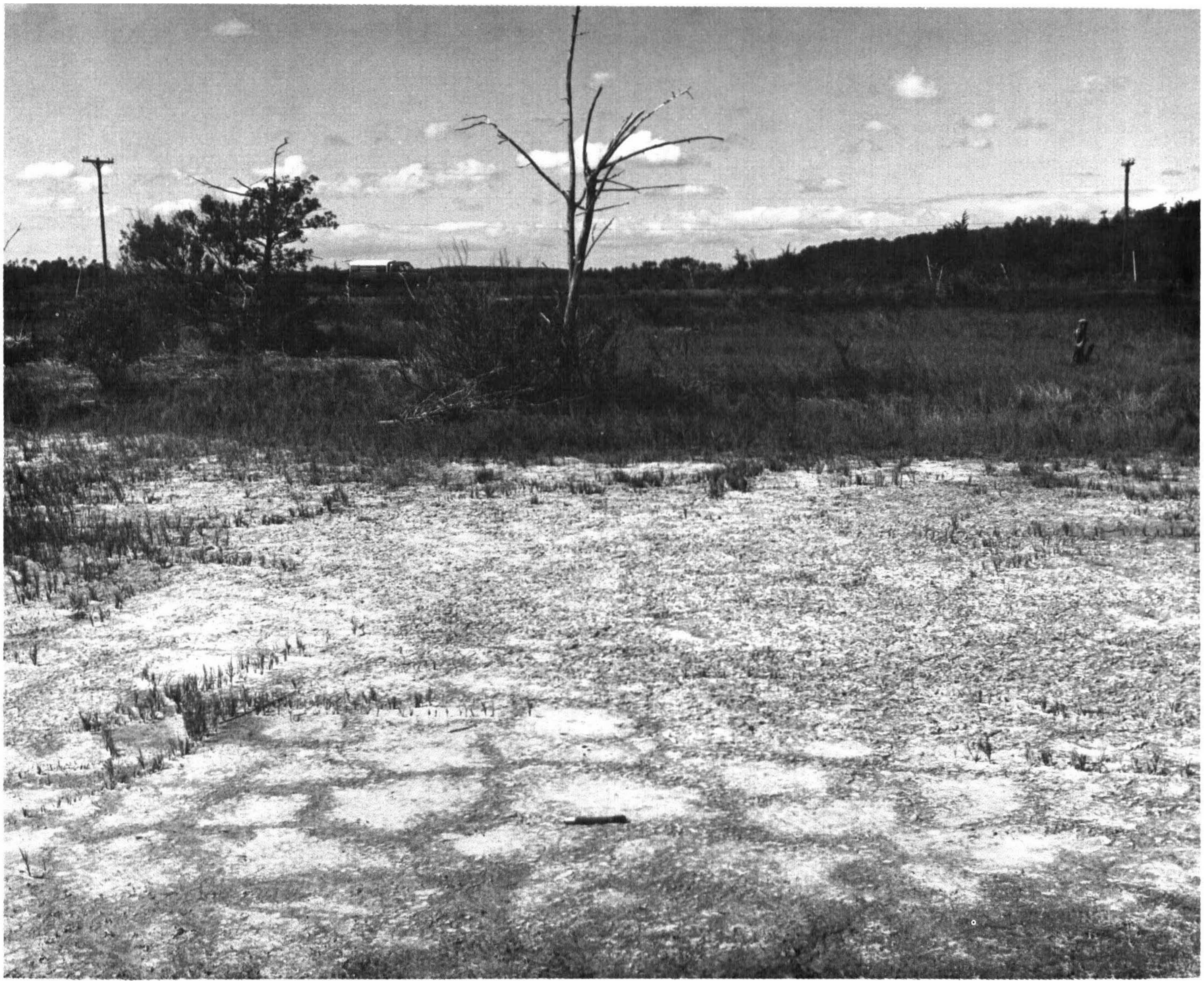


Figure 5.—The splotches on the surface of Magotha fine sandy loam, 0 to 2 percent slopes, are evidence of salt in the soil.

and is 8 inches thick. The subsoil is 31 inches thick. The upper 12 inches of the subsoil is light yellowish brown loam mottled with yellowish brown. The next 15 inches is mottled yellowish brown and light gray loam. The lower 4 inches is mottled yellowish brown and light gray sandy loam. The substratum is mottled yellowish brown and very pale brown sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of somewhat excessively drained Molena soils, poorly drained Nimmo soils, and very poorly drained Polawana soils. The Molena soils are on side slopes. The Nimmo soils are on broad flats and in depressions. The Polawana soils are along drainageways. Also included are areas of soils that have more gray or more sand, or both, in the lower part of the subsoil. Included soils make up about 20 percent of this unit.

Permeability in this Munden soil is moderate in the subsoil and rapid in the substratum. Available water capacity is moderate. Surface runoff is slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to moderately acid. The seasonal high water table is 1.5 to 2.5 feet below the surface.

This soil is used mainly for cultivated crops. Some areas are in woodland.

This soil is well suited to cultivated crops, especially soybeans, small grains, vegetables, and ornamentals. Erosion hazard is slight by water and moderate by wind (fig. 6). Tilth is good. Crops respond well if lime and fertilizer are applied to the soil. Cover crops help reduce wind erosion.

Pasture grasses and legumes are well suited to this soil. The main pasture management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer.

The potential productivity for loblolly pine on this soil is very high, and the estimated production of wood per acre is 130 cubic feet. Seedling survival is limited by plant competition. Wetness limits use of equipment for managing timber.

The seasonal high water table, seepage, the rapid permeability, and instability of the soil are the main limitations of the soil for community development. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The seasonal high water table is also a limitation for those uses. The instability limits the soil as a site for shallow excavations. Areas of this soil are a source of roadfill.

Capability subclass is IIw.

NmA—Nimmo sandy loam, 0 to 2 percent slopes. This soil is nearly level, very deep, and poorly drained. It is on flats and in depressions of Carolina bays, locally known as whale wallows, and on low terraces. The areas range from 5 to 400 acres.

Typically, the surface layer is very dark grayish brown sandy loam 4 inches thick. The subsoil is 39 inches thick. The upper 28 inches of the subsoil is light brownish gray loam mottled with yellowish brown. The lower 11 inches is grayish brown fine sandy loam mottled with yellowish brown. The substratum is light brownish gray fine sand mottled with yellow. It extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Bojac soils, moderately well drained Munden soils, and moderately well drained Seabrook soils. These soils are on higher areas. Included soils make up about 20 percent of this unit.

Permeability in this Nimmo soil is moderate in the subsoil and rapid in the substratum. Available water capacity is moderate. Surface runoff is very slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is extremely acid to strongly acid. The seasonal high water table is between the surface and a depth of 1 foot.

This soil is used mainly for cultivated crops. Some areas are in woodland.

Undrained areas of this soil are poorly suited to cultivated crops. Drained areas are moderately well suited to and used for such crops as soybeans, small grains, vegetables, and ornamentals. Instability in the substratum is a limitation for open-ditch drainage systems. Sedimentation is a hazard for tile systems. Erosion hazard is slight. Tilth is good. Crops respond well if lime and fertilizer are applied to the soil.

Pasture grasses and legumes are well suited to this soil. The main pasture management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer. Grazing during periods of seasonal wetness cuts and compacts the surface layer.

The potential productivity for loblolly pine on this soil is very high, and the estimated production of wood per acre is 140 cubic feet. Seedling survival is limited by wetness and plant competition. Wetness limits use of equipment for managing timber.

The seasonal high water table, seepage, the rapid permeability, and the instability of the soil are the main limitations for community development. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The seasonal high water table is also a limitation for those uses, as well as for local roads and streets. The instability is a limitation of the soil as a site for shallow excavations. Areas of this soil are a probable source of sand.

Capability subclass is IVw undrained and IIIw drained.

PoA—Polawana loamy sand, 0 to 2 percent slopes, occasionally flooded. This soil is nearly level, very deep, and very poorly drained. It is in drainageways along small freshwater streams on uplands and low terraces. The areas range from 2 to 30 acres.

Typically, the surface layer is black loamy sand 35 inches thick. The substratum is grayish brown fine sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of

Figure 6.—Windblown sand on Munden sandy loam, 0 to 2 percent slopes.

well drained Bojac soils, very poorly drained Chincoteague soils, and somewhat excessively drained Molena soils. The Bojac and Molena soils are in higher areas. The Chincoteague soils are in tidal marshes. Also included are areas of soils with thin lenses of finer textured material in the substratum. Included soils make up about 20 percent of this unit.

Permeability in this Polawana soil is rapid. Available water capacity is low. Surface runoff is ponded or very slow. Natural fertility and shrink-swell potential are low. Organic matter content is very high. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to neutral. The seasonal high water table is between the surface and a depth of 6 inches.

This soil is unsuited to cultivated crops. Flooding and wetness are major limitations. Erosion hazard is slight.

Pasture grasses and legumes are moderately well suited to this soil. Flooding, wetness, and weed competition are limitations. The main pasture management practices are removing excess water, maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer.

This soil is used mainly for woodland. The potential productivity for loblolly pine on this soil is very high, and the estimated production of wood per acre is 150 cubic feet. Wetness limits the use of equipment for managing timber and causes seedling mortality. Plant competition interferes with establishment of desirable timber species.

The seasonal high water table, the permeability, seepage, flooding, ponding, and instability of the soil are limitations for community development. Flooding and the water table are the major limitations.

Capability subclass is VIw.

SeA—Seabrook loamy sand, 0 to 2 percent slopes. This soil is nearly level, very deep, and moderately well drained. It is along the base of rims of Carolina bays, locally known as whale wallows, and in depressions on low terraces. The areas range from 2 to 20 acres.

Typically, the surface layer is dark grayish brown loamy sand 9 inches thick. The substratum extends to a depth of at least 85 inches. The upper 17 inches of the substratum is yellowish brown loamy sand. The next 18 inches is light brownish gray loamy sand. The lower part is light gray sand.

Included with this soil in mapping are small areas of well drained Bojac soils and poorly drained Nimmo soils. The Bojac soils are on broad flats. The Nimmo soils are on rims and in depressions. Included soils make up about 20 percent of this unit.

Permeability in this Seabrook soil is rapid, and available water capacity is low. Surface runoff is slow. Natural fertility, organic matter content, and shrink-swell potential are low. The root zone extends to a depth of at least 60 inches. Reaction is very strongly acid to slightly acid. The seasonal high water table is 2 to 4 feet below the surface.

This soil is used mainly for cultivated crops. Some areas are in woodland.

This soil is moderately well suited to cultivated crops, such as soybeans, small grains, vegetables, and ornamentals. The available water capacity is a limitation. Erosion hazard is slight by water and severe by wind. Tilth is good. Crops respond well if lime and fertilizer are applied to the soil. Applications of fertilizer and lime and seasonal moisture changes produce fluctuations in available plant nutrients in the sandy surface layer. Thus, fertilizers, particularly nitrogen, are more effective if applied as needed during the growing season rather than as a single early-spring application. The levels of calcium and magnesium in the soil fluctuate widely, making small, yearly or biyearly applications of lime necessary. Cover crops reduce wind and water erosion.

Pasture grasses and legumes are moderately well suited to this soil. The available water capacity is a limitation. The main pasture management practices are maintaining a mixture of grasses and legumes, rotation and deferred grazing, controlling weeds, using proper stocking rates, and applying lime and fertilizer.

The potential productivity for loblolly pine on this soil is very high, and the estimated production of wood per acre is 125 cubic feet. Seedling survival is limited by moisture stress. Wetness and the sandy texture limit use of equipment for managing timber.

The seasonal high water table, the permeability, seepage, the sandy texture, instability of the soil, and droughtiness are the main limitations for community development. The rapid permeability in the substratum causes a hazard of ground-water pollution in areas used as sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. The seasonal high water table is also a limitation for those uses, as well as for local roads and streets. The instability is a limitation of the soil as a site for shallow excavations.

Capability subclass is IIIs.

UPD—Udorthents and Udipsamments soils, 0 to 30 percent slopes. This unit consists of nearly level to moderately steep, very deep soils on the uplands, low terraces, and barrier islands. The units on the uplands and low terraces are in urban areas, around ponds, and along highways. Those on the barrier islands are around structures and in tidal marshes near dredged and filled areas. The areas of the unit range from 5 to 50 acres. They are about 40 percent well drained to somewhat poorly drained Udorthents, 35 percent excessively drained to somewhat poorly drained Udipsamments, and 25 percent other soils. The Udorthents are mainly fill materials, and the Udipsamments are mainly sandy materials in excavated areas. The fill areas are generally more than 20 inches thick. They contain material for roads and construction sites and spoil from dredging operations.

The texture of the fill material ranges from sandy loam to silty clay loam. The texture of the soils in excavated areas ranges from coarse sand to loamy fine sand.

Included with this unit in mapping are small areas of Bojac, Chincoteague, Magotha, Nimmo, and Polawana soils. These soils are generally near the boundaries of the unit. Areas of nonsoil materials, such as asphalt, concrete, wood, water, and shells, are in some units.

The permeability of these Udorthents and Udipsamments ranges from very slow to moderately rapid. Available water capacity ranges from low to high, depending on the texture and thickness of the soil and the amount and type of nonsoil material. Surface runoff ranges from very slow to rapid. Natural fertility and organic matter content range from low to high. The root zone is between depths of 18 inches and at least 60 inches. Reaction of these soils is extremely acid to moderately alkaline. Shrink-swell potential ranges from low to moderate. The seasonal high water table is between depths of 1.5 and more than 5 feet.

Some areas of these soils are used as wildlife habitat. Lime and fertilizer are needed to establish a plant cover in some areas.

The characteristics of this unit are so variable that onsite investigation is needed to determine the suitability for most uses.

Capability subclass is unassigned.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. Identification of prime farmland is a major step in meeting the Nation's needs for food and fiber.

The U.S. Department of Agriculture defines prime farmland as the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops while using acceptable farming methods. Prime farmland produces the highest yields and requires minimal amounts of energy and economic resources, and farming it results in the least damage to the environment.

An area identified as prime farmland must be used for producing food or fiber or must be available for those uses. Thus, urban and built-up land and water areas are not classified as prime farmland.

The general criteria for prime farmland are as follows: a generally adequate and dependable supply of moisture from precipitation or irrigation, favorable temperature and growing-season length, acceptable levels of acidity or alkalinity, few or no rocks, and permeability to air and water. Prime farmland is not excessively erodible, is not saturated with water for long periods, and is not flooded during the growing season. The slope range is mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

The survey area contains about 88,000 acres of prime farmland. That acreage makes up about 60 percent of the total acreage in the survey area and is mainly on the mainland.

The soil map units that make up prime farmland in the survey area are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4, and the location of each unit is shown on the detailed soil maps at the back of this publication. The soil properties and characteristics that affect use and management of the units are described in the section "Detailed Soil Map Units."

Some soils in table 5 are classified as prime farmland if certain limitations of the soil are overcome. The measures needed to overcome the limitations of such soils are given in parentheses after the name of the map unit.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm or sandy soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Fred Diem, extension agent for the Virginia Cooperative Extension Service, helped with the preparation of this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1983 the county had 46,000 acres of crops, according to the Cooperative Extension Service. Soybeans and small grains covered 32,200 acres. The rest of the acreage consisted mainly of Irish potatoes, sweet potatoes, cucumbers, tomatoes, snap beans, green peppers, spinach and other greens, cabbages, and nursery crops. The main trend in the mid-1980's has been toward more acreage of small grains and soybeans and less acreage of vegetables. On the mainland the soils and a climate that provides an annual average of 230 frost-free days are well suited to most of the common crops in the area. The saltmarshes and barrier islands are generally unsuited to crops and pasture.

Though most of the mainland is suited to hay and pasture, only about 500 acres in the county was used for forage crops, mainly a mixture of fescue and clover, in 1983. Proper stocking rates, rotation and deferred grazing, and lime and fertilizer help to increase the carrying capacity of pastures. Alfalfa is unsuited to the soils with a seasonal high water table.

Nursery stock is well suited to most of the mainland soils, but artificial drainage is needed on the Dragston and Nimmo soils and irrigation usually is needed throughout the county during the growing season. Liming and using peat, pine bark, and other types of organic matter are the main management practices for nursery stock.

Most of the mainland soils in the county respond well to nitrate, phosphate, and potash fertilizers. The soils are very strongly acid to moderately acid and require lime to lower the acidity for most crops. Most of those soils have a subsoil of sandy loam, fine sandy loam, or loam and have a sandy substratum at a depth of 2.5 to 4.0 feet. Therefore, the main limitation for crops, especially vegetables, is low available water capacity, and irrigation and conservation cropping systems are used in many areas.

Most of the soils in the survey area used for crops have a surface layer of sandy loam or fine sandy loam and a low content of organic matter. Incorporation of organic matter, such as manure, into the soil helps increase water retention and provides a source of nitrogen for crops. This in turn increases water infiltration, reduces surface crusting and erosion, and promotes good tilth. Leaving crop residue on the surface also helps to prevent crusting and erosion.

Erosion by water in Northampton County is generally slight, but it does occur, mainly on the moderately sloping to steep Molena soils and the gently sloping Bojac soils. Wind erosion, or soil blowing, is a hazard on all soils used for crops, particularly on the Bojac, Molena, Munden, and Seabrook soils. Erosion reduces available plant nutrients, organic matter content, water infiltration, available water capacity, and tilth. In many areas of farmland it causes hazards of pollution and sedimentation to the nearby tidal creeks. The main erosion-control practices are no-till farming, strip tilling, stubble mulching and chiseling, planting cover crops, and planting trees for windbreaks (fig. 7). A cover crop also increases the nitrogen in the soil and improves tilth.

Most of the drainage in the survey area is on the Dragston and Nimmo soils. The design of the system depends on the soil. A combined surface and subsurface system is used in some areas of poorly drained soils that are farmed intensively. Adequate drainage outlets are not available in some areas.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(5)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. The levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Figure 7.—No-till soybeans on Munden sandy loam, 0 to 2 percent slopes.

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Most of the woodland in the county is on soils that are too wet or too stony for farming or is in areas used for esthetic purposes. The total commercial woodland in the county is 30,500 acres, or about 21 percent of the county, and most of that is in units 1 and 2 on the general soil map.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, that the indicator species can produce. The larger the number, the greater the potential productivity. The number 1 indicates low productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 through 8, high; 9 through 11, very high; and 12 or more, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation for use and management. The letter *R* indicates steep slopes; *X*, stones or rocks on the surface; *W*, excessive water in or on the soil; *T*, excessive alkalinity, acidity, sodium salts, or other toxic substances in the soil; *D*, restricted rooting depth caused by bedrock, hardpan, or other restrictive layer; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, high content of rock fragments in the soil profile. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that erosion can occur as a result of site preparation or following cutting operations and where the soil is exposed, for example, roads, skid trails, fire lanes, and log handling areas. Forests that are abused by fire or overgrazing are also subject to erosion. The ratings for the erosion hazard are based on the percent of the slope and on the erosion factor K shown in table 14. A rating of *slight* indicates that no particular measures to prevent erosion are needed under ordinary conditions. A rating of *moderate* indicates that erosion control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

The proper construction and maintenance of roads, trails, landings, and fire lanes will help overcome the erosion hazard.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates equipment use normally is not restricted either in kind of equipment that can be used or time of year because of soil factors. If soil wetness is a factor, equipment use can be restricted for a period not to exceed 2 months. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If soil wetness is a factor, equipment use is restricted for 2 to 6 months. A rating of *severe* indicates that equipment use is severely restricted either in kind of equipment or season of use. If soil wetness is a factor, equipment use is restricted for more than 6 months.

Choosing the most suitable equipment and timing harvesting and other management operations to avoid seasonal limitations help overcome the equipment limitation.

Seedling mortality refers to the probability of death of naturally occurring or planted tree seedlings as influenced by kinds of soil or topographic conditions. The factors considered in rating the soils for seedling mortality are texture of the surface layer, depth and duration of the water table, rock fragments in the surface layer, rooting depth, and aspect of the slope. A rating of *slight* indicates that under usual conditions the expected mortality is less than 25 percent. A rating of *moderate* indicates that the expected mortality is 25 to 50 percent. Extra precautions are advisable. A rating of *severe* indicates that the expected mortality is more than 50 percent. Extra precautions are important. Replanting may be necessary.

The use of special planting stock and special site preparation, such as bedding, furrowing, or surface drainage, can help reduce seedling mortality.

Windthrow hazard is the likelihood of trees being uprooted (tipped over) by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions are a seasonal high water table and bedrock or a fragipan or other limiting layer. A rating of *slight* indicates that normally no trees are blown down by the wind. Strong winds may break trees but do not uproot them. A rating of *moderate* indicates that moderate or strong winds occasionally blow down a few trees during periods of soil wetness. A rating of *severe* indicates that moderate or strong winds may blow down many trees during periods of soil wetness.

The use of specialized equipment that does not damage surficial root systems during partial cutting operations can help reduce windthrow. Care in thinning or no thinning also can help reduce windthrow.

Plant competition is the likelihood of the invasion or growth of undesirable species where openings are made in the canopy. The main factors that affect plant competition are depth to the water table and available water capacity of the soil. A rating of *slight* indicates that competition from unwanted plants is not likely to suppress the more desirable species or prevent their natural regeneration. Planted seedlings have good prospects for development without undue competition. A rating of *moderate* indicates that competition may delay the natural regeneration of desirable species or of planted trees and may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent natural regeneration or restrict planted seedlings unless precautionary measures are taken.

Adequate site preparation before planting the new crop can help reduce plant competition.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Common trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, represents an expected volume produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. One cubic meter per hectare equals 14.3 cubic feet per acre.

The first tree species listed under common trees for a soil is the indicator species for that soil. The indicator species is the species that is common in the area and is generally the most productive on the soil. The productivity class of the indicator species is the number used for the ordination symbol.

Trees to plant are those that are suited to the soil and are planted for commercial wood production.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

The county provides habitat for a large and varied population of wildlife and fish. On the mainland, white-tailed deer, gray squirrel, cottontail rabbit, quail, mourning dove, woodcock, and songbirds inhabit the wooded areas and some farms. The county is a major wintering area for many species of migratory waterfowl and has a large area of wetland habitat. The saltmarshes and the barrier islands provide habitat for rails and shorebirds such as sandpipers, plovers, oystercatchers, godwits, and dowitchers. Many species of finfish and crabs, oysters, and clams inhabit the saltwater areas.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are tall fescue, orchardgrass, and clover.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are broom sedge, goldenrod, beggartick, pokeberry, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, birch, cherry, maple, apple, hawthorn, dogwood, hickory, and blackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are gray dogwood, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, swamps, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, mourning dove, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, gulls, herons, shore birds, muskrat, and frogs.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, sandy layers, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by soil texture, depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous, loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

One soil in table 16 is assigned to two hydrologic soil groups because it has a seasonal high water table that can be drained. In this instance the first letter applies to the drained condition of the soil and the second letter to the undrained condition.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable period of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional, common*, or *frequent*. *None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). *Common* is used when a classification such as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely, grayish colors or mottles in the soil. Indicated in table K are the depth to the seasonal high water table; the kind of water table—that is, *perched, artesian*, or *apparent*; and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table—Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 16 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(4)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquult (*Aqu*, meaning water, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ochraquults (*Ochr*, meaning presence of an ochric epipedon, plus *aquult*, the suborder of the Ultisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ochraquults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, thermic, Typic Ochraquults.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (3)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (4)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Assateague Series

The soils of the Assateague series are very deep and excessively drained. They formed in sandy sediments. They are on dunes and interdunal areas. Slopes range from 2 to 50 percent.

Assateague soils are near Bojac, Camocca, and Fisherman soils. Assateague soils have more sand in the solum than Bojac soils. Assateague soils are brown in the lower part of the substratum, and Camocca and Fisherman soils are gray.

Typical profile of Assateague sand, 2 to 50 percent slopes, about 0.7 mile north of the termination of Highway VA 624 and 670 yards west of Highway VA 634, on Savage Neck:

A—0 to 4 inches; grayish brown (10YR 5/2) sand; single grain; loose; common fine and medium roots; very strongly acid; gradual wavy boundary.

C1—4 to 36 inches; pale brown (10YR 6/3) sand; single grain; loose; common fine and medium roots; very strongly acid; gradual wavy boundary.

C2—36 to 85 inches; very pale brown (10YR 7/3) sand; single grain; loose; few fine roots; strongly acid.

The thickness of the A and C horizons is more than 80 inches. Reaction is extremely acid through mildly alkaline. The content of shell fragments ranges from 0 to 15 percent.

Some pedons have an O horizon that has hue of 10YR through 5Y, value of 2 or 3, and chroma of 1 through 3.

The A horizon has hue of 10YR or 2.5Y, value of 4 through 7, and chroma of 1 or 2. It is coarse sand, sand, or fine sand.

The C horizon has hue of 10YR or 2.5Y, value of 6 through 8, and chroma of 2 through 8. It is coarse sand, sand, or fine sand.

Bojac Series

The soils of the Bojac series are very deep and well drained. They formed in moderately coarse textured sediments. They are on uplands. Slopes range from 0 to 6 percent.

Bojac soils are near Dragston, Munden, and Nimmo soils but do not have the gray in the solum than is typical of those soils.

Typical profile of Bojac fine sandy loam, 0 to 2 percent slopes, about 2 miles west of the junction of Highways Business U.S. 13 and VA 630 and 17 yards south of Highway VA 630, on Old Towne Neck:

Ap—0 to 9 inches; dark brown (10YR 4/3) fine sandy loam; weak fine granular structure; friable; few fine roots; slightly acid; clear smooth boundary.

Bt1—9 to 32 inches; strong brown (7.5YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many distinct clay films and bridges between sand grains; moderately acid; gradual wavy boundary.

Bt2—32 to 42 inches; strong brown (7.5YR 5/8) loamy fine sand; weak coarse subangular blocky structure; very friable; many distinct clay films and bridges between sand grains; moderately acid; gradual wavy boundary.

C—42 to 80 inches; light yellowish brown (10YR 6/4) fine sand; few fine distinct strong brown (7.5YR 5/6) mottles; single grain; loose; moderately acid.

The solum thickness is 30 to 60 inches. The content of rock fragments is 0 to 5 percent throughout the soil. Reaction is extremely acid through slightly acid.

Some pedons have an A horizon that has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 through 6, and chroma of 1 through 4. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. It mainly is sandy loam, fine sandy loam, or loam in the upper part and loamy sand or loamy fine sand in the lower part. Some pedons have thin subhorizons of sandy clay loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 4 through 7, and chroma of 3 through 8. Mottles are in some pedons. It is sand or fine sand.

Camocca Series

The soils of the Camocca series are very deep and poorly drained. They formed in sandy marine sediments in dunes and saltmarshes. Slopes range from 0 to 2 percent.

Camocca soils are near Assateague, Chincoteague, and Fisherman soils. Camocca soils are gray in the upper part of the solum, and Assateague and Fisherman soils are brown in the upper part of the solum. Camocca soils have more sand in the solum than Chincoteague soils.

Typical profile of Camocca fine sand, 0 to 2 percent slopes, frequently flooded, about 1.3 miles northeast of

Wise Point and 0.7 mile southeast of the Chesapeake Bay Bridge-Tunnel Toll Plaza:

Oe—2 inches to 0; decayed leaves and twigs.
A—0 to 7 inches; dark gray (10YR 4/1) fine sand; single grain; loose; common fine, medium, and coarse roots; slightly acid; gradual wavy boundary.
Cg1—7 to 16 inches; dark gray (10YR 4/1) fine sand; single grain; loose; few fine roots; faint sulfur smell; slightly acid; gradual wavy boundary.
Cg2—16 to 85 inches; gray (5Y 5/1) fine sand; single grain; loose; few fine roots; faint sulfur smell; moderately acid.

The thickness of the sandy horizons is more than 80 inches. Reaction is extremely acid through moderately alkaline. The content of shell fragments ranges from 0 to 15 percent throughout the soil.

The A horizon has hue of 10YR through 5Y or is neutral. It has value of 5 through 8 and chroma of 0 through 2. It is sand or fine sand.

The Cg horizon has hue of 10YR through 5Y, value of 4 through 8, and chroma of 0 through 2. It is sand or fine sand.

Thin buried horizons are in some pedons.

Chincoteague Series

The soils of the Chincoteague series are very deep and very poorly drained. They formed in medium textured sediments. They are in saltmarshes. Slopes range from 0 to 1 percent.

Chincoteague soils are near Camocca, Magotha, and Nimmo soils. Chincoteague soils have more silt in the upper part of the solum than these soils.

Typical profile of Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded, about 2.8 miles north-northeast of the junction of Highways VA 624 and VA 600, on Mockhorn Island:

A—0 to 6 inches; dark gray (5Y 4/1) silt loam; massive; friable, slightly sticky, slightly plastic; many fine, medium, and coarse roots; 2.0 n value; moderate sulfur odor; many fiddler crab burrows; neutral (pH 7.0), extremely acid (pH 3.0) after moist incubation; diffuse smooth boundary.
Cg1—6 to 13 inches; dark gray (5Y 4/1) silt clay loam; massive; friable, slightly sticky, slightly plastic; few fine roots; 2.0 n value; moderate sulfur odor; neutral (pH 7.0), extremely acid (pH 3.0) after moist incubation; diffuse smooth boundary.
Cg2—13 to 26 inches; dark gray (5Y 4/1) silty clay loam; massive; friable, slightly sticky, slightly plastic; 2.0 n value; moderate sulfur odor; neutral (pH 7.2), extremely acid (pH 3.8) after moist incubation; diffuse smooth boundary.
Cg3—26 to 40 inches; dark gray (5Y 4/1) silty clay loam; massive; friable, slightly sticky, slightly plastic; 2.3 n value; moderate sulfur odor; neutral (pH 7.1), extremely acid (pH 2.9) after moist incubation; diffuse smooth boundary.
Cg4—40 to 60 inches; dark gray (5Y 4/1) silt loam; massive; friable, slightly sticky, slightly plastic; moderate sulfur odor; neutral, extremely acid after moist incubation.

The combined thickness of the A and C horizons is more than 60 inches. Reaction is slightly acid through mildly alkaline. After moist incubation, reaction changes to extremely acid and jarosite mottles are within a depth of 20 inches. The salt content is more than 2 percent in the upper 40 inches. Electrical conductivity is more than 16 mmhos/cm.

Some pedons have an O horizon that has hue of 10YR through 5Y, value of 2 or 3, and chroma of 1 or 2.

The A horizon has hue of 10YR through 5BG or is neutral. It has value of 2 through 5 and chroma of 0 through 2. It is fine sandy loam, loam, or silt loam.

The Cg horizon has hue of 10YR through 5BG or is neutral. It has value of 2 through 7 and chroma of 0 through 2. Mottles are in some profiles. It is loam, silt loam, silty clay loam, or clay loam to a depth of 40 inches and ranges from coarse sand to silty clay loam below a depth of 40 inches.

Dragston Series

The soils of the Dragston series are very deep and somewhat poorly drained. They formed in moderately coarse textured marine sediments. They are on uplands. Slopes range from 0 to 2 percent.

Dragston soils are near Bojac, Munden, and Nimmo soils. Dragston soils are gray in the solum, and Bojac soils are brown in the solum. Dragston soils are grayer in the upper part of the solum than Munden soils and are not as gray as Nimmo soils.

Typical profile of Dragston fine sandy loam, 0 to 2 percent slopes, about 135 yards north of Eyreville Road and 0.6 mile east of the intersection of Eyreville Road and Highway U.S. 13:

A—0 to 2 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable; common fine, medium, and coarse roots; strongly acid; abrupt wavy boundary.
E—2 to 6 inches; light yellowish brown (10YR 6/4) fine

sandy loam; common medium distinct light gray (10YR 7/2) mottles; weak fine granular structure; friable; common fine, medium, and coarse roots; strongly acid; clear wavy boundary.

Bt—6 to 18 inches; yellowish brown (10YR 5/4) loam; common medium distinct light gray (2.5Y 7/2) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common very fine and fine roots; many distinct clay films and bridges between sand grains; strongly acid; gradual wavy boundary.

Btg1—18 to 39 inches; light brownish gray (10YR 6/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many faint clay bridges between sand grains; strongly acid; gradual wavy boundary.

Btg2—39 to 45 inches; light brownish gray (10YR 6/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; friable; few fine roots; many distinct clay films and bridges between sand grains; strongly acid; clear wavy boundary.

Cg—45 to 60 inches; light gray (10YR 7/2) fine sand; many medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; strongly acid.

The solum thickness is 25 to 50 inches. Reaction is very strongly acid through slightly acid. The content of rock fragments ranges from 0 to 2 percent in the solum and 0 to 10 percent in the Cg horizon.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

Some pedons have an Ap horizon that has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 through 4. It contains few or common high- and low-chroma mottles. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The E horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. It contains high- and low-chroma mottles. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 through 8. It contains low-chroma mottles. The Btg horizon has hue of 10YR or 2.5Y or is neutral. It has value of 4 through 6 and chroma of 0 through 4, or it is mottled. The Bt and Btg horizons are sandy loam, fine sandy loam, or loam.

Some pedons have a BC horizon that has hue of 10YR or 2.5Y or is neutral, has value of 5 or 6, and has chroma of 0 through 2. It contains high-chroma mottles. It is loamy sand, loamy fine sand, sandy loam, or fine sandy loam.

The Cg or C horizon has hue of 10YR or 2.5Y or is neutral. It has value of 5 through 7 and chroma of 0 through 8. It contains high-chroma mottles. It is sand, fine sand, loamy sand, or loamy fine sand.

Fisherman Series

The soils of the Fisherman series are very deep and moderately well drained. They formed in sandy sediments. They are in depressions and undulating areas on dunes and in saltmarshes. Slopes range from 0 to 6 percent.

Fisherman soils are near Assateague, Camocca, and Chincoteague soils. Fisherman soils are gray in the lower part of the solum, and Assateague soils are brown in the lower part of the solum. Fisherman soils do not have the gray in the upper part of the solum that is typical of the Camocca and Chincoteague soils.

Typical profile of Fisherman fine sand, 0 to 6 percent slopes, occasionally flooded, about 0.6 mile south of the Chesapeake Bay Bridge-Tunnel Toll Plaza, 165 yards east of U.S. 13, at Wise Point:

A—0 to 6 inches; grayish brown (2.5Y 5/2) fine sand; single grain; loose; common fine and medium roots; very strongly acid; clear wavy boundary.

C1—6 to 14 inches; light yellowish brown (2.5Y 6/4) fine sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few fine and medium roots; moderately acid; clear wavy boundary.

C2—14 to 25 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; few fine roots; moderately acid; gradual wavy boundary.

Cg—25 to 85 inches; grayish brown (2.5Y 5/2) sand; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few fine roots; moderately acid.

The thickness of the A and C horizons is more than 80 inches. The content of shell fragments ranges from 0 to 15 percent. Reaction is very strongly acid through mildly alkaline.

Some pedons have an O horizon that has hue of 7.5YR through 5Y, value of 0 through 3, and chroma of 1 through 3.

The A horizon has hue of 10YR or 2.5Y, value of 2 through 6, and chroma of 1 through 3. It is coarse sand, sand, or fine sand.

The upper part of the C horizon has hue of 10YR or 2.5Y, value of 4 through 7, and chroma of 4 through 6. The lower part has hue of 10YR through 5Y or is neutral. It has value of 2 through 8 and chroma of 0 through 4. High-chroma mottles are in most pedons. Low-chroma mottles are at a depth of 20 to 40 inches. The C horizon is coarse sand, sand, or fine sand.

Buried horizons are in some pedons at a depth of more than 40 inches.

Magotha Series

The soils of the Magotha series are very deep and poorly drained. They formed in loamy sediments. They are in saltmarshes. Slopes range from 0 to 2 percent.

Magotha soils are near Chincoteague, Munden, and Nimmo soils. Magotha soils are more loamy in the upper part of the soil than Chincoteague soils, have higher levels of sodium than Nimmo soils, and are grayer than Munden soils.

Typical pedon of Magotha fine sandy loam, 0 to 2 percent slopes, frequently flooded, about 1.3 miles east-southeast of the junction of Highways VA 645 and VA 600 (GATR military communication station):

A—0 to 5 inches; gray (10YR 5/1) fine sandy loam; common medium prominent dark reddish brown (5YR 3/4) mottles; weak fine granular structure; friable; common fine and medium roots; slightly acid; SAR 33; clear smooth boundary.

Btg1—5 to 25 inches; light gray (10YR 6/1) loam; many medium distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and medium roots; many distinct clay films and bridges between sand grains; neutral; SAR 39; gradual wavy boundary.

Btg2—25 to 45 inches; light gray (10YR 6/1) loam; distinct brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; many distinct clay films and bridges between sand grains; neutral; SAR 36; clear wavy boundary.

Cg—45 to 60 inches; gray (10YR 5/1) sand; single grain; loose; neutral.

The solum thickness is 30 to 60 inches. The content of pebble-size rounded rock fragments ranges from 0 to 15 percent. The content of shell fragments ranges from 0 to 15 percent. Reaction is extremely acid through neutral. Sodium adsorption ratio (SAR) is more than 13. Electrical conductivity is more than 16 mmhos/cm.

Some pedons have an O horizon that has hue of 10YR through 5Y, value of 2 or 3, and chroma of 1 or 2.

The A horizon has hue of 10YR through 5Y or is neutral. It has value of 2 through 6 and chroma of 0 through 2. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

Some pedons have an Eg horizon that has hue of 10YR or 2.5Y or is neutral, has value of 4 through 7, and has chroma of 0 through 2. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The Btg horizon has hue of 10YR through 5Y or is neutral. It has value of 3 through 7 and chroma of 0 through 2. Mottles in shades of red, brown, yellow, and olive are in some pedons. It mainly is sandy loam, fine sandy loam, or loam. Some pedons have thin subhorizons of loamy sand or sandy clay loam.

The Cg horizon has hue of 10YR through 5Y or is neutral. It has value of 5 through 7 and chroma of 0 through 2. Mottles in shades of red, brown, yellow, and olive are in some pedons. It is coarse sand through loamy fine sand.

Molena Series

The soils of the Molena series are very deep and somewhat excessively drained. They formed in coarse textured sediments. They are on uplands. Slopes range from 6 to 35 percent.

Molena soils are near Bojac, Munden, and Polawana soils. Molena soils have more sand in the subsoil than Bojac or Munden soils. Molena soils are brown in the solum, and Polawana soils are gray in the solum.

Typical profile of Molena loamy sand, 6 to 35 percent slopes, about 1.1 miles south of the junction of Highways VA 600 and VA 604 and 200 yards east of Highway VA 600:

A—0 to 5 inches; very dark grayish brown (10YR 3/2) loamy sand; weak fine granular structure; very friable; common fine and medium roots; very strongly acid; clear smooth boundary.

E—5 to 18 inches; light yellowish brown (10YR 6/4) loamy sand; weak fine granular structure; very friable; common fine and medium roots; very strongly acid; clear smooth boundary.

Bt1—18 to 37 inches; strong brown (7.5YR 5/6) loamy sand; weak coarse subangular blocky structure; very friable; common fine roots; many distinct clay films and bridges between sand grains; strongly acid; gradual wavy boundary.

Bt2—37 to 46 inches; strong brown (7.5YR 5/6) loamy sand; weak coarse granular structure; very friable; few fine roots; many distinct clay films and bridges between sand grains; moderately acid; gradual wavy boundary.

C—46 to 72 inches; strong brown (7.5YR 5/8) sand; single grain; loose; medium acid.

The solum thickness is 40 to 60 inches. The content of pebble-size rounded rock fragments ranges from 0 to 15 percent in the solum and from 0 to 35 percent in the C horizon. Reaction is very strongly acid through medium acid.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 through 4. It is sand or loamy sand.

The E horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. It is sand or loamy sand.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 through 8. It mainly is loamy sand or loamy fine sand. Some pedons have thin subhorizons of sandy loam or fine sandy loam.

The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 6 through 8. It is sand or fine sand in the fine earth fraction.

Munden Series

The soils of the Munden series are very deep and moderately well drained. They formed in moderately coarse textured sediments. They are on uplands. Slopes range from 0 to 2 percent.

Munden soils are near Bojac, Dragston, and Nimmo soils. Munden soils are gray in the lower part of the subsoil, and Bojac soils are brown in the lower part of the subsoil. Munden soils are not as gray in the upper part of the solum as Dragston and Nimmo soils are.

Typical profile of Munden sandy loam, 0 to 2 percent slopes, about 670 yards west of the junction of Highways VA 600 and VA 636 and 200 yards south of Highway VA 636:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary.

E—3 to 11 inches; pale brown (10YR 6/3) sandy loam; few medium faint yellowish brown (10YR 5/4) mottles; weak coarse granular structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary.

Bt1—11 to 23 inches; light yellowish brown (10YR 6/4) loam; common medium faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots; many distinct clay films and bridges between sand grains; strongly acid; gradual wavy boundary.

Bt2—23 to 38 inches; mottled yellowish brown (10YR 5/6) and light gray (10YR 7/2) loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many distinct clay films and bridges between sand grains; very strongly acid; clear wavy boundary.

Bt3—38 to 42 inches; mottled yellowish brown (10YR 5/6) and light gray (10YR 7/2) sandy loam; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; many distinct clay films and bridges between sand grains; strongly acid; clear wavy boundary.

C1—42 to 53 inches; mottled yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) sand; single grain; loose; strongly acid; gradual wavy boundary.

C2—53 to 60 inches; very pale brown (10YR 7/4) sand; common medium distinct strong brown (7.5YR 5/8) mottles; single grain; loose; medium acid.

The solum thickness is 25 to 45 inches. Reaction is very strongly acid through moderately acid. The Ap or A horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 through 4. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The E horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 through 6. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The Bt horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 4 through 8, or it is mottled with high- and low-chroma mottles. It is sandy loam, fine sandy loam, or loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 2 through 8, or it is mottled with high- and low-chroma mottles. It is sand or fine sand.

Nimmo Series

The soils of the Nimmo series are very deep and poorly drained. They formed in moderately coarse textured marine and fluvial sediments. They are on uplands. Slopes range from 0 to 2 percent.

Nimmo soils are near Bojac, Dragston, and Munden soils. Nimmo soils are gray in the solum, and Bojac soils are brown. Nimmo soils are grayer in the upper part of the solum than Dragston and Munden soils.

Typical profile of Nimmo sandy loam, 0 to 2 percent slopes, about 0.6 mile west of the junction of Highway VA 634 and U.S. 13 and 100 yards north of Highway VA 634, across from the Virginia Department of Highways Residency Shop:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; friable; common fine, medium, and coarse roots; very strongly acid; clear wavy boundary.

Btg1—4 to 20 inches; light brownish gray (2.5Y 6/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and medium roots; many distinct clay films and bridges between sand grains; very strongly acid; gradual wavy boundary.

Btg2—20 to 32 inches; light brownish gray (10YR 6/2) loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine roots; many distinct clay films and bridges between sand grains; very strongly acid; gradual wavy boundary.

Btg3—32 to 43 inches; grayish brown (10YR 5/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; many distinct clay films and bridges between sand grains; strongly acid; gradual wavy boundary.

Cg—43 to 65 inches; light brownish gray (10YR 6/2) fine sand; common medium distinct yellow (10YR 7/6) mottles; single grain; loose; strongly acid.

The solum thickness is 25 to 45 inches. Reaction is extremely acid through strongly acid. The content of pebble-size rounded rock fragments ranges from 0 to 3 percent.

The A or Ap horizon has hue of 10YR through 5Y, value of 2 through 5, and chroma of 1 or 2. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, or loam.

The Btg horizon has hue of 10YR through 5Y, value of 4 through 7, and chroma of 1 or 2. It mainly is sandy loam, fine sandy loam, or loam. Some pedons have thin subhorizons of sandy clay loam.

The Cg horizon has hue of 10YR through 5Y or is neutral. It has value of 4 through 7 and chroma of 0 through 8. It is sand, fine sand, loamy sand, or loamy fine sand.

Polawana Series

The soils of the Polawana series are very deep and very poorly drained. They formed in coarse textured marine sediments. They are on flood plains. Slopes range from 0 to 2 percent.

Polawana soils are near Bojac, Chincoteague, and Molena soils. Polawana soils are gray throughout the solum, and Bojac and Molena soils are brown throughout the solum. Polawana soils have more sand in the upper part of the solum than Chincoteague soils.

Typical profile of Polawana loamy sand, 0 to 2 percent slopes, occasionally flooded, about 0.4 mile northwest of the intersection of Highways VA 600 and VA 617 and 50 yards west of Highway VA 600:

A—0 to 35 inches; black (10YR 2/1) loamy sand; massive; friable, slightly sticky, slightly plastic; common fine and medium roots; strongly acid; clear smooth boundary.

Cg—35 to 60 inches; grayish brown (10YR 5/2) fine sand; single grain; loose; few fine roots; strongly acid.

The thickness of the sandy horizons is more than 60 inches. Reaction is very strongly acid through neutral.

The A horizon has hue of 10YR through 5Y or is neutral. It has value of 2 or 3 and chroma of 0 through 2. It is loamy sand, loamy fine sand, or fine sand.

The Cg horizon has hue of 10YR through 5Y or is neutral. It has value of 3 through 7 and chroma of 0 through 2. It is fine sand, loamy sand, or loamy fine sand.

Seabrook Series

The soils of the Seabrook series are very deep and moderately well drained. They formed in coarse textured marine sediments. They are on uplands. Slopes range from 0 to 2 percent.

Seabrook soils are near Bojac, Munden, and Nimmo soils. Seabrook soils have more sand in the upper part of the solum than these soils.

Typical profile of Seabrook loamy sand, 0 to 2 percent slopes, about 667 yards west of the junction of Highways VA 600 and VA 633 and 67 yards south of Highway VA 633:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loamy sand; weak fine granular structure; very friable; slightly acid; clear smooth boundary.

C—9 to 26 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; slightly acid; gradual smooth boundary.

Cg1—26 to 44 inches; light brownish gray (2.5Y 6/2) loamy sand; single grain; loose; strongly acid; gradual smooth boundary.

Cg2—44 to 85 inches; light gray (2.5Y 7/2) sand; single grain; loose; medium acid.

The thickness of the sandy horizons is more than 72 inches. Reaction is very strongly acid through slightly acid.

The Ap or A horizon has hue of 10YR, value of 3 through 5, and chroma of 2 or 3. It is fine sand, loamy sand, or loamy fine sand.

The upper part of the C horizon has hue of 10YR, value of 4 through 7, and chroma of 3 through 8. The lower part has hue of 2.5Y or 5Y, value of 6 or 7, and chroma of 1 or 2. It contains high-chroma mottles in some profiles. The C horizon is sand, fine sand, loamy sand, or loamy fine sand.

Udipsamments

Udipsamments in this survey area are very deep and excessively drained to somewhat poorly drained. They formed in coarse textured sediments. They are on uplands, on flood plains, and in saltmarshes. Slopes range from 0 to 30 percent.

Udipsamments are near Bojac, Chincoteague, Magotha, Nimmo, and Polawana soils. Udipsamments are sandier in the upper part of the solum than Bojac, Chincoteague, Magotha, or Nimmo soils. Udipsamments have a lighter colored and thinner surface layer than Polawana soils.

Because of the variability of Udipsamments, a typical profile is not given. The content of shell fragments ranges from 0 to 75 percent. The content of rounded pebble-size rock fragments ranges from 0 to 35 percent. Reaction is extremely acid through moderately alkaline.

The A horizon has hue of 7.5YR through 5Y, value of 4 through 8, and chroma of 3 through 8. It is coarse sand through loamy fine sand in the fine earth fraction.

The upper part of the C horizon has hue of 7.5YR through 5Y, value of 3 through 8, and chroma of 3 through 8. The lower part has hue of 7.5YR through 5BG or is neutral. It has value of 1 through 8 and chroma of 0 through 8. It is coarse sand through loamy fine sand in the fine earth fraction.

Udorthents

Udorthents in this survey area are very deep and well drained to somewhat poorly drained. They formed in moderately coarse textured to moderately fine textured marine sediments. They are on uplands, on flood plains, and in saltmarshes. Slopes range from 0 to 30 percent.

Udorthents are near Bojac, Chincoteague, Magotha, Nimmo, and Polawana soils. Udorthents do not have the diagnostic horizons typical of the Bojac, Magotha, Nimmo, and Polawana soils and are not as gray in the upper part of the solum as Chincoteague soils.

Because of the variability of Udorthents, a typical profile is not given. The content of shell fragments ranges from 0 to 75 percent. The content of rounded pebble-size rock fragments ranges from 0 to 35 percent. Reaction is extremely acid to moderately alkaline.

The A horizon has hue of 7.5YR through 5Y, value of 4 through 8, and chroma of 3 through 8. It is sandy loam through silty clay loam in the fine earth fraction.

The upper part of the C horizon has hue of 7.5YR through 5Y, value of 3 through 8, and chroma of 3 through 8. The lower part has hue of 7.5YR through 5BG or is neutral. It has value of 1 through 8 and chroma of 0 through 8. The upper part is sandy loam through silty clay loam in the fine earth fraction. The lower part is stratified coarse sand through silty clay loam in the fine earth fraction.

Formation of the Soils

This section describes the factors of soil formation as they relate to the soils of Northampton County and explains the major processes in the development of soil horizons.

Factors of Soil Formation

Soils are formed through the interaction of five major factors: climate, parent material, plant and animal life, topography, and time. All five factors contribute to the formation of every soil; however, the relative importance of each factor differs from place to place. In some places, one factor will be dominant in the formation of a soil and determine many of its properties and characteristics.

Climate

Climatic factors such as temperature and precipitation exert a strong influence on soil formation. Temperature determines the physical, chemical, and biological activities that take place in the soil and the speed at which they take place. Water dissolves minerals, supports biological activity, and transports minerals and organic leachates through the soil.

The level of rainfall and the air temperature in Northampton County are sufficient to cause leaching of plant nutrients from the soil, oxidation of organic matter in the surface layer, and strong weathering of minerals in the soils. This generally results in soils with high acidity, low natural fertility, and low organic matter content. The precipitation has been ample enough to cause the gradual translocation of clay from the surface layer into the subsoil; consequently, most soils in the county have more clay in the subsoil than in the surface layer. Local variations in climate generally are caused by relief, the degree of direction of slope, and the proximity to large bodies of water. The climate of Northampton County is relatively uniform. Therefore, other factors account for significant differences among the soils. A more detailed description of the climate of the county is given in the "Climate" section under "General Nature of the Survey Area."

Parent Material

Parent material is the unconsolidated material from which soils form. It influences the physical, chemical, and mineralogical composition of the soil. All of the parent material of the soils of Northampton County is transported sediments that have been moved and deposited by marine and stream action. These sediments are mainly 3,000 to 5,000 feet thick over bedrock.

The soils in the county have developed from parent material on three main landforms: terraces, tidal marshes, and barrier islands. The Bojac, Dragston, Munden, and Nimmo soils formed in moderately coarse textured sediments on the mainland terraces. The Chincoteague soils formed in silty sediments in the low-energy tidal marshes. The relatively young barrier islands are the landforms for the Fisherman, Camocca, and Assateague soils, all of which formed in sandy sediments. All the soils in Northampton County are underlain by sand.

Plant and Animal Life

All living organisms influence soil formation. Vegetation, for instance, influences the amount of organic matter in the soil, which is about 1 or 2 percent on the mainland in the county and up to 20 percent in the tidal marshes. Burrowing animals, earthworms, and insects keep the soil open and porous. Micro-organisms decompose vegetation into organic matter that is incorporated into the soil. Man has also influenced soil formation by clearing woodland, by cultivating, by introducing new plants, by altering natural drainage, and by adding farm chemicals, lime, and fertilizer to the soil. Man has also had a profound negative influence on soil formation by using practices that accelerate soil erosion.

Topography

Topography, or lay of the land, influences soil formation through its effects on moisture in the soil, erosion, depth of the soil, and plant cover. It can alter the effects of parent material to the extent that several different kinds of soils may form from the same kind of parent material.

The topography of Northampton County on the mainland generally consists of broad, nearly level terraces that are broken occasionally by narrow elliptical ridges, gentle escarpments, tidal creeks, and drainageways. Gently sloping to steep areas are adjacent to creeks, bays, and major drainageways, especially on the western side of the county. The tidal-marsh topography consists of broad flats dissected by meandering drains. The barrier islands are nearly level to steep and are bordered by tidal marsh and saltwater.

In steep areas the effect of relief is erosion caused by rapid surface runoff. This erosion removes soil material and results in reduced water infiltration and percolation and movement of clay and bases. Soils formed in this kind of environment are generally thin and have weakly expressed horizons.

Nearly level and gently sloping areas are well drained or moderately well drained. Erosion is generally slight. The soils in such areas are mature and have well defined horizons. The large plane areas and depressions are wet and often ponded. Soils formed in this environment, such as those in tidal marshes and on flood plains, are mainly gray or mottled.

Time

The length of time the soil has been subjected to the other soil-forming factors strongly influences the degree of development within the soil. If the factors of soil formation have existed long enough to form well defined, genetically related horizons, and a soil is in equilibrium with its environment, the soil is considered mature. Bojac and Munden soils, for example, are mature. If, however, the soil shows little or no horizonation and if the soil-forming processes are still active, the soil is considered immature. Fisherman, Chincoteague, and Assateague soils are examples of immature soils. Several soils range in maturity between these extremes.

Soils that formed in the same kind of parent material but in areas of different topography do not necessarily mature in the same length of time. Some soils on steep slopes have no definite horizons or have weakly expressed horizons because soil material has been removed by erosion almost as rapidly as it has formed. In less sloping areas there is sufficient time for development of mature soils, such as Bojac soils.

Soils that formed in material resistant to weathering require more time to reach maturity than soils formed in easily weathered material. In some soils on flood plains, such as Chincoteague soils, the development of genetically related horizons is slowed or prevented if alluvium is being deposited frequently.

Processes of Soil Formation

Soils are formed as a result of physical and chemical weathering of parent rock. Soil formation begins with physical weathering. Large pieces of rock are broken into small pieces by frost action and other forces. These rocks and rock fragments are further reduced to sand, silt, and clay particles.

The parent materials for the soils in Northampton County are unconsolidated sediments deposited by ancient seas and streams. These sediments formed a layer in which plants could grow. Soil horizons resulted from the transfer of materials, such as organic matter and clay, from one horizon to another by downward movement of water. Organic matter was added to the mineral material as the plants and animals died.

The rock fragments and the organic matter are chemically weathered by solution, carbonation, oxidation, reduction, and the action of weak acids. These processes release potassium, calcium, magnesium, iron, and other elements from the parent material in a form that plants can use.

The transfer of materials from one part of the profile to another takes place in most soils. Clayey and organic matter are suspended in solution and moved. Calcium and other elements are leached from the surface layer. To some extent these elements are held by the clay in the subsoil or lower part of the profile, but some are leached out of the soil with the ground water.

Bases are absorbed by plant roots and stored in the stems, leaves, and twigs of plants. When the plants die and decay, they return to the soil the elements they took from it. In most of the soils of the county, the translocation and development in place of clay minerals have had a strong influence on the development of soil horizons. As the soil develops, horizons gradually develop characteristics that are recognizable and that distinguish one layer from another.

Major Soil Horizons

The results of the soil-forming factors can be distinguished by the different layers, or soil horizons, in the soil profile. The soil profile extends from the surface of the land downward to materials that are little altered by the soil-forming processes.

Most mature soils contain three major horizons, called A, B, and C horizons. These major horizons may be further subdivided by the use of subscripts and letters to indicate changes within one horizon. An example would be the Bt2 horizon, a second layer within the Bt horizon with translocated clay eluviated from the A horizon above.

The A horizon is the surface layer. It is the layer with the largest accumulation of organic matter. It is also the layer of maximum leaching, or eluviation, of clay and iron. When considerable leaching has taken place, an E horizon is formed. The E horizon of some of the soils in Northampton County shows light colors resulting from the loss of iron, aluminum, and clay minerals. Some soils have a BE horizon, which is transitional between the E and B horizons.

The B horizon is underneath the A or E horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the A or E horizon. In some soils the B horizon is formed in place by the alteration of feldspars and other primary minerals to clays rather than by illuviation from overlying horizons. The alteration may be due to oxidation and reduction of iron or the weathering of clay minerals. The B horizon is generally firmer and has a finer texture, stronger structure, and darker or redder colors than the E horizon. Most young soils do not have a B horizon.

The C horizon is below the A or B horizon. It consists of materials that are little altered by the soil-forming processes, but it may be modified by weathering.

Soil Horizon Differentiation

Several processes are involved in the formation of soil horizons, especially the formation of mineral soil horizons. Among these are the accumulation of organic matter, the leaching of soluble salts, the reduction and transfer of iron, the formation of soil structure, and the formation and translocation of clay minerals. These processes are continually taking place and have been for thousands of years.

The accumulation and incorporation of organic matter takes place with the decomposition of plant residue. These additions darken the surface layer and help to form the A horizon in mineral soils. Organic matter, once lost, normally takes a long time to replace. In Northampton County the organic matter content of the surface layer of mineral soils is about 1 or 2 percent.

For mineral soils to have a distinct subsoil, it is believed that some of the lime and soluble salts must be leached before the translocation of clay minerals. Among the factors that affect this leaching are the kinds of salts originally present, the depth to which the soil solution percolates, and the texture of the soil profile.

Well drained and moderately well drained soils in Northampton County have a yellowish brown to strong brown subsoil. These colors are caused mainly by thin coatings of iron oxides associated primarily with the clay fraction. In some soils, however, the colors are inherited from the materials in which the soil formed. The structure of well drained and moderately well drained soils is weak to moderate subangular blocky, and the subsoil contains more clay than the overlying surface layer.

The reduction and transfer of iron, called gleying, is associated mainly with the wetter, more poorly drained soils. Moderately well drained soils have yellowish brown and strong brown mottles, which indicate the segregation of iron. In poorly drained soils, such as Magotha and Nimmo soils, the subsoil and substratum are grayish, which indicates reduction and transfer of iron by removal in solution.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(4) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(5) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(6) United States Department of Agriculture. 1920. Soil survey of Accomack and Northampton Counties, Virginia, 62 pp., illus.

(7) Virginia Agricultural Experiment Station. 1985. Classification and floral relationships of seaside saltmarsh soils in Accomack and Northampton Counties, Virginia. Bull. 85-8, 146 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

Very low	0 to 2.4 inches
Low	2.4 to 3.2 inches
Moderate	3.2 to 5.2 inches
High	more than 5.2 inches

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage and planting system in which crop residue covers at least 30 percent of the soil surface after planting.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil

is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in the lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or

tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are—

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density ánd bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1949-81 at Cheriton, Virginia, and 1956-81 at Painter, Virginia)

Month	Temperature						Precipitation			
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--	
	°F	°F	°F	°F	°F	Units	In	In	In	
CHERITON:										
January---	47.9	30.3	39.1	70	10	108	3.33	3.71	2.40	4
February--	48.5	30.8	39.7	73	12	104	3.44	4.65	2.63	6
March-----	57.9	38.8	48.4	80	22	246	3.64	4.40	2.83	6
April-----	67.3	46.1	56.7	87	30	478	2.55	3.30	1.78	5
May-------	75.3	55.9	65.6	92	39	758	2.98	4.23	1.85	6
June------	82.5	64.5	73.5	95	48	949	3.20	4.69	1.63	5
July------	85.6	69.0	77.3	98	56	1087	4.27	5.91	2.29	6
August----	85.4	69.1	77.3	95	56	1090	4.28	5.59	1.94	6
September-	80.0	63.7	71.9	92	46	864	3.82	5.02	1.77	4
October---	70.7	53.8	62.3	84	34	683	3.18	5.08	1.26	4
November--	60.1	42.5	51.3	78	23	322	2.88	4.57	1.43	4
December--	50.7	34.5	42.6	73	16	146	3.22	4.11	2.35	
Yearly:										
Average-	69.3	51.4	60.4	---	---	---	---	---	---	---
Extreme-	---	---	---	102	5	---	---	---	---	---
Total---	---	---	---	---	---	6,836	40.79	55.26	24.16	61
PAINTER:										
January---	45.5	27.6	36.6	70	5	78	3.44	4.27	2.58	7
February--	48.3	29.6	39.0	70	8	90	3.43	4.44	2.08	7
March-----	55.8	36.3	46.1	79	20	224	4.14	5.04	2.72	8
April-----	66.7	45.0	55.9	86	26	473	3.00	4.05	1.85	6
May-------	74.6	54.2	64.4	91	34	756	3.55	5.15	1.99	6
June------	82.3	62.8	72.6	94	45	973	3.40	4.72	1.90	5
July------	85.9	67.5	76.7	95	51	1,137	4.29	5.73	2.00	6
August----	85.1	66.6	75.9	95	50	1,109	3.87	5.15	1.77	6
September-	79.7	60.5	70.1	91	42	899	3.41	4.45	1.84	5
October---	69.0	49.2	59.1	83	28	591	3.72	5.70	1.61	5
November--	60.0	40.6	50.3	78	20	318	2.79	5.51	1.41	5
December--	50.7	32.7	41.7	71	12	131	3.69	5.40	2.49	7
Yearly:										
Average-	67.2	47.9	57.6	---	---	---	---	---	---	---
Extreme-	---	---	---	98	-5	---	---	---	---	---
Total---	---	---	---	---	---	6,779	42.73	59.61	24.24	73

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
CHERITON:			
Last freezing temperature in spring:			
1 year in 10 later than--	Mar. 20	Mar. 29	Apr. 20
2 years in 10 later than--	Mar. 16	Mar. 18	Apr. 9
5 years in 10 later than--	Mar. 4	Mar. 14	Apr. 5
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 19	Nov. 18	Oct. 31
2 years in 10 earlier than--	Nov. 25	Nov. 23	Nov. 8
5 years in 10 earlier than--	Dec. 10	Nov. 24	Nov. 16
PAINTER:			
Last freezing temperature in spring:			
1 year in 10 later than--	Mar. 31	Apr. 16	May 9
2 years in 10 later than--	Mar. 22	Apr. 12	Apr. 22
5 years in 10 later than--	Mar. 12	Apr. 4	Apr. 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Nov. 7	Oct. 22	Oct. 15
2 years in 10 earlier than--	Nov. 12	Oct. 30	Oct. 19
5 years in 10 earlier than--	Nov. 24	Nov. 9	Oct. 29

TABLE 3.--GROWING SEASON

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
CHERITON:			
9 years in 10	253	233	207
8 years in 10	253	257	216
5 years in 10	280	263	223
2 years in 10	289	271	230
1 year in 10	295	280	238
PAINTER:			
9 years in 10	234	200	173
8 years in 10	240	203	185
5 years in 10	256	216	191
2 years in 10	278	241	206
1 year in 10	283	254	217

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AsE	Assateague sand, 2 to 50 percent slopes	499	0.3
AtD	Assateague fine sand, 2 to 35 percent slopes, rarely flooded	211	0.1
BeB	Beaches, 0 to 10 percent slopes	1,802	1.2
BhB	Bojac loamy sand, 2 to 6 percent slopes	5,483	3.8
BkA	Bojac sandy loam, 0 to 2 percent slopes	25,011	17.3
BoA	Bojac fine sandy loam, 0 to 2 percent slopes	27,558	19.1
CaA	Camocca fine sand, 0 to 2 percent slopes, frequently flooded	1,097	0.8
ChA	Chincoteague silt loam, 0 to 1 percent slopes, frequently flooded	35,387	24.4
DrA	Dragston fine sandy loam, 0 to 2 percent slopes	1,594	1.1
FhB	Fisherman fine sand, 0 to 6 percent slopes, occasionally flooded	1,685	1.2
FmD	Fisherman-Assateague complex, 0 to 35 percent slopes, rarely flooded	402	0.3
FrB	Fisherman-Camocca complex, 0 to 6 percent slopes, frequently flooded	1,551	1.1
MaA	Magotha fine sandy loam, 0 to 2 percent slopes, frequently flooded	1,848	1.3
MoD	Molena loamy sand, 6 to 35 percent slopes	4,324	3.0
MuA	Munden sandy loam, 0 to 2 percent slopes	15,063	10.4
NmA	Nimmo sandy loam, 0 to 2 percent slopes	13,312	9.2
PoA	Polawana loamy sand, 0 to 2 percent slopes, occasionally flooded	1,112	0.8
SeA	Seabrook loamy sand, 0 to 2 percent slopes	201	0.1
UPD	Udorthents and Udipsamments soils, 0 to 30 percent slopes	287	0.2
	Water	6,213	4.3
	Total	144,640	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
BhB	Bojac loamy sand, 2 to 6 percent slopes
BkA	Bojac sandy loam, 0 to 2 percent slopes
BoA	Bojac fine sandy loam, 0 to 2 percent slopes
DrA	Dragston fine sandy loam, 0 to 2 percent slopes (where drained)
MuA	Munden sandy loam, 0 to 2 percent slopes
NmA	Nimmo sandy loam, 0 to 2 percent slopes (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Wheat	Irish potatoes	Snap beans	Cucumbers	Tomatoes	Tall fescue
		Bu	Bu	Cwt	Bu	Tons	Tons	Tons
AsE, AtD-------- Assateague	VIIs	---	---	---	---	---	---	---
BeB*------------ Beaches	VIIIw	---	---	---	---	---	---	---
BhB------------- Bojac	IIe	80	50	250	120	---	12	6
BkA, BoA-------- Bojac	I	110	45	300	160	---	15	8
CaA------------- Camocca	VIIIw	---	---	---	---	---	---	---
ChA------------- Chincoteague	VIIIw	---	---	---	---	---	---	---
DrA*------------ Dragston	IIw	120	40	290	110	---	10	7
FhB------------- Fisherman	VIs	---	---	---	---	---	---	---
FmD. Fisherman-Assateague								
FrB. Fisherman-Camocca								
MaA------------- Magotha	VIIIw	---	---	---	---	---	---	---
MoD------------- Molena	VIIs	---	---	---	---	---	---	---
MuA------------- Munden	IIw	115	50	300	150	---	15	8
NmA*------------ Nimmo	IVw	120	35	290	100	---	8	7
PoA------------- Polawana	VIw	---	---	---	---	---	---	---
SeA------------- Seabrook	IIIs	65	45	250	120	12	8.5	7
UPD. Udorthents and Udipsamments								

* The yield for each column except tall fescue is based on the use of artificial drainage.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
AsE, AtD----------- Assateague	5S	Severe	Moderate	Severe	Slight	Slight	Loblolly pine-------	60	5	Loblolly pine, longleaf pine.
							Live oak------------	---	---	
							American holly------	---	---	
BhB---------------- Bojac	8S	Slight	Slight	Moderate	Slight	Moderate	Loblolly pine-------	80	8	Loblolly pine, sweetgum.
							Southern red oak----	70	4	
							Virginia pine-------	75	8	
							Sweetgum------------	80	6	
BkA, BoA----------- Bojac	8A	Slight	Slight	Slight	Slight	Moderate	Loblolly pine-------	80	8	Loblolly pine, sweetgum.
							Southern red oak----	70	4	
							Virginia pine-------	75	8	
							Sweetgum------------	80	6	
DrA---------------- Dragston	4W	Slight	Moderate	Slight	Slight	Moderate	Southern red oak----	80	4	Loblolly pine, sweetgum, yellow-poplar.
							Loblolly pine-------	86	9	
							Sweetgum------------	90	7	
							Yellow-poplar-------	90	6	
							White oak-----------	---	---	
FhB---------------- Fisherman	5S	Severe	Moderate	Moderate	Slight	Moderate	Loblolly pine-------	60	5	Loblolly pine, longleaf pine.
							Live oak------------	---	---	
							American holly------	---	---	
							Black cherry--------	---	---	
							Longleaf pine-------	60	4	
FmD**:										
Fisherman---------	5S	Severe	Moderate	Moderate	Slight	Moderate	Loblolly pine-------	60	5	Loblolly pine, longleaf pine.
							Live oak------------	---	---	
							American holly------	---	---	
							Black cherry--------	---	---	
							Longleaf pine-------	60	4	
Assateague--------	5S	Severe	Moderate	Severe	Slight	Slight	Loblolly pine-------	60	5	Loblolly pine, longleaf pine.
							Live oak------------	---	---	
							American holly------	---	---	
FrB**:										
Fisherman---------	5S	Severe	Moderate	Moderate	Slight	Moderate	Loblolly pine-------	60	5	Loblolly pine, longleaf pine.
							Live oak------------	---	---	
							American holly------	---	---	
							Black cherry--------	---	---	
							Longleaf pine-------	60	4	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Productivity class*	
FrB**: Camocca.										
MoD----------------- Molena	8S	Slight	Moderate	Moderate	Slight	Slight	Loblolly pine-------	80	8	Loblolly pine, slash pine.
							Northern red oak----	86	5	
							White oak-----------	68	4	
							Shortleaf pine------	---	---	
							Water oak-----------	---	---	
MuA----------------- Munden	9W	Slight	Moderate	Slight	Slight	Moderate	Loblolly pine-------	90	9	Loblolly pine.
							Sweetgum------------	90	7	
							White oak-----------	76	4	
NmA----------------- Nimmo	9W	Slight	Moderate	Moderate	Moderate	Severe	Loblolly pine-------	95	9	Loblolly pine, sweetgum.
							Sweetgum------------	95	8	
							White oak-----------	80	4	
							Water oak-----------	80	---	
							Red maple-----------	---	---	
PoA----------------- Polawana	7W	Slight	Severe	Severe	Slight	--------	Sweetgum------------	90	7	Sweetgum, water tupelo.
							Baldcypress---------	---	---	
							Water tupelo--------	---	---	
							Blackgum------------	---	---	
							Water oak-----------	---	---	
SeA----------------- Seabrook	9S	Slight	Moderate	Moderate	Slight	--------	Loblolly pine-------	87	9	Loblolly pine, slash pine, longleaf pine.
							Slash pine----------	87	11	
							Longleaf pine-------	70	6	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AsE: Assateague	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.	Severe: droughty, slope.
AtD: Assateague	Severe: flooding, slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty, slope.
BeB*: Beaches	Severe: flooding, wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness, flooding.	Severe: wetness, too sandy.	Severe: wetness, droughty, flooding.
BhB: Bojac	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
BkA, BoA: Bojac	Slight	Slight	Slight	Slight	Slight.
CaA: Camocca	Severe: flooding, ponding, too sandy.	Severe: ponding, too sandy, excess salt.	Severe: too sandy, ponding, flooding.	Severe: ponding, too sandy.	Severe: excess salt, ponding, droughty.
ChA: Chincoteague	Severe: flooding, ponding, excess salt.	Severe: ponding, excess salt.	Severe: ponding, flooding, excess salt.	Severe: ponding.	Severe: excess salt, excess sulfur, ponding.
DrA: Dragston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
FhB: Fisherman	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
FmD*:					
Fisherman	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Assateague	Severe: flooding, slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty, slope.
FrB*:					
Fisherman	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy, flooding.	Severe: too sandy.	Severe: droughty, flooding.
Carteret	Severe: flooding, ponding, too sandy.	Severe: ponding, too sandy, excess salt.	Severe: too sandy, ponding, flooding.	Severe: ponding, too sandy.	Severe: excess salt, ponding, droughty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MaA------------------- Magotha	Severe: flooding, wetness, excess sodium.	Severe: wetness, excess sodium, excess salt.	Severe: wetness, flooding, excess sodium.	Severe: wetness.	Severe: excess salt, excess sodium, wetness.
MoD------------------- Molena	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
MuA------------------- Munden	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
NmA------------------- Nimmo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
PoA------------------- Polawana	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
SeA------------------- Seabrook	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Severe: droughty.
UPD*: Udorthents.					
Udipsamments.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AsE, AtD----------- Assateague	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BeB*--------------- Beaches	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BhB---------------- Bojac	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
BkA, BoA----------- Bojac	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CaA---------------- Camocca	---	---	---	---	---	Fair	Good	---	---	Fair.
ChA---------------- Chincoteague	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
DrA---------------- Dragston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Fair.
FhB---------------- Fisherman	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.
FmD*:										
Fisherman---------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.
Assateague--------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
FrB*:										
Fisherman---------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.
Camocca-----------	---	---	---	---	---	Fair	Good	---	---	Fair.
MaA---------------- Magotha	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
MoD---------------- Molena	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
MuA---------------- Munden	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
NmA---------------- Nimmo	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
PoA---------------- Polawana	Very poor.	Very poor.	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair.
SeA---------------- Seabrook	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AsE: Assateague	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
AtD: Assateague	Severe: cutbanks cave, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: slope.	Severe: droughty, slope.
BeB*: Beaches	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, droughty, flooding.
BhB: Bojac	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Slight	Moderate: droughty.
BkA, BoA: Bojac	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Slight.
CaA: Camocca	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: excess salt, ponding, droughty.
ChA: Chincoteague	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: excess salt, excess sulfur, ponding.
DrA: Dragston	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
FhB: Fisherman	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: droughty.
FmD*:						
Fisherman	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: droughty.
Assateague	Severe: cutbanks cave, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: slope.	Severe: droughty, slope.
FrB*:						
Fisherman	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
Carteret	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: excess salt, ponding, droughty.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
MaA--------------- Magotha	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: excess salt, excess sodium, wetness.
MoD--------------- Molena	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MuA--------------- Munden	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
NmA--------------- Nimmo	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
PoA--------------- Polawana	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
SeA--------------- Seabrook	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
UPD*: Udorthents.						
Udipsamments.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "severe," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AsE, AtD: Assateague	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
BeB*: Beaches	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
BhB, BkA, BoA: Bojac	Moderate: wetness.	Severe: seepage.	Severe: wetness, seepage.	Severe: seepage.	Fair: thin layer.
CaA: Camocca	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
ChA: Chincoteague	Severe: flooding, ponding, percs slowly.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, ponding.	Poor: ponding, excess salt.
DrA: Dragston	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness, thin layer.
FhB: Fisherman	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
FmD*:					
Fisherman	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Assateague	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
FrB*:					
Fisherman	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
Carteret	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MaA: Magotha	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness, excess salt, excess sodium.
MoD: Molena	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
MuA: Munden	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness, thin layer.
NmA: Nimmo	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
PoA: Polawana	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
SeA: Seabrook	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
UPD*:					
Udorthents.					
Udipsamments.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AsE: Assateague	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
AtD: Assateague	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
BeB*: Beaches	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
BhB: Bojac	Good	Probable	Improbable: too sandy.	Fair: too sandy.
BkA, BoA: Bojac	Good	Probable	Improbable: too sandy.	Good.
CaA: Camocca	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, excess salt, wetness.
ChA: Chincoteague	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
DrA: Dragston	Fair: wetness.	Probable	Improbable: too sandy.	Fair: thin layer.
FhB: Fisherman	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
FmD*:				
Fisherman	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Assateague	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
FrB*:				
Fisherman	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Carteret	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, excess salt, wetness.
MaA: Magotha	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess salt, wetness, excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MoD------------------- Molena	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: slope.
MuA------------------- Munden	Fair: wetness.	Probable-------------	Improbable: too sandy.	Fair: thin layer.
NmA------------------- Nimmo	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: thin layer, wetness.
PoA------------------- Polawana	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: wetness.
SeA------------------- Seabrook	Fair: wetness.	Probable-------------	Improbable: too sandy.	Fair: too sandy, small stones.
UPD*: Udorthents.				
Udipsamments.				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "moderate" and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
AsE, AtD---------- Assateague	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
BeB*-------------- Beaches	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Flooding, slope, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, droughty.
BhB--------------- Bojac	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake, soil blowing.	Droughty.
BkA, BoA---------- Bojac	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Soil blowing---	Favorable.
CaA--------------- Camocca	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: salty water, cutbanks cave.	Ponding, flooding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, excess salt, droughty.
ChA--------------- Chincoteague	Moderate: seepage.	Severe: ponding, excess salt.	Severe: slow refill, salty water.	Ponding, flooding, excess salt.	Ponding, droughty, flooding.	Wetness, excess salt, erodes easily.
DrA--------------- Dragston	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
FhB--------------- Fisherman	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, slope, cutbanks cave.	Wetness, droughty, fast intake.	Droughty.
FmD*:						
Fisherman--------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Slope, cutbanks cave.	Wetness, droughty, fast intake.	Droughty.
Assateague-------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, droughty.
FrB*:						
Fisherman--------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, slope, cutbanks cave.	Wetness, droughty, fast intake.	Droughty.
Carteret---------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: salty water, cutbanks cave.	Ponding, flooding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, excess salt, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
MaA: Magotha	Severe: seepage.	Severe: piping, wetness, excess sodium.	Severe: salty water, cutbanks cave.	Flooding, excess salt, excess sodium.	Wetness, flooding.	Wetness, excess salt, excess sodium.
MoD: Molena	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Slope, droughty.
MuA: Munden	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, soil blowing.	Favorable.
NmA: Nimmo	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
PoA: Polawana	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Flooding, cutbanks cave, ponding.	Ponding, droughty, fast intake.	Wetness, droughty.
SeA: Seabrook	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Droughty.
UPD*:						
Udorthents.						
Udipsamments.						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AsE-------------- Assateague	0-4	Sand-------------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	4-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
AtD-------------- Assateague	0-4	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	4-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
BeB*------------- Beaches	0-6	Sand-------------	SP	A-1, A-3	0	100	75-100	5-85	0-5	---	NP
	6-60	Coarse sand, sand, fine sand.	SP	A-1, A-3	0	100	75-100	5-85	0-5	---	NP
BhB-------------- Bojac	0-6	Loamy sand-------	SM	A-2	0	95-100	95-100	50-100	15-30	<20	NP
	6-38	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	38-60	Stratified loamy fine sand to coarse sand.	SM, SP, SW-SM	A-1, A-2, A-3	0	80-100	75-100	12-100	2-35	<20	NP
BkA-------------- Bojac	0-8	Sandy loam-------	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	95-100	55-100	30-60	<25	NP-7
	8-38	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	38-60	Stratified loamy fine sand to coarse sand.	SM, SP, SW-SM	A-1, A-2, A-3	0	80-100	75-100	12-100	2-35	<20	NP
BoA-------------- Bojac	0-9	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	95-100	55-100	30-60	<25	NP-7
	9-32	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	32-60	Stratified loamy fine sand to coarse sand.	SM, SP, SW-SM	A-1, A-2, A-3	0	80-100	75-100	12-100	2-35	<20	NP
CaA-------------- Camocca	0-85	Fine sand--------	SP, SP-SM, SM	A-3, A-1-b	0-3	95-100	90-100	60-90	4-10	---	NP
ChA-------------- Chincoteague	0-6	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	98-100	70-100	50-95	20-40	NP-20
	6-60	Loam, silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	98-100	85-100	60-95	25-45	7-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
DrA-------------- Dragston	0-6	Fine sandy loam	SM, SC, SM-SC, CL-ML	A-2, A-4	0	100	95-100	60-85	30-60	<20	NP-8
	6-45	Fine sandy loam, sandy loam, loam.	SM, SC, SM-SC, CL-ML	A-2, A-4	0	100	95-100	60-85	30-60	<25	NP-10
	45-60	Sand, loamy sand, fine sandy loam.	SM, SP-SM, SM-SC	A-1, A-2, A-3	0	95-100	85-100	35-70	5-30	<18	NP-7
FhB-------------- Fisherman	0-6	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	6-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
FmD*:											
Fisherman-------	0-6	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	6-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
Assateague------	0-4	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	4-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
FrB*:											
Fisherman-------	0-6	Fine sand--------	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-10	---	NP
	6-85	Coarse sand, sand, fine sand.	SP, SW, SP-SM, SW-SM	A-1, A-3	0	100	75-100	35-99	0-8	---	NP
Camocca---------	0-85	Fine sand--------	SP, SP-SM, SM	A-3 A-1-b	0-3	95-100	90-100	60-90	4-10	---	NP
MaA-------------- Magotha	0-5	Fine sandy loam	SM, SC, ML, CL	A-2, A-4, A-6	0	100	75-100	45-95	30-65	20-35	NP-15
	5-40	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	100	75-100	45-95	30-65	20-35	NP-15
	40-63	Coarse sand, fine sand, loamy fine sand.	SC, SP-SM, SM, SM-SC	A-1, A-2	0	100	75-100	35-99	10-35	10-25	NP-10
MoD-------------- Molena	0-5	Loamy sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	55-95	5-15	---	NP
	5-46	Loamy fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	100	98-100	55-95	7-25	---	NP
	46-72	Sand, coarse sand, gravelly sand.	SP, SP-SM	A-2, A-3	0-5	90-100	60-100	51-80	2-12	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MuA-------------- Munden	0-8	Sandy loam-------	SM, SC, SM-SC	A-4	0	100	90-100	60-95	35-75	<22	NP-10
	8-42	Sandy loam, loam, fine sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	90-100	60-95	30-75	<30	NP-15
	42-60	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	90-100	50-90	5-35	<18	NP-7
NmA-------------- Nimmo	0-7	Sandy loam-------	SM, SC, SM-SC, ML	A-4	0	100	95-100	60-85	36-60	<22	NP-10
	7-43	Loam, fine sandy loam, sandy loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	100	95-100	60-95	30-75	<30	22-41
	43-65	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	95-100	50-80	5-35	<18	NP-7
PoA-------------- Polawana	0-35	Loamy sand-------	SM, SP-SM	A-2	0	100	98-100	70-90	10-35	---	NP
	35-60	Loamy fine sand, loamy sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	75-98	5-20	---	NP
SeA-------------- Seabrook	0-9	Loamy sand-------	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-99	5-25	---	NP
	9-85	Loamy fine sand, fine sand, sand.	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-100	5-25	---	NP
UPD*: Udorthents.											
Udipsamments.											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
AsE, AtD--------- Assateague	0-4	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.3	<2	Low-------	0.10	5	1	0-.5
	4-85	0-5	1.30-1.60	>20	0.02-0.06	5.6-7.8	<2	Low-------	0.10			
BeB*------------- Beaches	0-6	0-1	---	>6.0	0.03-0.05	---	<2	Low-------	0.05	5	1	<.1
	6-60	0-1	---	>6.0	0.03-0.05	---	<2	Low-------	0.05			
BhB------------- Bojac	0-6	3-8	1.20-1.50	6.0-20	0.05-0.10	3.6-6.5	<2	Low-------	0.17	3	2	.5-1
	6-38	11-16	1.35-1.55	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low-------	0.17			
	38-60	1-8	1.30-1.50	6.0-20.0	0.02-0.07	4.5-6.0	<2	Low-------	0.17			
BkA------------- Bojac	0-8	3-8	1.20-1.50	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low-------	0.24	3	3	.5-2
	8-38	11-16	1.35-1.55	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low-------	0.17			
	38-60	1-8	1.30-1.50	6.0-20.0	0.02-0.07	4.5-6.0	<2	Low-------	0.17			
BoA------------- Bojac	0-9	3-8	1.20-1.50	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low-------	0.24	3	3	.5-2
	9-32	11-16	1.35-1.55	2.0-6.0	0.08-0.16	3.6-6.5	<2	Low-------	0.17			
	32-60	1-8	1.30-1.50	6.0-20.0	0.02-0.07	4.5-6.0	<2	Low-------	0.17			
CaA------------- Camocca	0-85	5-12	1.45-1.60	>6.0	0.02-0.10	5.6-8.4	>16	Low-------	0.15	5	---	.5-2
ChA------------- Chincoteague	0-6	10-35	1.20-1.50	0.2-2.0	0.02-0.07	5.6-7.3	>16	Moderate	0.32	5	---	2-10
	6-60	20-35	1.30-1.60	0.2-2.0	0.02-0.07	5.6-7.3	>16	Moderate	0.37			
DrA------------- Dragston	0-6	4-12	1.20-1.50	2.0-6.0	0.08-0.15	4.5-5.5	<2	Low-------	0.20	4	3	1-2
	6-45	10-18	1.25-1.45	2.0-6.0	0.08-0.16	4.5-5.5	<2	Low-------	0.17			
	45-60	2-12	1.35-1.55	6.0-20.0	0.04-0.10	4.5-6.5	<2	Low-------	0.17			
FhB------------- Fisherman	0-6	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.8	<2	Low-------	0.10	5	1	0-1
	6-85	0-5	1.30-1.60	>20	0.02-0.06	4.5-7.8	<2	Low-------	0.10			
FmD*:												
Fisherman-------	0-6	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.8	<2	Low-------	0.10	5	1	0-1
	6-85	0-5	1.30-1.60	>20	0.02-0.06	4.5-7.8	<2	Low-------	0.10			
Assateague------	0-4	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.3	<2	Low-------	0.10	5	1	0-.5
	4-85	0-5	1.30-1.60	>20	0.02-0.06	5.6-7.8	<2	Low-------	0.10			
FrB*:												
Fisherman-------	0-6	0-10	1.30-1.60	>20	0.02-0.08	4.5-7.8	<2	Low-------	0.10	5	1	0-1
	6-85	0-5	1.30-1.60	>20	0.02-0.06	4.5-7.8	<2	Low-------	0.10			
Camocca---------	0-85	5-12	1.45-1.60	>6.0	0.02-0.10	5.6-8.4	>16	Low-------	0.15	5	---	.5-2
MaA------------- Magotha	0-5	10-26	1.20-1.50	0.6-6.0	0.13-0.22	4.5-7.3	>16	Low-------	0.28	5	---	2-8
	5-40	10-26	1.30-1.60	0.6-2.0	0.12-0.19	4.5-7.3	>16	Low-------	0.28			
	40-63	0-15	1.30-1.60	6.0-20	0.02-0.10	4.5-7.3	>16	Low-------	0.15			
MoD------------- Molena	0-5	2-7	1.35-1.55	6.0-20	0.05-0.07	4.5-6.5	<2	Low-------	0.10	5	---	.5-2
	5-46	5-10	1.45-1.60	6.0-20	0.06-0.09	4.5-6.0	<2	Low-------	0.17			
	46-72	<5	1.45-1.60	6.0-20	0.03-0.05	4.5-6.0	<2	Low-------	0.15			
MuA------------- Munden	0-8	4-16	1.20-1.35	2.0-6.0	0.08-0.16	4.5-6.0	<2	Low-------	0.20	4	3	1-2
	8-42	8-18	1.20-1.35	0.6-6.0	0.08-0.18	4.5-6.0	<2	Low-------	0.17			
	42-60	2-12	1.35-1.55	2.0-20.0	0.04-0.08	4.5-6.0	<2	Low-------	0.17			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
NmA--------------	0-7	4-14	1.20-1.35	2.0-6.0	0.08-0.16	3.6-5.5	<2	Low--------	0.20	4	4	1-3
Nimmo	7-43	8-18	1.20-1.35	0.6-2.0	0.08-0.18	3.6-5.5	<2	Low--------	0.17			
	43-65	1-8	1.35-1.55	2.0-20.0	0.04-0.08	3.6-5.5	<2	Low--------	0.17			
PoA--------------	0-35	2-12	1.30-1.55	6.0-20	0.07-0.12	4.5-7.3	<2	Low--------	0.10	5	8	3-12
Polawana	35-60	2-12	1.50-1.60	6.0-20	0.04-0.10	4.5-7.3	<2	Low--------	0.15			
SeA--------------	0-9	2-12	1.30-1.60	6.0-20	0.05-0.11	4.5-6.5	<2	Low--------	0.10	5	2	.5-2
Seabrook	9-85	2-12	1.30-1.60	6.0-20	0.02-0.09	4.5-6.5	<2	Low--------	0.10			
UPD*:												
Udorthents.												
Udipsamments.												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "frequent," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
AsE------------ Assateague	A	None--------	---	---	>6.0	---	---	---	---	Moderate	Low.
AtD------------ Assateague	A	Rare--------	---	---	>6.0	---	---	---	---	Moderate	Low.
BeB*----------- Beaches	D	Frequent---	Very brief to long.	Jan-Dec	0-6.0	Apparent	Jan-Dec	---	---	---	---
BhB, BkA, BoA-- Bojac	B	None--------	---	---	4.0-6.0	Apparent	Nov-Apr	---	---	Low-------	High.
CaA------------ Camocca	D	Frequent---	Very brief.	Jan-Dec	+3-1.0	Apparent	Jan-Dec	---	---	High------	High.
ChA------------ Chincoteague	D	Frequent---	Very brief.	Jan-Dec	+3.-0	Apparent	Jan-Dec	---	---	High------	High.
DrA------------ Dragston	C	None--------	---	---	1.0-2.5	Apparent	Nov-Apr	---	---	Low-------	High.
FhB------------ Fisherman	D	Occasional	Very brief.	Jan-Dec	1.5-3.0	Apparent	Jan-Dec	---	---	Low-------	Low.
FmD*:											
Fisherman------	D	Rare--------	---	---	1.5-3.0	Apparent	Jan-Dec	---	---	Low-------	Low.
Assateague-----	A	Rare--------	---	---	>6.0	---	---	---	---	Moderate	Low.
FrB*:											
Fisherman------	D	Frequent---	Very brief.	Jan-Dec	1.5-3.0	Apparent	Jan-Dec	---	---	Low-------	Low.
Camocca--------	D	Frequent---	Very brief.	Jan-Dec	+3-1.0	Apparent	Jan-Dec	---	---	High------	High.
MaA------------ Magotha	D	Frequent---	Very brief.	Jan-Dec	0-1.0	Apparent	Jan-Dec	---	---	High------	High.
MoD------------ Molena	A	None--------	---	---	>6.0	---	---	---	---	Low-------	High.
MuA------------ Munden	B	None--------	---	---	1.5-2.5	Apparent	Dec-Apr	---	---	Low-------	High.
NmA------------ Nimmo	D	None--------	---	---	0-1.0	Apparent	Dec-Apr	---	---	Low-------	High.
PoA------------ Polawana	A/D	Occasional	Very long.	Dec-Mar	+1-0.5	Apparent	Nov-Apr	---	---	High------	High.
SeA------------ Seabrook	C	None--------	---	---	2.0-4.0	Apparent	Dec-Mar	---	---	Low-------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Assateague	Mixed, thermic Typic Udipsamments
Bojac	Coarse-loamy, mixed, thermic Typic Hapludults
Camocca	Mixed, thermic Typic Psammaquents
Chincoteague	Fine-silty, mixed, nonacid, thermic Typic Sulfaquents
Dragston	Coarse-loamy, mixed, thermic Aeric Ochraquults
Fisherman	Mixed, thermic Aquic Udipsamments
Magotha	Coarse-loamy, mixed, thermic Typic Natraqualfs
Molena	Sandy, mixed, thermic Psammentic Hapludults
Munden	Coarse-loamy, mixed, thermic Aquic Hapludults
Nimmo	Coarse-loamy, mixed, thermic Typic Ochraquults
Polawana	Sandy, mixed, thermic Cumulic Humaquepts
Seabrook	Mixed, thermic Aquic Udipsamments
Udipsamments	Udipsamments
Udorthents	Udorthents

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