United States
Department of
Agriculture

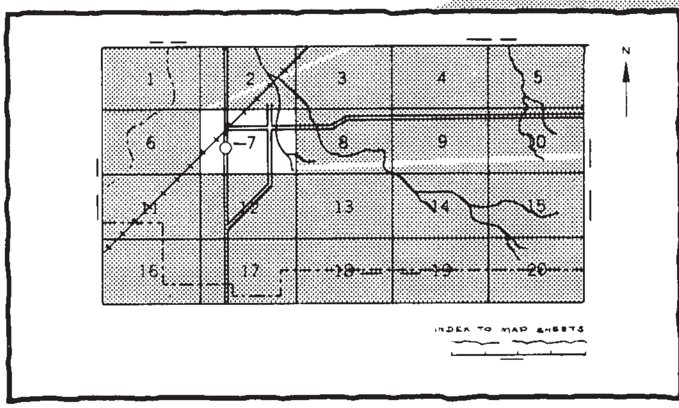
Soil
Conservation
Service

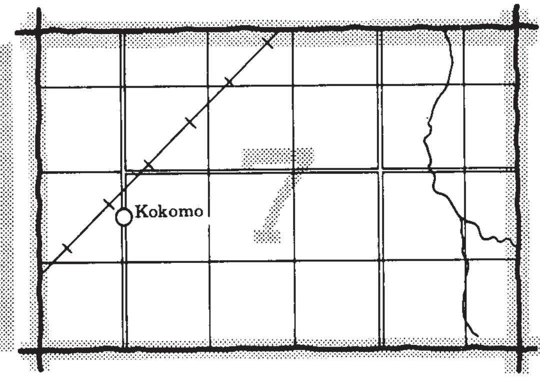
In Cooperation with
Virginia Polytechnic
Institute and
State University

Soil Survey of James City and York Counties and the City of Williamsburg Virginia

HOW TO USE

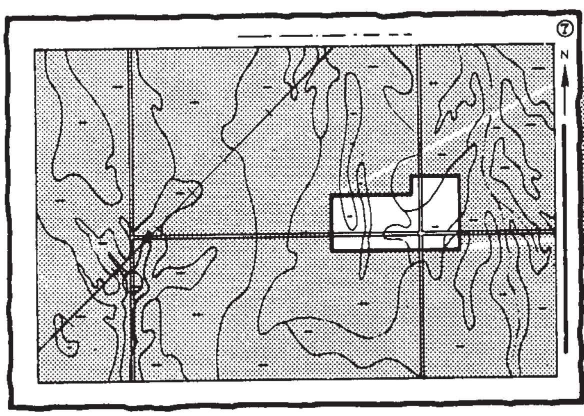
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

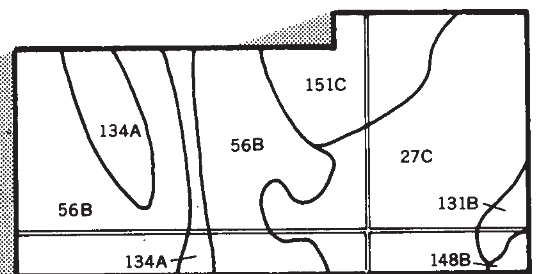




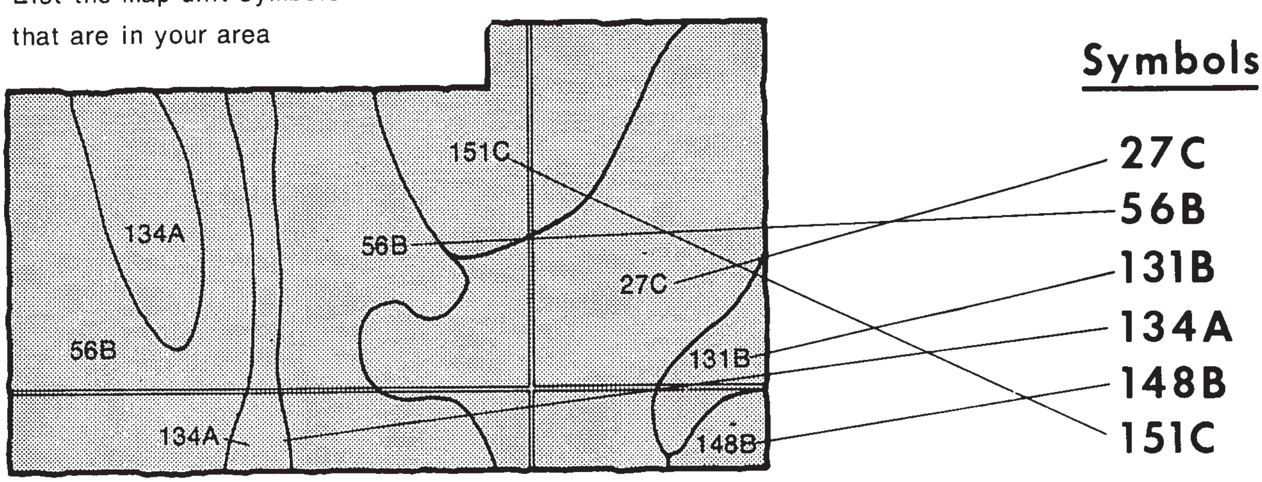
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



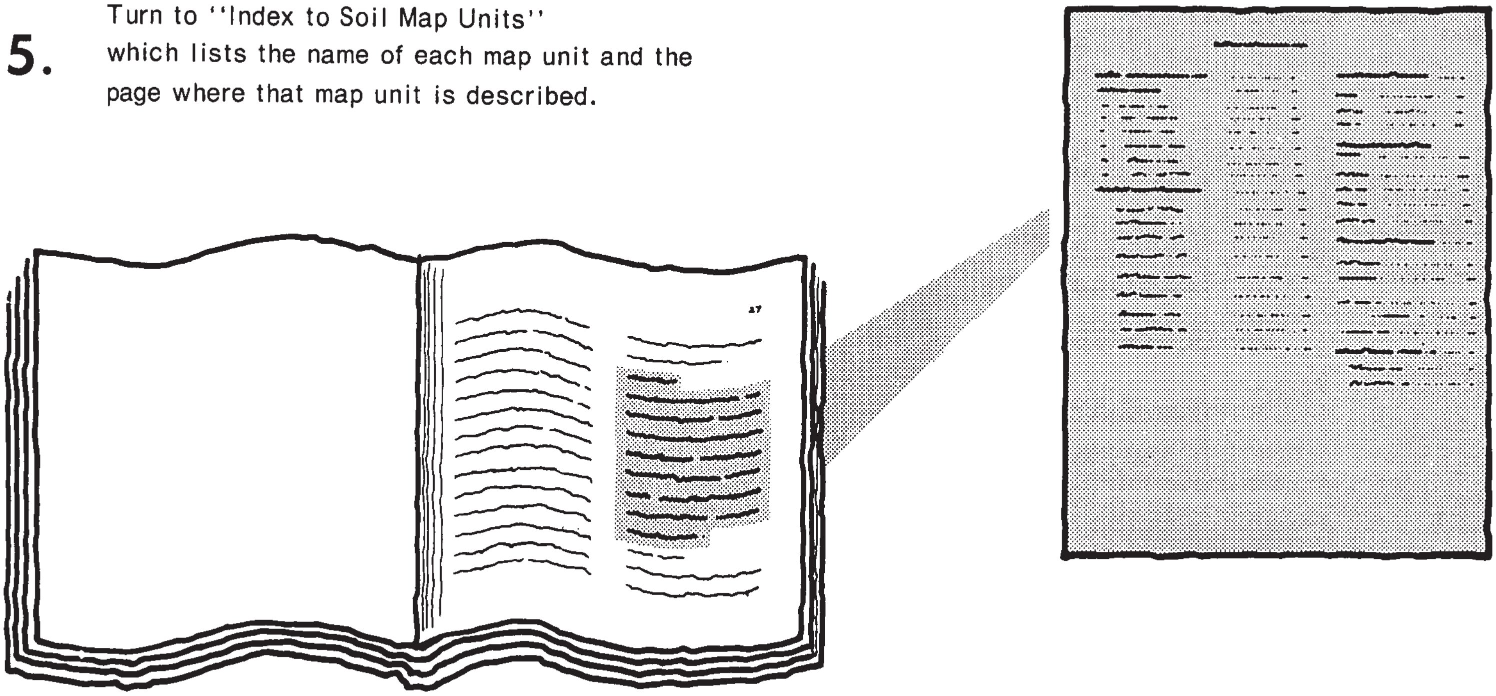


4. List the map unit symbols that are in your area

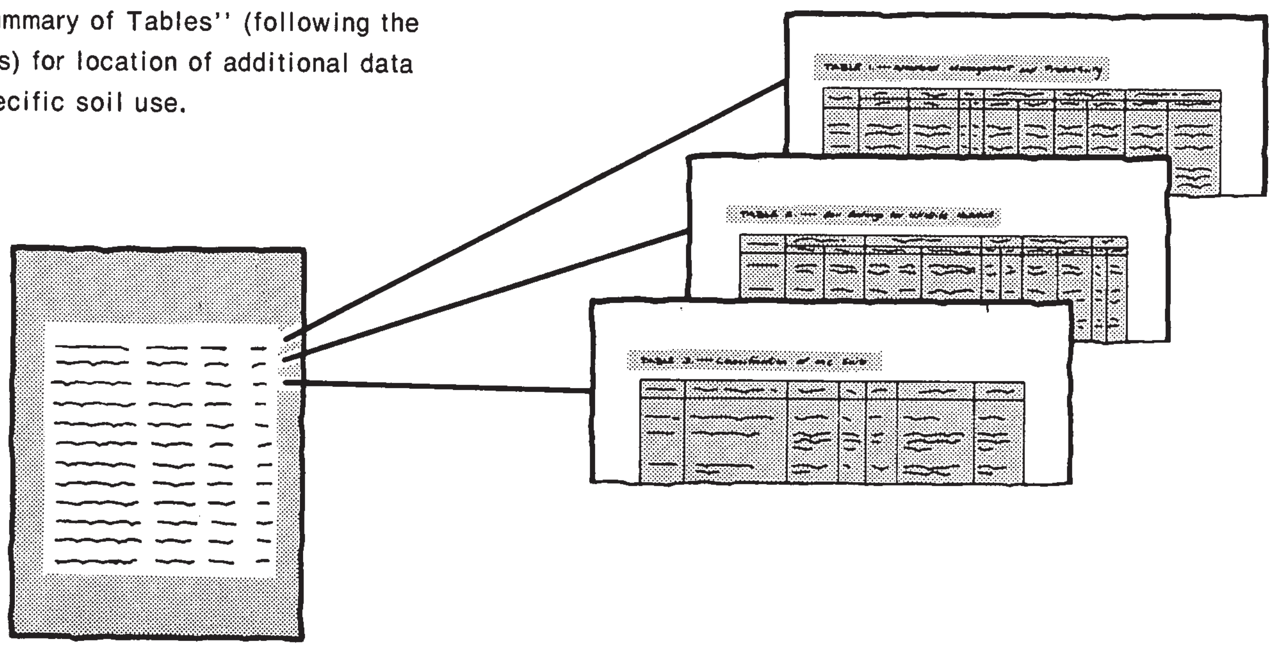


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

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, or age.

Major fieldwork for this soil survey was performed in the period September 1975 to June 1980. Soil names and descriptions were approved in January 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Soil Conservation Service and the Virginia Polytechnic Institute and State University. Assistance was provided by the Boards of Supervisors, James City County and York County; the City of Williamsburg City Council; and the Virginia Soil and Water Conservation Commission. The survey is part of the technical assistance furnished to the Colonial Soil and Water Conservation District and the City of Williamsburg.

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: Carter's Grove, a stately l8th century mansion overlooking the James River near Williamsburg, is on an area of Suffolk fine sandy loam. (Photo courtesy of The Colonial Williamsburg Foundation.)

Contents

Soil Series

Issued April 1985

Index to Map Units

Summary of Tables

Foreword

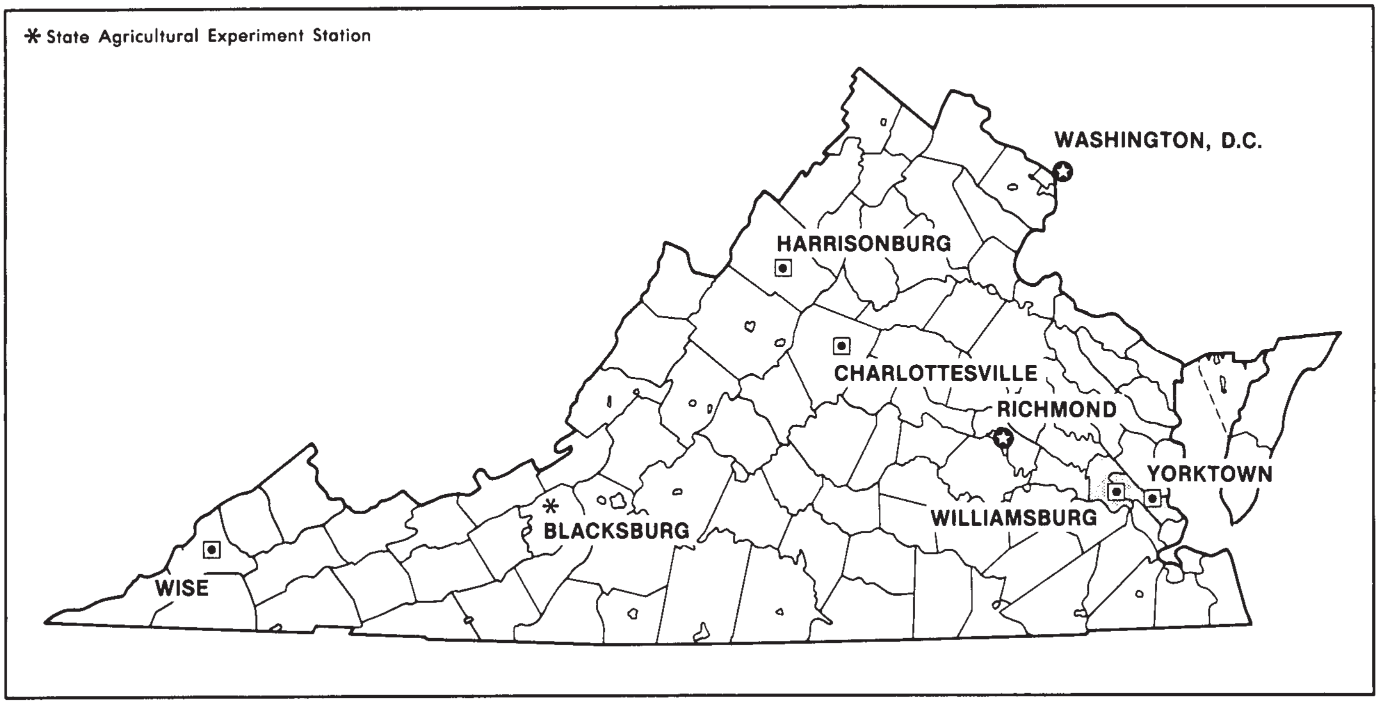
This soil survey contains information that can be used in land-planning programs in James City and York Counties and the City of Williamsburg, Virginia. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements 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 insure 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 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.

Manly S. Wilder
State Conservationist
Soil Conservation Service



Location of James City and York Counties and the City of Williamsburg in Virginia.

Soil Survey of James City and York Counties and the City of Williamsburg, Virginia

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

JAMES CITY COUNTY, YORK COUNTY, and the CITY OF WILLIAMSBURG are in the east-central Coastal Plain of Virginia in an area on the Chesapeake Bay locally known as the "Peninsula." Together, they make up the survey area of 194,848 acres, or 304.5 square miles.

Yorktown, the county seat of York County, is in the southeastern part of the survey area. The City of Williamsburg is near the center of the survey area, and although now an independent city, it also serves as the county seat of James City County. In 1979, the population of the survey area was approximately 70,000.

The tourist trade is an important part of the economy of the survey area. Historic Williamsburg, Yorktown, and Jamestown, especially, attract thousands of tourists yearly.

About 68 percent of the land area is in woodland. Only about 14 percent of the land area is used for agriculture. In recent years the number of acres farmed has been on the decline. Military installations in the survey area take up much of the land area and make up an important part of the economy.

General Nature of the Survey Area

This section gives general information about the climate, history and development, water resources, industry, transportation, agriculture, and physiography, relief, and drainage of the survey area.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Williamsburg, Virginia, in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 41 degrees F, and the average daily minimum temperature is 30 degrees. The lowest temperature on record, which occurred at Williamsburg on January 22, 1970, is 1 degree. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred at Williamsburg on June 26, 1952, is 104 degrees.

Growing degree days are shown in table 1. They 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.

Of the total annual precipitation, 26 inches, or about 55 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 21 inches. The heaviest 1-day rainfall during the period of record was 9.95 inches at Williamsburg on September 1, 1975. Thunderstorms occur on about 40 days each year, and most occur in summer.

Average seasonal snowfall is 9 inches. The greatest snow depth at any one time during the period of record was 19 inches. On an average of 3 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in March.

History and Development

James City County, named for James I of England, was one of the eight original shires into which Virginia was divided. It can rightly be called the birthplace of Virginia and of the United States because it was in this area in 1607 that the first English settlement in America was established.

From 1607 to 1698, Jamestown was the colonial capital of Virginia and one of the most important centers of trade and government in the colonies. In 1633, a second settlement was made several miles to the north at the Middle Plantation, which was on high ground and had better drainage, good water, and less danger from disease. When the State House in Jamestown burned in 1698, the capital of Virginia was moved to Middle Plantation. In 1699, Middle Plantation was renamed the City of Williamsburg in honor of King William III, and in 1779, the capital was moved to Richmond. Williamsburg is the county seat of James City County.

York County was also one of the eight original shires into which Virginia was divided. It was originally named Charles River County and was renamed York in 1643, either after Charles Duke of York who became Charles I, or in honor of James who became Duke of York and later James II. The county was settled at an early date, and by 1691, the Town of York was established. Yorktown has always been the county seat.

It was at Yorktown in 1781 that Cornwallis surrendered his British army to the allied American and French forces, bringing the Revolutionary War to an end. In 1862, York County was involved in the famous Peninsula campaign of the Civil War. In 1917 and 1918, during World War I, the York River was the base of the Atlantic Fleet of the U.S. Navy. During World War II, several important military installations were established or enlarged. These installations include the U.S. Coast Guard Officers School, the Naval Weapons Station, and Camp Peary northwest of Yorktown, near Williamsburg.

From 1779 to 1927, the growth of the population and the economy in the Peninsula outside of Richmond and the greater Hampton Roads trade centers remained static or declined.

In 1927, the restoration of Williamsburg was begun by John D. Rockefeller, Jr. The old colonial capital has been restored and serves as one of the major tourist attractions on the east coast. Jamestown Island has been restored by the National Park Service, and a unique parkway now connects Jamestown, Williamsburg, and Yorktown in a historic triangle. In recent years, this triangle and its associated tourist industries have been highly important to the local economy.

Since World War II, the great ocean terminals of Hampton Roads have markedly expanded northward. The economy depends heavily upon shipping, defense industries, military bases, and research centers. As Newport News and Hampton expanded up the Peninsula, James City County and the City of Williamsburg became very desirable residential locations. The completion of the interstate highways has made commuting a reasonable alternative to living in the more metropolitan areas and has led to increased residential development within the county.

Water Resources

Ground water from deep aquifers generally east of Williamsburg has limited use because of the high chloride content, and water from the shallow aquifers has a high iron content in some places. Wells less than 150 feet deep generally yield less than 10 gallons per minute. Wells 200 to 350 feet deep generally produce the best quality water; yields are 50 to 250 gallons per minute. In James City County the most numerous and productive aquifers occur between 350 and 550 feet below ground level. They yield from 100 gallons per minute to over 900 gallons per minute. The largest yield is from a 524-foot well near Williamsburg that has an output of 1,326 gallons per minute.

The survey area is partly bounded by the York River on the north and by the James River on the south. Both the York and James Rivers have a good flow throughout the year. There are no large freshwater streams flowing into these rivers, and the use of these rivers as a major source of water is not likely. Large quantities of freshwater can be supplied by the Chickahominy River, which forms the western boundary of James City County. Generally, the surface waters of the lower peninsula are soft and slightly acid.

Williamsburg has its own water system. James City County is served mostly by private wells. York County is served by private wells, by several privately owned water systems for subdivisions in the western part, and by the municipal water system of the City of Newport News in the eastern part of the county.

Industry

Urban and industrial developments utilize approximately 220 additional acres annually in the survey area (*3, 4*). Some principal industrial products in the peninsula area are beer, petroleum, synthetic fibers, glass and metal containers, and shipping equipment. The building of ships and turbines is based in nearby Newport News.

Transportation

U.S. Highways 60 and 17 and Interstate Highway 64 all serve the survey area, affording connections with other national and state routes. Bus service is available from Williamsburg to Richmond, Newport News, and Norfolk.

A major railway connects the survey area to other centers of the nation. This major railway from Newport News to Richmond passes through Williamsburg.

About 12 interstate carriers are authorized to handle motor freight shipments in this area (*3, 4*). Some of these carriers are authorized to handle intrastate shipments.

The Patrick Henry International Airport at Newport News is the nearest commercial airport to Williamsburg. A local airport near the city has facilities for small aircraft.

Agriculture

Farming is on the decline in the survey area. Most of the farms are now generally located in the western part of James City and York Counties and along the James River in James City County. The major crops are corn, soybeans, and small grains. A few small orchards and several small truck farms that raise specialty crops, such as beans, melons, pumpkins, and strawberries, are scattered throughout the survey area. Only a few dairies and livestock farms still operate in the survey area.

Physiography, Relief, and Drainage

The survey area lies entirely within the Atlantic Coastal Plain physiographic province in an area locally called the "Peninsula." The elevation in the survey area ranges from about sea level to 130 feet above sea level, in the western part of James City County.

The survey area consists of both wet, flat areas and well drained, nearly level to very steep areas. The eastern part of the survey area is low and flat to gently sloping and has many tidal creeks and marshes. Escarpments and side slopes that are generally short and steep dissect the areas.

West of U.S. Highway 17 the survey area generally consists of a highly dissected dendritic drainage pattern. The ridges are more pronounced, and side slopes are longer and steeper than in the eastern part. Interstate Highway 64 is the approximate watershed divide between the York River on the north and the James and Chickahominy Rivers on the south and west, respectively. Generally, streams that drain northward into the York River have very steep side slopes, and streams that drain to the south and west into the James and Chickahominy Rivers generally have longer drainageways and less steep side slopes. Also, along the rivers at an elevation of approximately 40 to 45 feet, the drainage patterns become more irregularly branched and weakly expressed. Escarpments and side slopes along these areas are generally short and steep.

The streams and creeks are generally small and are influenced by tidal action where they drain into the James and York Rivers. The marshes are mostly saline or brackish along the York River and contain brackish or fresh water along the James and Chickahominy Rivers.

How This Survey Was Made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; and the kinds of native plants or crops. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units 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 map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Soils on low coastal plains and river terraces

The soils in this group are along the major rivers. The soils formed mostly in alluvium in marshes and on low flats and stream terraces. Some formed in alluvium on high stream terraces or in fluviomarine sediments on very steep escarpments and side slopes that are adjacent to upland areas. The soils range from well drained to very poorly drained and have a substratum that is sandy or a subsoil that is loamy or clayey.

1. Tomotley-Altavista-Dragston

Deep, poorly drained, moderately well drained, and somewhat poorly drained soils that dominantly are loamy and are nearly level; on low flats and terraces

The landscape in this map unit consists of low broad flats and of terraces. The unit borders upland areas on the west and has many tidal creeks and rivers that empty into the York and Poquoson Rivers. The areas along watercourses are locally known as "necks" and "coves." The soils adjacent to the watercourses are generally better drained than those in the interior of the unit. Some of the soils in the interior have been drained by open ditches, but drainage has not been maintained in all places. Slopes range from about 0 to 3 percent, except for steeper areas along streambanks and terrace breaks.

This map unit makes up about 10 percent of the land area. The unit is about 26 percent Tomotley soils, 8 percent Altavista soils, 8 percent Dragston soils, and 58 percent soils of minor extent (fig. 1).

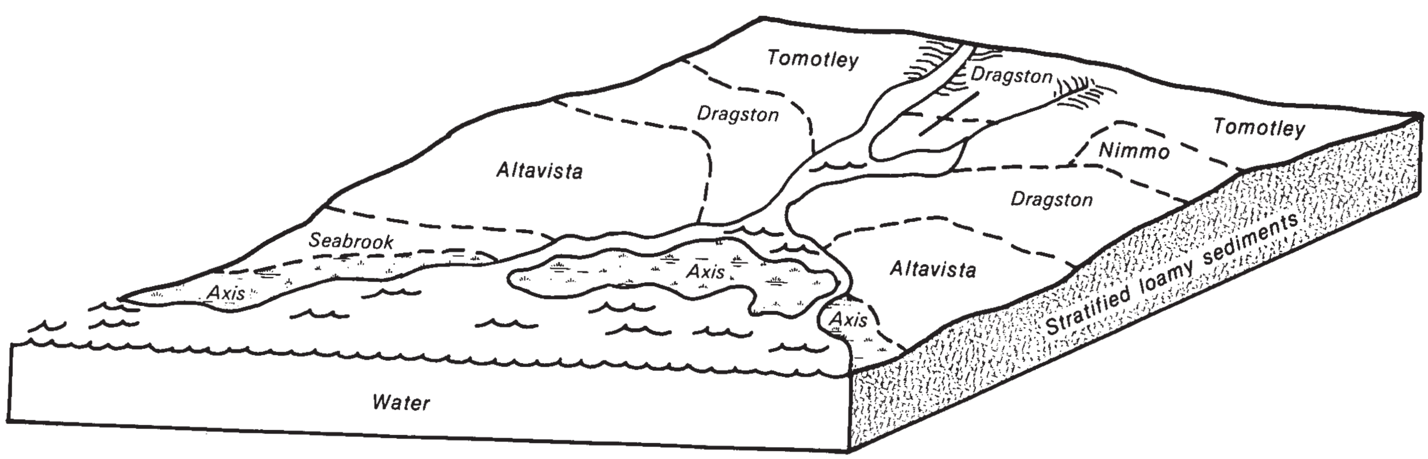

Figure 1.—Pattern of soils and underlying material in the Tomotley-Altavista-Dragston map unit.

The Tomotley soils are poorly drained and generally are in the large wet flats of the interior areas. They have a surface layer of very dark grayish brown fine sandy loam and a subsoil of mostly gray fine sandy loam and sandy clay loam.

The Altavista soils are moderately well drained and are generally near point bars and alluvial fans and along the higher streambanks. The surface layer is dark gray fine sandy loam. The subsoil is mostly yellowish brown fine sandy loam and sandy clay loam in the upper part and mottled and gray sandy clay loam in the lower part.

The somewhat poorly drained Dragston soils are generally in long, narrow areas or in transitional areas between the poorly drained soils and the moderately well drained soils. The surface layer is olive gray fine sandy loam, and the subsoil is mostly mottled olive and brown fine sandy loam.

Of minor extent in this map unit are the poorly drained Nimmo soils and the somewhat poorly drained Augusta and Yemassee soils, in scattered areas throughout the unit. Also, very poorly drained Axis soils are along the waterfronts of tidal streams. Beaches and Urban land are near the waterfronts, and the moderately well drained Seabrook and Munden soils and well drained Bojac soils are on point bars of the larger creeks.

About 50 percent of this unit has been cleared and is used mostly for farming and for community development. Soybeans and truck crops are grown in small areas, and a few small areas are in pasture. The woodland is mostly mixed hardwoods and pines on wet flats.

The moderately well drained and well drained soils are suited to crops and pasture. Droughtiness and leaching of plant nutrients are the main limitations. Overgrazing and grazing when the soils are wet are major pasture management concerns. Deep-rooted pasture grasses are needed on the more droughty soils, such as Seabrook and Bojac soils.

Most of the acreage of the poorly drained and somewhat poorly drained soils is in woodland. These soils, however, are well suited to crops and pasture if drained.

The soils in this unit are suited to trees. Water-tolerant trees, such as maple, sycamore, sweetgum, elm, ash, and water oak, occur in the broad wet areas. Loblolly pine, oaks, and yellow-poplar are moderately high in productivity on the moderately well drained and well drained soils. The sandy soils and wet soils restrict the use of logging equipment in wet seasons.

The soils in this unit are poorly suited to sanitary facilities and to community development. The seasonal high water table, flooding, and ponding are the main limitations, and pollution of ground water by onsite waste disposal is possible. The soils are subject to flooding by northeasterly storms and by hurricanes.

2. Levy-Pamunkey-Dogue

Deep, very poorly drained, well drained, and moderately well drained soils that dominantly are clayey or loamy and are nearly level or gently sloping; in freshwater marshes and on low terraces

The landscape of this map unit consists mostly of fresh and brackish water marshes and low lying flats and terraces along the James and Chickahominy Rivers. The marshes are flooded twice daily by tidal waters that are mostly brackish east of Jamestown Island and fresh west of Jamestown Island. Old stream and scour channels on the lower river terraces are still evident. In many areas the soils are undulating. Most of the acreage of this unit is drained by small streams. Slopes range from about 0 to 6 percent, except at steeper streambanks and escarpment breaks.

This map unit makes up about 5 percent of the land area. The unit is about 25 percent Levy soils, 12 percent Pamunkey soils, 9 percent Dogue soils, and 54 percent soils of minor extent (fig. 2).

The nearly level Levy soils are very poorly drained and are along the tidal creeks and streams. They have a surface layer of dark olive gray silty clay and a substratum of very dark gray silty clay.

The Pamunkey soils are well drained and gently sloping. Pamunkey soils are on the higher elevations of

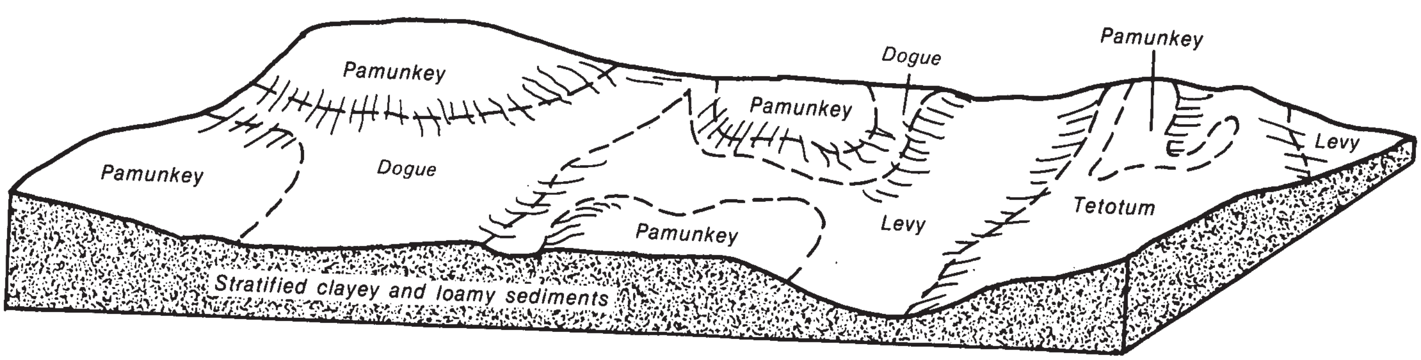

Figure 2.—Pattern of soils and underlying material in the Levy-Pamunkey-Dogue map unit.

the river terraces. They have a surface layer of dark grayish brown sandy loam. The subsoil is mostly yellowish brown sandy loam and dark brown sandy clay loam.

The nearly level Dogue soils are moderately well drained. They are mostly at intermediate elevations between the Levy and Pamunkey soils. They have a surface layer of dark grayish brown loam. The subsoil is mostly yellowish brown loam and clay in the upper part, yellowish brown and reddish yellow clay in the middle part, and gray sandy clay loam in the lower part.

Of minor extent in this map unit are the moderately well drained Altavista and Tetotum soils at intermediate elevations throughout the unit. Also of minor extent throughout the unit are the well drained Bojac soils; the moderately well drained Seabrook and Munden soils; the somewhat poorly drained Newflat, Dragston, and Augusta soils; and the poorly drained Nimmo and Tomotley soils. Beaches are along the James and Chickahominy Rivers.

About 50 percent of the acreage has been cleared and is used for farming. Soybeans, corn, and small grains are the principal crops. The wooded areas, including most of the National Park Service areas, consist of mixed hardwoods and pines.

The higher lying soils on river terraces along the James River are well suited to farming. The higher lying soils on river terraces along the Chickahominy River are well suited to farming but tend to be more droughty and less fertile than those along the James River.

The terrace soils in this map unit are suited to trees; the wooded areas are mostly of mixed hardwoods and pine. Water-tolerant species of oak, maple, and sweetgum are along the drainageways. Productivity is moderately high. The marsh soils do not generally support tree growth, but in places baldcypress may grow near the uplands or near some stream channels. The use of logging equipment is restricted on the wetter soils of this unit during winter and after large rainstorms.

The soils in this unit are poorly suited to sanitary facilities and to community development. Ground water contamination by onsite waste disposal facilities and wetness are the major limitations.

3. Emporia-Bohicket-Slagle

Deep, well drained, very poorly drained, and moderately well drained soils that dominantly are loamy or clayey and are nearly level to very steep; on escarpments and side slopes and in saline or brackish water marshes

This map unit consists of areas mostly along the York River. The landscape is that of brackish and saline water marshes, high and low river terraces, and escarpments and side slopes that join upland areas. The marshes are flooded twice daily by tidal waters. The river terraces are mostly nearly level and gently sloping and have steep side slopes. Most of the acreage is drained by small streams that have deep and well formed drainageways. Also, several large ponds and lakes are in the unit. Slopes on the terraces range from about 0 to 6 percent, and those on the escarpments and side slopes range from about 6 to 50 percent.

This map unit makes up about 10 percent of the land area. The unit is about 30 percent Emporia soils, 12 percent Bohicket soils, 12 percent Slagle soils, and 46 percent soils of minor extent.

The Emporia soils are well drained and are mostly gently sloping to very steep. They are mostly on the side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled, gray and brown, firm sandy clay loam in the lower part.

The nearly level Bohicket soils are very poorly drained and are along tidal rivers and creeks. They have a surface layer of dark gray muck and a substratum of dark gray clay and silty clay.

The Slagle soils, which are mostly nearly level and gently sloping, are moderately well drained and are on high terrace positions. They are separated from the marshes and from higher uplands by steep slopes and escarpments. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is mostly mottled, yellowish brown clay loam in the upper part and mottled clay loam and sandy clay loam in the lower part.

Of minor extent in this map unit are the well drained Pamunkey and Bojac soils on points of ridges and the moderately well drained Altavista, Munden, Dogue, and Craven soils, the somewhat poorly drained Newflat and Dragston soils, and the poorly drained Chickahominy soils, which are scattered throughout the unit. The very poorly drained Johnston soils are along drainageways. The very poorly drained Axis soils are in the marshes; Beaches are along waterfronts; and areas of Urban land are concentrated mostly along the waterfronts.

About 10 percent of the acreage has been cleared and is used for military bases, subdivisions, and farming. Soybeans, corn, and pasture are the main crops.

The terrace and upland soils in this unit are suited to trees; however, the marsh soils are not suited to trees. The majority of the woodland on the uplands is mixed hardwoods and pines. Productivity is moderately high. Soil wetness and steep slopes restrict the use of logging equipment during wet seasons.

The soils in this unit are poorly suited to sanitary facilities and to community development. The seasonal high water table, moderate shrink-swell potential, and slope are the main limitations.

4. Peawick-Emporia-Levy

Deep, moderately well drained, well drained, and very poorly drained soils that dominantly are clayey or loamy and are nearly level to very steep; on high terraces, escarpments, and side slopes and in freshwater marshes

In this unit the landscape consists mostly of high river terraces, escarpments and side slopes, and fresh and brackish water marshes along the James and Chickahominy Rivers. Most of the acreage is drained by small streams that have deep and well formed drainageways. A few large lakes are in this unit. The marshes are flooded twice daily by tidal waters that are mostly brackish east of Jamestown Island and fresh west of the island. The river terraces are mostly nearly level and gently sloping. Steep side slopes are adjacent to both the marshes and upland areas. On the terraces, slope ranges from about 0 to 3 percent, and on side slopes, it ranges from about 3 to 50 percent.

This map unit makes up about 12 percent of the land area. The unit is about 20 percent Peawick soils, 20 percent Emporia soils, 11 percent Levy soils, and 49 percent soils of minor extent.

The Peawick soils are moderately well drained, nearly level soils occurring mostly on the higher terraces. They are separated from the marshes and higher uplands by steep escarpments and side slopes. They have a surface layer of dark grayish brown silt loam. The subsoil is mostly yellowish brown silty clay loam and clay in the upper part; mottled brown and gray silty clay in the middle part; and mottled gray silty clay and clay in the lower part.

The Emporia soils are well drained, gently sloping to very steep soils, and they are mostly on the side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part.

The Levy soils are very poorly drained and are along the tidal creeks and streams. They have a surface layer of dark olive gray silty clay and a substratum of very dark gray silty clay.

Of minor extent in this map unit are mostly poorly drained Chickahominy soils on nearly level flats and very poorly drained Johnston soils along drainageways. The somewhat poorly drained Newflat soils are in slightly higher areas joining Chickahominy soils. The moderately well drained Slagle soils are adjacent to upland escarpments and terrace breaks. Also, the well drained Uchee soils are along some side slopes.

About 30 percent of the acreage has been cleared and is used mainly for small grains, soybeans, and corn. Some areas are in pasture, and some are in community development. Soil wetness, soil acidity, and low fertility are the main limitations for cultivated crops. Overgrazing and grazing when the soils are wet are major concerns of pasture management because of puddling and compaction.

The soils in this unit are suited to trees. The native trees are mostly oak, hickory, beech, and pines. Some large areas have been planted to loblolly pine within the past 20 years. Productivity is moderate. The steep slopes, high water table, and clayey soil material restrict the use of logging equipment, especially in wet seasons. Erosion is a hazard along logging roads and skid trails in sloping areas.

The soils in this unit are poorly suited to sanitary facilities and to community development. The seasonal high water table, high shrink-swell potential, and slope are the main limitations.

Soils on coastal plain uplands

The map units in this group are mostly inland. The soils formed mostly in fluviomarine deposits on uplands and side slopes. They range from dominantly well drained to poorly drained, and they have a subsoil that is dominantly loamy or clayey.

5. Bethera-Izagora-Slagle

Deep, poorly drained and moderately well drained soils that dominantly are clayey or loamy and are nearly level to gently sloping; on flats and in depressions on uplands

In this unit the landscape consists of broad upland flats, ridges, and slight depressions. Drainage patterns are generally weakly expressed, but in most places, drainageways have steep or very steep, short side slopes. Geologic terrace escarpments are evident at an elevation of about 50 feet. Slopes are mostly 0 to 6 percent but range to about 40 percent along escarpments and side slopes.

This map unit makes up about 10 percent of the land area. The unit is about 16 percent Bethera soils, 12 percent Izagora soils, 10 percent Slagle soils, and 62 percent soils of minor extent (fig. 3).

The Bethera soils are poorly drained, nearly level soils on flats and in slight depressions. The surface layer is dark grayish brown silt loam, and the subsoil is gray clay, clay loam, and silty clay loam.

The Izagora soils are moderately well drained and nearly level and are on medium to broad, weakly expressed ridges. They have a surface layer of very dark gray loam. The subsoil is light olive brown loam in the upper part; mottled brown and gray clay loam in the middle part; and mottled, gray clay loam and clay in the lower part.

The Slagle soils are moderately well drained. These nearly level to gently sloping soils are on ridges and in weak depressions. They have a surface layer of dark grayish brown fine sandy loam and a subsoil of mostly

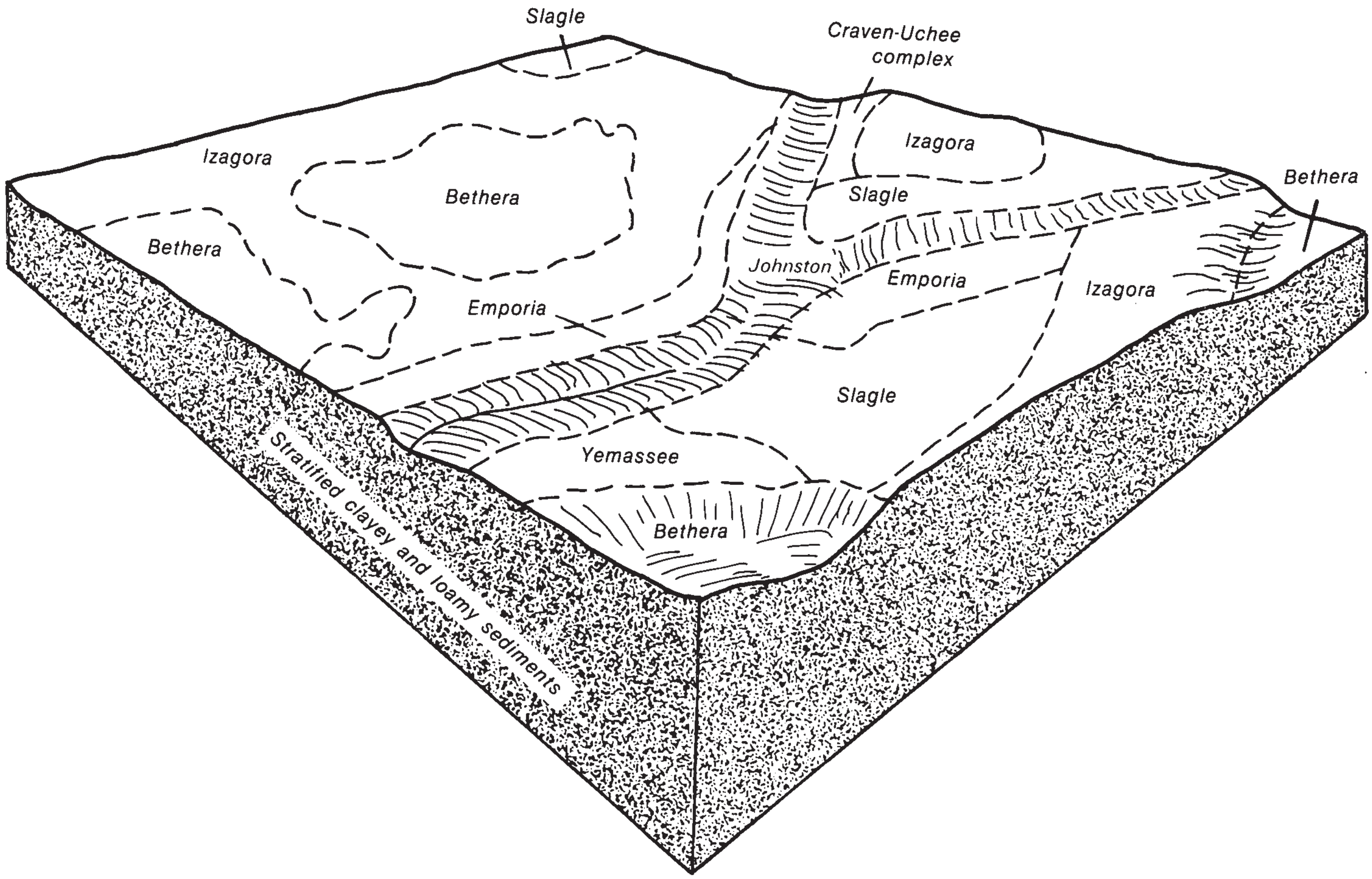

Figure 3.—Pattern of soils and underlying material in the Bethera-Izagora-Slagle map unit.

mottled, yellowish brown clay loam in the upper part and mottled clay loam and sandy clay loam in the lower part.

Of minor extent in this map unit are the well drained Uchee and moderately well drained Craven soils on narrow ridges and on rolling side slopes, the well drained Emporia soils on slightly higher ridges, and the somewhat poorly drained Newflat and Yemassee soils on low ridges and flats. Also, of minor extent are the well drained Kempsville soils on narrow, weakly expressed ridges and the very poorly drained Johnston soils along small stream channels.

About 40 percent of the acreage has been cleared and is used for farming, community development, and recreation facilities.

Cultivated crops are mostly soybeans, corn, and small grains. Some small areas are in pasture. Soil wetness and erosion are the main limitations for cultivated crops. Overgrazing and grazing when the soils are wet are major concerns of pasture management.

The soils in this map unit are suited to trees, mostly oak, sweetgum, yellow-poplar, hickory, and pines. Productivity is moderately high. The steeper slopes along drainageways and wetness are the main restrictions for logging equipment.

The soils in this unit are poorly suited to sanitary facilities and to community development. Soil wetness, shrink-swell potential, and low strength are the main limitations.

6. Slagle-Emporia-Uchee

Deep, moderately well drained and well drained soils that dominantly are loamy and are gently sloping to very steep; on uplands

The landscape in this map unit consists mostly of nearly level and gently sloping upland ridges and sloping to very steep side slopes. On most ridges the slope ranges from about 0 to 10 percent, and on side slopes it ranges from about 10 to 50 percent.

This map unit makes up about 16 percent of the land area. The unit is about 27 percent Slagle soils, 25 percent Emporia soils, 10 percent Uchee soils, and 38 percent soils of minor extent (fig. 4).

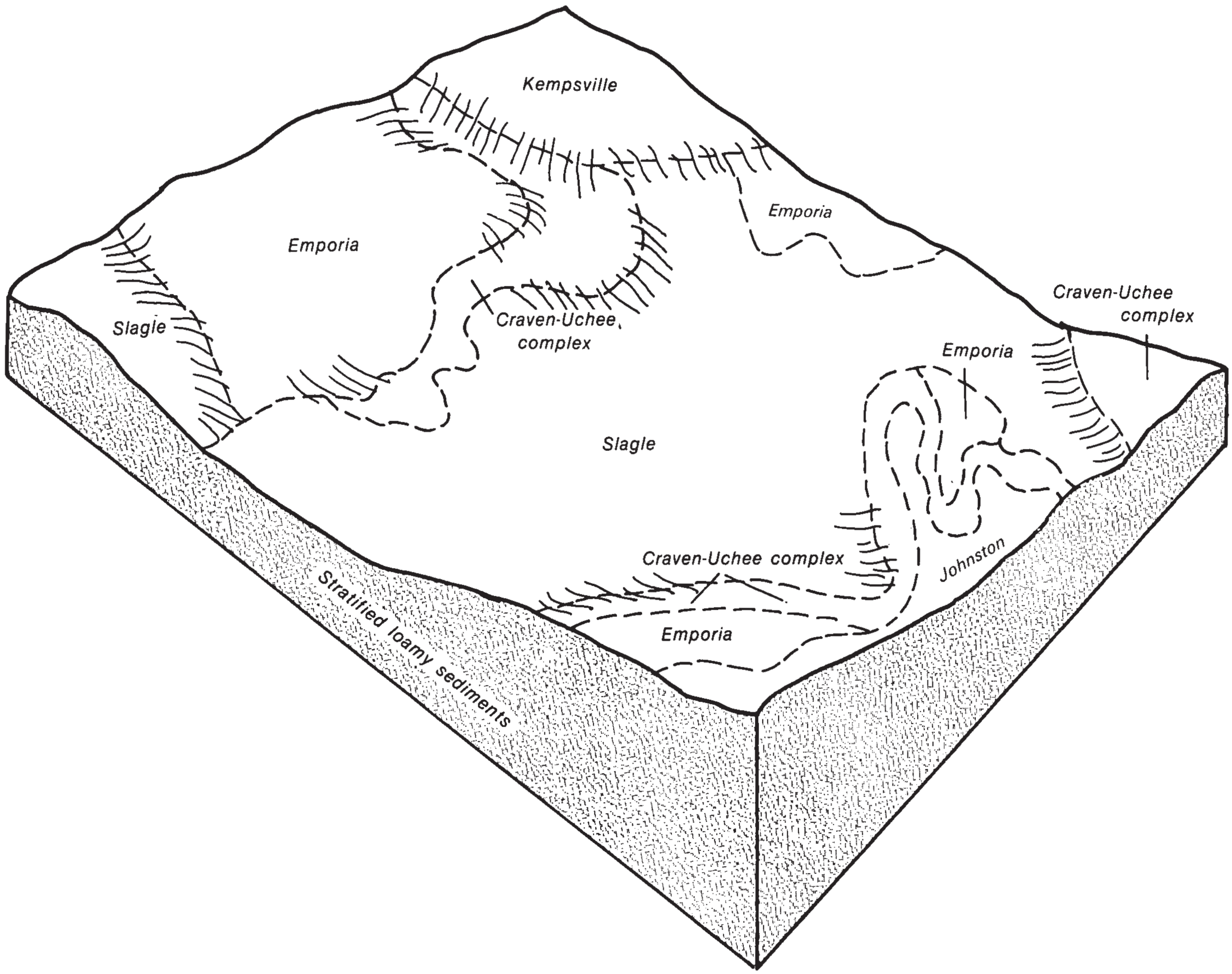

Figure 4.—Pattern of soils and underlying material in the Slagle-Emporia-Uchee map unit.

The Slagle soils are moderately well drained. These nearly level and gently sloping soils are on broad ridges. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is mostly mottled, yellowish brown clay loam in the upper part and mottled clay loam and sandy clay loam in the lower part.

The gently sloping and strongly sloping to very steep Emporia soils are well drained and are on ridges and side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part.

The Uchee soils are well drained and are mostly on strongly sloping ridges and side slopes. They have a surface layer of dark grayish brown loamy fine sand. The subsoil is strong brown sandy clay loam in the upper part and mottled, strong brown sandy clay loam and clay in the lower part.

Of minor extent in this map unit are the moderately well drained Craven soils, which generally occur with Uchee soils. The very poorly drained Johnston soils are along the major drainageways and small streams. Also, the well drained Kempsville, Norfolk, and Suffolk soils are scattered throughout the unit on higher areas. Other minor soils include the moderately well drained Izagora soils on positions similar to those of the Slagle soils and small areas of well drained Caroline soils on high knolls. Areas of Urban land are along major highways and in the City of Williamsburg.

About 40 percent of the acreage has been cleared and is used for industry, housing developments, and farming. The wooded areas are military bases, private woodland, and cooperatively owned land.

In most farmed areas, the soils are used for small grains, corn, soybeans, and pasture. Wetness, soil acidity, and the hazard of erosion are the main limitations in these areas. Overgrazing and grazing when the soils are wet are major concerns of pasture management.

The soils in this unit are suited to trees, mostly oak, hickory, beech, sweetgum, and pine. Many reforested areas are in loblolly pines. Productivity is moderately high. Steep slopes and wetness restrict the use of logging equipment. Erosion on steep slopes is a hazard along logging roads and skid trails.

The soils in this map unit are poorly suited to sanitary facilities and to community development. Wetness, shrink-swell potential, slope, and low strength are the main limitations.

7. Emporia-Craven-Uchee

Deep, well drained and moderately well drained soils that dominantly are loamy or clayey and are gently sloping to very steep; on upland ridges and side slopes

In this unit the landscape consists mostly of gently sloping upland ridges and sloping to very steep side slopes. Drainageways emptying into the York River generally have steeper side slopes than those emptying into the James or Chickahominy Rivers. Also, the ridges leading toward the York River are generally more narrow than those leading toward the James or Chickahominy. In most places, the soils are highly dissected by small streams and the ridges have benches. On most ridges, the slope ranges from 2 to 10 percent, and on side slopes it ranges from 10 to 50 percent.

This map unit makes up about 27 percent of the land area. The unit is about 37 percent Emporia soils, 19 percent Craven soils, 13 percent Uchee soils, and 31 percent soils of minor extent.

The Emporia soils are well drained and are gently sloping on ridges and strongly sloping to very steep on side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown firm sandy clay loam in the lower part.

The Craven soils are moderately well drained soils that are on narrow to medium, gently sloping ridges and strongly sloping side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown clay in the upper part and mottled, yellowish brown sandy clay loam in the lower part.

The Uchee soils are well drained and are gently sloping and strongly sloping. Uchee soils are on narrow to medium ridges and side slopes. They have a surface layer of dark grayish brown loamy fine sand. The subsoil is strong brown sandy clay loam in the upper part and mottled, strong brown sandy clay loam and clay in the lower part.

Of minor extent in this map unit are the well drained Kempsville and Suffolk soils on gently sloping ridges, the very poorly drained Johnston soils along drainageways, and the well drained Kenansville and Caroline soils and moderately well drained Slagle soils that are scattered throughout the unit.

About 30 percent of the acreage has been cleared and is used for farming. The farmland is scattered throughout the unit. Also in this unit are urban areas, water reservoirs, and recreation facilities. Wooded areas include some military bases and parks in addition to privately owned land.

The farmland consists of gently sloping soils that are used mostly for soybeans, corn, and small grains. A few areas of hay and pasture are in this unit. Soil acidity, low fertility, and the hazard of erosion are the main limitations to farming. Overgrazing and grazing when the soils are wet are major concerns of pasture management.

The soils in this unit are suited to trees. The native climax forest is a mixture of hardwoods—oak, hickory, and beech; however, several large areas have been reforested with pines. Productivity is moderately high. Steep slopes restrict the use of logging equipment and cause erosion to be a hazard along logging roads and skid trails.

The soils in this unit are moderately well suited to sanitary facilities and community development. Slopes, shrink-swell potential, and the seasonal high water table are the main limitations.

8. Kempsville-Emporia-Suffolk

Deep, well drained soils that dominantly are loamy and are gently sloping to very steep; on upland ridges and side slopes

The landscape in this map unit consists mostly of broad, gently sloping upland ridges and sloping to very steep side slopes. This map unit is on the drainage divide between the York and James Rivers. The headwaters of creeks and streams that lead to the York River and to the James and Chickahominy Rivers are in this unit. The slope on most ridges ranges from 2 to 10 percent, and on side slopes it ranges from 10 to 50 percent.

This map unit makes up about 10 percent of the land area. The unit is about 30 percent Kempsville soils, 28 percent Emporia soils, 18 percent Suffolk soils, and 24 percent soils of minor extent (fig. 5).

The Kempsville soils are well drained and gently sloping soils on medium to broad ridges. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is mostly yellowish brown and strong brown fine sandy loam and sandy clay loam in the upper part and mottled fine sandy loam and sandy clay loam in the lower part.

The Emporia soils are well drained. They are on medium to narrow, gently sloping and strongly sloping ridges and moderately steep to very steep side slopes. They have a surface layer of dark grayish brown fine sandy loam. The subsoil is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part.

The Suffolk soils are well drained and are on broad, gently sloping ridges. They have a surface layer of very dark grayish brown fine sandy loam. The subsoil is mostly strong brown fine sandy loam and sandy clay loam.

Of minor extent in this map unit are the well drained Kenansville, Norfolk, and Caroline soils on ridges, the moderately well drained Slagle soils in slight depressions, the moderately well drained Craven and well drained Uchee soils on side slopes, and the very poorly drained Johnston soils along drainageways.

About 50 percent of the acreage is used for farming. The farmland is scattered throughout the unit. Also, some areas are used for industry and community development. The wooded areas consist of mixed hardwoods and pine.

The farmed areas are used mostly for soybeans, corn, and small grains. Some areas are used for pasture and hay. Soil acidity, low fertility, and the hazard of erosion are the main limitations to farming. Overgrazing and grazing when the soils are wet are the major concerns of pasture management.

The soils in this unit are suited to trees. The native climax forest is mixed hardwoods; however, some areas have been reforested with loblolly pine. Productivity is moderately high. Steep slopes restrict the use of logging equipment and cause erosion to be a hazard along logging roads and skid trails.

The soils in this unit are moderately well suited to sanitary facilities and community development. Slope, the seasonal high perched water table, and restricted permeability are the main limitations.

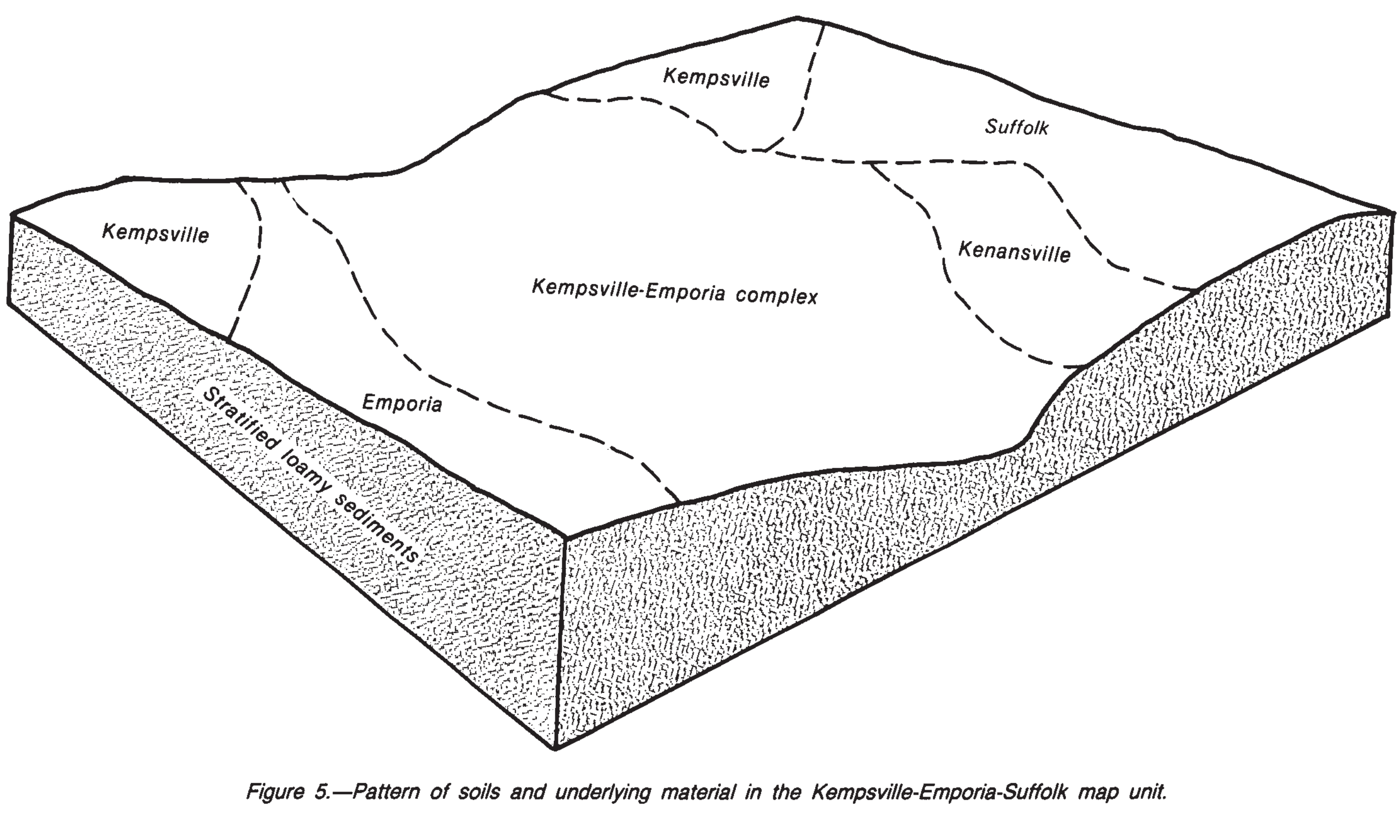

Figure 5.—Pattern of soils and underlying material in the Kempsville-Emporia-Suffolk map unit.

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 underlying material, 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 underlying material. They also can differ in slope, 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, Emporia fine sandy loam, 2 to 6 percent slopes, is one of several phases in the Emporia series.

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

A *soil complex* consists of two or more soils 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. Craven-Uchee complex, 2 to 6 percent slopes, is an example.

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 a mapped area 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. Pamunkey soils, 2 to 6 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

1—Altavista fine sandy loam. This soil is deep, nearly level, and moderately well drained. It is on medium to broad stream terraces. Areas of this soil commonly are elongated or irregularly oval and range from about 4 to 40 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is dark gray fine sandy loam about 5 inches thick. The subsurface layer is light olive brown fine sandy loam 8 inches thick. The subsoil extends to a depth of 53 inches. It is mostly yellowish brown fine sandy loam and sandy clay loam to a depth of 26 inches. Below this depth, it is mottled and gray sandy clay loam. The substratum is gray fine sandy loam from 53 to at least 65 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Augusta and Dragston soils and moderately well drained Seabrook soils. The Augusta and Dragston soils are in slight depressions. The Seabrook soils are throughout the unit. Included soils make up about 15 percent of this unit.

The permeability of this Altavista soil is moderate, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It is very strongly acid through medium acid, but reaction in the surface layer varies because of local liming practices. A seasonal high water table is at a depth of 1 1/2 to 2 1/2 feet during winter and early spring.

Areas of this soil are about equally divided between woodland and cropland.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet in spring in some areas. Drainage helps to alleviate wetness and protects crops from damage. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, sweetgum, yellow-poplar, and oaks. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, and this limits the use of heavy timber equipment.

The seasonal high water table is the main limitation of the soil for community development, especially as a building site, or a site for sanitary landfills or septic tank absorption fields and for most types of recreation.

This soil is in capability subclass IIw.

2—Augusta fine sandy loam. This soil is deep, nearly level, and somewhat poorly drained. It is on low-lying stream terraces and broad flats. Areas of this soil commonly are elongated, but some smaller areas are irregularly oval and slightly concave. They range from about 4 to 15 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 11 inches thick. The subsurface layer is light yellowish brown fine sandy loam 6 inches thick. The subsoil extends to a depth of 56 inches. It is mostly mottled sandy clay loam and mottled grayish brown loam in the upper part and mottled grayish brown and gray sandy clay loam in the lower part. The substratum is mottled sandy loam from 56 to at least 70 inches.

Included with this soil in mapping are small areas of moderately well drained Altavista, Munden, and Seabrook soils, somewhat poorly drained Dragston soils, and poorly drained Nimmo and Tomotley soils. The Altavista, Munden, and Seabrook soils are on slightly higher, oval, or elongated ridges. The Dragston soils are throughout the map unit. The Nimmo and Tomotley soils are around small drainageways and in depressions. Also included are small areas of soils that have water on the surface for brief periods after heavy or prolonged rainfall. Included soils make up about 20 percent of this unit.

The permeability of this Augusta soil is moderate, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It is very strongly acid through medium acid, but reaction in the surface layer varies because of local liming practices. A seasonal high water table is at a depth of 1 foot to 2 feet during winter and spring.

Most of the acreage of this soil is in woodland. The rest is farmed or in pasture.

If drained, this soil is well suited to cultivated crops. Alfalfa is short lived because of seasonal wetness. Crops respond well to lime and fertilizer but are sometimes damaged in undrained areas after heavy or prolonged rains. The soil is wet and cold in spring, and wetness often interferes with tillage. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

If drained, this soil is moderately well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, sweetgum, yellow-poplar, and oak. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table is the main limitation of the soil for community development, especially as a building site or a site for sanitary landfills or septic tank absorption fields and for most types of recreation.

This soil is in capability subclass IIIw.

3—Axis very fine sandy loam. This soil is deep, nearly level, and very poorly drained. It is on tidal marshes. Areas of this soil are irregularly narrow to broad and range from about 2 to 200 acres. Slopes are less than 1 percent.

Typically, the surface layer of this soil is very dark grayish brown very fine sandy loam about 14 inches thick. The substratum is mostly gray very fine sandy loam and fine sandy loam to a depth of at least 70 inches.

Included with this soil in mapping are small areas of very poorly drained Bohicket, Johnston, and Levy soils. The Bohicket and Levy soils are throughout the unit. The Johnston soils are on smaller streams up the flood plain and are not flooded by tidal waters. Also included are a few areas of Beaches. Included soils make up about 20 percent of this unit.

The permeability of this Axis soil is moderate. The available water capacity is high, but the water is saline or brackish and only suitable for salt-tolerant species of grasses and forbs. Surface runoff is very slow. The soil is high in organic matter content and medium in natural fertility. It ranges from medium acid through moderately alkaline, but upon drying or exposure to air, it becomes extremely acid. The soil is flooded daily by tidal water and is continuously saturated.

In most areas this soil is in saltwater-tolerant grasses and forbs. This soil is unsuited to any present farming methods or woodland uses because of flooding and salt content.

Tidal flooding, high salinity, and high content of sulfur make this soil unsuitable for most uses other than as wetland wildlife habitat.

This soil is in capability subclass VIIw.

4—Beaches. This map unit consists of areas that are subject to tidal flooding, primarily fringe areas along marshes and rivers that have been formed by wave action. The soil material is primarily sandy, but many areas have shells, gravel, and tidal debris on the surface. Areas range from about 2 to 20 acres. Slopes range from 0 to 10 percent.

Included in mapping are small areas of Axis and Bohicket soils that are mostly inland. Also included are areas that have been filled by dredging or for development, small areas of dunes that are as high as 5 feet, and small areas that are covered by impervious surfaces. The included soils make up about 30 percent of the unit.

This unit is used mostly for recreation and wildlife habitat. State wetland control legislation prohibits the development of most areas.

The soils in this map unit are in capability subclass VIIIw.

5—Bethera silt loam. This soil is deep, nearly level, and poorly drained. It is on upland flats and in depressions. Areas of this soil are irregularly oval or rectangular or are elongated. They range from about 2 to 30 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is dark grayish brown and light brownish gray silt loam about 7 inches thick. The subsoil extends to a depth of more than 65 inches. It is mostly mottled gray clay loam, silty clay loam, and clay.

Included in mapping are small areas of moderately well drained Izagora and Slagle soils and somewhat poorly drained Yemassee soils that are on slightly higher areas throughout the unit. Also included are areas of soils that have water on the surface throughout early summer, soils at the base of escarpments that have less clay, and soils that have a thinner solum. Included soils make up about 15 percent of this unit.

The permeability of this Bethera soil is slow, and available water capacity is moderate. Surface runoff is very slow or ponded. The erosion hazard is slight. The surface layer is generally wet and not easily tilled. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It ranges from extremely acid through strongly acid, but reaction in the surface layer varies in areas that have been limed. A seasonal high water table is 1 foot above the surface to 1 1/2 feet below the surface during winter and spring.

In most areas this soil is in woodland. In a few areas it is farmed, and in some areas it is in pasture.

If drained, the soil is moderately well suited to cultivated crops. It is poorly suited in undrained areas. Crops respond well to lime and fertilizer, but the soil is wet and cold in spring, and wetness often interferes with tillage. Drainage generally does not completely overcome wetness or protect crops from damage because outlets for drainage are not always available and water does not readily percolate through the clayey subsoil. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

If drained, this Bethera soil is moderately well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet cause compaction of the surface layer and damage the stands of grasses and legumes. Ponding of water during winter and spring also damages the stands of grasses and legumes.

The potential for trees is high, but generally is restricted to water-tolerant species. Seed and seedling survival are limited by wetness. Drainage helps to increase productivity and seedling survival. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table, ponding, and slow permeability are the main limitations of the soil for community development. The high water table, ponding, and permeability limit the use of this soil as a building site, as a site for sanitary landfills or septic tank absorption fields, and for most types of recreation.

This soil is in capability subclass IIIw, drained, and subclass IVw, undrained.

6—Bohicket muck. This soil is deep, nearly level, and very poorly drained. It is on tidal marshes. Areas of this soil are commonly long and winding, but some are very broad. The areas range from about 3 to 100 acres. Slopes are less than 1 percent.

Typically, the surface layer of this soil is dark gray muck about 6 inches thick. The substratum is dark gray clay and silty clay to a depth of at least 80 inches.

Included with this soil in mapping are small areas of very poorly drained Axis, Johnston, and Levy soils. The Axis and Levy soils are throughout the unit. The Johnston soils, along small streams on the upper end of the flood plain, are not flooded by tidal waters. Included soils make up about 10 percent of the unit.

The permeability of this Bohicket soil is very slow, and available water capacity is high. Surface runoff is very slow. The soil has very high organic matter content and high natural fertility. The substratum has high shrink-swell potential. The soil ranges from slightly acid through moderately alkaline, but becomes extremely acid when dry. It is flooded daily by tidal water and is continuously saturated.

In most areas this soil is in saltwater-tolerant grasses and forbs.

Tidal flooding, low strength, wetness, high shrink-swell potential, and high sulfur content make this soil unsuitable for most uses other than wetland wildlife habitat (fig. 6).

Figure 6.—This saline marsh, an area of Bohicket muck, provides habitat for a variety of wildlife. It also provides nutrients for shellfish.

This soil is in capability subclass VIIIw.

7—Bojac sandy loam. This soil is deep, nearly level, and well drained. It is on low stream terraces. Areas of this soil commonly are broad and irregular. They range from about 3 to 40 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is very dark gray and brown sandy loam about 11 inches thick. The subsurface layer is dark yellowish brown sandy loam 7 inches thick. The subsoil extends to a depth of 53 inches. It is mostly brown sandy loam. The substratum is yellowish brown loamy sand from 53 to at least 71 inches.

Included in mapping are small areas of moderately well drained Altavista, Munden, and Seabrook soils and somewhat poorly drained Dragston soils. The Altavista, Munden, and Seabrook soils are in slightly lower areas throughout the map unit, and the Dragston soils are in swales and around poorly defined drainageways. Also included are soils that are somewhat excessively drained and other soils that have a thicker surface layer. Included soils make up about 20 percent of this unit.

The permeability of this Bojac soil is moderately rapid, and available water capacity is low. Surface runoff is slow. The erosion hazard is slight. The surface layer is very friable and easily tilled. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil has low organic matter content and natural fertility. In unlimed areas, the surface layer and subsoil range from extremely acid through slightly acid, and the substratum ranges from very strongly acid through medium acid. A high water table is within a depth of 4 feet during the fall and spring.

In most areas this soil is in woodland. In few small areas it is farmed or in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer, but growth and yields are sometimes limited by the low available water capacity. Conservation tillage, using cover crops and grasses and legumes in the cropping system, stubble mulching, and use of crop residue help to maintain organic matter content and tilth, reduce erosion and crop damage, and increase the available water capacity in the soil.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing causes compaction of the surface layer and damages the stands of grasses and legumes.

The potential for trees on this soil is moderately high, especially for southern red oak, loblolly pine, sweetgum, and Virginia pine. Seeds and seedlings grow well.

The seasonal high water table, moderately rapid permeability of the subsoil, and coarse texture of the soil are the main limitations for community development. The high water table and permeability of the subsoil limit the use of the soil for septic tank absorption fields, sewage lagoons, and sanitary landfills. The coarse texture of the soil limits excavation because of sloughing and limits establishment of lawns because of droughtiness.

This soil is in capability class I.

8B—Caroline fine sandy loam, 2 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on narrow upland ridges and side slopes. Areas commonly are irregularly elongated, and slopes are 150 to 350 feet long. They range from about 5 to 20 acres.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 9 inches thick. The subsoil extends to a depth of 47 inches. It is mostly strong brown clay loam and yellowish red clay, sandy clay, and sandy clay loam. The substratum is strong brown, stratified clay, clay loam, and fine sandy loam that extends from 47 to at least 72 inches.

Included with this soil in mapping are small areas of well drained Emporia and Uchee soils and moderately well drained Slagle soils. The Emporia and Uchee soils are throughout the unit. The Slagle soils are in slight depressions and on foot slopes. Also included are soils that have a redder subsoil than Caroline soils. Included soils make up about 15 percent of this unit.

The permeability of this Caroline soil is moderately slow, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled when moist. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices.

In most areas this soil is in woodland. In a few areas it is farmed or in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The erosion hazard is moderate and is a major management concern. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, control erosion, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing causes compaction of the surface layer. This reduces the stands of desirable grasses and legumes and thereby increases runoff and the erosion hazard.

The potential for trees on this soil is moderately high, especially for loblolly pine, shortleaf pine, white oak, and southern red oak. Seeds and seedlings grow well.

The moderately slow permeability, moderate shrink-swell potential, low strength, and high clay content of the subsoil are the main limitations of the soil for community development. The moderately slow permeability, moderate shrink-swell potential, and high clay content limit the use of this soil for septic tank absorption fields, building sites, and sanitary landfills and for most types of recreation. The low strength of the subsoil is a limitation if the soil is used for roads and streets and as a source of roadfill.

This soil is in capability subclass IIe.

9—Chickahominy silt loam. This soil is deep, nearly level, and poorly drained. It is on broad, low-lying flats and in slight depressions on stream terraces. Areas of this soil are irregular or oval and range from about 3 to 50 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is dark grayish brown and grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of at least 85 inches. It is mostly gray silty clay loam, silty clay, and clay loam with yellowish brown mottles.

Included with this soil in mapping are small areas of moderately well drained Dogue, Peawick, and Tetotum soils and somewhat poorly drained Augusta and Newflat soils that are in slightly higher areas. Also included are soils that have a gravelly sand substratum and soils that have a thinner subsoil than this Chickahominy soil. Some included soils have water on the surface during winter and early in spring and during periods of prolonged rainfall. Included soils make up about 20 percent of the unit.

The permeability of this Chickahominy soil is very slow, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable but is not easy to till because of wetness. The subsoil has high shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It is extremely acid or very strongly acid, but reaction in the surface layer varies in areas that are limed. A high water table is at or near the surface during winter and spring.

Most areas of this soil are in woodland. A few areas are farmed or used for pasture, and some areas are used as a source of clay for pottery products.

This soil is poorly suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet and cold in spring, and wetness often delays tillage and damages crops. Surface drainage systems will reduce wetness if suitable outlets can be established. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce clodding, and increase water infiltration.

This soil is moderately well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet compact the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, sweetgum, and sycamore. Seeds and seedlings grow well if competing vegetation is controlled. Drainage helps to alleviate wetness and increase productivity. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table, very slow permeability, and high clay content, which causes high shrink-swell potential of the subsoil, are the main limitations of the soil for community development. These soil properties limit the use of this soil as a site for buildings, sanitary landfills, and septic tank absorption fields and for most types of recreation.

This soil is in capability subclass IVw, undrained, and subclass IIIw, drained.

10B—Craven fine sandy loam, 2 to 6 percent slopes. This soil is deep, gently sloping, and moderately well drained. It is on broad upland flats and narrow to broad ridges and side slopes. Areas commonly are irregularly oval or irregularly rectangular. They range from about 2 to 15 acres. Slopes are about 200 to 800 feet long.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam 5 inches thick. The subsoil extends to a depth of 42 inches. It is yellowish brown clay in the upper part and yellowish brown sandy clay loam with gray mottles in the middle and lower parts. The substratum to a depth of at least 72 inches is brownish yellow fine sandy loam mottled with gray in the upper part and gray loamy fine sand mottled with yellow in the lower part.

Included with this soil in mapping are small areas of well drained Caroline, Emporia, Kempsville, and Uchee soils and moderately well drained Slagle soils. The well drained soils are generally in higher areas throughout the unit, and the Slagle soils are in similar areas throughout the unit. Included soils make up about 20 percent of this unit.

The permeability of this Craven soil is slow, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled when moist. The subsoil is plastic and has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility.

It commonly is extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 2 to 3 feet in winter and early in spring.

Most areas of this soil are in woodland. A few areas are farmed or used for pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer; however, wetness in spring restricts tillage and makes crops such as alfalfa short lived. The erosion hazard is moderate and is a major management concern. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content, improve tilth, control erosion, and reduce crusting. Grassed waterways and diversions also help to reduce erosion in critical areas.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures on this soil. Grazing during wet periods compacts the surface layer of the soil, damages the grasses and legumes, and increases erosion.

The potential of this soil for trees, especially loblolly pine and Virginia pine, is moderately high. Much of the acreage is wooded. Seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, limiting the use of timber equipment.

The seasonal high water table, slow permeability, moderate shrink-swell potential, clayey texture, and low strength of the soil are the main limitations for community development. The slow permeability and seasonal high water table limit use of the soil as a site for sanitary landfills and septic tank absorption fields, and the wetness, low strength, and moderate shrink-swell potential limit use as a building site. The low strength of the clayey subsoil restricts vehicular traffic when the soil is wet.

This soil is in capability subclass IIe.

10C—Craven fine sandy loam, 6 to 10 percent slopes. This soil is deep, strongly sloping, and moderately well drained. It is on narrow to medium upland ridges and side slopes. Areas commonly are elongated or irregularly rectangular. Slopes are 150 to 250 feet long. They range from about 2 to 15 acres.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam 5 inches thick. The subsoil extends to a depth of 42 inches. It is yellowish brown clay in the upper part and yellowish brown sandy clay loam with gray mottles in the middle and lower parts. The substratum extends to a depth of at least 72 inches. It is brownish yellow fine sandy loam with gray mottles in the upper part and gray loamy fine sand with yellow mottles in the lower part.

Included with this soil in mapping are small areas of well drained Caroline, Emporia, Kempsville, and Uchee soils and moderately well drained Slagle soils. The well drained soils are generally in the higher areas throughout the unit, and the Slagle soils are in similar areas throughout the unit. Included soils make up about 20 percent of this unit.

The permeability of the Craven soil is slow, and available water capacity is moderate. Runoff is rapid. The erosion hazard is severe. The surface layer is friable and easily tilled when moist. The subsoil is plastic and has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 2 to 3 feet during winter and early in spring.

In most areas this soil is in woodland. In a few areas it is farmed or used for pasture.

This soil is poorly suited to cultivated crops. Crops respond well to lime and fertilizer; however, wetness in spring restricts tillage and makes crops such as alfalfa short lived. The erosion hazard is severe and is a major management concern. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content, improve tilth, control erosion, and reduce crusting. Grassed waterways and diversions also help to reduce erosion in critical areas.

This soil is poorly suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures on this soil. Grazing during wet periods compacts the surface layer of the soil, damages the grasses and legumes, and increases erosion.

The potential for trees on this soil is moderately high, especially for loblolly pine and Virginia pine. Seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, thus limiting the use of timber equipment.

The seasonal high water table, slow permeability, moderate shrink-swell potential, clayey texture, low strength, and slope of the soil are the main limitations for community development. The high water table, slow permeability, and slope limit its use as a site for septic tank absorption fields and sanitary landfills. The wetness, shrink-swell potential, and low strength limit use as a building site. The low strength of the clayey subsoil restricts vehicular traffic when the soil is wet.

This soil is in capability subclass IIIe.

11B—Craven-Uchee complex, 2 to 6 percent slopes. This complex consists of moderately well drained Craven soils and well drained Uchee soils.

These deep, gently sloping soils are so intermingled that it is not practical to separate them at the scale used in mapping. Areas of this complex are on narrow ridgetops. Slopes are uneven and are 100 to 500 feet long. Areas are long and winding and range from about 2 to 6 acres.

Of the total acreage of this map unit, about 35 percent is Craven soils, 35 percent is Uchee soils, and 30 percent is other soils.

Typically, the surface layer of the Craven soils is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam 5 inches thick. The subsoil extends to a depth of 42 inches. It is yellowish brown clay in the upper part and yellowish brown sandy clay loam mottled with gray in the middle and lower parts. The substratum to a depth of at least 72 inches is brownish yellow fine sandy loam mottled with gray in the upper part and gray loamy fine sand mottled with yellow in the lower part.

Typically, the surface layer of the Uchee soils is dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is light yellowish brown and very pale brown loamy fine sand 19 inches thick. The subsoil extends to a depth of 56 inches. It is strong brown sandy clay loam above a depth of 36 inches and strong brown sandy clay loam and clay mottled with gray and red from 36 to 56 inches. The substratum from 56 to at least 65 inches is variegated red, brown, and gray stratified sandy loam and sandy clay loam.

Included with these soils in mapping are small, intermingled areas of well drained Caroline, Emporia, Kempsville, and Kenansville soils and moderately well drained Slagle soils. These soils are throughout the map unit. Also included are small areas of ferricrete outcrops and areas of severely eroded soils that are generally on points of ridges and the upper part of side slopes.

In the Craven soils, permeability is slow; and in the Uchee soils, it is moderate in the upper part of the subsoil and moderately slow in the lower part. The available water capacity is moderate for the Craven soils and low or moderate for the Uchee soils. Surface runoff is medium. The erosion hazard is moderate. The surface layer of both soils is friable and easily tilled, and the subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. Both soils are low in organic matter content and natural fertility. The Craven soils range from extremely acid through strongly acid, and the Uchee soils commonly are very strongly acid or strongly acid; however, the surface layer of both soils varies in reaction because of local liming practices. During winter and early spring a seasonal high water table is at a depth of 2 to 3 feet in the Craven soils and 3 1/2 to 5 feet in the Uchee soils.

Most of the acreage is in woodland. A small acreage is farmed or in pasture, and a few areas are in urban development.

The soils in this complex are poorly suited to cultivated crops. Crops respond well to lime and fertilizer; however, wetness in the spring often restricts tillage on the Craven soils, and the low available water capacity often limits crop response to lime and fertilizer on the Uchee soils. Also, blowing soil often damages or covers up small plants early in spring on the Uchee soils. Conservation tillage, using cover crops and grasses and legumes in the cropping system, stubble mulching, and use of crop residue help to maintain organic matter content and tilth, reduce erosion and crop damage, and hold moisture in the soil. Grassed waterways and diversions also help to reduce erosion in critical areas.

These soils are moderately well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Grazing during wet periods compacts the surface layer, damages the stands of grasses and legumes, and increases erosion.

The potential for trees on this complex is moderately high, especially for loblolly pine, Virginia pine, sweetgum, and oak. Seeds and seedlings grow well on the Craven soils if competing vegetation is controlled, but survival and growth are often limited by the low available water capacity of the Uchee soils during the growing season. The surface layer of both soils is soft when wet, thus limiting the use of heavy timber equipment.

The seasonal high water table and the slow and moderately slow permeability and moderate shrink-swell potential of the subsoil are the main limitations for community development. These soil features especially limit use for septic tank absorption fields, sanitary landfills, and building sites and for most types of recreation. The sandy texture of the surface and subsurface layers of the Uchee soils also restricts excavations because of sloughing and caving. It restricts growth of grasses and shrubs because of low available water capacity.

The soils in this complex are in capability subclass IIIe.

11C—Craven-Uchee complex, 6 to 10 percent slopes. This complex consists of moderately well drained Craven soils and well drained Uchee soils. These deep, strongly sloping soils are so intermingled that it is not practical to separate them at the scale used in mapping. Areas of this complex are on side slopes and narrow ridge tops. Slopes are uneven and complex and are 100 to 500 feet long. Areas of this complex are long and winding and range from about 4 to 20 acres.

Of the total acreage of this map unit, about 35 percent is Craven soils, 35 percent is Uchee soils, and 30 percent is other soils.

Typically, the surface layer of the Craven soils is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale olive fine sandy loam 5 inches thick. The subsoil extends to a depth of 42 inches. It is yellowish brown clay in the upper part and yellowish brown sandy clay loam mottled with gray in the middle and lower parts. The substratum extends to a depth of at least 72 inches. It is brownish yellow fine sandy loam mottled with gray in the upper part and gray loamy fine sand with yellow mottles in the lower part.

Typically, the surface layer of the Uchee soils is dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is light yellowish brown and very pale brown loamy fine sand 19 inches thick. The subsoil extends to a depth of 56 inches. It is strong brown sandy clay loam above a depth of 36 inches and strong brown sandy clay loam and clay mottled with gray and red from 36 to 56 inches. The substratum from 56 to at least 65 inches is variegated red, brown, and gray stratified sandy loam and sandy clay loam.

Included with these soils in mapping are small, intermingled areas of well drained Caroline, Emporia, and Kempsville soils and moderately well drained Slagle soils. These soils are throughout the map unit. Also included are small areas of ferricrete outcrops and areas of severely eroded soils that are generally on points of ridges and the upper part of side slopes. Also included are steeper soils on side slopes and along narrow escarpments. In some areas seeps are at the base of slopes.

In the Craven soils, permeability is slow; and in the Uchee soils, it is moderate in the upper part of the subsoil and moderately slow in the lower part. The available water capacity is moderate for the Craven soils and low or moderate for the Uchee soils. Surface runoff is rapid. The erosion hazard is severe. The surface layer of both soils is friable and easily tilled. The subsoil of both soils has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. Both soils are low in organic matter content and natural fertility. The Craven soils range from extremely acid through strongly acid, and the Uchee soils commonly are very strongly acid or strongly acid; however, reaction in the surface layer of both soils varies because of local liming practices. During winter and early spring a seasonal high water table is at a depth of 2 to 3 feet in the Craven soils and 3 1/2 to 5 feet in the Uchee soils.

Most of the acreage is in woodland. A small acreage is farmed or in pasture.

The soils in this complex are poorly suited to cultivated crops. Crops respond well to lime and fertilizer; however, wetness in spring often restricts tillage on the Craven soils, and the low available water capacity often limits crop response to lime and fertilizer on the Uchee soils. The erosion hazard is severe and is a major management concern. Also, the complex, short slopes are an equipment limitation and erosion hazard in some areas. Conservation tillage, using cover crops and grasses and legumes in the cropping system, stubble mulching, and use of crop residue help to maintain organic matter content and tilth, reduce erosion and crop damage, and help to hold moisture in the soil. Grassed waterways and diversions also help to reduce erosion in critical areas.

These soils are poorly suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Grazing during wet periods compacts the surface layer of this complex, damages the stands of grasses and legumes, and increases erosion.

The potential for trees on this complex is moderately high, especially for loblolly pine, Virginia pine, sweetgum, and oak. Seeds and seedlings grow well on the Craven soils if competing vegetation is controlled, but survival and growth are often limited by the low available water capacity of the Uchee soils during the growing season. The surface layer of both soils is soft when wet, thus limiting the use of heavy timber equipment during wet periods.

The seasonal high water table, slope, slow and moderately slow permeability, and moderate shrink-swell potential of the subsoil are the main limitations if the soils are used for community development. These soil features especially limit use for septic tank absorption fields, sanitary landfills, and building sites and for most types of recreation.

The soils in this complex are in capability subclass IVe.

12—Dogue loam. This soil is deep, nearly level, and moderately well drained. It is on narrow ridges and low-lying terraces. Most areas of this soil are irregularly oval or irregularly rectangular and range from about 2 to 40 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is dark grayish brown loam about 11 inches thick. The subsoil extends to a depth of 52 inches. It is mostly yellowish brown loam and clay in the upper part, yellowish brown and reddish yellow clay in the middle part, and gray sandy clay loam in the lower part. Gray mottles are at a depth below 26 inches. The substratum is mottled sandy loam from 52 to at least 60 inches.

Included with this soil in mapping are small areas of well drained Pamunkey soils, moderately well drained Altavista and Peawick soils, somewhat poorly drained Newflat soils, and poorly drained Chickahominy soils. The Pamunkey soils are on slightly higher areas throughout the unit. The Altavista and Peawick soils are throughout the unit. The Newflat and Chickahominy soils are in slight depressions or at slightly lower positions. Also, the small acreage of Dogue soils along the James River have more silt than other Dogue soils in the survey area. Included soils make up about 15 percent of the unit.

The permeability of this Dogue soil is moderately slow, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 1 1/2 to 3 feet during winter and early spring.

In most areas this soil is farmed. In a few areas it is in woodland, and in a few it is in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet and cold in the early spring, and wetness often interferes with early tillage. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes. Overgrazing also increases runoff and the erosion hazard.

The potential for trees on this soil is high, especially for loblolly pine, sweetgum, and oak. Seeds and seedlings grow well. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table and the moderate shrink-swell potential of the subsoil are the main limitations if the soil is used for community development. The high water table limits use of the soil as a building site and as a site for sanitary landfills or septic tank absorption fields. The shrink-swell potential of the subsoil limits its use as a subgrade material for roads and streets and as a foundation for buildings.

This soil is in capability subclass IIw.

13—Dragston fine sandy loam. This soil is deep, nearly level, and somewhat poorly drained. It is on broad low-lying terraces. Areas of this soil commonly are oblong and irregular. They range from about 3 to 50 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is olive gray fine sandy loam about 10 inches thick. The subsurface layer is mottled, olive fine sandy loam 7 inches thick. The subsoil is mostly mottled, olive and brown fine sandy loam and extends to a depth of 31 inches. The substratum is mostly mottled brown and gray, stratified sandy loam, loamy fine sand, and sand to a depth of at least 72 inches.

Included with this soil in mapping are small areas of moderately well drained Altavista and Seabrook soils, somewhat poorly drained Augusta soils, and poorly drained Nimmo and Tomotley soils. The Altavista and Seabrook soils are in small, slightly higher convex areas; the Augusta soils are throughout the unit; the Nimmo and Tomotley soils are in slight depressions. Included soils make up about 15 percent of the unit.

The permeability of this Dragston soil is moderately rapid, and available water capacity is low. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid in the surface layer and upper part of the subsoil, but reaction in the surface layer varies because of local liming practices. It ranges from very strongly acid through slightly acid in the lower part of the subsoil and in the substratum. A high water table is at a depth of 1 foot to 2 1/2 feet during winter and spring.

In most areas this soil is in woodland. In a few areas it is farmed, and in some areas it is in pasture.

If drained, this soil is well suited to cultivated crops. Drainage systems are difficult to install, however, because of the wet sandy substratum. The soil is droughty during the growing season, and the low available water capacity limits crop response to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and hold moisture in the soil.

This soil is moderately well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing cuts the soft surface layer and damages the stands of grasses and legumes.

The potential for trees is high, but drought during the growing season limits the survival of seeds and seedlings. Loblolly pine, sweetgum, and oak grow well on this soil. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table and the moderately rapid permeability of the soil are the main limitations for community development, especially for the use of the soil as a building site or as a site for sanitary landfills or septic tank absorption fields. Also, both cause effluent seepage, which is a contamination hazard to ground water and nearby streams in areas used for septic tanks or landfills.

This soil is in capability subclass IIw, drained, and subclass IIIw, undrained.

14B—Emporia fine sandy loam, 2 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on medium and broad upland ridges. Slopes are smooth, commonly convex, and 150 to 800 feet long. Areas of this soil commonly are elongated or irregularly oval. They range from 3 to 40 acres.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 9 inches thick. The subsoil extends to a depth of 58 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum is variegated gray, brown, and red, firm sandy clay loam to a depth of at least 75 inches.

Included with this soil in mapping are small areas of well drained Caroline, Kenansville, Kempsville, Suffolk, and Uchee soils and moderately well drained Izagora and Slagle soils. The Caroline, Kenansville, Suffolk, and Uchee soils are on small knolls, and the Izagora and Slagle soils are in shallow depressions. The Emporia soils and the Kempsville soils are in similar areas throughout the map unit. Included soils make up about 20 percent of the unit.

In this Emporia soil, permeability is moderate in the upper part of the subsoil and moderately slow to slow in the lower part. The available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more, but is somewhat restricted by a firm, compacted layer at about 37 inches. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. A perched high water table is at a depth of 3 to 4 1/2 feet in winter and spring.

In most areas this soil is in woodland. Some of the acreage is in farmland or pasture, and some is in residential developments.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, control erosion, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing causes compaction of the surface layer and increases runoff and erosion.

The potential for trees on this soil is moderately high, especially for loblolly pine, sweetgum, and yellow-poplar. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft and will not support heavy timber equipment.

The low strength of the soil, moderate shrink-swell potential, seasonal high water table, and slow permeability of the subsoil are the main limitations for community development. The low strength and the moderate shrink-swell potential limit use of the soil as a building site, and the high water table limits excavation. The slowly permeable subsoil and the water table also limit use of the soil for septic tank absorption fields.

This soil is in capability subclass IIe.

14C—Emporia fine sandy loam, 6 to 10 percent slopes. This soil is deep, strongly sloping, and well drained. It is on side slopes and narrow ridges. Slopes are smooth and commonly convex and are 80 to 200 feet long. Areas of this soil commonly are long and winding. They range from about 2 to 10 acres.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 9 inches thick. The subsoil extends to a depth of 58 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum to a depth of at least 75 inches is variegated gray, brown, and red, firm sandy clay loam.

Included with this soil in mapping are small areas of well drained Caroline, Kempsville, Kenansville, and Uchee soils and moderately well drained Slagle soils. The Caroline soils are on small knolls, and the Kempsville, Kenansville, Uchee, and Slagle soils are on similar side slope positions throughout the map unit. Also included are areas that have seeps at the base of toe slopes. Also included are soils that have a red clayey subsoil. Included soils make up about 20 percent of this unit.

In this Emporia soil, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is rapid. The erosion hazard is severe. The surface layer is friable and easily tilled when moist. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more, but it is somewhat restricted by a firm, compacted layer at a depth of about 37 inches. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. A perched high water table is at a depth of 3 to 4 1/2 feet in winter and spring.

Most of the acreage is in woodland. A small acreage is cultivated or used for pasture.

This soil is moderately well suited to cultivated crops and to hay crops. Crops respond well to lime and fertilizer. The erosion hazard is severe and is a major management concern (fig. 7). Conservation tillage, using cover crops and grasses and legumes in the cropping system, stubble mulching, contour tillage, and use of crop residue help to maintain organic matter content and tilth, control erosion, reduce crusting, and increase water infiltration. Grassed waterways and diversions also help to control rapid surface runoff and reduce erosion.

The soil is moderately well suited to pasture. Establishing and maintaining a mixture of adapted grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet cause compaction of the surface layer and a reduction in plant growth. Runoff and erosion are also increased.

The potential for trees is moderately high, especially for loblolly pine, sweetgum, and southern red oak. Seeds and seedlings grow well if competing vegetation is controlled. When this soil is wet, it is soft and will not support heavy timber equipment.

The low strength of the soil and the moderate shrink-swell potential, moderately slow permeability, and seasonal high water table in the subsoil, and slope are the main limitations if the soil is used for community development. Slope, the seasonal high water table, and the shrink-swell potential limit use of the soil as a

Figure 7.—Gullies can form quickly on Emporia fine sandy loam, 6 to 10 percent slopes, unless this soil is adequately protected.

building site. The low strength of the clay loam subsoil limits vehicular traffic in unpaved areas when the soil is wet. Slope, seasonal wetness, and the permeability of the subsoil limit use of the soil for septic tank absorption fields, sanitary landfills, and some types of recreation.

This soil is in capability subclass IIIe.

15D—Emporia complex, 10 to 15 percent slopes. This complex consists of areas of deep, moderately steep, well drained Emporia soils and areas of similar soils that formed over layers of fossil shells. Individual areas of these soils are so intermingled that it is not practical to separate them at the scale used in mapping. This complex is on side slopes along rivers, creeks, and drainageways. Slopes are convex and irregularly shaped and range from 50 to 200 feet long. Areas of this complex are long and winding, and they range from about 2 to 20 acres.

Of the total acreage of this map unit, about 50 percent is Emporia soils, 25 percent is similar soils, and 25 percent is other soils.

Typically, the surface layer of Emporia soils is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 7 inches thick. The subsoil extends to a depth of 54 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum is variegated brown, red, and gray, firm sandy clay loam to a depth of at least 75 inches.

Included with these soils in mapping are small areas of well drained Caroline and Uchee soils, moderately well drained Craven and Slagle soils, and very poorly drained Johnston soils. The Caroline and Uchee soils are in similar areas. The Craven and Slagle soils are in gently sloping areas around the heads of drainageways. The Johnston soils are in small drains and along the edge of large drainageways. Also included are soils that have a sandy subsoil and small areas of gravelly or severely eroded soils that are on some knobs and short, steep side slopes. Small areas of fossiliferous shells are on the surface in some units. Also included are areas having springs or seeps, especially at the base of the slopes.

In these Emporia soils, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is rapid. The erosion hazard is severe. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more, but is somewhat restricted by a firm, compacted layer at a depth of 37 inches. The soils are low in organic matter content and natural fertility. They commonly are very strongly acid or strongly acid. A perched high water table is at a depth of 3 to 4 1/2 feet during winter and spring.

Slope limits the use of farm equipment and makes these soils generally unsuitable for farming. The potential for trees on these soils is moderately high. Most of the acreage is in woodland that is managed for loblolly pine, sweetgum, and oak. Logging roads and skid trails should be on the contour of the landscape, where possible, to help reduce the concentration of runoff and thereby control erosion.

Slope is the main limitation of these soils for community development, especially if they are used for recreation sites and building sites and for sanitary facilities.

The soils in this complex are in capability subclass IVe.

15E—Emporia complex, 15 to 25 percent slopes. This complex consists of areas of deep, steep, well drained Emporia soils and areas of similar soils that formed over layers of fossil shells. Individual areas of these soils are so intermingled that it is not practical to separate them at the scale used in mapping. This complex is on side slopes along rivers, creeks, and drainageways. Slopes are convex and irregularly shaped and range from 50 to 200 feet long. Areas of this complex are long and winding and range from about 2 to 100 acres.

Of the total acreage of this map unit, about 50 percent is Emporia soils, 25 percent is similar soils, and 25 percent is other soils.

Typically, the surface layer of Emporia soils is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 5 inches thick. The subsoil extends to a depth of 50 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum is variegated brown, red, and gray, firm sandy clay loam to a depth of at least 75 inches.

Included with this complex in mapping are small areas of moderately well drained Slagle soils and very poorly drained Johnston soils. The Slagle soils are in gently sloping areas around the heads of drainageways. The Johnston soils are in small drains and along the edge of large drainageways. Also included are soils that have a sandy subsoil; small areas of gravelly soils or severely eroded soils on some knobs and short steep slopes; small areas of fossiliferous shells on the surface in some units; and areas having springs or seeps, especially at the base of the slopes.

In these Emporia soils, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is very rapid. The erosion hazard is severe. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more, but is somewhat restricted by a firm, compacted layer at a depth of 37 inches. The soils are low in organic matter content and natural fertility. They commonly are very strongly acid or strongly acid. A perched seasonal high water table is at a depth of 3 to 4 1/2 feet during winter and spring.

Slope limits the use of farm equipment and makes these soils generally unsuitable for farming. The potential for trees on these soils is moderately high. Most of the acreage is in woodland and is managed for loblolly pine, sweetgum, and oaks; however, slope also limits the safe operation of heavy timber equipment. Logging roads and skid trails should be on the contour of the landscape, where possible, to help reduce the concentration of runoff and thereby control erosion.

Slope is the main limitation of these soils for community development (fig. 8), especially for recreation sites, building sites, and sanitary facilities.

The soils in this complex are in capability subclass VIe.

15F—Emporia complex, 25 to 50 percent slopes. This complex consists of areas of deep, very steep, well drained Emporia soils and areas of similar soils that formed over layers of fossil shells. Individual areas of these soils are so intermingled that it is not practical to separate them at the scale used in mapping. This complex is on side slopes along rivers, creeks, and drainageways. Slopes are convex and irregularly shaped and range from 50 to 150 feet long. Areas of this complex are long and winding, and they range from about 2 to 150 acres.

Figure 8.—Stabilization of this roadbank on Emporia complex, 15 to 25 percent slopes, is an important erosion control measure.

Of the total acreage of this map unit, about 45 percent is Emporia soils, 30 percent is similar soils, and 25 percent is other soils.

Typically, the surface layer of Emporia soils is dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is pale brown loam 3 inches thick. The subsoil extends to a depth of 45 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum is variegated brown, red, and gray, firm sandy clay loam to a depth of at least 75 inches.

Included with these soils in mapping are small areas of moderately well drained Slagle soils and very poorly drained Johnston soils. The gently sloping Slagle soils are in areas around the heads of drainageways. The Johnston soils are in small drains and along the edge of large drainageways. Also included are soils that have a sandy or clayey subsoil; small areas of gravelly or severely eroded soils on some knobs and short, steep side slopes; small areas of fossiliferous shells on the surface in some units; and areas having springs or seeps, especially at the base of the slopes.

In these Emporia soils, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is very rapid. The erosion hazard is severe. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more, but is somewhat restricted by a firm, compacted layer at a depth of 37 inches. The soils are low in organic matter content and natural fertility. They commonly are very strongly acid or strongly acid. A perched high water table is at a depth of 3 to 4 1/2 feet in winter and spring.

Slope limits the use of farm equipment and makes these soils generally unsuitable for farming. The potential for trees on these soils is moderately high. Most areas are in woodland and are managed for loblolly pine, sweetgum, and oak; however, slope also limits the safe operation of heavy timber equipment. Logging roads and skid trails should be on the contour of the landscape, where possible, to reduce the concentration of runoff and thereby control erosion.

Slope is the main limitation of these soils for community development, especially for recreation sites, building sites, and sanitary facilities.

The soils in this complex are in capability subclass VIIe.

16—Izagora loam. This soil is deep, nearly level, and moderately well drained. It is on broad upland flats.

Areas of this soil commonly are irregularly oval and range from about 4 to 60 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is very dark gray loam about 4 inches thick. The subsurface layer is light yellowish brown loam 9 inches thick. The subsoil extends to a depth of at least 78 inches. It is light olive brown loam in the upper part, mottled brown and gray clay loam in the middle part, and gray clay loam and clay with mostly yellowish brown mottles in the lower part.

Included with this soil in mapping are well drained Emporia soils, moderately well drained Slagle soils, somewhat poorly drained Yemassee soils, and poorly drained Bethera soils. The Emporia soils are in slightly higher areas throughout the unit. The Slagle soils are in similar areas, and the Bethera and Yemassee soils are in lower areas and slight depressions throughout the unit. Included soils make up about 15 percent of the unit.

In this Izagora soil, permeability is moderate in the upper part of the subsoil and slow in the lower part. Available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled, but will clod if worked when wet. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly ranges from extremely acid through strongly acid in the surface layer, but reaction varies because of local liming practices. The subsoil is very strongly acid or strongly acid. A high water table is at a depth of 2 to 3 feet in winter and early in spring.

In most areas this soil is in woodland. In a few areas it is farmed, in a few it is in pasture, and in some it is in urban development.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet in spring. Drainage helps to reduce wetness and protects crops from damage. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees is high, especially for loblolly pine, sweetgum, yellow-poplar, and oak. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, thus limiting use of heavy timber equipment.

The seasonal high water table, moderate shrink-swell potential, and slow permeability are the main limitations of the soil for community development, especially as a building site or a site for sanitary landfills or septic tank absorption fields and for some types of recreation.

This soil is in capability subclass IIw.

17—Johnston complex. This complex consists of areas of nearly level, very poorly drained Johnston soils and areas of similar soils that formed over layers of fossil shells. Individual areas of these soils are so intermingled that it is not practical to separate them at the scale used in mapping. These soils are on flood plains and along major drainageways throughout the survey area. Areas of this complex are elongated or irregularly oval. They are 200 to over 500 feet wide and up to 3/4 mile long. Areas range from about 2 to 450 acres. Slopes range from 0 to 2 percent.

Of the total acreage of this map unit, about 45 percent is Johnston soils, 30 percent is similar soils, and 25 percent is other soils.

Typically, the surface layer of Johnston soils is black silt loam about 8 inches thick. The subsoil is black silty clay loam 26 inches thick. The substratum is black sandy clay loam and gray fine sandy loam to a depth of at least 60 inches.

Included with this complex in mapping are small areas of poorly drained Nimmo and Tomotley soils and very poorly drained Axis, Bohicket, and Levy soils. The Nimmo and Tomotley soils are scattered throughout the map unit. The Axis, Bohicket, and Levy soils are mostly in the lower part of the flood plains. Also included throughout the map unit are soils that have a clay subsoil; soils that are sandy; soils that are flooded for a very long duration; and somewhat poorly drained soils near the base of side slopes. Strata of weathered, calcareous shells are in some areas.

The permeability is moderate in the Johnston soils and ranges from slow to moderately rapid for some of the similar soils. The available water capacity is high. The shrink-swell potential is low for Johnston soils and is high for some of the other soils. The root zone extends to a depth of 60 inches or more. Johnston soils are high in organic matter content and medium in natural fertility. They commonly are strongly or very strongly acid above a depth of 40 inches, but reaction in the surface layer may vary due to recent sediments from the higher, surrounding cultivated fields. Below a depth of 40 inches, the reaction ranges from very strongly acid through medium acid. A seasonal high water table is 1 foot above the surface to 1 1/2 feet below the surface during summer months. Flooding commonly occurs in summer and early in fall as a result of intense rainstorms. The soils commonly are flooded or ponded from late in fall to late in spring.

This complex is not suited to cultivated crops or to pasture and hay crops because of flooding and wetness. Most areas are in woodland. The potential for trees is very high, especially for water-tolerant hardwoods, such as sweetgum, blackgum, swamp tupelo, and water oak.

These hardwoods generally regenerate naturally after timber is harvested. Flooding and wetness (fig. 9) are the main limitations for timber harvesting equipment.

Flooding and wetness preclude the use of this complex for most uses other than for woodland and for wildlife habitat.

The soils in this complex are in capability subclass VIIw.

18B—Kempsville fine sandy loam, 2 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on broad uplands and side slopes. Slopes commonly are 200 to 600 feet long. Areas of this soil are elongated, irregularly rectangular, or oval. They range from about 3 to 60 acres.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 10 inches thick. The subsoil extends to a depth of 55 inches. It is yellowish brown and strong brown fine sandy loam and sandy clay loam to a depth of 32 inches; and below that depth, it is mottled fine sandy loam that is somewhat firm and compact over yellowish brown sandy clay loam. The substratum is yellowish brown fine sandy loam to a depth of at least 68 inches.

Included with this soil in mapping are small areas of well drained Emporia, Kenansville, and Suffolk soils and moderately well drained Slagle soils. The Emporia soils are in slightly lower areas, the Kenansville and Suffolk soils are on small knolls throughout the unit, and the

Figure 9.—Ponding is common in some areas of Johnston complex in winter. These ponds provide important wetland wildlife habitat.

Slagle soils are adjacent to drainageways and in depressions. Also included are small areas of soils in York County that are east of U.S. Highway 17 and that have a seasonal high water table at a depth of 4 to 6 feet. Included soils make up about 20 percent of this unit.

The permeability of this Kempsville soil is moderate, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices.

In most areas this soil is in woodland. In some areas it is farmed, and in some areas it is in community developments.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to control runoff and erosion, maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet compact the surface layer and damage the stands of grasses and legumes. This results in reduced yields and increased runoff and erosion.

The potential for trees on this soil is moderately high, especially for loblolly pine, yellow-poplar, sweetgum, and southern red oak. The wooded areas are managed for both pine and hardwoods. Seeds and seedlings grow well if competing vegetation is controlled.

The moderate permeability and slope are the main limitations of this soil for community development. The permeability of the subsoil and slope limit use of the soil as a site for septic tank absorption fields, sewage lagoons, and small commercial buildings.

This soil is in capability subclass IIe.

19B—Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes. This complex consists of deep, gently sloping, well drained soils that are so intermingled that it is not practical to separate them at the scale used in mapping. Areas of this complex are on medium to broad upland ridges and side slopes. Slopes are commonly smooth and range from 400 to 1,000 feet long. Areas commonly are elongated or irregularly oval and range from about 2 to 30 acres.

Of the total acreage of this map unit, about 50 percent is Kempsville soil, 30 percent is Emporia soil, and 20 percent is other soils.

Typically, the surface layer of this Kempsville soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 10 inches thick. The subsoil extends to a depth of 55 inches. It is yellowish brown and strong brown fine sandy loam and sandy clay loam to a depth of 32 inches. Below this, the subsoil is mottled fine sandy loam that is somewhat firm and compact over yellowish brown sandy clay loam. The substratum is yellowish brown fine sandy loam to a depth of at least 68 inches.

Typically, the surface layer of this Emporia soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 9 inches thick. The subsoil extends to a depth of 58 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part, yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part, and mottled gray and brown firm sandy clay loam in the lower part. The substratum is variegated gray, brown, and red firm sandy clay loam to a depth of at least 75 inches.

Included with these soils in mapping are small areas of well drained Caroline, Kenansville, Suffolk, and Uchee soils and moderately well drained Slagle soils. The Caroline soils are in slightly lower areas; the Kenansville and Suffolk soils are on small knolls; and the Slagle soils are adjacent to drainageways and in depressions.

The permeability of the Kempsville soil is moderate. In the Emporia soil, permeability is moderate in the upper part of the subsoil and moderately slow to slow in the lower part. The available water capacity is moderate for both soils. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and is easily tilled throughout a wide range of moisture conditions. The subsoil of the Kempsville soil has low shrink-swell potential, and that of the Emporia soil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more, but is somewhat restricted in the Emporia soil by a firm, compact layer at a depth of about 37 inches. Both soils are low in organic matter content and natural fertility. Both soils are very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. The Emporia soil has a perched high water table at a depth of 3 to 4 1/2 feet in winter and spring.

In most areas these soils are in woodland. In some areas they are farmed, and in some areas they are in pasture. A small acreage is in urban development.

The soils in this complex are well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to control runoff and erosion, maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This complex is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet compact the surface layer and increase runoff and erosion.

The potential for trees on this complex is moderately high, especially for loblolly pine, yellow-poplar, and oak. Seeds and seedlings grow well if competing vegetation is controlled. The surface layer of the Emporia soil is often soft during wet periods and, consequently, will not support heavy timber equipment.

The low strength, moderate shrink-swell potential, and seasonal high water table of the Emporia soil and the slow permeability of the Emporia subsoil and moderate permeability of the Kempsville subsoil are the main limitations for community development. The low strength and moderate shrink-swell potential limit use of the Emporia soil as a building site, and the seasonal perched high water table limits excavation. The slow permeability and the water table also limit use of the Emporia soil for septic tank absorption fields. The low strength of the Emporia subsoil also limits use as a subgrade material for roads and streets.

The soils in this complex are in capability subclass IIe.

20B—Kenansville loamy fine sand, 2 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on upland ridges. Slopes are smooth and are 150 to 500 feet long. Areas commonly are long and narrow or irregularly oval. They range from about 2 to 40 acres.

Typically, the surface layer of this soil is dark grayish brown loamy fine sand about 2 inches thick. The subsurface layer is light yellowish brown loamy fine sand 23 inches thick. The subsoil is yellowish brown and strong brown fine sandy loam 18 inches thick. The substratum is yellowish brown loamy fine sand with lamellae of brown fine sandy loam to a depth of at least 78 inches.

Included with this soil in mapping are small areas of moderately well drained Slagle soils and well drained Kempsville, Suffolk, and Uchee soils. Slagle soils are in slight depressions, generally adjacent to drainageways. Suffolk, Kempsville, and Uchee soils commonly are throughout the unit. Also included in mapping are small areas that are sandy throughout. Included soils make up about 15 percent of the unit.

The permeability of this Kenansville soil is moderately rapid, and available water capacity is low. Surface runoff is slow. The hazard of water erosion is slight, but the hazard of wind erosion is moderate. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 4 to 6 feet in winter and spring.

In most areas this soil is farmed, and in a few areas it is in woodland.

This soil is well suited to cultivated crops. It is droughty during the growing season, however, and the low available water capacity limits crop response to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and hold moisture in the soil.

This soil is moderately well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing cuts the soft surface layer and damages the stands of grasses and legumes.

The potential for trees on this soil is moderately high, especially for loblolly pine, but the survival of seeds and seedlings is limited by drought during the growing season.

The moderately rapid permeability, the sandy texture, and the seasonal high water table are the main limitations for community development. Because of the moderately rapid permeability and the seasonal high water table, seepage of effluent into ground water and nearby streams is a pollution hazard if this soil is used for septic tank absorption fields and sanitary landfills. The sandy texture limits excavation, and the surface of the soil is dusty when dry. The low available water capacity of this soil limits the growth of grasses and shrubs.

This soil is in capability subclass IIs.

21—Levy silty clay. This soil is deep, nearly level, and very poorly drained. It is on tidal marshes. Areas of this soil are irregular in shape. They range from about 3 to 100 acres. Slopes are less than 1 percent.

Typically, the surface layer of this soil is dark olive gray silty clay about 18 inches thick. The substratum is very dark gray silty clay to a depth of at least 80 inches.

Included with this soil in mapping are small areas of very poorly drained Axis, Bohicket, and Johnston soils. The Axis and Bohicket soils are throughout the unit. The Johnston soils are on the flood plains of smaller streams but are not flooded by tidal waters. Also included are areas of soil, which are in tidal marshes and have sandy layers within a depth of 60 inches. Included soils make up about 15 percent of this unit.

The permeability of this Levy soil is slow, and available water capacity is high. Surface runoff is very slow. The substratum has high shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is high in organic matter content and medium in natural fertility.

It is very strongly acid or strongly acid throughout. The soil is continuously saturated with water. It is flooded daily by tides and covered with 1 to 2 feet of water.

Areas of this soil are in water-tolerant grasses and forbs, especially arrowleaf, cattails, giant cordgrass, and lilies. Scattered baldcypress and tupelo are in some areas; however, the soil is very soft and will not support heavy timber equipment or animals, thus harvesting timber is limited or impractical.

Flooding and wetness make this soil generally unsuitable for farming or community development. A lack of suitable outlets makes drainage impractical.

This soil is in capability subclass VIIw.

22—Munden loamy fine sand. This soil is deep, nearly level, and moderately well drained. It is on ridges and in weakly expressed depressions. Areas of this soil commonly are irregularly oval. They range from about 2 to 10 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is dark grayish brown loamy fine sand about 6 inches thick. The subsurface layer is brown loamy fine sand 5 inches thick. The subsoil is mostly olive and yellowish brown fine sandy loam 37 inches thick. Gray mottles are below a depth of 24 inches. The substratum is mostly light olive brown fine sandy loam and sandy loam to a depth of at least 80 inches.

Included with this soil in mapping are small areas of moderately well drained Altavista soils and well drained Bojac soils in slightly higher areas and somewhat poorly drained Dragston soils in lower areas and in slight depressions. Included soils make up about 10 percent of the unit.

The permeability of this Munden soil is moderate, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 1 1/2 to 2 1/2 feet in winter and early in spring.

In most areas this soil is in woodland. In some areas it is farmed, and in a few it is in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help in maintaining organic matter content and tilth, reducing crusting, and increasing water infiltration.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, shortleaf pine, yellow-poplar, sweetgum, and oak. Seed and seedlings grow well. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table and the moderate permeability of the subsoil are the main limitations if the soil is used for community development. Because of the moderate permeability of the subsoil and the high water table, seepage of effluent into ground water and nearby streams is a hazard if this soil is used for septic tank absorption fields or landfills.

This soil is in capability subclass IIw.

23—Newflat silt loam. This soil is deep, nearly level, and somewhat poorly drained. It is on broad flats of intermediate river terraces. Areas of this soil are irregularly elongated. They range from 3 to 20 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is dark grayish brown and light yellowish brown silt loam about 8 inches thick. The upper 3 inches of the subsoil is pale brown silty clay loam. Below this, to a depth of at least 80 inches, the subsoil is light olive brown clay or gray clay with mostly yellowish brown mottles.

Included with this soil in mapping are small areas of moderately well drained Peawick and Tetotum soils and poorly drained Chickahominy soils. The Peawick and Tetotum soils are in slightly higher areas, and the Chickahominy soils are in slight depressions and near drainageways. Also included are soils that are ponded in winter and early in spring or after prolonged periods of heavy rainfall. Also included are some soils that are similar to the Newflat soil but have less silt and clay and a thinner solum. Included soils make up about 20 percent of this unit.

The permeability of this Newflat soil is very slow, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled. The subsoil has high shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It is extremely acid or very strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 1/2 foot to 1 1/2 feet in winter and early in spring.

Most of the acreage of this soil is in woodland. A few areas are in pasture.

This soil is moderately well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet and cold in spring, and wetness often interferes with tillage and crop harvest. If suitable outlets are available, a surface drainage system is usually needed to remove surface water. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet compact the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, sweetgum, and red maple. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The shallow depth to the seasonal high water table, slow permeability, and high shrink-swell potential are the main limitations of the soil for community development. These properties limit the use of this soil for building sites and sanitary landfills or septic tank absorption fields and for most types of recreation uses. Low strength is the main limitation to the use of this soil as subgrade material for local roads and streets.

This soil is in capability subclass IIIw.

24—Nimmo fine sandy loam. This soil is deep, nearly level, and poorly drained. It is on broad low-lying flats. Areas of this soil commonly are elongated and range from about 3 to 50 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 8 inches thick. The subsurface layers are dark gray and gray fine sandy loam 9 inches thick. The subsoil is mostly mottled, gray fine sandy loam 19 inches thick. The substratum extends to a depth of at least 60 inches. It is mostly gray loamy fine sand and sand with many yellowish brown mottles.

Included with this soil in mapping are small areas of moderately well drained Altavista, Munden, and Seabrook soils in slightly higher areas and poorly drained Tomotley soils that are throughout the unit. In some included areas the soils have water on the surface in winter and early in spring and during periods of prolonged rainfall. Included soils make up about 20 percent of the unit.

In this Nimmo soil, permeability is moderate in the solum and moderately rapid in the substratum. Available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is moderate in organic matter content and low in natural fertility. It ranges from extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is between the surface and a depth of 1/2 foot in winter and spring.

In most areas this soil is in woodland, but in some drained areas it is farmed.

If drained, this soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet and cold in spring, and the wetness often interferes with tillage. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, drainage, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, sycamore, yellow-poplar, sweetgum, and oak. Seeds and seedlings grow well only if competing vegetation is controlled. Productivity and seedling survival are enhanced by drainage. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table and the sandy texture of the substratum are the main limitations if the soil is used for community development. The seasonal high water table limits use of the soil as a building site or a site for sanitary landfills or septic tank absorption fields and for many types of recreation. The seasonal high water table and the low strength of the substratum limit excavation.

This soil is in capability subclass IIIw, drained, and subclass IVw, undrained.

25B—Norfolk fine sandy loam, 2 to 6 percent slopes. This soil is deep, nearly level, and well drained. It is on medium upland ridges. Areas of this soil are elongated or irregularly oval. They range from about 3 to 15 acres.

Typically, the surface layer of this soil is grayish brown fine sandy loam about 10 inches thick. The subsurface layer is yellowish brown fine sandy loam 7 inches thick. The subsoil extends to a depth of at least 72 inches. It is mostly yellowish brown sandy clay loam and strong brown sandy clay loam with yellowish brown mottles.

Included with this soil in mapping are small areas of well drained Emporia and Kempsville soils and moderately well drained Slagle soils. The Emporia and Kempsville soils are on small knobs and in areas similar to those of the Norfolk soils. The Slagle soils are in slight upland depressions and near drainageways. Included soils make up about 15 percent of the unit.

The permeability of this Norfolk soil is moderate, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled when moist. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. A perched high water table is at a depth of 4 to 6 feet in winter and early in spring.

In most areas this soil is in woodland. In a small acreage it is farmed.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and improve water infiltration. Grassed waterways and diversions help to reduce erosion in critical areas.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of adapted grasses and legumes, using proper stocking rates, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pasture. Overgrazing and grazing when the soil is too wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine. Seeds and seedlings grow well.

The seasonal high water table and moderate permeability of the subsoil are the main limitations to the use of this soil for community development, especially for septic tank absorption fields, sewage lagoons, shallow excavations, and buildings with basements. Slope restricts development of small commercial buildings.

This soil is in capability subclass IIe.

26B—Pamunkey soils, 2 to 6 percent slopes. These soils are deep, gently sloping, and well drained. They are on broad high terraces. Areas of these soils commonly are elongated or irregularly oval. They range from about 3 to 25 acres.

The texture of the surface layer of these soils is highly variable throughout the survey area. Typically, the surface layer of the Pamunkey soils is dark grayish brown sandy loam about 4 inches thick. The subsurface layer is brown sandy loam 10 inches thick. The subsoil extends to a depth of 43 inches. It is mostly yellowish brown sandy loam and dark brown sandy clay loam. The substratum is mostly brown and strong brown loamy sand and sand to a depth of at least 75 inches.

Included with these soils in mapping are small areas of well drained Bojac soils and moderately well drained Altavista, Dogue, and Tetotum soils. The Bojac soils are in similar areas throughout the unit. The Altavista, Dogue, and Tetotum soils are in slightly lower areas and near drainageways. Included soils make up about 15 percent of this unit.

The permeability of these Pamunkey soils is moderate, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is very friable and easily tilled. The soils have low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soils have low organic matter content and medium natural fertility. They commonly are very strongly acid through slightly acid in the surface layer and upper part of the subsoil, but reaction in the surface layer varies because of local liming practices. The soils are medium acid through neutral in the lower part of the subsoil and in the substratum.

In most areas these soils are farmed. In a few areas they are in woodland.

These soils are well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, increase water infiltration, and reduce erosion.

These soils are well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing damages the stands of desirable grasses and legumes, thereby increasing the runoff and the erosion hazard.

The potential for trees on these soils is high, especially for loblolly pine, yellow-poplar, and black walnut. Seeds and seedlings grow well if competing vegetation is controlled.

The rapid permeability of the substratum and the low strength of the subsoil are the main limitations of the soils for community development. The rapid permeability limits use of these soils as a site for sewage lagoons or trench sanitary landfills. These soils need a suitable base material to provide good strength and stability to support vehicular traffic.

The soils in this map unit are in capability subclass IIe.

27—Peawick silt loam. This soil is deep, nearly level, and moderately well drained. It is on broad ridges of high stream terraces. Areas of this soil are elongated, irregularly rectangular, or oval. They range from about 3 to 100 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is dark grayish brown silt loam about 2 inches thick. The upper 14 inches of the subsoil is light yellowish brown silty clay loam and yellowish brown silty clay. The next 25 inches of the subsoil is mottled brown and gray silty clay. The lower part of the subsoil is mostly mottled, gray silty clay and clay to a depth of at least 99 inches.

Included with this soil in mapping are small areas of well drained Pamunkey soils, moderately well drained Dogue soils, somewhat poorly drained Newflat soils, and poorly drained Chickahominy soils. The Pamunkey soils are in slightly higher areas, and the Dogue soils are throughout the unit. The Newflat and Chickahominy soils are in lower areas, in slight depressions, and near drainageways. Also included in mapping are large, intermingled areas of soils that are similar to the Peawick soil but have a thinner subsoil. Included soils make up about 20 percent of this unit.

The permeability of this Peawick soil is very slow, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable but is thin in most areas. The subsoil has high shrink-swell potential. The root zone commonly extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It is extremely acid or very strongly acid, but reaction in the surface layer varies because of local liming practices. In winter and early in spring, a perched high water table is at a depth of 1 1/2 to 3 feet.

In most areas this soil is in woodland. In a few areas it is farmed, and some are in pasture.

This soil is moderately well suited to cultivated crops. However, in most areas the thin surface layer and the high clay content of the upper part of the subsoil hinder cultivation, especially when the soil is too wet. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to reduce runoff and control erosion, maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is moderately well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet often cut up and compact the surface layer, thereby reducing yields and increasing the erosion hazard.

The potential for trees on this soil is moderately high, especially for loblolly pine. Seeds and seedlings grow well if competing vegetation is controlled. The use of heavy timber equipment on this soil is limited during wet periods.

The seasonal high water table and the high shrink-swell potential and slow permeability of the subsoil are the main limitations if the soil is used for community development. The seasonal high water table and the high shrink-swell potential and slow permeability of the subsoil limit use of the soil as a building site or site for sanitary landfills or septic tank absorption fields and for many types of recreation. Low strength limits the use of the soil for subgrade material for local roads and streets.

This soil is in capability subclass IIw.

28—Seabrook loamy fine sand. This soil is deep, nearly level, and moderately well drained. It is on low terraces along drainageways adjacent to the major rivers. Areas of this soil commonly are elongated and irregularly oblong. They range from about 3 to 20 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is very dark grayish brown and dark brown loamy fine sand about 9 inches thick. The substratum is mostly yellowish brown and olive brown loamy fine sand to a depth of at least 72 inches. It is mottled below a depth of 25 inches.

Included with this soil in mapping are small areas of well drained Bojac soils, moderately well drained Altavista and Munden soils, somewhat poorly drained Dragston soils, and poorly drained Nimmo and Tomotley soils. The Bojac soils are in slightly higher areas throughout the map unit. The Altavista and Munden soils are in similar areas throughout the unit. The Dragston soils are in slight depressions and along drainageways. Also included in mapping are sandy soils that have thin sandy loam lamellae in the substratum. Included soils make up about 20 percent of this unit.

The permeability of this Seabrook soil is rapid, and available water capacity is low. Surface runoff is slow. The erosion hazard is slight. The surface layer is very friable and easily tilled throughout a wide range of moisture conditions. The substratum has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. The surface layer commonly is very strongly acid or strongly acid, but reaction varies because of local liming practices. The substratum ranges from very strongly acid through medium acid. A high water table is at a depth of 2 to 4 feet in winter and early in spring.

In most areas this soil is in woodland. In some areas it is farmed.

This soil is moderately well suited to cultivated crops. The soil is droughty during the growing season. Crop response to lime and fertilizer is limited by the low available water capacity. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and hold moisture in the soil.

This soil is moderately well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing cuts the soft surface layer and damages the stands of grasses and legumes.

The potential for trees on this soil is moderately high, especially for loblolly pine, sweetgum, and oak. The survival of seeds and seedlings is hindered by drought during the growing season. The soil is soft when wet, thus limiting use of heavy timber equipment.

The rapid permeability of the substratum, the seasonal high water table, and the sandy texture of the soil are the main limitations for community development. Because of the rapid permeability and the seasonal high water table, seepage of effluent into ground water and nearby streams is a hazard in areas used for septic tank absorption fields or sanitary landfills. The sandy texture limits excavation, and the surface of the soil is dusty when dry. The low available water capacity of this soil limits the growth of grasses and shrubs.

This soil is in capability subclass IIIs.

29A—Slagle fine sandy loam, 0 to 2 percent slopes. This soil is deep, nearly level, and moderately well drained. It is on upland terraces and broad flat uplands and in slight depressions. Areas of this soil commonly are elongated, but some smaller areas are irregularly oval or rectangular. They range from about 2 to 80 acres.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 5 inches thick. The subsoil extends to a depth of 50 inches. It is mostly mottled yellowish brown clay loam to a depth of 25 inches. Below this depth, it is mostly mottled clay loam and sandy clay loam. The substratum is mottled sandy clay loam to a depth of at least 60 inches.

Included with this soil in mapping are small areas of well drained Emporia, Kempsville, and Uchee soils; moderately well drained Izagora and Peawick soils; somewhat poorly drained Yemassee soils; and poorly drained Bethera soils. The Emporia, Kempsville, and Uchee soils are in slightly higher areas; the Izagora and Peawick soils are in similar areas; and the Yemassee and Bethera soils are in slight depressions and around drainageways. Also included are many small areas of soils that have water on the surface for brief periods after heavy or prolonged rainfall in winter and spring and soils that are similar to this Slagle soil but have a thicker surface layer. Included soils make up about 20 percent of this unit.

In this Slagle soil, permeability is moderate in the upper part of the subsoil and moderately slow or slow in the lower part. The available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It ranges from extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high perched water table is at a depth of 1 1/2 to 3 feet in winter and spring.

In most areas this soil is in woodland. In a few areas it is cultivated, and in a few it is in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer, but the soil is wet and cold in spring, and wetness often interferes with tillage. Drainage helps to protect crops from damage caused by wetness. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, oak, and sweetgum. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table and the low strength and slow permeability of the subsoil are the main limitations of the soil for community development. The high water table and slow permeability of the subsoil limit the use of the soil as a building site or site for sanitary landfills or septic tank absorption fields and for most types of recreation. The low strength limits its use as a subgrade material for roads and streets.

This soil is in capability subclass IIw.

29B—Slagle fine sandy loam, 2 to 6 percent slopes. This soil is deep, gently sloping, and moderately well drained. It is on terraces and side slopes on the uplands. Slopes range from about 200 to 1,000 feet long. Areas of this soil commonly are elongated, but some smaller areas are irregularly oval or rectangular. They range from about 2 to 80 acres.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 5 inches thick. The subsoil extends to a depth of 50 inches. It is mostly mottled yellowish brown clay loam to a depth of 25 inches. Below this depth, the subsoil is mostly mottled clay loam and sandy clay loam. The substratum is mottled sandy clay loam to a depth of at least 60 inches.

Included with this soil in mapping are small areas of well drained Emporia, Kempsville, and Uchee soils and moderately well drained Izagora and Peawick soils. The Emporia, Kempsville, and Uchee soils are in slightly higher areas, and the Izagora and Peawick soils are in similar areas throughout the unit. Also included are small areas that are ponded for brief periods after heavy or prolonged rainfall during winter and spring. Included soils make up about 20 percent of this unit.

In this Slagle soil, permeability is moderate in the upper part of the subsoil and moderately slow or slow in the lower part. The available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It ranges from extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high perched water table is at a depth of 1 1/2 to 3 feet in winter and spring.

In most areas this soil is in woodland. In a few areas it is cultivated, and in a few it is in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer, but the soil is wet and cold in spring, and wetness often interferes with tillage. Drainage helps to protect crops from damage caused by wetness. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce surface crusting, increase water infiltration, and reduce erosion.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, oak, and sweetgum. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, thus limiting the use of heavy timber equipment.

The seasonal high water table and the low strength and slow permeability of the subsoil are the main limitations of the soil for community development. The high water table and slow permeability of the subsoil limit the use of the soil as a building site or site for sanitary landfills or septic tank absorption fields and for most types of recreation. The low strength limits its use as a subgrade material for roads and streets.

This soil is in capability subclass IIe.

30—State fine sandy loam. This soil is deep, nearly level, and well drained. It is on low-lying terraces. Areas range from about 3 to 25 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 5 inches thick. The subsoil is mostly dark yellowish brown fine sandy loam and dark brown loam, clay loam, and sandy clay loam 47 inches thick. The substratum is dark brown fine sandy loam to a depth of at least 97 inches.

Included with this soil in mapping are small areas of well drained Pamunkey soils, moderately well drained Altavista, Dogue, and Tetotum soils, and somewhat poorly drained Augusta soils. The Pamunkey soils are in slightly higher areas, the Altavista, Dogue, and Tetotum soils are in similar areas, and the Augusta soils are in slightly lower areas and in slight depressions throughout the unit. Included soils make up about 15 percent of the unit.

The permeability of this State soil is moderate, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is slight. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid in the surface layer and subsoil, but reaction in the surface layer varies because of local liming practices. The substratum ranges from very strongly acid through medium acid. A high water table is at a depth of 4 to 6 feet in winter and spring.

In most areas this soil is farmed, but in some areas it is in woodland.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing causes compaction of the surface layer and reduces the stands of grasses and legumes.

The productivity for trees on this soil is very high, especially for loblolly pine, yellow-poplar, sweetgum, and oak. Seeds and seedlings grow well if competing vegetation is controlled.

Moderate permeability and the seasonal high water table are the main limitations if the soil is used for community development. The moderate permeability may cause effluent to seep into the ground water and nearby streams if this soil is used for septic tank absorption fields or sanitary landfills.

This soil is in capability class I.

31B—Suffolk fine sandy loam, 2 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is in long, narrow areas on broad uplands and on side slopes next to drainageways. Areas range from about 3 to 50 acres.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam 10 inches thick. The subsoil is strong brown fine sandy loam and sandy clay loam 26 inches thick. The substratum is brown loamy fine sand to a depth of at least 64 inches.

Included with this soil in mapping are small areas of well drained Emporia, Kempsville, and Kenansville soils and moderately well drained Slagle soils. The Kempsville and Kenansville soils are throughout the unit. The

Emporia and Slagle soils are in slightly lower areas or in depressions. Included soils make up about 20 percent of the unit.

The permeability of this Suffolk soil is moderate, and available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly ranges from extremely acid through strongly acid in the surface layer and upper part of the subsoil, but reaction in the surface layer varies because of local liming practices. The lower part of the subsoil and the substratum range from extremely acid through medium acid.

In most areas this soil is farmed, but in some it is in woodland.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content, reduce crusting, increase water infiltration, and control erosion.

This soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing causes compaction of the surface layer and reduces the stands of grasses and legumes.

The productivity for trees on this soil is moderately high, especially for loblolly pine, Virginia pine, yellow-poplar, sweetgum, and oak. Seeds and seedlings grow well if competing vegetation is controlled.

The rapidly permeable substratum is the main limitation for community development. Because of the permeability, effluent can seep into ground water and nearby streams if the soil is used for septic tank absorption fields, sewage lagoons, or sanitary landfills.

This soil is in capability subclass IIe.

32—Tetotum silt loam. This soil is deep, nearly level, and moderately well drained. It is on low-lying terraces. Areas of this soil are commonly elongated, irregularly oval, or irregularly rectangular. They range from about 2 to 15 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is dark grayish brown silt loam about 5 inches thick. The subsurface layer is dark brown loam 5 inches thick. The subsoil is mostly yellowish brown silt loam, silty clay loam, clay loam, and loam 41 inches thick. It has gray mottles at a depth of more than 27 inches. The substratum is mottled yellowish brown, gray, and strong brown fine sandy loam to a depth of at least 65 inches.

Included with this soil in mapping are small areas of somewhat poorly drained Augusta and Newflat soils, poorly drained Chickahominy soils, and well drained State and Pamunkey soils. The Augusta, Chickahominy, and Newflat soils are in slight depressions, and the State and Pamunkey soils are in slightly higher areas throughout the unit. Included soils make up about 15 percent of the unit.

The permeability of this Tetotum soil is moderate, and available water capacity is high. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled throughout a wide range of moisture conditions. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It ranges from extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 1 1/2 to 2 1/2 feet in winter and early in spring.

In most areas this soil is farmed. In some areas it is in woodland, and in a few it is in pasture.

This soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet and cold early in spring. Drainage helps to alleviate spring wetness and protects crops from damage. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

This soil is well suited to pasture and hay crops. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing and grazing when the soil is wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, yellow-poplar, sweetgum, and oak. Seeds and seedlings grow well. The soil is soft when wet, thus limiting the use of heavy timber equipment.

The seasonal high water table and the low strength of the soil are the main limitations for community development. The high water tabie limits use of the soil as a building site or a site for sanitary landfills or for septic tank absorption fields. The soil needs a suitable base material to provide enough strength and stability to support vehicular traffic.

This soil is in capability subclass IIw.

33—Tomotley fine sandy loam. This soil is deep, nearly level, and poorly drained. It is on broad low-lying flats. Areas of this soil commonly are irregularly oval or rectangular. They range from about 3 to 100 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is grayish brown fine sandy loam 4 inches thick. The subsoil is mostly grayish brown fine sandy loam, gray sandy clay loam, and mottled fine sandy loam 42 inches thick. The substratum is mostly gray fine sandy loam to a depth of at least 68 inches.

Included with this soil in mapping are small areas of well drained Bojac soils, moderately well drained Altavista, Munden, and Seabrook soils, somewhat poorly drained Augusta and Dragston soils, and poorly drained Nimmo soils. The Bojac soils are on old point bars. The Altavista, Munden, and Seabrook soils are on small knolls and ridges. The Augusta and Dragston soils are in slightly higher areas, and the Nimmo soils are in similar areas throughout the unit. Water is ponded on some included soils after heavy rains in winter and spring and during prolonged wet periods the rest of the year. Also included are soils west of U.S. Highway 17 that have fossiliferous shells or cobbles within 50 inches of the surface. Included soils make up about 20 percent of the unit.

The permeability of this Tomotley soil is moderate to moderately slow, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. Above about 50 inches it commonly is very strongly acid or strongly acid. Below this depth, it ranges from very strongly acid through medium acid. A high water table is between the surface and a depth of 1 foot during winter and spring.

In most areas this soil is in woodland, but in some it is drained and farmed.

Drained areas of this soil are well suited to cultivated crops or to pasture and hay. Undrained areas are poorly suited to cultivated crops and to pasture and hay. Overgrazing when the soil is wet compacts the surface layer and damages the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, sweetgum, and oak. Seeds and seedlings grow well only if competing vegetation is controlled. The soil is soft when wet, thus limiting use of heavy timber equipment.

The seasonal high water table is the main limitation of the soil for community development, especially as a building site or a site for septic tank absorption fields or sanitary landfills or for most types of recreation.

This soil is in capability subclass IIIw, drained, and subclass IVw, undrained.

34B—Uchee loamy fine sand, 2 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on upland ridges and side slopes. Slopes range from about 150 to 400 feet long. Areas of this soil commonly are irregularly elongated or irregularly circular. They range from about 2 to 10 acres.

Typically, the surface layer of this soil is dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is light yellowish brown and very pale brown loamy fine sand 19 inches thick. The subsoil extends to a depth of 56 inches. It is strong brown sandy clay loam above a depth of 36 inches and strong brown sandy clay loam and sandy clay with gray and red mottles below this depth. The substratum is variegated red, brown, and gray, stratified sandy loam and sandy clay loam from 56 to at least 65 inches.

Included with this soil in mapping are small areas of well drained Emporia, Kempsville, and Suffolk soils and moderately well drained Slagle soils. The Kempsville, Emporia, and Suffolk soils are in areas similar to those of the Uchee soil, and the Slagle soils are in slight depressions and adjacent to drainageways. Included soils make up about 15 percent of this unit.

In this Uchee soil, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. Available water capacity is low to moderate. Surface runoff is slow. The hazard of erosion by water is slight. The hazard of wind erosion is moderate. The surface layer is very friable and easily tilled. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. A perched high water table is at a depth of 3 1/2 to 5 feet in winter and early in spring.

More than half the acreage of this soil is in woodland. A few areas are farmed, and a few are in residential developments.

This soil is well suited to cultivated crops. It is droughty during the growing season, and crop response to lime and fertilizer is often limited by the low available water capacity. The hazard of wind erosion is moderate and is a major management concern, especially for row crops early in the growing season. Blowing soil often damages or covers up small plants. Conservation tillage, using cover crops and grasses and legumes in the cropping system, stubble mulching, and use of crop residue help to maintain organic matter content and tilth. They also reduce erosion and crop damage and help to hold moisture in the soil.

This soil is moderately well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing cuts up the soft surface layer and damages the stands of grasses and legumes, thereby reducing yields and increasing the erosion hazard.

The potential for trees on this soil is moderately high, especially for loblolly pine, sweetgum, and oak. The survival of seeds and seedlings is often limited by the low available water capacity during the growing season.

The moderately slow permeability and moderate shrink-swell potential of the subsoil, the sandy surface layer, and the seasonal high water table of the soil are the main limitations for community development. The permeability, shrink-swell potential, and high water table limit the use of the soil for sewage lagoons, septic tank absorption fields, building sites, and sanitary landfills. The sandy surface layer limits excavation because of sloughing and caving. Also, the sandy surface layer has low available water capacity, which limits the growth of grasses and shrubs.

This soil is in capability subclass IIs.

34C—Uchee loamy fine sand, 6 to 10 percent slopes. This soil is deep, strongly sloping, and well drained. It is on narrow upland ridges and side slopes. Areas of this soil commonly are long and winding. They have smooth, convex slopes about 50 to 200 feet long. They range from about 2 to 10 acres.

Typically, the surface layer of this soil is dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is light yellowish brown and very pale brown loamy fine sand 19 inches thick. The subsoil extends to a depth of 56 inches. It is strong brown sandy clay loam above a depth of 36 inches and, below this depth, is strong brown sandy clay loam and clay with gray and red mottles. The substratum is variegated red, brown, and gray, stratified sandy loam and sandy clay loam from 56 to at least 65 inches.

Included with this soil in mapping are small areas of well drained Emporia, Kempsville, and Suffolk soils and moderately well drained Slagle soils. The Emporia, Kempsville, and Suffolk soils are on broader parts of some ridges. The Slagle soils are adjacent to drainageways. Also included are small areas that have less clay in the subsoil. Included soils make up about 15 percent of the unit.

In this Uchee soil, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. Available water capacity is low to moderate. Surface runoff is medium. The hazard of erosion by wind and water is moderate. The surface layer is very friable and easily tilled. The subsoil has moderate shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly is very strongly acid or strongly acid, but reaction in the surface layer varies because of local liming practices. In winter and early in spring, a perched high water table is at a depth of 3 1/2 to 5 feet.

Most of the acreage is in woodland. A few areas are farmed or in pasture, and a few are in residential developments.

This soil is moderately well suited to cultivated crops. Crop response to lime and fertilizer may be limited during the growing season because of the low available water capacity. The erosion hazard is moderate and is a major management concern. Conservation tillage, using cover crops and grasses and legumes in the cropping system, contour tillage, and use of crop residue help in maintaining organic matter content and tilth, controlling erosion, and holding moisture in the soil.

This soil is moderately well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to increase the carrying capacity of pastures. Overgrazing cuts up the soft surface layer and damages the stands of grasses and legumes, thereby reducing yields and increasing the erosion hazard.

The potential for trees on this soil is moderately high, especially for loblolly pine, sweetgum, and oak. The survival of seeds and seedlings is often limited by the low available water capacity during the growing season.

The sandy texture, seasonal high water table, and slope and the moderate shrink-swell potential and moderately slow permeability of the subsoil are the main limitations if the soil is used for community development. The sandy texture limits excavation because of sloughing. The available water capacity in the surface layer is low, which limits the growth of grasses and shrubs. Slope, the seasonal high water table, permeability, and the moderate shrink-swell potential limit the use of the soil for septic tank absorption fields, sewage lagoons, sanitary landfills, and building sites and for most types of recreation.

This soil is in capability subclass IIIs.

35—Udorthents, loamy. This unit consists of deep, well drained and moderately well drained loamy soil material in areas where the soils have been disturbed during excavation and grading. In areas east of U.S. Highway 17, Udorthents resulted mostly from commercial quarrying operations for construction materials. Other areas were used mostly as a source of material for highway construction, pottery clay, bricks, and marl. The areas in Camp Peary were used to some extent for training, but most have been planted to pine trees. Areas range from about 3 to 100 acres. Slopes commonly are 2 to 30 percent, but range from 0 to 70 percent or more.

Included in mapping are small areas of undisturbed, well drained Caroline, Emporia, Suffolk, Pamunkey, and Uchee soils, moderately well drained Slagle and Izagora soils, and poorly drained Bethera soils. Also included are quarries where the soil material is neutral to moderately alkaline, small bodies of water, and areas of more poorly drained, disturbed soils. Included areas make up about 25 percent of this unit.

The permeability ranges from moderately rapid to slow. The available water capacity ranges from low to high, depending on the texture and gravel content of the material. Surface runoff ranges from very slow to rapid. The erosion hazard ranges from slight to severe. Reaction commonly ranges from extremely acid through strongly acid.

Udorthents generally are not suited to farming because the topsoil has been removed. The potential for trees on this soil material is low. These soils are limited for most types of community development and recreation uses. An onsite investigation is needed to determine the suitability and limitations of the soils for any given use.

The soils in this map unit are not assigned to a capability subclass.

36—Udorthents-Dumps complex. This complex consists of shallow to deep, excessively drained to moderately well drained soil material in areas that were disturbed during excavation. The excavations are partly filled with garbage, trees, stumps, metal, fly ash, or dredgings. Udorthents and Dumps are so intermingled that it is not practical to separate them at the scale used in mapping. Areas of this complex are rectangular or irregularly oval and range from 3 to 80 acres. Slopes range from 0 to 25 percent.

Of the total acreage of this map unit, about 50 percent is Udorthents, 25 percent is Dumps, and 25 percent is other soils.

Included in mapping are small areas of undisturbed well drained Caroline, Kempsville, Suffolk, and Uchee soils; moderately well drained Slagle and Izagora soils; and poorly drained Bethera soils. Also included are small bodies of water, sanitary landfills, and quarries where the soil material is neutral to moderately alkaline.

The permeability of the Udorthents in this complex ranges from moderately rapid to slow. The available water capacity ranges from low to high, depending on texture and gravel content of the material. Surface runoff ranges from very slow to rapid. The erosion hazard is slight to severe. The soil materials commonly range from extremely acid through strongly acid.

The soils in this complex are generally not suited to farming because the topsoil has been removed and they contain miscellaneous nonsoil materials. The potential for trees on this soil material is low.

The soils in this complex are limited for most types of community development and recreation. Onsite investigation is needed to determine the suitability and limitations of the unit for any given use.

The soils in this map unit are not assigned to a capability subclass.

37—Urban land. This map unit consists of areas where more than 85 percent of the surface is covered by asphalt, concrete, buildings, or other impervious surfaces. Examples are parking lots, shopping centers, and industrial parks. These areas are throughout the survey area, but the largest are near downtown business districts and along main roads. The areas range from about 2 to 100 acres. Slopes range from 0 to 15 percent.

Included with this unit in mapping are areas of undisturbed soils, commonly well drained Emporia soils, and moderately well drained Slagle soils. Also included in this unit are small areas of most soils in the survey area. These soils are between streets and sidewalks, in yards, and in traffic islands. These areas generally are less than an acre. They make up about 15 percent of the unit.

Onsite investigation is needed to determine the suitability and limitations of the soils in this unit for any use.

The soils in this map unit are not assigned to a capability subclass.

38—Yemassee fine sandy loam. This soil is deep, nearly level, and somewhat poorly drained. It is on broad low-lying uplands. Areas of this soil are elongated or irregularly oval. They range from about 2 to 30 acres. Slopes range from 0 to 2 percent.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is light yellowish brown fine sandy loam 7 inches thick. The subsoil extends to a depth of 51 inches. It is mottled light yellowish brown and light olive brown sandy clay loam to a depth of 20 inches; mottled gray, yellowish brown, and strong brown sandy clay loam to a depth of 30 inches; and gray sandy clay loam to a depth of 51 inches. The substratum is gray fine sandy loam with yellowish brown mottles from 51 to at least 63 inches.

Included with this soil in mapping are small areas of moderately well drained Izagora and Slagle soils that are in slightly higher areas and poorly drained Bethera soils in lower areas and slight depressions. Included soils make up about 15 percent of the unit.

The permeability of this Yemassee soil is moderate, and available water capacity is moderate. Surface runoff is slow. The erosion hazard is slight. The surface layer is friable and easily tilled. The subsoil has low shrink-swell potential. The root zone extends to a depth of 60 inches or more. The soil is low in organic matter content and natural fertility. It commonly ranges from extremely acid through strongly acid, but reaction in the surface layer varies because of local liming practices. A high water table is at a depth of 1 foot to 1 1/2 feet in winter and early in spring.

In most areas this soil is in woodland. In a few areas it is cultivated, and in a few areas it is used for pasture and hay crops.

If adequately drained, this soil is well suited to cultivated crops. Crops respond well to lime and fertilizer. The soil is wet and cold in the spring, and wetness often interferes with tillage. Drainage helps to protect crops from damage caused by wetness. Conservation tillage, using cover crops and grasses and legumes in the cropping system, and use of crop residue help to maintain organic matter content and tilth, reduce crusting, and increase water infiltration.

If adequately drained, this soil is well suited to pasture and hay. Establishing and maintaining a mixture of grasses and legumes, using proper stocking rates, rotational grazing of pasture, deferred grazing, and use of lime and fertilizer help to offset the acidity and low natural fertility and increase the carrying capacity of pastures. Overgrazing and grazing when the soil is too wet cause compaction of the surface layer and damage the stands of grasses and legumes.

The potential for trees on this soil is high, especially for loblolly pine, sweetgum, and oak. Seeds and seedlings grow well if competing vegetation is controlled. When the soil is wet, it is soft, limiting the use of heavy timber equipment.

The seasonal high water table and moderate permeability of the subsoil are the main limitations if the soil is used for community development. The seasonal high water table and moderate permeability limit the use of the soil as a building site or site for sanitary landfills or septic tank absorption fields and for most recreation uses. Wetness also limits use of the soil as a subgrade material for local roads and streets.

This soil is in capability subclass IIw.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in the survey area are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table may qualify as prime farmland soils if the limitation is overcome by drainage. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

Prime Farmland in the Survey Area

About 55,300 acres, or nearly 36 percent of the land area, is prime farmland. These areas are scattered throughout the survey area.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

The following map units, or soils, make up prime farmland in the survey area. On some soils included in the list, appropriate measures have been applied to overcome wetness. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

1	Altavista fine sandy loam
2	Augusta fine sandy loam (where drained)
7	Bojac sandy loam
8B	Caroline fine sandy loam, 2 to 6 percent slopes
10B	Craven fine sandy loam, 2 to 6 percent slopes
12	Dogue loam
13	Dragston fine sandy loam (where drained)
14B	Emporia fine sandy loam, 2 to 6 percent slopes
16	Izagora loam
18B	Kempsville fine sandy loam, 2 to 6 percent slopes
19B	Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes
22	Munden loamy fine sand
24	Nimmo fine sandy loam (where drained)
25B	Norfolk fine sandy loam, 2 to 6 percent slopes
26B	Pamunkey soils, 2 to 6 percent slopes
29A	Slagle fine sandy loam, 0 to 2 percent slopes (where drained)
29B	Slagle fine sandy loam, 2 to 6 percent slopes
30	State fine sandy loam
31B	Suffolk fine sandy loam, 2 to 6 percent slopes

32	Tetotum silt loam
33	Tomotley fine sandy loam (where drained)
38	Yemassee fine sandy loam (where drained)

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 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 wetness, very firm soil layers, or unstable cutbacks 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

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.

James City County had approximately 18,800 acres in farmland in 1978, according to the Virginia Cooperative Crop Reporting Service (*8*). Of this, 10,300 acres was used as cultivated cropland, 1,100 acres was used for cropland pasture, 6,300 acres was in woodland and woodland pasture, and the rest was used for specialty crops. York County had approximately 3,200 acres in farmland (*9*). Of this, 1,400 acres was used as cultivated cropland, 600 acres was used for cropland pasture, 700 acres was in woodland and woodland pasture, and the rest was used for specialty crops. Generally, the acreage in cropland has decreased over the past 10 years in both counties.

Corn, soybeans, wheat, and barley account for the major crops that are grown in the survey area. Most pastures are tall fescue or a mixture of clover and grasses. Hogs and cattle are raised on a limited basis. The climate and many of the soils are suited to vegetables, small fruits, melons, and ornamental plants. Deep, well drained soils, for example, Kenansville, Suffolk, and Kempsville soils on uplands and Pamunkey and Bojac soils on terraces, are especially well suited to vegetable and small fruit production because they warm early in spring.

Most of the well drained upland soils are also suited to orchards and nursery plants. Soils in low areas where air drainage is poor and frost is more frequent generally are poorly suited to early vegetables, small fruits, and orchards.

Soil fertility is low in most soils in the survey area, and most soils are very strongly acid or strongly acid unless they have been limed. Most of the arable soils respond well to nitrogen, phosphorous, and potassium fertilizers. The proper pH level enables crops to use fertilizer and soil moisture more efficiently. Periodic applications of ground limestone raise the soil pH sufficiently for good growth of crops and pasture. Lime and fertilizer applications should be based on the results of soil tests, on the needs of the crop, and on the expected yields. The Cooperative Extension Service can make recommendations for the kind and amount of fertilizer and lime needed for a particular crop.

Organic matter helps conserve moisture for plant use, reduce surface crusting, reduce soil loss from erosion, and promote good tilth. Most of the soils in the survey area that are used for crops have a surface layer of fine sandy loam or loam. Many of these soils have low organic matter content and generally have weak structure. Intense rainfall causes the surface layer to crust. This decreases permeability to air and water and causes increased runoff and soil erosion. Cover crops and additions of manure or other organic materials help maintain organic matter content, improve soil structure, and reduce crusting. Leaving crop residue on the surface also helps to prevent crust formation.

Soil erosion by water is a major concern on about 40 percent of the cropland in the survey area. Soils with slopes of more than about 2 percent are especially susceptible to erosion.

Loss of the surface layer of the soil to erosion reduces the productivity of the soil and reduces the fertility, organic matter content, and available water capacity. Erosion is especially damaging to soils that have a clayey subsoil, such as Caroline, Peawick, and Dogue soils.

Preparing a good seedbed through tilling is difficult in severely eroded areas because most of the original surface layer has been lost. It is also difficult to establish a good stand of any crop in eroded areas because of the reduced available moisture in the seedbed.

Soil erosion on farmland in many areas results in the pollution of streams by sediment, nutrients, and farm chemicals. Controlling erosion minimizes such pollution and improves the quality of water for municipal use and for fish and wildlife habitat.

Erosion control practices that provide protective surface cover reduce runoff and increase water infiltration. For example, a cropping system that keeps the plant cover on the soil for extended periods holds the erosion losses to amounts that will not reduce the productive capacity of the soils. Use of legume and grass forage crops in the cropping system reduces erosion on sloping land, provides nitrogen to plants, and improves soil tilth for the following crop in the system.

Conservation tillage and use of terraces, diversions, contouring, and cropping systems that rotate grass or close-growing crops with row crops help control erosion on cropland and pasture. Conservation tillage, especially for soybeans and corn, is increasing in the survey area. It is particularly effective in reducing erosion on sloping soils and can be used on most soils in the survey area.

Terraces and diversions reduce the length of slope and thereby reduce runoff and erosion. They are most practical on deep, well drained soils that have uniform, regular slopes. Soils such as Emporia, Kempsville, and Suffolk soils have these characteristics.

The Craven and Uchee soils have short, irregular slopes. On these soils, a cropping system that provides abundant plant cover helps control erosion. Leaving crop residue on the surface, either by conservation tillage or by stubble mulching, increases infiltration and reduces runoff and erosion. The extra cover is especially needed during seeding and early crop growth.

Soil blowing is a hazard on sandy Kenansville and Uchee soils. Maintaining plant cover and using surface mulch or wind barriers help to minimize soil blowing and erosion on these soils.

Drainage is a major management need on much of the acreage used for crops and pasture in the survey area. Soils such as Augusta, Dragston, Nimmo, and Tomotley soils are naturally so wet that the production of crops and pasture commonly grown in the area is generally not practical or possible unless the soils are drained. Other soils, such as Bohicket, Levy, Johnston, and Axis soils, are naturally so wet, brackish, or difficult to drain that they are not suited to crop production.

The design of surface and subsurface drainage systems varies with the kind of soil. A system combining surface drainage and tile drainage can be used on some soils. Drains have to be more closely spaced in slowly permeable soils than in the more permeable soils. Tile drainage is suitable for moderately permeable soils, such as Augusta, Tomotley, and Nimmo soils. Adequate outlets for drainage systems are often not available and are difficult to establish.

Pastures in the survey area commonly consist of tall fescue, ryegrass, common Bermudagrass, or tall fescue and Ladino or red clover mixtures. Pastures of cool-season plants provide most of the grazing in spring and autumn. Warm-season plants provide summer grazing.

Establishing and maintaining a mixture of grasses and legumes and the prevention of overgrazing are the major pasture management concerns. The use of proper stocking rates, rotational and deferred grazing, weed control, restricted grazing during the wet season on moderately well drained to poorly drained soils, and the use of lime and fertilizer are the major pasture management practices. Stockpiling the accumulated growth of tall fescue for winter grazing reduces the need for hay.

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 5. 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 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 insures 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 5 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.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. 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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider 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 and 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. These 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:

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, 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."

Woodland Management and Productivity

Woodland is one of the major land uses in the survey area. About 68 percent of the land area, or 105,200 acres, is wooded. Much of this acreage is in federal and state owned land. Most of the woodland is second growth hardwoods, loblolly pine, and Virginia pine. The largest areas of woodland are in map units 4 and 7 described in the section "General Soil Map Units."

The original forest consisted of mixed stands of white oak, post oak, scarlet oak, black oak, northern red oak, southern red oak, and hickory. Yellow-poplar was on the more moist sites. Shortleaf pine and Virginia pine were scattered throughout these hardwood stands. Poorly drained areas were covered by green ash, sweetgum, black gum, boxelder, and red maple.

Most of the original woodland on the uplands was cleared and the soils were cultivated. Gradually, as some of the soils became eroded and less fertile, the soils were allowed to return to woodland. Much of the woodland is too steep or too wet for farming to be practical. Much of the wooded areas are in areas that used to be farmed. A large percent of the woodland in the survey area is managed for loblolly pine.

Some management practices include thinning, clear cutting, drum-chopping, controlled burning for site preparation, and reforestation using seeds or seedlings. Soil erosion is a major management concern during timber harvest and reforestation.

The Virginia Division of Forestry, the Cooperative Extension Service, or the Soil Conservation Service can help determine specific woodland management needs.

Table 6 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 (woodland suitability) symbol for each 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 important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 6, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

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. Commonly grown 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.

Trees to plant are those that are suited to the soils and to commercial wood production.

Recreation

James City County, the City of Williamsburg, and York County have many areas of scenic, geologic, and historic interest. Many areas are available for camping, hiking, fishing, sightseeing, picnicking, hunting, and boating. Public lands available for recreation include York River State Park, the Colonial National Historical Park at Yorktown, Jamestown, and Colonial Williamsburg, and several other county and city parks.

Use of the recreation areas that are in the survey area has increased greatly in the last several years. Many soils in the survey area are well suited to development of recreation facilities. However, the soils in map unit 1 on the general soil map are generally too wet for recreation development. Most other parts of the survey area are characterized by sloping terrain and have wooded slopes and many streams that provide potential for recreation.

The soils of the survey area are rated in table 7 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 sewerlines. 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 7, 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 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 9.

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, horseback riding, and bicycling 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

Lawrence H. Robinson, Soil Conservation Service biologist, assisted in preparing this section.

Wildlife is abundant and habitats are diverse throughout the survey area, except in urban areas.

Some of the common types of wildlife in wooded areas are white-tailed deer, wild turkey, gray squirrel, gray fox, opossum, skunk, and raccoon. Quail, red fox, and cottontail inhabit areas along the edge of fields and wood lines. Owls, pileated woodpeckers, and hawks are among the other large birds that reside in the larger wooded areas. Furbearing animals, such as muskrat, mink, beaver, and otter, live in the swamps and marshes.

During winter, numerous species of waterfowl migrate to the marshes along the James, Chickahominy, and York Rivers and the wooded inland swamps. Sea gulls, bald eagles, and osprey are found along the York and James Rivers.

Fish common to the freshwater James and Chickahominy Rivers include catfish, rockfish, largemouth bass, white shad, and sunfish. Catfish and white shad are taken commercially from the James River. Largemouth bass and bluegill are common in small ponds. Saltwater areas of the York River support bluefish, croaker, spot, flounder, trout, crabs, oysters, and many other saltwater species.

Many areas can be improved for wildlife habitat by increasing the food supply and cover. The areas that are best suited to improvement of wildlife habitat are in map units 1, 5, 6, and 8 as described in the section "General Soil Map Units."

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 8, 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, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, soybeans, 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, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lespedeza, clover, and alfalfa.

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, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, panicgrass, goldenrod, beggarweed, foxtail millet, and dandelion.

Hardwood trees and the 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, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, blackgum, maple, hawthorn, dogwood, hickory, mulberry, holly, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, honeysuckle, and crabapple.

Coniferous plants furnish browse, seeds, and cones. 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 and redcedar.

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, and slope. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, pickrelweed, arrowhead, buttonbush, 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 wetness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, 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, 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 wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and opossum.

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

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, 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 9 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 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 a cemented pan, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 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 a cemented pan, a high water table, flooding, 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 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, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and the 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 10 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 a cemented pan, and flooding affect absorption of the effluent. A cemented pan interferes 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 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 effectively filter the effluent. 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 10 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 a cemented pan, flooding, 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 and cemented pans can cause construction problems.

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 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts 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 soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over 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 11 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 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. They 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 11, 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, 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 12 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 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, terraces and diversions, 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 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, organic matter, or salts. 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. The content of large stones affects 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 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 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.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

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 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, 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 classifications, 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 13 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 a soil contains particles coarser than sand, 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, SP-SM.

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 oven-dry 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 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 14 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 earth-moving 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 1/3 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.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 14, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of 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 15 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 intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

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.

Some soils in table 15 are assigned to two hydrologic soil groups. Dual grouping is used for soils that have a seasonal high water table but can be drained. The first letter applies to the drained condition of the soil and the second letter to the undrained condition.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information 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 that form in 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 15 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 high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

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 beneath 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.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is based on many soil borings and on observations during soil mapping.

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 (*7*). 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. In table 16, the soils of the survey area are classified according to the system. 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 Aquults (*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 Paleaquults (*Pale*, meaning old excessive development, plus *aquults*, the suborder of the Ultisols that have 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 Paleaquults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly 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 clayey, mixed, thermic Typic Paleaquults.

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 (*6*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*7*). 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."

Altavista Series

Soils of the Altavista series are deep and moderately well drained. They formed in loamy fluvial sediments. Altavista soils are on stream terraces on the Coastal Plain. Slopes range from 0 to 3 percent.

Altavista soils commonly are near Augusta, Dragston, Nimmo, and State soils. Altavista soils are not as poorly drained as Augusta, Dragston, or Nimmo soils, and they are not as well drained as State soils.

Typical pedon of Altavista fine sandy loam, approximately 1,500 feet north of junction of VA-173 and VA-718, 300 feet west of VA-173, 200 feet south of parking lot at Yorktown refinery main entrance, York County:

A1—0 to 5 inches; dark gray (10YR 4/1) fine sandy loam; weak fine granular structure; very friable, nonsticky, nonplastic; many fine medium and coarse roots; many medium and fine tubular pores; very strongly acid; clear smooth boundary.

A2—5 to 13 inches; light olive brown (2.5Y 5/4) fine sandy loam; weak fine granular structure; very friable, nonsticky, nonplastic; few coarse and common fine and medium roots; common fine and medium tubular pores; very strongly acid; clear smooth boundary.

B1t—13 to 19 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine and medium subangular blocky structure and weak medium granular structure; friable, slightly sticky, slightly plastic; common fine and medium roots; common fine and medium tubular pores; clay bridging between sand grains; few quartz pebbles; very strongly acid; clear smooth boundary.

B21t—19 to 26 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine faint pale brown (10YR 6/3) mottles and few fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; common fine and medium tubular pores; few thin patchy clay films on faces of peds; few quartz pebbles; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B22t—26 to 42 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/8), and light brownish gray (10YR 6/2) sandy clay loam; moderate medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; few fine pores; common medium patchy clay films on faces of peds; few concretions; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B3tg—42 to 53 inches; gray (5Y 6/1) sandy clay loam; many medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few fine roots; common fine pores; few thin patchy clay films on faces of peds; few concretions; few fine flakes of mica; very strongly acid; gradual smooth boundary.

Cg—53 to 65 inches; gray (5Y 6/1) fine sandy loam; many coarse prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; friable, slightly sticky, slightly plastic; few fine roots; few fine and medium pores; few concretions; few fine flakes of mica; very strongly acid.

The solum thickness ranges from 30 to 60 inches. The soil ranges from very strongly acid through medium acid unless limed. Pebbles and gravel make up 0 to 5 percent of the A and B horizons and 2 to 20 percent of the C horizon of some pedons. Flakes of mica are few or common in the B and C horizons of most pedons.

The A1 or Ap horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 1 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 3 through 6. The A horizon is sandy loam, fine sandy loam, or loam.

The B1 and B2t horizons have hue of 7.5YR through 2.5Y, value of 5 through 7, and chroma of 3 through 8. In some pedons the lower part of the B2t horizon has dominant hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 1 or 2. Mottles in shades of brown and red and a few red concretions are in the B2t horizon of some pedons. The B1 horizon is sandy loam, fine sandy loam, or loam. The B2t horizon is loam, clay loam, or sandy clay loam.

The B3 horizon has dominant hue of 7.5YR through 2.5Y, value of 5 through 7, and chroma of 1 through 8; or it is mottled. Mottles in shades of gray, brown, and red are common or many in most pedons. The B3 horizon is sandy loam, loam, or sandy clay loam.

The C horizon is dominantly gray or brown, or it is mottled. It commonly is stratified sand, loamy sand, sandy loam, or fine sandy loam.

Augusta Series

Soils of the Augusta series are deep and somewhat poorly drained. They formed in loamy fluvial sediments. Augusta soils are on low-lying stream terraces on the Coastal Plain. Slopes range from 0 to 2 percent.

Augusta soils commonly are near Altavista, Dragston, Munden, Nimmo, Seabrook, and Tomotley soils. Augusta soils are not as well drained as Altavista or Munden soils. They have more clay in the subsoil than Dragston soils, are not as poorly drained as Nimmo or Tomotley soils, and are more poorly drained and have more clay in the subsoil than Seabrook soils.

Typical pedon of Augusta fine sandy loam, approximately 600 feet northeast of end of VA-657 and 400 feet south of Chisman Creek, York County:

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; very friable, nonsticky, nonplastic; many fine and medium and few coarse roots; common medium and fine tubular pores; very strongly acid; abrupt smooth boundary.

A2—11 to 17 inches; light yellowish brown (2.5Y 6/4) fine sandy loam; common fine faint light yellowish brown (10YR 6/4) mottles and common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and medium roots; many medium and fine tubular pores; few krotovina up to 1/4 inch in diameter filled with Ap material; very strongly acid; clear smooth boundary.

B1t—17 to 22 inches; mottled light olive brown (2.5Y 5/4), pale olive (5Y 6/3), and yellowish brown (10YR 5/4) sandy clay loam; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and medium roots; many medium and fine tubular pores; clay bridging between sand grains; few fine prominent dark yellowish brown (10YR 4/4) concretions; few fine flakes of mica; very strongly acid; clear smooth boundary.

B21t—22 to 27 inches; grayish brown (10YR 5/2) loam; many medium distinct light olive brown (2.5Y 5/4) mottles, few fine faint yellowish brown (10YR 5/4) mottles, and common medium prominent olive (5Y 5/3) mottles on faces of peds; weak medium and coarse subangular blocky structure; friable, sticky, plastic; common fine and medium roots; common medium and fine tubular pores; few thin discontinuous clay films on faces of peds; few quartz pebbles up to 1/4 inch in diameter; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B22tg—27 to 41 inches; grayish brown (10YR 5/2) sandy clay loam; common medium prominent light olive brown (2.5Y 5/4) mottles and few fine faint yellowish brown (10YR 5/4) mottles; friable, sticky, plastic; common fine and medium roots; common fine and medium tubular pores; common thin discontinuous clay films on faces of peds; few quartz pebbles up to 1/4 inch in diameter; common fine flakes of mica; very strongly acid; gradual smooth boundary.

B3t—41 to 56 inches; gray (N 6/0) sandy clay loam; common medium prominent yellowish brown (10YR 5/8), light olive brown (2.5Y 5/4), and strong brown (7.5YR 5/6) mottles; weak coarse and medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium tubular pores; few thin patchy clay films on faces of peds; common fine flakes of mica; very strongly acid; gradual smooth boundary.

C—56 to 70 inches; gray (5Y 6/1) sandy loam; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; friable, slightly sticky, nonplastic; few fine roots; common fine tubular pores; common fine flakes of mica; very strongly acid.

The solum thickness ranges from 40 to 60 inches. The soil ranges from very strongly acid through medium acid unless limed. Quartz pebbles make up 0 to 2 percent of the solum and 0 to 10 percent of the C horizon.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR through 5Y, value of 5 through 7, and chroma of 2 through 4. The A horizon is sandy loam, fine sandy loam, or loam.

The B1 horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 3 or 4. It has high or low chroma mottles. It is sandy loam, loam, clay loam, or sandy clay loam.

The B21t horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 3 through 6. It has high or low chroma mottles. In some pedons it is gray and has common or many brown mottles. It is loam, clay loam, or sandy clay loam.

The B22t horizon has no hue or hue of 10YR through 2.5Y. It has value of 4 through 7 and chroma of 0 through 6, and it is mottled. It is loam, clay loam, or sandy clay loam.

The B3 horizon has no hue or hue of 10YR through 2.5Y. It has value of 5 through 7 and chroma of 0 through 2. Brown and gray mottles range from few to many. The B3 horizon is sandy loam, loam, clay loam, or sandy clay loam.

The C horizon has no hue or hue of 10YR through 5Y. It has value of 5 through 7 and chroma of 0 through 2. High chroma mottles range from few to many. Texture is loamy sand, sandy loam, or loam. Some pedons that are stratified have layers or pockets of sandy clay loam.

Axis Series

Soils of the Axis series are deep and very poorly drained. They formed in thick, loamy fluvial and marine sediments. Axis soils are along creeks and rivers on tidal marshes that are inundated twice daily by saline or brackish water. Slopes are less than 1 percent.

Axis soils commonly are near Bohicket, Dragston, Johnston, and Levy soils. Axis soils have less clay than Bohicket or Levy soils. They are more poorly drained than Dragston soils. They have more sulfur than Bohicket, Dragston, Johnston, and Levy soils.

Typical pedon of Axis very fine sandy loam, approximately 2,500 feet north of junction of VA-622 and VA-712, 300 feet northwest of VA-712, York County:

A1—0 to 14 inches; very dark grayish brown (10YR 3/2) very fine sandy loam; massive; slightly sticky, slightly plastic; flows through fingers when squeezed and leaves residue in hand; many fine and medium roots; weak sulfur odor; medium acid; clear smooth boundary.

C1g—14 to 35 inches; gray (5Y 5/1) very fine sandy loam; common medium distinct olive (5Y 5/4) mottles and few fine prominent dark yellowish brown (10YR 4/4) mottles; massive; slightly sticky, slightly plastic; moderate sulfur odor; medium acid; gradual smooth boundary.

C2g—35 to 50 inches; dark gray (5Y 4/1) fine sandy loam; common medium distinct olive (5Y 5/4) mottles; massive; slightly sticky, slightly plastic; moderate sulfur odor; mildly alkaline; gradual smooth boundary.

C3g—50 to 70 inches; mottled gray (5Y 6/1) and light olive brown (2.5Y 5/4) fine sandy loam; massive; nonsticky, nonplastic; few fine flakes of mica; moderate sulfur odor; moderately alkaline.

The soil ranges from medium acid through moderately alkaline. After air drying, the soil in some horizons within a depth of 40 inches is extremely acid.

The A1 horizon has hue of 10YR through 5Y, value of 3, and chroma of 1 or 2. It is sandy loam, very fine sandy loam, fine sandy loam, loam, silt loam, or their mucky analogues. Some pedons have an Oa horizon less than 7 inches thick.

The Cg horizon has no hue or hue of 2.5Y or 5Y, value of 4 through 7, and chroma of 0 through 2. It is sandy loam, fine sandy loam, very fine sandy loam, or loam. Some pedons have pockets of finer or coarser textured material.

Bethera Series

Soils of the Bethera series are deep and poorly drained. They formed in clayey fluvial and marine sediments. Bethera soils are on upland flats and depressions in the Coastal Plain. Slopes range from 0 to 2 percent.

Bethera soils commonly are near Emporia, Izagora, Kempsville, Slagle, and Yemassee soils. Bethera soils are more poorly drained and have more clay in the subsoil than any of those soils.

Typical pedon of Bethera silt loam, approximately 4,200 feet southwest of intersection of VA-613 and VA-614 on VA-613, and 350 feet west of VA-613, James City County:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable, slightly sticky, slightly plastic; many fine and few coarse roots; extremely acid; abrupt smooth boundary.

A2—3 to 7 inches; light brownish gray (2.5Y 6/2) silt loam; few fine prominent yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and few coarse roots; many very fine tubular pores; very strongly acid; clear smooth boundary.

B21tg—7 to 12 inches; light gray (5Y 7/1) clay loam; many fine prominent strong brown (7.5YR 5/8) mottles; weak medium and fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and few coarse roots; many very fine tubular pores; thin continuous clay films on faces of peds and in pores; extremely acid; gradual smooth boundary.

B22tg—12 to 18 inches; gray (5Y 6/1) silty clay loam; many fine prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; few fine and few coarse roots; many very fine tubular pores; thin continuous clay films on faces of peds and in pores; extremely acid; gradual smooth boundary.

B23tg—18 to 38 inches; gray (5Y 5/1) clay loam; few fine distinct brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; few fine roots; few very fine tubular pores; thin continuous clay films on faces of peds and in pores; few quartz pebbles; extremely acid; clear smooth boundary.

B24tg—38 to 46 inches; gray (5Y 6/1) clay loam; few fine prominent brownish yellow (10YR 6/8) mottles and few medium prominent yellowish red (5YR 4/6) mottles; weak prismatic structure parting to moderate medium subangular blocky; firm, sticky, plastic; few fine roots; common very fine tubular pores; thick continuous gray (5Y 5/1) clay films on faces of peds and in pores; common quartz pebbles; extremely acid; clear wavy boundary.

B25tg—46 to 65 inches; light gray (5Y 7/1) silty clay; common medium prominent strong brown (7.5YR 5/8) mottles; strong medium prismatic structure parting to strong medium and fine subangular blocky; very firm, sticky, plastic; few fine roots along prism faces; common very fine tubular pores; thick continuous gray (5Y 6/1) clay films on faces of peds; few quartz pebbles; extremely acid.

The solum thickness is more than 60 inches. The soil ranges from extremely acid through strongly acid unless limed.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 2 through 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 1 or 2. The A horizon is fine sandy loam, loam, or silt loam.

Some pedons have a B1 horizon that has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 1 or 2. It is sandy loam, sandy clay loam, or clay loam.

The B2t horizon has no hue or hue of 10YR through 5Y, value of 4 through 7, and chroma of 0 through 2. This horizon is mottled. The texture is clay loam, silty clay loam, sandy clay, silty clay, or clay.

The C horizon, if present, has no hue or hue of 10YR through 5Y or 5BG, value of 5 through 7, and chroma of 0 through 2. It is mottled. The texture is sandy clay loam, sandy clay, or clay.

Bohicket Series

Soils of the Bohicket series are deep and very poorly drained. They formed in organic material over clayey fluvial sediments. Bohicket soils are along creeks and rivers in tidal marshes that are inundated twice daily by saline or brackish water. Slopes are less than 1 percent.

Bohicket soils commonly are near Altavista, Johnston, Nimmo, State, and Tomotley soils. Bohicket soils have sulfidic materials within 20 inches of the surface, whereas these associated soils do not.

Typical pedon of Bohicket muck, approximately 900 feet south of the York River and mouth of Taskinas Creek and 150 feet east of Taskinas Creek main channel in the York River State Park, James City County:

Oa—0 to 6 inches; dark gray (5Y 4/1) muck (sapric material); massive; slightly sticky; many fine and medium fibrous roots; soil flows easily between fingers when squeezed; many pockets and lenses of clay loam mineral material; weak sulfur odor; neutral; gradual smooth boundary.

C1g—6 to 16 inches; dark gray (5Y 4/1) clay; massive; sticky; common fine roots; soil flows easily between fingers when squeezed; common fibers and pockets and thin layers of organic (sapric) material; moderate sulfur odor; mildly alkaline; gradual smooth boundary.

C2g—16 to 80 inches; dark gray (5Y 4/1) silty clay; massive; sticky, soil flows easily between fingers when squeezed; few fibers and thin layers of organic (sapric) material; moderate sulfur odor; neutral.

The soil ranges from slightly acid through moderately alkaline. After air drying, it is extremely acid. The *n* value of all horizons within 10 to 40 inches of the surface is 1 or more. Soil salinity is high.

The Oa horizon is less than 16 inches thick. Some pedons have an A horizon that has hue of 10YR through 5Y, value of 2 through 4, and chroma of 1 or 2. This horizon is muck, silty clay loam, mucky silty clay loam, silty clay, or mucky silty clay.

The Cg horizon has hue of 10YR through 5Y, value of 2 through 4, and chroma of 1 or 2. It is silty clay, clay, or their mucky analogues. Some pedons have thin strata of clay loam, silt loam, sandy loam, loamy sand, or sand.

Bojac Series

Soils of the Bojac series are deep and well drained. They formed in loamy fluvial sediments. Bojac soils are on low-lying terraces adjacent to major streams on the Coastal Plain. Slopes range from 0 to 3 percent.

Bojac soils commonly are near Altavista, Dragston, Munden, and Seabrook soils. Bojac soils are better drained and have less clay in the subsoil than Altavista soils. They are better drained than Dragston or Munden soils. They are better drained and have more clay in the subsoil than Seabrook soils.

Typical pedon of Bojac sandy loam, approximately 1,300 feet northeast of mouth of Gordon Creek and Nayses Bay and 700 feet east of Gordon Creek channel where it flows north to south, James City County:

A11—0 to 4 inches; very dark gray (10YR 3/1) sandy loam; weak fine granular structure; very friable, slightly sticky, nonplastic; few coarse and common medium and fine roots; common medium and fine tubular pores; extremely acid; clear smooth boundary.

A12—4 to 11 inches; brown (10YR 4/3) sandy loam; weak fine granular structure; very friable, slightly sticky, nonplastic; many medium and fine roots; common medium and fine tubular pores; extremely acid; clear smooth boundary.

A2—11 to 18 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine granular structure; friable, slightly sticky, nonplastic; few medium and fine roots; common medium and fine tubular pores; very strongly acid; clear smooth boundary.

B1—18 to 25 inches; yellowish brown (10YR 5/4) sandy loam; moderate fine granular structure; friable, slightly sticky, nonplastic; few medium and fine roots; common medium and fine tubular pores; very strongly acid; clear smooth boundary.

B21t—25 to 31 inches; brown (7.5YR 5/4) sandy loam; weak medium and fine subangular blocky structure; friable, slightly sticky, nonplastic; few medium and fine roots; common medium and fine tubular pores; clay bridging between sand grains; very strongly acid; clear smooth boundary.

B22t—31 to 43 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few medium and fine roots; common medium and fine tubular pores; clay bridging between sand grains; very strongly acid; gradual smooth boundary.

B23t—43 to 53 inches; brown (7.5YR 5/4) sandy loam; weak medium subangular blocky and moderate medium granular structure; very friable, slightly sticky, nonplastic; few fine roots; common medium and fine tubular pores; clay bridging between sand grains; common fine distinct light yellowish brown (10YR 6/4) clean sand grains; few fine flakes of mica; very strongly acid; gradual smooth boundary.

C—53 to 71 inches; yellowish brown (10YR 5/6) loamy sand; massive; few fine roots; common medium and fine tubular pores; common medium distinct pale brown (10YR 6/3) clean sand grains; few fine flakes of mica; very strongly acid.

The solum thickness ranges from 30 to 65 inches. Unless limed, the A and B horizons range from extremely acid through slightly acid. The C horizon ranges from very strongly acid through medium acid. Quartz pebbles make up 0 to 5 percent of the soil.

The A1 or Ap horizon has hue of 7.5YR through 2.5Y, value of 3 through 6, and chroma of 1 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 4 through 7, and chroma of 4 or 6. The A horizon is sandy loam, fine sandy loam, or loam.

The B1 horizon has hue of 7.5YR through 2.5Y, value of 4 through 7, and chroma of 3 through 6. It is sandy loam, fine sandy loam, or loam.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. It is sandy loam, fine sandy loam, or loam. Some pedons have a subhorizon that is sandy clay loam or clay loam. Low chroma mottles are in some pedons below a depth of 40 inches.

Some pedons have a B3 horizon that has colors and mottles similar to those of the B2t horizon. This horizon is loamy sand or loamy fine sand.

The C horizon has hue of 7.5YR through 2.5Y, value of 4 through 7, and chroma of 3 through 8. Mottles with dominantly high and low chroma are in some pedons. The texture ranges from coarse sand to loamy fine sand. Many pedons are stratified.

Caroline Series

Soils of the Caroline series are deep and well drained. They formed in stratified clayey fluvial and marine sediments. Caroline soils are on uplands on the Coastal Plain. Slopes range from 2 to 6 percent.

Caroline soils commonly are near Emporia, Kempsville, Slagle, and Uchee soils. Caroline soils have more clay in the subsoil than Emporia, Kempsville, Slagle, and Uchee soils. They are better drained than Slagle soils and do not have a thick sandy surface layer characteristic of Uchee soils.

Typical pedon of Caroline fine sandy loam, 2 to 6 percent slopes, 2,200 feet northwest of junction of VA-604 and VA-606 in the York River State Park, James City County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; friable, slightly sticky, nonplastic; many fine medium and coarse roots; few fine tubular pores; 5 percent ironstone fragments up to 5 millimeters across; extremely acid; clear smooth boundary.

A2—4 to 13 inches; light yellowish brown (10YR 6/4) fine sandy loam; moderate medium granular and weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and medium and few coarse roots; common fine and medium tubular pores; 10 percent ironstone fragments up to 8 millimeters across; very strongly acid; gradual smooth boundary.

B1t—13 to 17 inches; strong brown (7.5YR 5/6) clay loam; few medium distinct light yellowish brown (10YR 6/4) mottles; weak medium and fine subangular blocky structure; friable, sticky, plastic; common fine and medium roots; common fine and few medium tubular pores; thin discontinuous clay films on faces of peds; 10 percent ironstone fragments up to 8 millimeters across; extremely acid; clear smooth boundary.

B21t—17 to 31 inches; yellowish red (5YR 4/6) clay; few fine prominent yellowish brown (10YR 5/6) and red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; common fine roots; common fine tubular pores; common medium continuous clay films on faces of peds; 10 percent ironstone fragments up to 8 millimeters across; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B22t—31 to 41 inches; yellowish red (5YR 5/6) sandy clay; moderate medium subangular blocky structure; friable, sticky, plastic; few fine roots; few fine tubular pores; common thin continuous clay films on faces of peds; 10 percent ironstone fragments up to 8 millimeters across; few fine flakes of mica; very strongly acid; gradual wavy boundary.

B3t—41 to 47 inches; yellowish red (5YR 4/6) sandy clay loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; compact in place; few fine roots; few fine tubular pores; few thin continuous clay films on faces of peds; 10 percent ironstone fragments up to 8 millimeters across; few fine flakes of mica; strongly acid; gradual wavy boundary.

C—47 to 72 inches; strong brown (7.5YR 5/6) stratified clay, clay loam, and fine sandy loam; few medium prominent yellowish red (5YR 5/6) and red (2.5YR 4/8) mottles; massive; friable, sticky, plastic; compact in place; few fine tubular pores; few fine flakes of mica; very strongly acid.

The solum thickness is more than 40 inches. The soil ranges from extremely acid through strongly acid unless limed. Coarse fragments of ironstone and quartz make up 0 to 10 percent of the soil.

The A1 or Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 through 5. The A2 horizon has hue of 10YR, value of 5 through 7, and chroma of 3 through 6. The A horizon is sandy loam, fine sandy loam, or loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 through 6. It is clay loam or sandy clay loam.

The B2t and B3 horizons have hue of 5YR through 10YR, value of 4 or 5, and chroma of 6 or 8. Some pedons have dominantly high or low chroma mottles in the lower part of the B2t horizon and in the B3 horizon. The B2t horizon is clay loam, sandy clay, or clay. The B3 horizon is clay loam or sandy clay loam.

The C horizon has colors similar to those of the B3 horizon, or it is mottled or variegated with both high and low chroma colors. It commonly is stratified fine sandy loam, sandy clay, clay loam, or clay.

The Caroline soils in this survey area are taxadjuncts to the Caroline series because they have a thinner clayey solum and less mottling in the subsoil than is defined in the range for the series. These differences, however, do not affect the use and management of the soils.

Chickahominy Series

Soils of the Chickahominy series are deep and poorly drained. They formed in clayey fluvial sediments. Chickahominy soils are on low-lying flats and depressions along major rivers on the Coastal Plain. Slopes range from 0 to 2 percent.

Chickahominy soils commonly are near Altavista, Augusta, Dogue, Newflat, Peawick, and Tetotum soils. Chickahominy soils are more poorly drained than all of those soils and have more clay in the subsoil than Altavista, Augusta, or Tetotum soils.

Typical pedon of Chickahominy silt loam, approximately 300 feet west of intersection of VA-5 and VA-613, 100 feet south of VA-5, James City County:

A1—0 to 2 inches; dark grayish brown (2.5Y 4/2) silt loam; moderate medium and fine granular structure; friable, sticky, plastic; many fine medium and coarse roots; few very fine tubular pores; extremely acid; abrupt smooth boundary.

A2—2 to 7 inches; grayish brown (2.5Y 5/2) silt loam; common fine faint light olive brown (2.5Y 5/4) mottles and common fine distinct very dark grayish brown (10YR 3/2) mottles; moderate medium granular and weak fine subangular blocky structure; friable, sticky, plastic; many fine medium and coarse roots; common very fine tubular pores; few fine flakes of mica; extremely acid; clear smooth boundary.

B21tg—7 to 13 inches; gray (N 6/0) silty clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; strong medium and fine subangular blocky structure; very firm, sticky, plastic; common fine medium and coarse roots; few very fine tubular pores; few thin continuous clay films on faces of peds; few fine flakes of mica; extremely acid; gradual smooth boundary.

B22tg—13 to 33 inches; gray (N 6/0) silty clay; common fine and medium prominent yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to strong fine and medium angular blocky; very firm, sticky, plastic; common fine and medium roots along primary structural faces; few very fine tubular pores; common thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B23tg—33 to 47 inches; gray (5Y 6/1) silty clay; common medium prominent yellowish brown (10YR 5/8) mottles; moderate coarse prismatic structure parting to strong medium and fine angular blocky; very firm, sticky, plastic; common fine and few medium roots along primary structural faces; common thick continuous clay films on faces of peds; few fine flakes of mica; extremely acid; gradual smooth boundary.

B24tg—47 to 61 inches; gray (5Y 5/1) silty clay; common medium prominent yellowish brown (10YR 5/8) mottles; strong medium and fine subangular and angular blocky structure; firm, sticky, plastic; few fine and medium roots; few thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B25tg—61 to 85 inches; gray (5Y 6/1) clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; strong medium and fine subangular and angular blocky structure; firm, sticky, plastic; few fine roots; few very fine tubular pores; few thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid.

The solum thickness is more than 60 inches. The soil is extremely acid or very strongly acid unless limed. Quartz pebbles make up 0 to 2 percent of the solum.

The A horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 or 2. It is loam or silt loam.

Some pedons have a B1 horizon that has no hue or hue of 10YR through 5Y, value of 4 through 6, and chroma of 0 through 2. Mottles with high chroma are in some pedons. Texture is loam, silt loam, clay loam, or silty clay loam.

The B2t horizon has no hue or hue of 10YR through 5Y, value of 4 through 7, and chroma of 0 through 2. Texture is clay loam, silty clay loam, silty clay, or clay.

Craven Series

Soils of the Craven series are deep and moderately well drained. They formed in clayey fluvial and marine sediments. Craven soils are on upland ridges and side slopes on the Coastal Plain. Slopes range from 2 to 10 percent.

Craven soils commonly are near Caroline, Emporia, Slagle, and Uchee soils. Craven soils are not as well drained as Caroline, Emporia, and Uchee soils. They have more clay in the subsoil than Emporia, Slagle, and Uchee soils and do not have the thick sandy surface layer characteristic of Uchee soils.

Typical pedon of Craven fine sandy loam in an area of Craven-Uchee complex, 6 to 10 percent slopes, approximately 2,700 feet east of Skimino Creek bridge on VA-602, 750 feet east of pond on Skimino Girl Scout Camp, York County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable, nonsticky, nonplastic; many fine and medium roots; very strongly acid; clear smooth boundary.

A2—4 to 9 inches; pale olive (5Y 6/3) fine sandy loam; weak medium granular structure; friable, slightly sticky, nonplastic; many fine and medium roots; very strongly acid; abrupt smooth boundary.

B21t—9 to 22 inches; yellowish brown (10YR 5/6) clay; strong fine subangular blocky structure; firm, sticky, plastic; common fine roots; thin continuous clay films on faces of peds; extremely acid; clear smooth boundary.

B22t—22 to 30 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium prominent light gray (2.5Y 7/2) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; few fine roots; thick discontinuous clay films on faces of peds; extremely acid; clear smooth boundary.

B3t—30 to 42 inches; yellowish brown (10YR 5/8) sandy clay loam; many fine prominent light gray (2.5Y 7/2) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; thin patchy clay films on faces of peds; extremely acid; clear smooth boundary.

C1—42 to 60 inches; brownish yellow (10YR 6/6) fine sandy loam; common medium prominent light gray (10YR 7/2) mottles; massive; very friable, nonsticky, nonplastic; extremely acid; clear smooth boundary.

C2g—60 to 72 inches; light gray (2.5Y 7/2) loamy fine sand; few fine prominent brownish yellow (10YR 6/6) mottles; massive; very friable, nonsticky, nonplastic; extremely acid.

The solum thickness ranges from 40 to 60 inches. The soil ranges from extremely acid through strongly acid unless limed. Coarse fragments make up 0 to 2 percent of the soil.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 1 through 3. The A2 horizon has hue of 10YR through 5Y, value of 5 through 7, and chroma of 2 through 4. The A horizon is fine sandy loam, loam, or silt loam.

Some pedons have a B1t horizon that has hue of 10 YR or 2.5Y, value of 5 or 6, and chroma of 4 through 8. This horizon is loam, clay loam, or silty clay loam.

The B21t horizon has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 4 through 8. It is clay loam, silty clay loam, silty clay, or clay. The B22t horizon has hue of 7.5YR through 2.5Y, value of 5 through 7, and chroma of 4 through 8. Mottles are in shades of red, brown, yellow, or gray. Texture is sandy clay loam, clay loam, silty clay loam, silty clay, clay, or sandy clay.

The B3 horizon is mottled and has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 1 through 8. It is sandy clay loam, sandy clay, or silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 1 through 6. Mottles are in shades of red, brown, yellow, or gray. Texture ranges from loamy fine sand to sandy clay loam.

The Craven soils in this survey area are taxadjuncts to the Craven series because they have a thinner clayey Bt horizon and more sand in the lower part of the B2t horizon than is defined in the range for the series. These differences, however, do not affect the use and management of the soils.

Dogue Series

Soils of the Dogue series are deep and moderately well drained. They formed in clayey fluvial sediments. Dogue soils are on stream terraces along major streams and rivers on the Coastal Plain. Slopes range from 0 to 3 percent.

Dogue soils commonly are near Altavista, Chickahominy, Newflat, Pamunkey, and Peawick soils. Dogue soils have more clay in the subsoil than Pamunkey and Altavista soils and are not as poorly drained as Chickahominy or Newflat soils. Dogue soils are not as well drained as Pamunkey soils and have a thinner subsoil and lower shrink-swell potential than Peawick soils.

Typical pedon of Dogue loam, approximately 2,800 feet southeast of the mouth of Taskinas Creek and 500 feet south of the York River in York River State Park, James City County:

Ap1—0 to 3 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; friable, slightly sticky, slightly plastic; many fine, common medium, and few coarse roots; common fine pores; neutral; clear smooth boundary.

Ap2—3 to 11 inches; dark grayish brown (10YR 4/2) loam; moderate fine granular and weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and medium and few coarse roots; many fine pores; slightly acid; clear smooth boundary.

B1t—11 to 14 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable, sticky, plastic; few fine and common roots; many fine pores; medium acid; abrupt smooth boundary.

B21t—14 to 26 inches; yellowish brown (10YR 5/6) clay; few fine faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; common fine medium and coarse roots; common fine pores; common thin continuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—26 to 36 inches; yellowish brown (10YR 5/6) clay; many fine faint yellowish brown (10YR 5/8) mottles and common prominent gray (10YR 6/1) mottles; moderate fine and medium subangular blocky structure; very firm, sticky, plastic; few fine roots; few fine pores; many thick continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—36 to 43 inches; reddish yellow (7.5YR 6/8) clay; many medium prominent yellowish brown (10YR 5/6) mottles and many fine distinct gray (10YR 6/1) mottles; moderate medium and fine subangular and angular blocky structure; firm, sticky, plastic; few fine roots along vertical faces of peds; few fine pores; many medium continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B3tg—43 to 52 inches; light brownish gray (10YR 6/2) sandy clay loam; many medium distinct reddish yellow (7.5YR 6/8) mottles, common fine faint yellowish brown (10YR 5/6) mottles, and few fine prominent yellowish red (5YR 5/6) mottles; moderate coarse subangular blocky structure; friable, sticky, plastic; few fine and medium roots; few fine pores; very strongly acid; gradual smooth boundary.

C—52 to 60 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/8), pale brown (10YR 6/3), and light brownish gray (10YR 6/2) sandy loam; massive; friable, sticky, slightly plastic; strongly acid.

The solum thickness is more than 40 inches. The soil is extremely acid through strongly acid unless limed. Quartz pebbles make up 0 to 15 percent of the soil. Some pedons have few or common flakes of mica and grains of feldspar in the B and C horizons.

The A1 or Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 through 4. Some pedons have an A2 horizon that has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 3 through 6. The A horizon is fine sandy loam, loam, or silt loam.

The B1 horizon has hue of 10YR, value of 5 or 6, and chroma of 4 or 6. It is loam, clay loam, or sandy clay loam.

The upper part of the B2t horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. The lower part of the B2t horizon has hue of 7.5YR or 10YR, value of 5 through 7, and chroma of 1 through 8. It has dominantly low and high chroma mottles, or it is mottled without dominant matrix color. The B2t horizon is clay loam, sandy clay loam, sandy clay, or clay.

The B3 horizon has colors and mottles similar to those in the lower part of the B2t horizon. It is sandy loam, sandy clay loam, clay loam, or sandy clay.

The C horizon is mottled with both high and low chroma colors. It commonly is stratified and ranges from sand to sandy clay loam.

Dragston Series

Soils of the Dragston series are deep and somewhat poorly drained. They formed in loamy fluvial sediments. Dragston soils are on low-lying stream terraces on the Coastal Plain. Slopes range from 0 to 2 percent.

Dragston soils commonly are near Altavista, Augusta, Nimmo, Seabrook, and Tomotley soils. Dragston soils are more poorly drained than Altavista or Seabrook soils. In addition, they have less clay in the subsoil than Altavista soils and have more clay than Seabrook soils. They have less clay in the subsoil than Augusta and Tomotley soils and are not as poorly drained as Nimmo or Tomotley soils.

Typical pedon of Dragston fine sandy loam, approximately 2,500 feet north of junction of VA-173 and VA-629 and 500 feet south of the York River, York County:

Ap—0 to 10 inches; olive gray (5Y 4/2) fine sandy loam; weak fine granular structure; friable, nonsticky, nonplastic; common fine and medium roots; common fine and medium tubular pores; medium acid; abrupt smooth boundary.

A2—10 to 17 inches; olive (5Y 5/3) fine sandy loam; common medium distinct light yellowish brown (2.5Y 6/4) mottles, few fine distinct olive yellow (2.5Y 6/6) mottles, and common medium prominent grayish brown (10YR 5/2) mottles; weak fine granular structure; friable, nonsticky, nonplastic; few fine and medium roots; common fine and medium tubular pores; strongly acid; clear smooth boundary.

B1t—17 to 20 inches; olive (5Y 5/3) fine sandy loam; common distinct light olive brown (2.5Y 5/4) mottles; weak fine granular and subangular blocky structure; friable, slightly sticky, nonplastic; few fine roots; common fine and medium pores; common clay bridging between sand grains; few pebbles up to 1/4 inch in diameter; few concretions; few fine flakes of mica; strongly acid; clear wavy boundary.

B2tg—20 to 31 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; few medium prominent yellowish brown (10YR 5/6) mottles; weak medium granular and subangular blocky structure; friable, slightly sticky, nonplastic; few fine and medium roots; few fine and medium tubular pores; common clay bridging between sand grains; few pebbles up to 1/2 inch in diameter; few fine flakes of mica; medium acid; gradual irregular boundary.

B&C—31 to 42 inches; approximately 60 percent olive brown (2.5Y 4/4) sandy loam(B); weak fine granular structure; friable, nonsticky, nonplastic; many fine and medium pores; approximately 40 percent pockets of light brownish gray (2.5Y 6/2) sand(C); single grain; loose; few fine roots; few pebbles up to 1/2 inch in diameter; few fine flakes of mica; slightly acid; diffuse irregular boundary.

IIC1g—42 to 47 inches; dark grayish brown (2.5Y 4/2) sandy loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; friable, nonsticky, nonplastic; few fine roots; few fine and medium pores; few pebbles up to 3/4 inch in diameter; few fine flakes of mica; slightly acid; gradual wavy boundary.

IIC2—47 to 54 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium prominent olive gray (5Y 5/2) mottles; massive; friable, slightly sticky, slightly plastic; few fine roots; common fine and medium pores; few pebbles up to 3/4 inch in diameter; iron stains on 15 percent of sand grains; few fine flakes of mica; very strongly acid; gradual wavy boundary.

IIC3g—54 to 72 inches; gray (5Y 6/1) loamy fine sand; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; very friable, nonsticky, nonplastic; few fine flakes of mica; very strongly acid.

The solum thickness ranges from 25 to 50 inches. The soil is very strongly acid or strongly acid in the A horizon and upper part of the B horizon unless limed. It ranges from very strongly acid through slightly acid in the lower part of the B horizon and in the C horizon. Quartz pebbles make up 0 to 2 percent of the solum and 0 to 10 percent of the C horizon.

The A1 or Ap horizon has hue of 10YR through 5Y, value of 3 through 5, and chroma of 2 through 4. The A2 horizon has hue of 10YR through 5Y, value of 4 through 7, and chroma of 2 through 4. The A horizon is loamy fine sand or fine sandy loam.

The B1 horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 3 through 8. It has few or common mottles. The B2t horizon has no hue or hue of 10YR through 5Y, value of 4 through 6, and chroma of 0 through 8. The B2t horizon has high or low chroma mottles. The B1 and B2t horizons are sandy loam or fine sandy loam.

Some pedons have a B3 horizon that has colors and mottles similar to those of the B2t horizon. This horizon is loamy fine sand, sandy loam, or fine sandy loam.

The C horizon has no hue or has hue of 10YR through 5Y. It has value of 4 through 7 and chroma of 0 through 8. This horizon has high or low chroma mottles. It is sand, fine sand, loamy sand, loamy fine sand, fine sandy loam, or sandy loam.

Emporia Series

Soils of the Emporia series are deep and well drained. They formed in stratified loamy and clayey fluvial and marine sediments. Emporia soils are on uplands on the Coastal Plain. Slopes range from 2 to 50 percent.

Emporia soils commonly are near Caroline, Izagora, Kempsville, Kenansville, Slagle, Suffolk, and Uchee soils. Emporia soils have less clay in the subsoil than Caroline soils and are better drained than Izagora or Slagle soils. They have a perched water table, unlike Kempsville or Suffolk soils, and do not have the thick sandy surface layer characteristic of Kenansville or Uchee soils.

Typical pedon of Emporia fine sandy loam, 2 to 6 percent slopes, approximately 5,500 feet southwest of mouth of Carters Creek at the York River, 1,300 feet south of Carters Creek on Camp Peary, York County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable, slightly sticky, nonplastic; many fine medium and coarse roots; common fine and medium tubular pores; very strongly acid; clear smooth boundary.

A2—4 to 13 inches; pale brown (10YR 6/3) loam; weak fine and medium granular structure; friable, slightly sticky, nonplastic; common fine medium and coarse roots; many fine and medium tubular pores; very strongly acid; gradual smooth boundary.

B1t—13 to 19 inches; yellowish brown (10YR 5/6) loam; common medium faint light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable, sticky, plastic; common medium and fine roots; many fine and medium tubular pores; few thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

B21t—19 to 30 inches; yellowish brown (10YR 5/6) loam; common medium distinct strong brown (7.5YR 5/6) mottles and few medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium tubular pores; common thin continuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B22t—30 to 37 inches; yellowish brown (10YR 5/8) loam; common medium distinct strong brown (7.5YR 5/8) and pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium tubular pores; common thin discontinuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B23t—37 to 51 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium distinct strong brown (7.5YR 5/8) and light brownish gray (10YR 6/2) mottles; weak medium and coarse subangular blocky structure; firm, sticky, plastic; few fine roots; common fine and medium tubular pores; few thin discontinuous clay films on faces of peds; strongly acid; clear smooth boundary.

B3t—51 to 58 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/8), and strong brown (7.5YR 5/8) sandy clay loam; weak coarse subangular blocky structure; firm, sticky, plastic; common fine tubular pores; few thin patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

C—58 to 75 inches; variegated gray (5Y 6/1), strong brown (7.5YR 5/8), yellowish brown (10YR 5/6), and yellowish red (5YR 5/6) sandy clay loam; massive; firm, sticky, plastic; very strongly acid.

The solum thickness ranges from 40 to 75 inches. The soil is very strongly acid or strongly acid unless limed. Coarse fragments make up 0 to 5 percent of the soil.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. The A horizon is sandy loam, fine sandy loam, or loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 through 6. It is sandy loam, fine sandy loam, or loam.

The B21t and B22t horizons have hue of 5YR through 10YR, value of 4 through 6, and chroma of 3 through 8. Texture is sandy loam, loam, sandy clay loam, or clay loam. The B23t and B3 horizons have no hue or hue of 5YR through 2.5Y, and they have value of 4 through 6 and chroma of 0 through 8. These horizons have low chroma mottles or are mottled without dominant matrix color. Texture is sandy loam, loam, sandy clay loam, clay loam, sandy clay, or clay.

The C horizon has no hue or hue of 5YR through 5Y, value of 3 through 8, and chroma of 0 through 8. This horizon is mottled or variegated. Texture ranges from sandy loam to clay.

Izagora Series

Soils of the Izagora series are deep and moderately well drained. They formed in loamy and clayey fluvial and marine sediments. Izagora soils are on uplands on the Coastal Plain. Slopes range from 0 to 3 percent.

Izagora soils commonly are near Bethera, Emporia, Slagle, and Yemassee soils. Izagora soils are better drained and have less clay in the subsoil than Bethera soils. They are not as well drained as Emporia soils, have a thicker subsoil than Slagle and Yemassee soils, and are better drained than Yemassee soils.

Typical pedon of Izagora loam, approximately 3,250 feet west; southwest of the junction of US-17 and the Chesapeake and Ohio Railroad, 200 feet north of railroad, York County:

A1—0 to 4 inches; very dark gray (10YR 3/1) loam; weak fine granular structure; friable, slightly sticky, nonplastic; many fine medium and coarse roots; common fine and medium tubular pores; extremely acid; clear wavy boundary.

A2—4 to 13 inches; light yellowish brown (2.5Y 6/4) loam; weak fine granular structure; friable, slightly sticky, nonplastic; few fine coarse and common medium roots; common fine and medium tubular pores; krotovina up to 1/2 inch in diameter filled with A1 material; strongly acid; clear smooth boundary.

B1t—13 to 17 inches; light olive brown (2.5Y 5/4) loam; weak fine subangular blocky and moderate medium granular structure; friable, sticky, plastic; few fine and medium roots; common fine and medium tubular pores; few thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

B21t—17 to 27 inches; light olive brown (2.5Y 5/6) loam; weak medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; few fine tubular pores; thin discontinuous clay films on faces of peds; very strongly acid; gradual wavy boundary.

B22t—27 to 36 inches; mottled yellowish brown (10YR 5/8), light olive brown (2.5Y 5/4), gray (5Y 6/1), and strong brown (7.5YR 5/6) clay loam; moderate fine subangular blocky structure; friable, sticky, plastic; few fine roots; few fine vesicular pores; thin discontinuous clay films on faces of peds; vertical streaks 1/4 to 1/2 inch wide of gray (5Y 6/1) sandy clay loam; very strongly acid; gradual smooth boundary.

B23tg—36 to 44 inches; gray (5Y 6/1) clay loam; many coarse prominent yellowish brown (10YR 5/8) mottles and common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; few fine roots; few fine vesicular pores; thick continuous clay films on faces of peds; vertical streaks of gray (5Y 6/1) loam; very strongly acid; gradual smooth boundary.

B24tg—44 to 68 inches; gray (N 6/0) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm, sticky, plastic; few fine roots; few fine vesicular pores; thick continuous clay films on faces of peds; vertical streaks of gray (N 6/0) loam; very strongly acid; gradual smooth boundary.

B3tg—68 to 78 inches; gray (N 6/0) clay; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm, sticky, plastic; few thin patchy clay films on faces of peds; very strongly acid.

The solum is more than 60 inches thick. The A horizon ranges from extremely acid through strongly acid unless limed. The B horizon is very strongly acid or strongly acid.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 through 4. The A horizon is fine sandy loam or loam.

The B1 horizon and the upper part of the B2t horizon have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 through 8. Texture is loam or clay loam.

The lower part of the B2t horizon and the B3 horizon have no hue or hue of 10YR through 5Y, value of 5 or 6, and chroma of 0 through 8. They have few to many high and low chroma mottles, or some pedons are mottled without dominant matrix color. Texture is clay loam or clay.

Johnston Series

Soils of the Johnston series are deep and very poorly drained. They formed in loamy fluvial sediments. Johnston soils are on flood plains on the Coastal Plain. Slopes range from 0 to 2 percent.

Johnston soils commonly are near Axis, Bohicket, Chickahominy, Levy, Nimmo, and Tomotley soils. Johnston soils are commonly flooded from runoff, whereas Axis, Bohicket, and Levy soils are inundated twice daily by tidal waters. Johnston soils are more poorly drained than Chickahominy, Nimmo, or Tomotley soils.

Typical pedon of Johnston silt loam in an area of Johnston complex, on Long Hill Swamp flood plain, about 4,500 feet south of bridge on VA-612, James City County:

A—0 to 8 inches; black (5Y 2/1) silt loam; weak medium granular structure; friable, sticky, plastic; many fine and medium roots; 9 percent organic matter; very strongly acid; clear smooth boundary.

Bg—8 to 34 inches; black (10YR 2/1) silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; 13 percent organic matter; strongly acid; clear smooth boundary.

C1g—34 to 49 inches; black (5Y 2/1) sandy clay loam; few fine prominent light olive brown (2.5Y 5/4) mottles; massive; friable, sticky, plastic; 3 percent organic matter; strongly acid; gradual wavy boundary.

C2g—49 to 60 inches; gray (5Y 5/1) fine sandy loam; massive; friable, slightly sticky, slightly plastic; 1 percent organic matter; medium acid.

The soil is very strongly acid or strongly acid above a depth of 40 inches and ranges from very strongly acid to medium acid below this depth. Organic matter content decreases irregularly with depth and ranges from 8 to 15 percent in the upper part of the profile. Some pedons have a few inches of recent alluvial sediments deposited on the dark A horizon.

The A horizon has no hue or hue of 10YR through 5Y, value of 2 or 3, and chroma of 0 through 2. It is sandy loam, fine sandy loam, loam, silt loam, or silty clay loam.

The Bg horizon has no hue or hue of 10YR through 5Y, value of 2 or 3, and chroma of 0 through 2. Texture is fine sandy loam, loam, silt loam, clay loam, sandy clay loam, or silty clay loam.

The Cg horizon has no hue or hue of 10YR through 5Y, value of 2 through 6, and chroma of 0 through 2. It is stratified and ranges from sand to sandy clay loam. Some pedons contain shell fragments, and some pedons have few to many pebbles.

The Johnston soils in this survey area are taxadjuncts to the Johnston series because they have more clay in the subsoil and a higher reaction in the substratum than is defined in the range for the series. These differences, however, do not affect the use and management of the soils.

Kempsville Series

Soils of the Kempsville series are deep and well drained. They formed in loamy fluvial and marine sediments. Kempsville soils are on uplands in the Coastal Plain. Slopes range from 2 to 6 percent.

Kempsville soils commonly are near Emporia, Kenansville, Slagle, and Suffolk soils. Kempsville soils do not have the perched water table characteristic of Emporia soils. They do not have the thick sandy surface layer characteristic of Kenansville soils, are better drained than Slagle soils, and have a thicker subsoil than Suffolk soils.

Typical pedon of Kempsville fine sandy loam, 2 to 6 percent slopes, approximately 3 miles northwest of Williamsburg, 0.5 mile east of junction of US-60 and VA-645, 100 feet south of VA-645, York County:

A1—0 to 4 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; weak fine granular structure; very friable; many medium and common coarse roots; common fine and medium tubular pores; very strongly acid; clear smooth boundary.

A2—4 to 14 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak fine and medium granular structure; very friable; common coarse medium and fine roots; common fine and medium tubular pores; very strongly acid; gradual smooth boundary.

B1t—14 to 20 inches; yellowish brown (10YR 5/6) fine sandy loam; few medium faint light yellowish brown (10YR 6/4) mottles; weak fine and medium subangular blocky and weak fine angular blocky structure; friable; few coarse medium and fine roots; common fine and medium pores; few thin clay films on faces of peds and common clay bridging between grains of sand; very strongly acid; clear smooth boundary.

B21t—20 to 32 inches; strong brown (7.5YR 5/6) sandy clay loam; few medium distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable; few coarse fine and medium roots with the coarse roots mainly in the upper part of the horizon; few fine and medium pores; common thin clay films on faces of peds; very strongly acid; clear smooth boundary.

B22t—32 to 40 inches; mottled strong brown (7.5YR 5/6), light yellowish brown (10YR 6/4), and pale brown (10YR 6/3) fine sandy loam; weak coarse and medium subangular blocky structure; strong brown portion is friable, light yellowish brown and pale brown portion is firm and slightly compact in place; few fine roots; few fine and medium vesicular pores; few thin clay films on faces of peds; strongly acid; clear wavy boundary.

B23t—40 to 55 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium faint pale brown (10YR 6/3) and strong brown (7.5YR 5/6) mottles; weak coarse and medium subangular blocky structure; friable, slightly compact in place; few fine and very fine roots; few fine vesicular pores; few thin clay films on faces of peds and common clay bridging between sand grains; strongly acid; clear wavy boundary.

C—55 to 68 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium distinct strong brown (7.5YR 5/6) and light yellowish brown (10YR 6/4) mottles and many coarse prominent gray (5Y 6/1) mottles; massive; friable; few fine roots; few fine vesicular pores; strongly acid.

The solum thickness ranges from 50 to 85 inches. The soil is very strongly acid or strongly acid unless limed. Quartz pebbles make up 0 to 10 percent of the A and B horizons and 0 to 15 percent of the C horizon.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 2 through 4. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The A horizon is sandy loam or fine sandy loam.

The B1 horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 3 through 6. It is sandy loam or fine sandy loam.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. In some pedons, the lower part of the B2t horizon has hue of 2.5YR or 5YR. The B2t horizon is sandy loam, fine sandy loam, sandy clay loam, or loam. Some pedons have a subhorizon of the B2t horizon that is brittle and somewhat compact in up to 40 percent of the mass. This layer commonly has few to many pale brown, very pale brown, or light yellowish brown mottles, and it has slightly lower clay content than the overlying or underlying horizons.

The C horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. It ranges from loamy sand to sandy clay loam.

Kenansville Series

Soils of the Kenansville series are deep and well drained. They formed in loamy marine and fluvial sediments. Kenansville soils are on upland ridges on the Coastal Plain. Slopes range from 2 to 6 percent.

Kenansville soils commonly are near Kempsville, Slagle, Suffolk, and Uchee soils. Kenansville soils have a thicker and sandier surface layer than Kempsville, Slagle, or Suffolk soils, and they are also better drained than Slagle soils. They have less clay in the subsoil than Uchee soils.

Typical pedon of Kenansville loamy fine sand, 2 to 6 percent slopes, 0.5 mile north of Norge, 1,100 feet southwest of the junction of VA-602 and VA-607, James City County:

A1—0 to 2 inches; dark grayish brown (2.5Y 4/2) loamy fine sand; weak fine granular structure; very friable, nonsticky, nonplastic; common fine medium and few coarse roots; many medium and fine tubular pores; very strongly acid; clear smooth boundary.

A2—2 to 25 inches; light yellowish brown (10YR 6/4) loamy fine sand; weak fine granular structure; very friable, nonsticky, nonplastic; few fine medium and coarse roots; common medium and fine tubular pores; strongly acid; clear smooth boundary.

B1t—25 to 28 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium and fine granular and subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and medium roots; common fine and medium tubular pores; few sand grains bridged with clay; strongly acid; clear broken boundary.

B21t—28 to 40 inches; strong brown (7.5YR 5/6) fine sandy loam; weak medium subangular blocky and granular structure; friable, slightly sticky, slightly plastic; few fine and medium roots; few medium and common fine tubular pores; few thin patchy clay films on faces of peds; strongly acid; clear smooth boundary.

B22t—40 to 43 inches; strong brown (7.5YR 5/8) fine sandy loam; weak fine granular structure; very friable, slightly sticky, nonplastic; few fine roots; common fine and medium tubular pores; few sand grains coated and bridged with clay; strongly acid; clear smooth boundary.

C&Bt—43 to 78 inches; yellowish brown (10YR 5/8) loamy fine sand(C); massive; few fine and medium roots; common fine and medium tubular pores; white (10YR 8/2) sand grains in dendritic pattern of few root channels; 3 to 5 percent yellowish brown (10YR 5/4) fine sandy loam(Bt) lamellae 1/8 to 1/2 inch thick; clay bridging between sand grains; very strongly acid.

The solum thickness ranges from 40 to 55 inches. The soil is very strongly acid or strongly acid unless limed.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 through 6. The A horizon is fine sand, loamy fine sand, or loamy sand.

The B horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. It is sandy loam, fine sandy loam, or sandy clay loam. Some pedons have a B3 horizon that is loamy sand.

The C horizon has hue of 10YR, value of 5 through 7, and chroma of 3 through 8. It is sand, loamy sand, or loamy fine sand.

Levy Series

Soils of the Levy series are deep and very poorly drained. They formed in clayey fluvial sediments. Levy soils are along creeks and rivers on tidal marshes that are inundated twice daily by brackish or fresh water. Slopes are less than 1 percent.

Levy soils commonly are near Johnston, Nimmo, and Seabrook soils. None of these soils are on tidal marshes. Also, Levy soils are more poorly drained than Nimmo or Seabrook soils.

Typical pedon of Levy silty clay, approximately 1.5 miles southwest of junction of VA-633 and VA-611 and 0.25 mile east of end of VA-633, James City County:

A1—0 to 18 inches; dark olive gray (5Y 3/2) silty clay; massive; sticky; many fine roots; flows easily between fingers when squeezed, leaving residue of roots and fibers; about 15 percent organic (sapric) material; very strongly acid; clear smooth boundary.

C1g—18 to 30 inches; very dark gray (5Y 3/1) silty clay; massive; sticky; flows easily between fingers when squeezed; common fine roots and fibers; about 18 percent organic (sapric) material; strongly acid; clear smooth boundary.

C2g—30 to 80 inches; very dark gray (10YR 3/1) silty clay; massive; sticky; flows easily between fingers when squeezed; common fine fibers and pockets of organic (sapric) material; very strongly acid.

The soil has an *n* value greater than 1.0 in all mineral layers between the surface and a depth of 40 inches. The soil is very strongly acid or strongly acid in the upper 40 inches and ranges from very strongly acid through medium acid below this depth.

The A horizon has hue of 10YR through 5Y, value of 3 through 5, and chroma of 1 or 2. It is silt loam, silty clay loam, silty clay, clay, or their mucky analogues. Some pedons have an organic surface layer as much as 15 inches thick.

The C horizon has no hue or hue of 10YR through 5Y, value of 3 through 6, and chroma of 0 through 2. It is clay or silty clay. Some pedons have layers of sandy loam or loam below a depth of 40 inches.

Munden Series

Soils of the Munden series are deep and moderately well drained. They formed in loamy fluvial sediments. Munden soils are on stream terraces on the Coastal Plain. Slopes range from 0 to 3 percent.

Munden soils commonly are near Altavista, Dragston, Nimmo, and Tomotley soils. Munden soils contain less clay in the subsoil than Altavista soils. They are better drained than Dragston, Nimmo, or Tomotley soils.

Typical pedon of Munden loamy fine sand, approximately 8,000 feet northwest of Queen's Creek, 3,000 feet south of dam along Beaverdam Pond, 1,300 feet southwest of York River on Camp Peary, York County:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak fine granular structure; very friable, nonsticky, nonplastic; many fine medium and coarse roots; common fine and medium tubular pores; very strongly acid; clear smooth boundary.

A2—6 to 11 inches; brown (10YR 5/3) loamy fine sand; very friable, nonsticky, nonplastic; many fine medium and coarse roots; common fine and medium tubular pores; strongly acid; clear smooth boundary.

B1—11 to 24 inches; pale olive (5Y 6/3) fine sandy loam; very friable, nonsticky, nonplastic; few fine medium and coarse roots; many fine and medium tubular pores; strongly acid; clear smooth boundary.

B21t—24 to 32 inches; light yellowish brown (10YR 5/4) fine sandy loam; common medium distinct light gray (2.5Y 7/2) mottles and clean sand grains; weak medium and fine subangular blocky structure; friable, slightly sticky, slightly plastic; few fine medium and coarse roots; many fine and medium tubular pores; few thin patchy clay films on faces of peds; few fine flakes of mica; strongly acid; gradual smooth boundary.

B22t—32 to 42 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium distinct strong brown (7.5YR 5/6) and light gray (2.5Y 7/2) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few coarse roots; common fine tubular pores; few thin patchy clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual wavy boundary.

B3t—42 to 48 inches; light olive brown (2.5Y 5/4) fine sandy loam; common fine faint yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; very friable, slightly sticky, nonplastic; common fine tubular pores; few clay bridging between sand grains; few fine flakes of mica; very strongly acid; gradual wavy boundary.

C1—48 to 65 inches; light olive brown (2.5Y 5/4) fine sandy loam; massive; nonsticky, nonplastic; common fine tubular pores; few fine flakes of mica;

very strongly acid; gradual wavy boundary.

C2—65 to 80 inches; light olive brown (2.5Y 5/6) sandy loam; common fine distinct yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) mottles and common medium distinct gray (5Y 6/1) mottles; massive; nonsticky, nonplastic; common fine and medium tubular pores; common fine flakes of mica; very strongly acid.

The solum thickness ranges from 24 to 48 inches. The soil is very strongly acid or strongly acid unless limed.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 through 3. The A2 horizon has hue of 10YR through 5Y, value of 5 through 7, and chroma of 3 through 6. The A horizon is loamy fine sand or fine sandy loam.

The B1 horizon has hue of 10YR through 5Y, value of 5 or 6, and chroma of 3 through 6. It is sandy loam or fine sandy loam.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 4 through 8. It is sandy loam or fine sandy loam. Some pedons have a subhorizon that is sandy clay loam.

The B3 horizon has hue of 10YR through 2.5Y, value of 4 through 8, and chroma of 4 through 8; or it is mottled with high and low chroma colors. It is loamy sand, sandy loam, or fine sandy loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 5 through 7, and chroma of 2 through 8; or it is mottled with high and low chroma colors. It is loamy sand, sandy loam, or fine sandy loam.

Newflat Series

Soils of the Newflat series are deep and somewhat poorly drained. They formed in clayey fluvial sediments. Newflat soils are on stream terraces and low-lying flats along major rivers on the Coastal Plain. Slopes range from 0 to 2 percent.

Newflat soils commonly are near Augusta, Chickahominy, Dogue, Peawick, and Tetotum soils. Newflat soils have more clay in the subsoil than Augusta and Tetotum soils, are not as poorly drained as Chickahominy soils, and are more poorly drained than Dogue, Peawick, and Tetotum soils.

Typical pedon of Newflat silt loam, approximately 700 feet northeast of intersection of VA-5 and VA-613, James City County:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable, sticky, plastic; many fine medium and coarse roots; extremely acid; abrupt smooth boundary.

A2—2 to 8 inches; light yellowish brown (2.5Y 6/4) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium granular structure; friable, sticky, plastic; many fine medium and coarse roots; many very fine tubular pores; common fine prominent very dark grayish brown (10YR 3/2) concretions; extremely acid; clear smooth boundary.

B1t—8 to 11 inches; pale brown (10YR 6/3) silty clay loam; moderate medium subangular blocky structure; friable, sticky, plastic; many fine and medium and few coarse roots; common very fine tubular pores; thin discontinuous clay films on faces of peds, few fine prominent very dark grayish brown (10YR 3/2) concretions; few fine flakes of mica; extremely acid; clear smooth boundary.

B21t—11 to 17 inches; light olive brown (2.5Y 5/4) clay; few fine distinct yellowish brown (10YR 5/6) mottles; strong medium and fine subangular blocky structure; firm, sticky, plastic; common fine and medium and few coarse roots; common fine and very fine tubular pores; thin discontinuous clay films on faces of peds; few fine flakes of mica; extremely acid; clear smooth boundary.

B22tg—17 to 25 inches; olive gray (5Y 5/2) clay; common fine prominent yellowish brown (10YR 5/6) mottles and few medium prominent strong brown (7.5YR 5/6) mottles; strong medium and fine subangular blocky structure; firm, sticky, plastic; common fine and medium and few coarse roots; common fine and very fine tubular pores; thin continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; clear smooth boundary.

B23tg—25 to 35 inches; gray (5Y 5/1) clay; common medium prominent yellowish brown (10YR 5/8) mottles and few fine prominent dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to strong medium and fine subangular blocky; very firm, sticky, plastic; common fine and few medium roots; few very fine tubular pores; thin continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B24tg—35 to 52 inches; gray (N 5/0) clay; common medium prominent yellowish brown (10YR 5/6) mottles in vertical streaks up to 10 inches long; strong medium and coarse subangular blocky structure; very firm, sticky, plastic; few fine and medium roots; few very fine tubular pores; thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B25tg—52 to 66 inches; light gray (N 7/0) clay; common fine prominent yellowish brown (10YR 5/6) mottles; strong medium and fine subangular blocky structure; very firm, sticky, plastic; thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B26tg—66 to 80 inches; light gray (N 7/0) clay; common fine prominent yellowish brown (10YR 5/6) mottles;

moderate medium subangular blocky structure; very firm, sticky, plastic; few fine flakes of mica; very strongly acid.

The solum thickness is more than 60 inches. The soil is extremely acid or very strongly acid unless limed.

The A1 or Ap horizon has no hue or hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 0 through 2. The A2 horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 2 through 4. The A horizon is loam or silt loam.

The B1 horizon has hue of 10YR through 5Y, value of 5 or 6, and chroma of 3 through 6. In some pedons it is mottled with gray. It is loam, silt loam, clay loam, or silty clay loam. Some pedons do not have a B1 horizon.

The B21t horizon has hue of 10YR through 5Y, value of 5 or 6, and chroma of 3 through 6. This horizon has high or low chroma mottles. Below the B21t horizon, the B2t horizon has no hue or hue of 10YR through 5Y, value of 4 through 7, and chroma of 0 through 2. The B2t horizon is clay loam, silty clay loam, silty clay, or clay.

Some pedons have a B3 horizon that is similar in color to the lower part of the B2t horizon. It is loam, silty loam, sandy clay loam, clay loam, or clay.

Some pedons have a C horizon that has no hue or hue of 10YR through 5Y, value of 4 through 7, and chroma of 0 through 2. It ranges from fine sandy loam to clay.

Nimmo Series

Soils of the Nimmo series are deep and poorly drained. They formed in loamy fluvial sediments overlying sandy sediments. Nimmo soils are on low-lying flats and broad natural drains on the Coastal Plain. Slopes range from 0 to 2 percent.

Nimmo soils commonly are near Altavista, Augusta, Bojac, Dragston, Seabrook, and Tomotley soils. Nimmo soils are more poorly drained than Altavista, Augusta, Bojac, Dragston, and Seabrook soils. They have more clay in the subsoil than Seabrook soils and have less clay in the subsoil than Altavista, Augusta, and Tomotley soils.

Typical pedon of Nimmo fine sandy loam, approximately 1,600 feet northwest of the junction of VA-622 and VA-628 near Seaford, York County:

A1—0 to 8 inches; very dark grayish brown (2.5Y 3/2) fine sandy loam; weak fine granular structure; very friable, slightly sticky, nonplastic; many fine medium and coarse roots; few fine and medium pores; extremely acid; clear smooth boundary.

A21—8 to 11 inches; dark gray (5Y 4/1) fine sandy loam; weak fine granular structure; very friable, slightly sticky, slightly plastic; common fine medium and coarse roots; few fine and medium pores; extremely acid; clear smooth boundary.

A22—11 to 17 inches; gray (5Y 6/1) fine sandy loam; weak fine granular structure; very friable, nonsticky, nonplastic; few fine medium and coarse roots; common fine and medium pores; extremely acid; clear smooth boundary.

B1tg—17 to 21 inches; gray (5Y 6/1) fine sandy loam; few fine distinct olive yellow (2.5Y 6/6) mottles; weak coarse subangular blocky structure; very friable, nonsticky, nonplastic; few fine medium and coarse roots; few fine and medium pores; few sand grains bridged with clay; few fine flakes of mica; extremely acid; clear smooth boundary.

B21tg—21 to 29 inches; dark gray (5Y 4/1) and gray (5Y 5/1) fine sandy loam; common medium faint gray (5Y 5/1) and olive yellow (2.5Y 6/6) mottles and common medium prominent yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; very friable, slightly sticky, slightly plastic; few fine and medium roots; common fine and medium pores; many sand grains coated and bridged with clay; few fine flakes of mica; extremely acid; gradual smooth boundary.

B22tg—29 to 36 inches; dark gray (5Y 4/1) fine sandy loam; many medium faint gray (5Y 5/1) mottles and common coarse prominent yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) streaks and mottles; weak coarse subangular blocky structure; very friable, slightly sticky, slightly plastic; few fine roots; common fine and medium pores; few sand grains coated and bridged with clay; few fine flakes of mica; extremely acid; gradual smooth boundary.

C1g—36 to 45 inches; dark gray (5Y 4/1) loamy fine sand; many medium faint gray (5Y 5/1) mottles and common coarse prominent yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) streaks and mottles; massive; very friable, slightly sticky, slightly plastic; common fine flakes of mica; extremely acid; gradual wavy boundary.

C2g—45 to 52 inches; dark gray (5Y 4/1) loamy fine sand; many medium faint gray (5Y 5/1) mottles and common coarse prominent yellowish brown (10YR 5/6) mottles; massive; very friable, slightly sticky, slightly plastic; common fine flakes of mica; extremely acid; gradual wavy boundary.

C3g—52 to 60 inches; light olive gray (5Y 6/2) sand and strata of light gray (5Y 7/1) loamy fine sand; common coarse distinct olive yellow (2.5Y 6/8) mottles; single grain; loose; common fine flakes of mica; very strongly acid.

The solum thickness ranges from 24 to 45 inches. The soil ranges from extremely acid through strongly acid unless limed.

The A1 or Ap horizon has hue of 10YR through 5Y, value of 2 through 5, and chroma of 1 or 2. The A2 horizon has hue of 10YR through 5Y, value of 4 through 7, and chroma of 1 or 2. The A horizon is loamy fine sand or fine sandy loam.

The Btg horizon has hue of 2.5Y or 5Y, value of 4 through 6, and chroma of 1 or 2. It commonly is fine sandy loam, but some pedons have thin layers of sandy clay loam.

The IIC or C horizon has no hue or hue of 10YR through 5Y, value of 4 through 6, and chroma of 0 through 2. It is sand, fine sand, loamy sand, or loamy fine sand. Some pedons have strata of loamy texture.

Norfolk Series

Soils of the Norfolk series are deep and well drained. They formed in loamy fluvial and marine sediments. Norfolk soils are on broad uplands on the Coastal Plain. Slopes range from 2 to 6 percent.

Norfolk soils commonly are near Emporia, Kempsville, and Slagle soils. Norfolk soils have a thicker subsoil than Emporia, Kempsville, or Slagle soils, and they are better drained than Slagle soils.

Typical pedon of Norfolk fine sandy loam, 2 to 6 percent slopes, approximately 5,000 feet southwest of mouth of Carter's Creek at the York River, 800 feet south of Carter's Creek on Camp Peary, York County:

Ap—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam; weak fine and medium granular structure; friable, slightly sticky, nonplastic; many fine medium and coarse roots; common fine and medium tubular pores; very strongly acid; clear smooth boundary.

A2—10 to 17 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine faint yellowish brown (10YR 5/8) mottles; moderate medium and fine granular structure; friable, slightly sticky, slightly plastic; common fine and medium roots; common fine and medium tubular pores; strongly acid; gradual smooth boundary.

B1t—17 to 21 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; many fine and medium tubular pores; thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

B21t—21 to 39 inches; strong brown (7.5YR 5/6) sandy clay loam; few fine distinct light yellowish brown (10YR 6/4) mottles; moderate medium and fine subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium tubular pores; thin discontinuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—39 to 53 inches; strong brown (7.5YR 5/6) sandy clay loam; few medium distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine tubular pores; thin discontinuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B23t—53 to 72 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium distinct light yellowish brown (10YR 6/4) and pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few medium roots; common fine tubular pores; thin patchy clay films on faces of peds; strongly acid.

The solum thickness ranges from 60 to 90 inches. The soil is very strongly acid or strongly acid unless limed. Coarse fragments up to 1/2 inch in diameter make up 0 to 5 percent of the soil.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The A horizon is sandy loam or fine sandy loam.

The B1 horizon has hue of 10YR, value of 5, and chroma of 6 or 8. It is sandy loam or sandy clay loam.

The B2t horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 6 through 8. It is sandy loam, sandy clay loam, or clay loam.

Some pedons have a C horizon that commonly is mottled strong brown, red, gray, or yellow. It ranges from sandy loam to clay.

Pamunkey Series

Soils of the Pamunkey series are deep and well drained. They formed in loamy fluvial sediments. Pamunkey soils are on uplands of low stream terraces on the Coastal Plain. Slopes range from 2 to 6 percent.

Pamunkey soils commonly are near Altavista, Dogue, and Munden soils. Pamunkey soils are better drained than these associated soils. Also, they have less clay in the subsoil than Dogue soils, and they have more clay in the subsoil than Munden soils.

Typical pedon of Pumunkey sandy loam, in an area of Pamunkey soils, 2 to 6 percent slopes, approximately 3,000 feet northwest of mouth of Skimino Creek at the James River, 1,000 feet north of Skimino Creek, 800 feet west of patrol road on Camp Peary, James City County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) sandy loam; weak fine and medium granular structure; very friable, nonsticky, nonplastic; many coarse medium and fine roots; many medium tubular pores; medium acid; clear smooth boundary.

A2—4 to 14 inches; brown (10YR 5/3) sandy loam;

weak medium granular structure; very friable, slightly sticky, nonplastic; common coarse and few fine and medium roots; common fine and many medium tubular pores; slightly acid; gradual smooth boundary.

B2t—14 to 21 inches; yellowish brown (10YR 5/4) sandy loam; common medium prominent dark brown (7.5YR 4/4) mottles; weak medium and fine subangular blocky structure; friable, sticky, slightly plastic; common fine medium and coarse roots; many fine and common medium tubular pores; thin patchy clay films on faces of peds; few fine flakes of mica; slightly acid; clear smooth boundary.

B2t—21 to 36 inches; dark brown (7.5YR 4/4) sandy clay loam; weak fine and medium subangular blocky structure; friable, sticky, plastic; common medium and fine and few coarse roots; many fine and medium tubular pores; thin patchy clay films on faces of peds; few fine flakes of mica; slightly acid; clear smooth boundary.

B3t—36 to 43 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky and weak medium granular structure; friable, slightly sticky, slightly plastic; few fine and medium roots; many fine and medium pores; few thin patchy clay films on faces of peds and common clay bridging between sand grains; few fine flakes of mica; few grains of feldspar; slightly acid; clear smooth boundary.

C1—43 to 53 inches; brown (7.5YR 5/4) loamy sand; massive; very friable, slightly sticky, nonplastic; few medium roots; many medium and fine pores; few fine flakes of mica; few grains of feldspar; few quartz pebbles; slightly acid; gradual smooth boundary.

C2—53 to 65 inches; strong brown (7.5YR 5/8) loamy sand; massive; very friable, slightly sticky, nonplastic; many medium pores; few fine flakes of mica; common quartz pebbles; few grains of feldspar; slightly acid; gradual smooth boundary.

C3—65 to 75 inches; strong brown (7.5YR 5/8) sand; single grain; loose; few fine flakes of mica; common quartz pebbles; few grains of feldspar; slightly acid.

The solum thickness ranges from 40 to 60 inches or more. The soil ranges from very strongly acid through slightly acid in the A horizon and in the upper part of the B horizon unless limed. It ranges from medium acid through neutral in the lower part of the B horizon and in the C horizon. Quartz pebbles make up 0 to 5 percent of the soil.

The A1 or Ap horizon has hue of 7.5YR or 10YR, value of 3 through 5, and chroma of 2 through 4. The A2 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 through 4. The A horizon is fine sandy loam, sandy loam, loam, or silt loam.

The B1t horizon has hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 3 through 8. It is sandy loam, fine sandy loam, or loam.

The B2t and B3t horizons have hue of 5YR through 10YR, value of 4 through 6, and chroma of 3 through 8. The B2t horizon is fine sandy loam, loam, silt loam, sandy clay loam, clay loam, or silty clay loam. The B3t horizon is sandy loam, fine sandy loam, or loam.

The C horizon has colors similar to those of the B2t and B3t horizons. It ranges from sand through fine sandy loam. In some pedons it has strata of loamy texture.

Peawick Series

Soils of the Peawick series are deep and moderately well drained. They formed in clayey fluvial sediments. Peawick soils are on stream terrace uplands on the Coastal Plain. Slopes range from 0 to 3 percent.

Peawick soils commonly are near Chickahominy, Dogue, Newflat, Pamunkey, and Slagle soils. Peawick soils are better drained than Chickahominy or Newflat soils and are more poorly drained than Pamunkey soils. They have a thicker subsoil than Dogue soils and have more clay and silt in the subsoil than Pamunkey or Slagle soils.

Typical pedon of Peawick silt loam, approximately 3,200 feet north-northeast of intersection of VA-613 and VA-5, 100 feet south of private road, James City County:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium and fine granular structure; friable, sticky, plastic; many medium and fine and few coarse roots; extremely acid; abrupt smooth boundary.

B1t—2 to 7 inches; light yellowish brown (2.5Y 6/4) silty clay loam; moderate medium and fine subangular blocky structure and moderate medium granular structure; friable, sticky, plastic; common fine medium and coarse roots; many fine and common medium tubular pores; thin discontinuous clay films on faces of peds; extremely acid; clear smooth boundary.

B21t—7 to 16 inches; yellowish brown (10YR 5/6) silty clay; moderate medium and fine subangular and angular blocky structure; firm, sticky, plastic; common fine and medium and few coarse roots; common fine tubular pores; thin discontinuous clay films on faces of peds; extremely acid; clear smooth boundary.

B22t—16 to 28 inches; mottled yellowish brown (10YR 5/8), gray (10YR 6/1), and strong brown (7.5YR 5/6) silty clay; strong medium and fine angular blocky structure; firm, sticky, plastic; common fine and medium and few coarse roots; few fine tubular pores; thin continuous clay films on faces of peds; extremely acid; gradual smooth boundary.

B23t—28 to 41 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and gray (5Y 6/1) silty clay; weak medium prismatic structure parting to strong fine and medium angular blocky; very firm, very sticky, very plastic; few fine medium and coarse roots; few fine tubular pores; thick continuous clay films on faces of peds; few fine flakes of mica; extremely acid; gradual smooth boundary.

B24tg—41 to 70 inches; gray (5Y 6/1) silty clay; common medium prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to strong coarse and medium angular blocky; very firm, very sticky, very plastic; few fine and medium roots; few fine tubular pores; thick continuous clay films on faces of peds; few fine flakes of mica; extremely acid; gradual smooth boundary.

B25tg—70 to 99 inches; gray (5Y 6/1) clay; few fine prominent strong brown (7.5YR 5/8) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; very firm, very sticky, very plastic; thin continuous clay films on faces of peds; few fine flakes of mica; extremely acid.

The solum thickness is greater than 60 inches. The soil is extremely acid or very strongly acid unless limed. Quartz pebbles make up 0 to 2 percent of the soil.

The A horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 1 through 4. It is loam or silt loam. In eroded areas it is clay loam or silty clay loam.

The B1 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 4 through 8. It is clay loam or silty clay loam.

The upper part of the B2t horizon has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 4 through 8. The lower part of the B2t horizon, and the B3 horizon, if present, have no hue or hue of 10YR through 5Y, value of 5 through 7, and chroma of 0 through 8; or they are multicolored. The B2t and B3 horizons are silty clay loam, silty clay, or clay.

Some pedons have a C horizon that has colors similar to those of the B3 horizon. Texture ranges from fine sandy loam to clay.

Seabrook Series

Soils of the Seabrook series are deep and moderately well drained. They formed in sandy fluvial sediments. Seabrook soils are on low-lying stream terraces on the Coastal Plain. Slopes range from 0 to 2 percent.

Seabrook soils commonly are near Altavista, Bojac, Dragston, Munden, Nimmo, and Tomotley soils. Seabrook soils have less clay than any of these soils. In addition, they are not as well drained as Bojac soils, and they are better drained than Nimmo or Tomotley soils.

Typical pedon of Seabrook loamy fine sand, approximately 1,000 feet northeast of junction of Mill Creek and Diascund Creek, and 300 feet west of Mill Creek, James City County:

A11—0 to 3 inches; very dark grayish brown (10YR 3/2) loamy fine sand; weak fine granular structure; very friable; many fine medium and coarse roots; many fine and common medium pores; strongly acid; clear smooth boundary.

A12—3 to 9 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; common fine medium and coarse roots; many fine and medium pores; strongly acid; gradual smooth boundary.

C1—9 to 18 inches; yellowish brown (10YR 5/4) loamy fine sand; massive; very friable; few fine and medium roots; few fine pores; very strongly acid; gradual smooth boundary.

C2—18 to 25 inches; light yellowish brown (2.5Y 6/4) loamy fine sand; massive; very friable; few fine and medium roots; few fine pores; very strongly acid; gradual smooth boundary.

C3—25 to 40 inches; light yellowish brown (2.5Y 6/4) loamy fine sand; common fine prominent strong brown (7.5YR 5/8) mottles and common medium distinct light gray (2.5Y 7/2) mottles; massive; very friable; few fine and medium roots; few fine pores; common strong brown (7.5YR 5/8) fine sandy loam bodies up to 1/4 inch in diameter; strongly acid; clear wavy boundary.

C4—40 to 57 inches; light olive brown (2.5Y 5/6) loamy fine sand; common medium distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; massive; very friable; common strong brown (7.5YR 5/8) fine sandy loam bodies up to 1/4 inch in diameter; many fine flakes of mica; strongly acid; gradual wavy boundary.

C5—57 to 72 inches; mottled light yellowish brown (2.5Y 6/4), yellowish brown (10YR 5/6), dark greenish gray (5GY 4/1), and yellowish red (5YR 4/6) loamy fine sand; massive; very friable; common fine flakes of mica; strongly acid.

Some pedons have concretions and loamy bodies up to 2 inches in diameter throughout the soil. The soil is very strongly acid or strongly acid in the A horizon and ranges from very strongly acid through medium acid in the C horizon.

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

The upper part of the C horizon has hue of 10YR or 2.5Y, value of 4 through 7, and chroma of 3 through 8. The lower part of the C horizon has hue of 2.5Y or 5Y, value of 6 or 7, and chroma of 1 or 2; or it is mottled and does not have a dominant matrix color. Mottles have high and low chroma. The C horizon is sand, loamy sand, or loamy fine sand.

Slagle Series

Soils of the Slagle series are deep and moderately well drained. They formed in stratified loamy and clayey fluvial and marine sediments. Slagle soils are on upland flats, in slight depressions, and on side slopes of small drainageways on the Coastal Plain. Slopes range from 0 to 6 percent.

Slagle soils commonly are near Bethera, Caroline, Craven, Emporia, Izagora, Kempsville, and Uchee soils. Slagle soils have less clay in the upper part of the subsoil than Bethera, Caroline, or Craven soils. They are not as well drained as Emporia, Kempsville, or Uchee soils. They do not have as thick a subsoil as Izagora soils. They do not have a thick sandy surface layer characteristic of Uchee soils.

Typical pedon of Slagle fine sandy loam, 2 to 6 percent slopes, approximately 1.2 miles north of the Virginia Division of Highways office at Croaker, James City County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable, slightly sticky, nonplastic; many fine medium and coarse roots; common very fine and fine tubular pores; very strongly acid; abrupt wavy boundary.

A2—4 to 9 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak fine granular structure; friable, slightly sticky, nonplastic; common fine and medium roots; many fine and common medium tubular pores; very strongly acid; clear smooth boundary.

B21t—9 to 25 inches; yellowish brown (10YR 5/8) clay loam; common medium faint light yellowish brown (10YR 6/4) mottles and common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; common fine roots; common fine tubular pores; thin discontinuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B22t—25 to 31 inches; mottled yellowish brown (10YR 5/8), light gray (5Y 7/1), and strong brown (7.5YR 5/8) clay loam; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium pores; thin discontinuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B23tg—31 to 45 inches; light gray (5Y 7/1) sandy clay loam; common medium prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; firm, sticky, plastic; few fine roots; common fine and medium tubular pores; thick discontinuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B3t—45 to 50 inches; mottled yellowish brown (10YR 5/8), light gray (5Y 7/1), and strong brown (7.5YR 5/8) clay loam; weak coarse subangular blocky structure; firm, sticky, plastic; few fine roots; common fine and medium tubular pores; thick patchy clay films on faces of peds; few fine flakes of mica; very strongly acid; clear smooth boundary.

C—50 to 60 inches; mottled yellowish brown (10YR 5/8), light gray (5Y 7/1), and strong brown (7.5YR 5/8) sandy clay loam; massive; firm, sticky, plastic; few fine roots; few fine tubular pores; few thin vertical clay flows; few fine flakes of mica; very strongly acid.

The solum thickness ranges from 40 to 60 inches or more. The soil is extremely acid through strongly acid unless limed. Coarse fragments make up 0 to 5 percent of the soil.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. The A horizon is sandy loam, fine sandy loam, or loam.

Some pedons have a B1 horizon that has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 3 through 6. It is sandy loam, fine sandy loam, or loam.

The upper part of the B2t horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 through 8. The lower part of the B2t and the B3 horizons have hue of 7.5YR through 5Y, value of 4 through 7, and chroma of 1 through 8; or they are mottled or variegated with high and low chroma colors. The B2t horizon is sandy clay loam, loam, or clay loam. The lower part of the B2t horizon and the B3 horizon are sandy clay or clay in some pedons.

The C horizon is variable in color. It is gray and has high chroma mottles, or it is mottled or variegated in shades of red, yellow, brown, olive, and gray. Texture is variable and ranges from loamy sand to clay. In some pedons it is stratified.

State Series

Soils of the State series are deep and well drained. They formed in loamy fluvial sediments. State soils are on low-lying stream terraces on the Coastal Plain. Slopes range from 0 to 3 percent.

State soils commonly are near Altavista, Augusta, Dogue, Dragston, Pamunkey, and Tetotum soils. State soils are better drained than Altavista, Augusta, Dogue, Dragston, or Tetotum soils. Also, they have less clay in the subsoil than Dogue soils and more clay than Dragston soils. They have a higher seasonal water table than Pamunkey soils.

Typical pedon of State fine sandy loam, approximately 1.8 miles east of Jamestown Island parking lot on Loop Road and 500 feet north of Loop Road, James City County:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; many coarse medium and fine roots; few tubular pores; few fine flakes of mica; strongly acid; clear smooth boundary.

B1—5 to 11 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure and moderate medium granular structure; friable, slightly sticky, slightly plastic; many fine medium and coarse roots; few tubular pores; few quartz pebbles; few krotovinas filled with A1 material; few fine flakes of mica; strongly acid; clear smooth boundary.

B21t—11 to 19 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; few tubular pores; thin continuous clay films on faces of peds; few quartz pebbles; few krotovinas filled with A1 material; few fine flakes of mica; strongly acid; clear smooth boundary.

B22t—19 to 33 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; few tubular pores; thin continuous clay films on faces of peds; few quartz pebbles; few krotovinas; common fine flakes of mica; strongly acid; clear smooth boundary.

B23t—33 to 43 inches; dark brown (7.5YR 4/4) sandy clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium and coarse subangular blocky structure; friable, sticky, plastic; common fine and medium roots; few tubular pores; thin discontinuous clay films on faces of peds; few quartz pebbles; common fine flakes of mica; strongly acid; clear smooth boundary.

B3t—43 to 52 inches; dark brown (7.5YR 4/4) sandy clay loam; few fine faint light yellowish brown (10YR 6/4) mottles; weak coarse subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and medium roots; few tubular pores; thin patchy clay films on faces of peds; few quartz pebbles; common fine flakes of mica; strongly acid; gradual smooth boundary.

C—52 to 97 inches; dark brown (7.5YR 4/4) fine sandy loam; few medium faint light yellowish brown (10YR 6/4) mottles; massive; slightly compact in place; very friable, slightly sticky, nonplastic; few quartz pebbles; common fine flakes of mica; strongly acid.

The solum thickness ranges from 40 to 60 inches. The soil is very strongly acid or strongly acid in the A and B horizons unless limed. The C horizon ranges from very strongly acid through medium acid. Pebbles make up 0 to 2 percent of the soil. Flakes of mica are throughout the soil.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 2 through 4. Some pedons have an A2 horizon that has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 3 through 6. The A horizon is fine sandy loam or loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 through 6. It is fine sandy loam or loam.

The upper part of the B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 through 6. In the lower part of the B2t horizon and in the B3 horizon, hue is 7.5YR through 2.5Y, value is 4 or 5, and chroma is 4 through 6. The B2t horizon is sandy clay loam, clay loam, loam, sandy loam, or silt loam.

The B3 horizon is sandy loam, fine sandy loam, loam, or sandy clay loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 4 through 6; or it is mottled. The C horizon ranges from sand to fine sandy loam. It commonly is stratified.

Suffolk Series

Soils of the Suffolk series are deep and well drained. They formed in loamy fluvial and marine sediments. Suffolk soils are on uplands on the Coastal Plain. Slopes range from 2 to 6 percent.

Suffolk soils commonly are near Emporia, Kempsville, Kenansville, and Uchee soils. Suffolk soils do not have a perched water table, which is characteristic of Emporia soils. They have a thinner subsoil than that of Kempsville soils. They do not have a thick sandy surface layer characteristic of Kenansville or Uchee soils.

Typical pedon of Suffolk fine sandy loam, 2 to 6 percent slopes, approximately 900 feet west of VA-612 at Chisel Run Swamp, and 200 feet southwest of the road leading into Middle Plantation subdivision, James City County:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; very friable; many medium and fine roots; many fine and medium pores; extremely acid; clear smooth boundary.

A2—4 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium granular structure; very friable; common fine and medium and few coarse roots; many fine and medium pores; strongly acid; clear smooth boundary.

B1t—14 to 19 inches; strong brown (7.5YR 5/6) fine sandy loam; common fine faint light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure and moderate medium granular structure; friable; common fine and medium roots; common fine and medium pores; few sand grains bridged with clay; strongly acid; clear smooth boundary.

B2t—19 to 32 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; friable; common fine and medium roots; common fine and medium pores; thin patchy clay films on faces of peds; strongly acid; clear smooth boundary.

B3t—32 to 40 inches; strong brown (7.5YR 5/6) fine sandy loam; weak fine subangular blocky structure and weak fine granular structure; friable; few fine roots; common fine and medium pores; few sand grains bridged with clay; medium acid; clear smooth boundary.

C1—40 to 50 inches; yellowish brown (10YR 5/8) loamy fine sand; few fine faint pale brown (10YR 6/3) mottles; massive; very friable; few fine and medium roots; many fine and medium pores; few concretions; medium acid; abrupt wavy boundary.

C2—50 to 64 inches; strong brown (7.5YR 5/6) loamy fine sand; massive; friable; few medium roots; many fine and few medium pores; few very fine dark mineral grains; strongly acid.

The solum thickness ranges from 30 to 50 inches. The soil ranges from extremely acid through strongly acid in the A horizon and upper part of the B horizon unless limed, and it ranges from extremely acid through medium acid in the lower part of the B horizon and in the C horizon. Quartz pebbles and ferricrete fragments make up 0 to 2 percent of the soil.

The Ap or A1 horizon has hue of 10YR, value of 3 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 through 6. The A horizon is loamy sand or fine sandy loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 through 6. It is sandy loam or fine sandy loam.

The B2t and B3 horizons have hue of 7.5YR or 10YR, value of 4 through 6, and chroma of 4 through 8. The B2t horizon is sandy loam, fine sandy loam, or sandy clay loam. The B3 horizon is loamy sand, sandy loam, or fine sandy loam.

The C horizon has hue of 7.5YR through 2.5Y, value of 5 through 7, and chroma of 2 through 8. In some pedons, mottles in the lower part of the C horizon have high and low chroma. The C horizon is sand, fine sand, loamy sand, or loamy fine sand.

Tetotum Series

Soils of the Tetotum series are deep and moderately well drained. They formed in loamy fluvial sediments. Tetotum soils are on stream terraces on the Coastal Plain. Slopes range from 0 to 2 percent.

Tetotum soils commonly are near Chickahominy, Newflat, Pamunkey, and State soils. Tetotum soils have less clay and are not as poorly drained as Chickahominy or Newflat soils. They are not as well drained as State or Pamunkey soils.

Typical pedon of Tetotum silt loam, approximately 1.7 miles east of Jamestown Island parking lot on Loop Road and 500 feet north of Loop Road, James City County:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; many fine medium and coarse roots; common fine tubular pores; few fine flakes of mica; very strongly acid; clear smooth boundary.

A2—5 to 10 inches; dark brown (10YR 4/3) loam; moderate medium granular structure and weak fine subangular blocky structure; friable, sticky, plastic; common fine and medium and few coarse roots; common fine tubular pores; few fine flakes of mica; very strongly acid; clear smooth boundary.

B1t—10 to 14 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; common fine tubular pores; thin patchy clay films and silt coatings on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; very strongly acid; clear smooth boundary.

B21t—14 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; common fine tubular pores; thin continuous clay films and silt coatings on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; strongly acid; gradual smooth boundary.

B22t—27 to 35 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium and fine subangular blocky structure; friable, sticky, plastic; few fine roots; common fine tubular pores; thin discontinuous clay films and silt coatings on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; very strongly acid; gradual smooth boundary.

B23t—35 to 46 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/8), and light brownish gray (10YR 6/2) clay loam; moderate medium and coarse subangular blocky structure; firm, sticky, plastic; few fine roots; few fine tubular pores; thin discontinuous clay films on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; very strongly acid; gradual smooth boundary.

B3t—46 to 51 inches; mottled yellowish brown (10YR

5/6), strong brown (7.5YR 5/8), and gray (5Y 6/1) loam; moderate coarse subangular blocky structure; friable, sticky, plastic; few fine roots; few fine tubular pores; thin patchy clay films on faces of peds; common fine flakes of mica; common fine prominent dark brown (10YR 3/3) mineral stains; extremely acid; gradual smooth boundary.

C—51 to 65 inches; mottled gray (5Y 6/1), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/8) fine sandy loam; massive; friable, sticky, plastic; few fine roots; few fine tubular pores; common fine flakes of mica; very strongly acid.

The solum thickness ranges from 40 to 60 inches. The soil ranges from extremely acid through strongly acid unless limed. Quartz pebbles make up 0 to 2 percent of the soil.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 2 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. The A horizon is fine sandy loam, loam, or silt loam.

The B1 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 4 through 6. It is loam, silt loam, or sandy clay loam.

The upper part of the B2t horizon has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 4 through 6. In the lower part of the B2t horizon and in the B3 horizon, hue is 7.5YR through 5Y, value is 5 through 7, and chroma is 1 through 8. In some pedons, mottles in the lower part of the B2t horizon and in the B3 horizon have high and low chroma. The B2t horizon is clay loam, loam, silt loam, or silty clay loam. The B3 horizon is fine sandy loam or loam.

The C horizon is gray with high chroma mottles, or it is mottled and does not have dominant matrix color. It is stratified sand to sandy clay loam.

Tomotley Series

Soils of the Tomotley series are deep and poorly drained. They formed in loamy fluvial sediments. Tomotley soils are on broad flats along stream terraces on the Coastal Plain. Slopes range from 0 to 2 percent.

Tomotley soils commonly are near Altavista, Augusta, Bojac, Dragston, Munden, Nimmo, and Seabrook soils. Tomotley soils are more poorly drained than Altavista, Augusta, Bojac, Dragston, Munden, or Seabrook soils. They have more clay in the subsoil than Bojac, Dragston, Munden, Nimmo and Seabrook soils.

Typical pedon of Tomotley fine sandy loam, approximately 1,800 feet north of the intersection of VA-622 and VA-1236 (Rebecca Drive) near Seaford, York County:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; friable, slightly sticky, slightly plastic; common fine and medium roots; common fine and medium pores; very strongly acid; abrupt smooth boundary.

A2—4 to 8 inches; grayish brown (2.5Y 5/2) fine sandy loam; common fine distinct brownish yellow (10YR 6/6) mottles; weak fine granular structure; friable, slightly sticky, slightly plastic; common fine medium and coarse roots; common fine pores; very strongly acid; clear smooth boundary.

B1tg—8 to 11 inches; grayish brown (2.5Y 5/2) fine sandy loam; common medium prominent yellowish brown (10YR 5/6) mottles and few medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; common fine and medium pores; thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

B21tg—11 to 24 inches; dark gray (N 4/0) sandy clay loam; many coarse distinct gray (5Y 5/1) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; very firm, sticky, plastic; common fine and medium roots; few fine pores; thick continuous clay films on faces of peds; few fine pebbles; few fine flakes of mica; very strongly acid; clear smooth boundary.

B22tg—24 to 35 inches; dark gray (N 4/0) sandy clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; common fine and medium roots; few fine pores; thin continuous clay films on faces of peds; few fine pebbles; few fine flakes of mica; strongly acid; gradual smooth boundary.

B3tg—35 to 50 inches; mottled light olive gray (5Y 6/2), dark gray (5Y 4/1), and gray (5Y 5/1) fine sandy loam; many coarse prominent yellowish brown (10YR 5/6) mottles and many medium prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable, sticky, plastic; few fine roots; few fine and medium pores; thin discontinuous clay films on faces of peds; common fine flakes of mica; strongly acid; gradual smooth boundary.

Cg—50 to 68 inches; light gray (5Y 7/1) and gray (5Y 6/1) fine sandy loam; common coarse prominent yellowish brown (10YR 5/6) mottles; massive; friable, sticky, plastic; few fine roots; few fine pores; common fine flakes of mica; medium acid.

The solum thickness ranges from 40 to 60 inches or more. The upper part of the soil is very strongly acid or strongly acid unless limed. Below a depth of about 50 inches, the soil ranges from very strongly acid through medium acid.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 2 through 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 1 or 2. The A horizon is fine sandy loam or loam.

The B1g horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 1 or 2. It is fine sandy loam or loam.

The B2tg horizon has no hue or hue of 10YR through 5Y, value of 4 through 7, and chroma of 0 through 2. It is loam, sandy clay loam, or clay loam.

The B3g horizon has no hue or hue of 10YR through 5Y, value of 5 through 7, and chroma of 0 through 2. It is fine sandy loam, loam, or sandy clay loam.

The Cg horizon has no hue or hue of 10YR through 5Y, value of 6 or 7, and chroma of 0 through 2. It is loamy sand, loamy fine sand, or fine sandy loam.

Uchee Series

Soils of the Uchee series are deep and well drained. They formed in loamy fluvial and marine sediments. Uchee soils are on upland ridges and side slopes on the Coastal Plain. Slopes range from 2 to 10 percent.

Uchee soils commonly are near Emporia, Kempsville, Kenansville, Slagle, and Suffolk soils. Uchee soils have a thicker sandier surface layer than Emporia, Kempsville, Slagle, or Suffolk soils. They have more clay in the subsoil than Kenansville soils.

Typical pedon of Uchee loamy fine sand, 2 to 6 percent slopes, approximately 1.3 miles north of Croaker on VA-607, 1,500 feet southeast of VA-607 on logging road, 1,000 feet south of York River State Park and 1,000 feet west of Taskinas Creek, James City County:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak fine granular structure; very friable; nonsticky, nonplastic; many fine medium and coarse roots; many fine pores; very strongly acid; clear smooth boundary.

A21—5 to 11 inches; light yellowish brown (10YR 6/4) loamy fine sand; weak fine granular structure; very friable, nonsticky, nonplastic; many fine medium and coarse roots; many fine and common medium pores; very strongly acid; clear smooth boundary.

A22—11 to 24 inches; very pale brown (10YR 7/4) loamy fine sand; weak fine granular structure; very friable, nonsticky, nonplastic; few fine roots; many fine pores; strongly acid; abrupt smooth boundary.

B1t—24 to 29 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium faint light yellowish brown (10YR 6/4) mottles; moderate fine and medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and common medium roots; common fine and medium pores; few patchy clay films on faces of peds; strongly acid; clear smooth boundary.

B21t—29 to 36 inches; strong brown (7.5YR 5/6) sandy clay loam; few fine prominent yellowish red (5YR 5/6) mottles and common medium distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; many fine pores; thick patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—36 to 50 inches; strong brown (7.5YR 5/6) sandy clay loam; many fine prominent yellowish red (5YR 5/6) mottles, common fine distinct brownish yellow (10YR 6/6) mottles, and few fine distinct light gray (10YR 7/1) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; many fine and medium pores; thick patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—50 to 56 inches; strong brown (7.5YR 5/6) sandy clay; common fine distinct light yellowish brown (10YR 6/4) and light gray (10YR 7/1) mottles, and few fine prominent yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure; friable, sticky, plastic; few fine roots; common fine pores; thick patchy clay films on faces of peds; very strongly acid; gradual wavy boundary.

C—56 to 65 inches; variegated yellowish red (5YR 5/6), yellowish brown (10YR 5/6), very pale brown (10YR 7/4), light gray (10YR 7/1), and strong brown (7.5YR 5/6) strata of sandy loam and sandy clay loam; massive; friable, sticky, plastic; few fine roots; common fine pores; very strongly acid.

The solum thickness ranges from 40 to 60 inches. The soil is very strongly acid or strongly acid unless limed. Pebbles and ferricrete coarse fragments make up 0 to 15 percent of the soil.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. Some pedons have an Ap horizon with hue of 10YR, value of 4 or 5, and chroma of 2 through 4. The A2 horizon has hue of 10YR, value of 4 through 7, and chroma of 3 through 6. The A horizon is sand, loamy sand, or loamy fine sand.

The B1 horizon and upper part of the B2t horizon have hue of 7.5YR or 10YR, value of 5 through 7, and chroma of 4 through 8. Most pedons have few or common high chroma mottles. Texture is sandy loam or sandy clay loam. The lower part of the B2t horizon has colors similar to those in the upper part of the B2t horizon and has few to many high and low chroma mottles; or it is mottled and does not have a dominant matrix color. It is sandy clay loam, sandy clay, or clay.

The C horizon is mottled or variegated in shades of yellow, brown, red, or gray. It is sandy loam or sandy clay loam. Some pedons have pockets or strata of sand or clay.

Udorthents

Udorthents in this survey area consist of deep, excessively drained to moderately well drained soils. The soils formed mostly in loamy fluvial and marine sediments. Udorthents are mainly on ridgetops and side slopes along drainageways and make up mostly areas that have been quarried for sand, gravel, or roadfill. Slopes range from 0 to 70 percent or more.

Udorthents commonly are near Emporia, Kempsville, Slagle, and Suffolk soils. Udorthents have been excavated to depths of as much as 30 feet or more. Some areas have been filled by earthy and nonearthy materials. All associated soils have a well-defined subsoil due to natural soil-forming processes.

Because of the variability of these soils, a typical pedon is not given. The soils range from extremely acid through strongly acid. Quartz pebbles make up 0 to 50 percent of some pedons. Thin discontinuous ironstone fragments make up 0 to 50 percent of some pedons. Common fine flakes of mica are in some pedons.

The surface layer has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 2 or 3. It is loamy sand, sandy loam, clay loam, or gravelly sandy loam. The surface layer ranges from about 2 to 10 inches in thickness, but it commonly is about 2 to 5 inches thick.

The lower layers to a depth of more than 60 inches have hue of 2.5YR through 10YR, value of 3 through 7, and chroma of 4 through 8. They range from fine sandy loam to clay loam. Mottles that have hue of 5YR through 2.5Y, value of 3 through 8, and chroma of 1 through 8 are in some pedons.

Yemassee Series

Soils of the Yemassee series are deep and somewhat poorly drained. They formed in loamy fluvial and marine sediments. Yemassee soils are on low-lying uplands in the Coastal Plain. Slopes range from 0 to 2 percent.

Yemassee soils commonly are near Bethera, Izagora, and Slagle soils. Yemassee soils are better drained than Bethera soils and have less clay in the subsoil. They are not as well drained as Izagora and Slagle soils.

Typical pedon of Yemassee fine sandy loam, approximately 1,600 feet northwest of junction of VA-636 with the Chessie and Ohio Railroad along powerline and 250 feet north of powerline, York County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine and medium granular structure; very friable, slightly sticky, slightly plastic; many fine medium and coarse roots; common fine tubular pores; extremely acid; clear smooth boundary.

A2—4 to 11 inches; light yellowish brown (2.5Y 6/4) fine sandy loam; moderate fine granular structure; friable, slightly sticky, slightly plastic; common fine medium and coarse roots; common fine and very fine tubular pores; few krotovinas up to 1/4 inch in diameter; extremely acid; clear smooth boundary.

B21t—11 to 15 inches; light yellowish brown (2.5Y 6/4) sandy clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium and fine subangular blocky structure; friable, sticky, plastic; common fine medium and coarse roots; common fine and very fine tubular pores; few thin discontinuous clay films on faces of peds; few krotovinas up to 1/4 inch in diameter; extremely acid; clear smooth boundary.

B22t—15 to 20 inches; light olive brown (2.5Y 5/4) sandy clay loam; common fine prominent dark brown (7.5YR 4/4) mottles and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; common fine and medium roots; few fine tubular pores; common thin continuous clay films on faces of peds; few krotovinas up to 1/4 inch in diameter; very strongly acid; gradual smooth boundary.

B23t—20 to 30 inches; mottled light gray (10YR 6/1), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) sandy clay loam; weak medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; few very fine tubular pores; thin discontinuous clay films on faces of peds; mottling pattern is vertically oriented but not continuous or streaked; the yellowish brown and strong brown portion is firmer in place than the gray portion; very strongly acid; gradual smooth boundary.

B24tg—30 to 51 inches; gray (5Y 6/1) sandy clay loam; many coarse prominent yellowish brown (10YR 5/6) mottles and common fine prominent strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; friable, sticky, plastic; few fine and medium roots; few very fine tubular pores; thin discontinuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

Cg—51 to 63 inches; gray (5Y 6/1) fine sandy loam; common medium prominent yellowish brown (10YR 5/8) mottles; massive; friable, sticky, plastic; few fine flakes of mica; very strongly acid.

The solum thickness is more than 40 inches. The soil ranges from extremely acid through strongly acid unless limed. Few to many very fine flakes of mica and fine black minerals are in the lower part of the B horizon and in the C horizon of many pedons.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 2 through 5, and chroma of 1 or 2. The A2 horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 3 or 4. The A horizon is sandy loam or fine sandy loam.

The upper part of the B horizon has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 3 through

8. The lower part of the B horizon has hue of 10YR through 5Y, value of 5 through 7, and chroma of 1 or 2; or it is mottled. The B2t horizon is sandy clay loam, clay loam, or fine sandy loam. Some pedons have a B1 horizon of sandy loam or fine sandy loam, and some pedons have a B3 horizon of sandy loam or sandy clay loam.

The C horizon has colors similar to those of the B2t horizon or is coarsely mottled. Texture is variable and ranges from sand to sandy clay loam. Some pedons are stratified.

In this survey area the Yemassee soils are taxadjuncts to the Yemassee series because they have brighter colors in the upper part of the B horizon and do not have gray mottles immediately below the A1 horizon as is defined in the range for the series. These differences, however, do not affect the use and management of the soils.

Formation of the Soils

In this section the factors and processes that have affected the formation and morphology of the soils in James City County, York County, and City of Williamsburg are discussed.

Factors of Soil Formation

Soil is formed by weathering and other processes that act upon parent material (*5*). The characteristics of the soil at any given point depend upon interaction of (1) parent material, (2) climate, (3) plants and animals, (4) relief, and (5) time.

Climate and plants and animals are the active forces of soil formation. They act on the parent material accumulated through the deposition of sediments and slowly change it into soil. Although all five factors affect the formation of every soil, the relative importance of each differs from place to place. In extreme cases one factor may dominate in the formation of a soil and fix most of its properties. In general, however, it is the combined action of the five factors that determines the characteristics of each soil.

Parent material

The unconsolidated mass from which a soil formed is parent material. It is largely responsible for the chemical and mineralogical composition of the soil and the rate at which soil-forming processes take place.

All of the parent materials in this survey area have been transported and deposited by marine or fluvial action. Deposition has occurred over different periods of geologic time, and sediments from different sources have combined, giving rise to four somewhat distinct areas of soils in the county.

The largest and oldest area consists of upland ridges and side slopes. This area is at the highest elevations in the survey area and is dominated by loamy soils, such as Emporia, Kempsville, and Slagle soils, and by clayey soils, such as Craven and Caroline soils.

The second distinct area is at intermediate elevations in the survey area and consists mostly of upland flats and depressions. This area, which is in the eastern part of the survey area, is dominated by loamy Izagora and Slagle soils and by clayey Bethera soils.

A third distinct group of soils includes those on flats, primarily in the extreme eastern part of the survey area, and those on fluvial terraces, primarily along the major rivers. The flats, especially, are at some of the lowest elevations in the survey area and are dominated by loamy Tomotley, Dragston, and Altavista soils. The fluvial terraces along the rivers are dominated by loamy soils, such as State, Pamunkey, and Tetotum soils, and by clayey soils, such as Dogue and Peawick soils.

The fourth distinct area of soils includes those on the flood plains, mostly loamy Johnston soils, and those on the marshes along the major streams and rivers. The marsh soils are Axis, Bohicket, and Levy soils. Although considered mineral soils, they have thin accumulations of organic matter on the surface in many places. These flood plain and marsh soils vary considerably in texture, have little profile development, and are mostly continuously wet or flooded.

Climate

As a genetic factor, climate affects the physical, chemical, and biological relationships in soils, principally through the influence of precipitation and temperature. Water dissolves minerals, supports biological activity, and transports mineral and organic residue through the soil. Temperature determines the types of physical, chemical, and biological activities that take place and the rate of activity.

Because precipitation exceeds evapotranspiration, the humid climate has caused the soils to be leached. Much of the soluble material that originally was present or was released through weathering has been removed, except in alluvial areas, which are recharged with eroded sediments from surrounding uplands.

Precipitation is the main factor responsible for the formation of the type of subsoil that characterizes most soils in the survey area. In addition to leaching soluble materials, water that percolates through the soil moves clay from the surface layer to the subsoil. Except for those soils formed in recent alluvium or sand or on very steep slopes, all the soils of the survey area typically have a subsoil that contains more clay than the surface layer.

Also influenced by climate is the formation of blocky structure in the subsoil of well developed soils. The development of peds (aggregates) in the subsoil is caused partly by changes in volume of the soil mass that are primarily the result of alternate wetting and drying.

Plant and Animal Life

Micro-organisms, vegetation, animals, and man are major factors in the formation of soils. Vegetation is generally responsible for the amount of organic matter, the color of the surface layer, and the amount of nutrients. Earthworms, cicada, and burrowing animals help keep the soil open and porous. Micro-organisms decompose the vegetation and animal matter, thus releasing nutrients for plant food. Man changes the soil by mixing the upper layers.

Before humans settled in the survey area, native vegetation was the major living organism affecting soil development. The native vegetation consisted mainly of pines and hardwoods. The oaks, hickories, and pines were the dominant trees in the original forest cover. Most hardwoods use a large amount of the available calcium and other bases and constantly recycle them through leaf fall and decay. This characteristic of the hardwoods has prevented the soils of the survey area from becoming as leached as much as would be possible under a coniferous forest cover. Also, because the soils formed under forest vegetation, rapid decay of organic matter and constant recycling of nutrients have prevented organic matter accumulation in large quantities. In addition, the present climate favors rapid decay of plant materials, oxidation of organic matter, and leaching of nutrients.

As farming developed in the area, man became an important factor in the development of the soils. The clearing of the forests, land cultivation, introduction of new plants, and changes in natural drainage all have their effect on soil development. The most important changes brought about by man are the mixing of the upper layers of the soil to form a plow layer; cultivating strongly sloping soils, resulting in accelerated erosion; and liming and fertilizing to change the content of plant nutrients, especially in the upper layers of the soils.

Relief

The underlying formations, the geological history of the general region, and the effects of dissection by rivers and streams largely determine the relief of an area. Relief affects the formation of soils by influencing the rate of surface runoff, soil temperature, and geologic erosion. It can alter the effects of climatic factors acting on the parent material to the extent that several different kinds of soils may form from the same kind of parent material. Relief also affects the amount of radiant energy absorbed by the soils, which in turn affects the type of native vegetation that grows on the soil.

Relief in the survey area ranges from nearly level to very steep. The nearly level soils are commonly on upland flats, flood plains of streams, and marshes. Most of these soils are often wet because of frequent flooding or a seasonal high water table, and the surface runoff is generally slow. The soils typically have a subsoil or substratum that is gray or mottled gray and are somewhat poorly drained or poorly drained. Izagora, Bethera, Johnston, and Bohicket soils are examples of such soils.

The gently sloping to very steep soils are generally well drained or moderately well drained. Geologic erosion is slight, surface runoff is medium to rapid, and translocation of bases and clay has usually occurred downward through the soil. On the steeper soils, however, surface runoff is very rapid, water infiltration and translocation of clay and bases through the soil are reduced, and the erosion hazard is severe.

Where natural stream dissection has not created drainage outlets in upland areas, moderately well drained to poorly drained soils have formed. In most of these areas the parent materials and other soil-forming factors are essentially the same and relief, or topography, has modified the effects of the other soil-forming factors. Emporia and Slagle soils are examples of these soils. Emporia soils are well drained and slightly higher on the landscape than the adjacent Slagle soils, which are moderately well drained.

Drainage is also commonly related to the texture and position of the alluvium as well as to the relief. Thus, on the fluvial terraces, poorly drained Chickahominy soils formed in fine-textured slack water deposits, whereas the well drained Pamunkey soils formed in coarse-textured deposits that are generally adjacent to the rivers and streams.

Time

As a factor of soil formation, time generally is related to the degree of development or degree of horizon differentiation within the soil. A soil that has little or no horizon development is considered a young soil, and one that has strongly developed horizons is considered an old, or mature, soil.

The oldest soils in the survey area are those formed on well drained uplands at higher elevations, such as Norfolk and Emporia soils, which have a strong degree of horizon differentiation. Young soils, such as Johnston and Levy soils, formed in recent alluvium. They have been in place only a relatively short time and show little or no horizon development. They are commonly stratified and have an irregular distribution of organic matter in the profile.

Morphology of the Soils

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

Most soils have three major horizons called A, B, and C. These major horizons may be further subdivided by the use of numbers and letters to indicate changes within one horizon. An example would be the B2t horizon, a B horizon that has an accumulation of clay.

The A horizon is the surface layer. An A1 horizon is that part of the surface layer that has the largest accumulation of organic matter. The A horizon is also the layer of maximum leaching and eluviation of clay and iron. If considerable leaching has taken place and organic matter has not darkened the material, this horizon is called an A2 horizon.

The B horizon underlies the A 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 surface layer. In some soils the B horizon formed by alteration in place rather than by illuviation. The alteration can be caused by oxidation and reduction of iron or by the weathering of clay minerals. The B horizon commonly has blocky or prismatic structure, and it generally is firmer and lighter in color than the A1 horizon but darker in color than the C horizon.

The C horizon is below the B horizon, or in some cases, below the A horizon. It consists of materials that are little altered by the soil-forming processes.

Processes of Soil Horizon Differentiation

In this survey area several processes are involved in the formation of 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 generally at the same time throughout the profile. Such processes have been going on for thousands of years.

The accumulation and incorporation of organic matter take place with the decomposition of plant residue. These additions darken the surface layer and help to form the A1 horizon. In many places, much of the surface layer has been eroded away or has been mixed with material from underlying layers through cultivation. Organic matter, once lost, normally takes a long time to replace. In James City and York Counties the organic matter content of the surface layer varies from low in sandy soils such as Seabrook soils to high in fine-textured marsh soils such as Bohicket soils. A low or medium amount of organic matter is typical for most soils in the county.

For soils to have distinct subsoil horizons, some of the lime and soluble salts probably 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 the survey area have a yellowish brown to yellowish red subsoil. These colors are caused mainly by thin coatings of iron oxides on sand and silt grains, although in some soils the colors are inherited from the materials in which they formed. The structure is weak to moderate subangular blocky, and the subsoil contains more clay than the overlying surface horizon.

The reduction and transfer of iron is associated mainly with the wetter, more poorly drained soils. This process is called gleying. The moderately well drained and somewhat poorly drained soils, such as Slagle and Yemassee soils, have yellowish brown and strong brown mottles, which indicate the segregation of iron. In poorly drained soils, such as Tomotley and Bethera soils, the subsoil and underlying materials are grayish, which indicates reduction and transfer of iron by removal in solution.

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Glossary

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.

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

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 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

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

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

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 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.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

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.

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.

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.

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.

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.

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.

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

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.

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.

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

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

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.

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 7.5 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 (7.5 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.

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 upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
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, a plowed surface horizon, most of which was originally part of a B horizon.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A 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) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
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 A or B 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, the Roman numeral II precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock 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 a 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.

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

Lamellae. Thin layers of illuvial clay, too thin to qualify as an argillic horizon, individually. Sometimes called fibers, lamellae may form in sands and loamy sands.

Large stones (in tables). Rock fragments 3 inches (7.5 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.

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

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. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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 the 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.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

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 0.20 inch
Moderately slow	0.20 to 0.60 inch
Moderate	0.60 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.

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.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

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.

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.

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 degree of acidity or alkalinity is expressed as—

	pH
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

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.

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.

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.

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.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

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 underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

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.

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.

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.

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.

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 (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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.

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 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.

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 grained* (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. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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.

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. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

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.

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.

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.

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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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 and 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 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 1951-76 at Williamsburg, Virginia]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	49.5	28.1	38.8	75	5	107	3.49	2.13	4.70	8	3.9
February	52.1	29.9	41.0	76	9	117	3.71	2.30	4.97	8	1.9
March	59.8	36.1	48.0	85	17	280	4.11	2.95	5.16	8	1.6
April	70.9	45.3	58.1	91	27	543	2.88	1.61	3.91	7	.0
May	78.1	54.4	66.3	93	36	815	4.27	2.59	5.78	7	.0
June	84.8	62.4	73.6	98	46	1,008	4.43	2.47	6.02	6	.0
July	87.9	66.9	77.4	98	53	1,159	5.28	3.01	7.12	8	.0
August	86.7	66.2	76.5	97	50	1,132	4.62	2.33	6.48	7	.0
September	81.2	60.2	70.7	95	43	921	4.45	1.68	6.67	6	.0
October	71.2	48.8	60.0	88	28	620	3.61	1.21	5.53	5	.0
November	62.0	38.6	50.3	82	19	314	2.89	1.23	4.25	5	.0
December	52.1	30.9	41.5	75	9	167	3.55	2.02	4.79	6	1.3
Yearly:											
Average	69.7	47.3	58.5	---	---	---	---	---	---	---	---
Extreme	---	---	---	99	4	---	---	---	---	---	---
Total	---	---	---	---	---	7,183	47.29	39.87	55.01	81	8.7

[1]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 (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-76 at Williamsburg, Virginia]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 29	April 14	May 3
2 years in 10 later than--	March 24	April 9	April 27
5 years in 10 later than--	March 14	March 30	April 16
First freezing temperature in fall:			
1 year in 10 earlier than--	November 6	October 29	October 15
2 years in 10 earlier than--	November 12	November 3	October 20
5 years in 10 earlier than--	November 22	November 12	October 29

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-76 at Williamsburg, Virginia]

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
9 years in 10	231	206	175
8 years in 10	238	213	182
5 years in 10	253	226	196
2 years in 10	268	240	210
1 year in 10	275	247	217

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	James City County	York County	City of Williamsburg	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Acres	Pct
1	Altavista fine sandy loam	252	1,574	0	1,826	0.9
2	Augusta fine sandy loam	194	663	0	857	0.4
3	Axis very fine sandy loam	6	1,098	0	1,104	0.6
4	Beaches	32	42	0	74	*
5	Bethera silt loam	275	2,882	0	3,157	1.6
6	Bohicket muck	1,326	1,161	0	2,487	1.3
7	Bojac sandy loam	638	425	0	1,063	0.5
8B	Caroline fine sandy loam, 2 to 6 percent slopes	522	107	0	629	0.3
9	Chickahominy silt loam	1,328	237	0	1,565	0.8
10B	Craven fine sandy loam, 2 to 6 percent slopes	851	146	12	1,009	0.5
10C	Craven fine sandy loam, 6 to 10 percent slopes	709	58	0	767	0.4
11B	Craven-Uchee complex, 2 to 6 percent slopes	245	33	0	278	0.1
11C	Craven-Uchee complex, 6 to 10 percent slopes	16,229	7,019	848	24,096	12.4
12	Dogue loam	657	276	0	933	0.5
13	Dragston fine sandy loam	226	1,578	0	1,804	0.9
14B	Emporia fine sandy loam, 2 to 6 percent slopes	3,464	1,501	85	5,050	2.6
14C	Emporia fine sandy loam, 6 to 10 percent slopes	1,048	174	0	1,222	0.6
15D	Emporia complex, 10 to 15 percent slopes	3,234	913	111	4,258	2.2
15E	Emporia complex, 15 to 25 percent slopes	9,229	2,062	362	11,653	6.0
15F	Emporia complex, 25 to 50 percent slopes	13,996	5,714	147	19,857	10.2
16	Izagora loam	154	2,214	82	2,450	1.3
17	Johnston complex	5,978	1,564	144	7,686	3.9
18B	Kempsville fine sandy loam, 2 to 6 percent slopes	1,836	357	45	2,238	1.1
19B	Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes	7,026	1,707	105	8,838	4.5
20B	Kenansville loamy fine sand, 2 to 6 percent slopes	1,110	124	20	1,254	0.6
21	Levy silty clay	4,855	181	31	5,067	2.6
22	Munden loamy fine sand	120	128	0	248	0.1
23	Newflat silt loam	1,494	187	0	1,681	0.9
24	Nimmo fine sandy loam	205	1,000	0	1,205	0.6
25B	Norfolk fine sandy loam, 2 to 6 percent slopes	537	17	0	554	0.3
26B	Pamunkey soils, 2 to 6 percent slopes	884	432	0	1,316	0.7
27	Peawick silt loam	4,443	554	0	4,997	2.6
28	Seabrook loamy fine sand	577	582	0	1,159	0.6
29A	Slagle fine sandy loam, 0 to 2 percent slopes	1,547	1,462	2	3,011	1.5
29B	Slagle fine sandy loam, 2 to 6 percent slopes	3,996	7,088	930	12,014	6.2
30	State fine sandy loam	381	0	0	381	0.2
31B	Suffolk fine sandy loam, 2 to 6 percent slopes	3,163	524	51	3,738	1.9
32	Tetotum silt loam	488	47	0	535	0.3
33	Tomotley fine sandy loam	107	5,006	0	5,113	2.6
34B	Uchee loamy fine sand, 2 to 6 percent slopes	1,180	265	27	1,472	0.8
34C	Uchee loamy fine sand, 6 to 10 percent slopes	389	22	0	411	0.2
35	Udorthents, loamy	854	2,255	0	3,109	1.6
36	Udorthents-Dumps complex	30	116	0	146	0.1
37	Urban land	826	789	304	1,919	1.0
38	Yemassee fine sandy loam	0	524	0	524	0.3
	Water	20,809	19,269	15	40,093	20.7
	Total	117,450	74,077	3,321	194,848	100.0

* Less than 0.1 percent.

TABLE 5.--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	Corn	Soybeans	Wheat	Barley	Tall fescue	Grass-clover	Grass-legume hay
	Bu	Bu	Bu	Bu	AUM*	AUM*	Ton
1----------------------- Altavista	120	45	55	60	7.0	8.0	4.0
2----------------------- Augusta	100	40	30	35	9.5	10.0	5.0
3. Axis							
4. Beaches							
5----------------------- Bethera	---	---	---	---	4.5	5.0	2.5
6. Bohicket							
7----------------------- Bojac	120	45	40	50	5.5	6.0	3.0
8B---------------------- Caroline	110	40	60	65	5.5	6.0	3.0
9----------------------- Chickahominy	---	---	---	---	4.5	5.0	2.5
10B--------------------- Craven	105	40	50	50	5.5	6.0	3.0
10C--------------------- Craven	---	---	---	---	3.5	4.0	2.0
11B--------------------- Craven-Uchee	90	35	40	45	7.5	8.0	4.0
11C--------------------- Craven-Uchee	60	20	35	35	4.5	5.0	2.5
12---------------------- Dogue	125	45	60	60	6.5	7.0	3.5
13---------------------- Dragston	80	30	40	40	---	---	---
14B--------------------- Emporia	100	30	50	60	9.5	10.0	5.0
14C--------------------- Emporia	90	25	45	50	7.5	8.0	4.0
15D--------------------- Emporia	70	20	25	25	3.5	4.0	2.0
15E. Emporia							
15F. Emporia							
16---------------------- Izagora	100	35	35	45	9.5	10.0	5.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Wheat	Barley	Tall fescue	Grass-clover	Grass-legume hay
	Bu	Bu	Bu	Bu	AUM*	AUM*	Ton
17. Johnston							
18B Kempsville	145	40	50	60	7.0	7.6	4.0
19B Kempsville-Emporia	130	35	50	60	6.5	7.0	3.5
20B Kenansville	85	25	35	40	7.5	8.0	4.0
21. Levy							
22 Munden	120	30	45	45	5.5	6.0	3.0
23 Newflat	85	30	45	45	7.5	8.0	4.0
24. Nimmo							
25B Norfolk	100	35	55	60	10.0	11.0	6.0
26B Pamunkey	125	40	75	75	10.0	11.0	6.0
27 Peawick	90	30	30	35	5.5	6.0	3.0
28 Seabrook	75	30	45	45	4.5	5.0	2.5
29A Slagle	125	40	45	50	9.5	10.0	5.0
29B Slagle	115	35	40	50	9.5	9.0	4.5
30 State	130	45	60	65	9.5	10.0	5.0
31B Suffolk	125	35	40	55	6.0	7.0	3.5
32 Tetotum	150	40	45	50	9.5	10.0	5.0
33. Tomotley							
34B Uchee	70	30	45	45	5.5	6.0	3.0
34C Uchee	65	25	30	30	3.5	4.0	2.0
35. Udorthents							
36. Udorthents-Dumps							
37. Urban land							

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Wheat	Barley	Tall fescue	Grass-clover	Grass-legume hay
	Bu	Bu	Bu	Bu	AUM*	AUM*	Ton
38------------------------- Yemassee	120	45	35	35	7.0	7.5	4.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--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	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
1 Altavista	2w	Slight	Moderate	Slight	Slight	Loblolly pine	91	Loblolly pine, yellow-poplar, black walnut, sweetgum, American sycamore.
						Shortleaf pine	77	
						Sweetgum	85	
						White oak	---	
2 Augusta	2w	Slight	Moderate	Slight	Slight	Loblolly pine	90	Loblolly pine, sweetgum, American sycamore, yellow-poplar.
						Sweetgum	90	
						American sycamore	90	
						White oak	80	
						Southern red oak	80	
						Water oak	---	
						Shortleaf pine	---	
5 Bethera	2w	Slight	Severe	Severe	Moderate	Loblolly pine	92	Loblolly pine, sweetgum.
						Sweetgum	85	
7 Bojac	3o	Slight	Slight	Slight	Slight	Southern red oak	70	Loblolly pine.
						Virginia pine	75	
						Loblolly pine	80	
8B Caroline	3o	Slight	Slight	Slight	Slight	Shortleaf pine	70	Loblolly pine.
						Virginia pine	70	
						Loblolly pine	76	
						Southern red oak	70	
						White oak	75	
9 Chickahominy	2w	Slight	Severe	Severe	Moderate	Loblolly pine	88	Loblolly pine, sweetgum.
						Sweetgum	95	
						Water oak	---	
						Willow oak	---	
						Red maple	---	
10B, 10C Craven	3w	Slight	Moderate	Slight	Slight	Loblolly pine	81	Loblolly pine.
						Water oak	---	
						Sweetgum	---	
						White oak	---	
						Southern red oak	---	
						Red maple	---	
11B*, 11C*:								
Craven	3w	Slight	Moderate	Slight	Slight	Loblolly pine	81	Loblolly pine.
						Water oak	---	
						Sweetgum	---	
						White oak	---	
						Southern red oak	---	
						Red maple	---	
Uchee	3s	Slight	Moderate	Moderate	Slight	Loblolly pine	82	Loblolly pine.
						Shortleaf pine	---	
12 Dogue	2w	Slight	Moderate	Slight	Slight	Loblolly pine	90	Loblolly pine.
						Southern red oak	80	
						Sweetgum	90	
						Yellow-poplar	95	
						White oak	80	

See footnote at end of table.

TABLE 6.--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	Common trees	Site index	
13 Dragston	2w	Slight	Moderate	Slight	Slight	Southern red oak Loblolly pine Sweetgum Yellow-poplar White oak	80 86 90 90 ---	Loblolly pine, sweetgum, yellow-poplar.
14B, 14C, 15D* Emporia	3o	Slight	Slight	Slight	Slight	Loblolly pine Southern red oak	76 70	Loblolly pine, sweetgum.
15E* Emporia	3r	Slight	Moderate	Slight	Slight	Loblolly pine Southern red oak Virginia pine	76 70 ---	Loblolly pine, sweetgum.
15F* Emporia	3r	Moderate	Severe	Slight	Slight	Loblolly pine Southern red oak Virginia pine	76 70 ---	Loblolly pine, sweetgum.
16 Izagora	2w	Slight	Moderate	Slight	Slight	Loblolly pine Sweetgum Yellow-poplar Water oak	90 90 100 ---	Loblolly pine, sweetgum, yellow-poplar, water oak.
17* Johnston	1w	Slight	Severe	Severe	Moderate	Loblolly pine Sweetgum Water oak	97 100 95	Loblolly pine, baldcypress, yellow-poplar, sweetgum, green ash, water tupelo.
18B Kempsville	3o	Slight	Slight	Slight	Slight	Southern red oak Loblolly pine Virginia pine Sweetgum Yellow-poplar	74 82 74 80 82	Loblolly pine.
19B*:								
Kempsville	3o	Slight	Slight	Slight	Slight	Southern red oak Loblolly pine Virginia pine Sweetgum Yellow-poplar	74 82 74 80 82	Loblolly pine.
Emporia	3o	Slight	Slight	Slight	Slight	Loblolly pine Southern red oak	76 70	Loblolly pine, sweetgum.
20B Kenansville	3s	Slight	Moderate	Moderate	Slight	Loblolly pine Virginia pine	80 ---	Loblolly pine.
21 Levy	3w	Slight	Severe	Severe	Slight	Water tupelo Sweetgum Red maple Baldcypress	--- --- --- ---	Baldcypress.
22 Munden	2w	Slight	Moderate	Slight	Slight	Loblolly pine Sweetgum White oak	90 90 76	Loblolly pine.
23 Newflat	2w	Slight	Moderate	Moderate	Moderate	Loblolly pine Sweetgum White oak Southern red oak Water oak	90 95 --- --- ---	Loblolly pine, sweetgum.
24 Nimmo	2w	Slight	Severe	Severe	Slight	Loblolly pine Sweetgum White oak	95 95 80	Loblolly pine, sweetgum.
25B Norfolk	2o	Slight	Slight	Slight	Slight	Loblolly pine Southern red oak	86 ---	Loblolly pine.

See footnote at end of table.

TABLE 6.--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	Common trees	Site index	
26B*: Pamunkey	2o	Slight	Slight	Slight	Slight	Southern red oak	80	Loblolly pine, black walnut, yellow-poplar.
						Yellow-poplar	90	
						Virginia pine	80	
						Loblolly pine	90	
27: Peawick	3w	Slight	Moderate	Slight	Slight	Loblolly pine	77	Loblolly pine.
						Sweetgum	---	
						Yellow-poplar	---	
						Water oak	---	
						White oak	---	
28: Seabrook	3s	Slight	Moderate	Moderate	Slight	Loblolly pine	84	Loblolly pine.
						Virginia pine	---	
29A, 29B: Slagle	2w	Slight	Moderate	Slight	Slight	Loblolly pine	86	Loblolly pine, sweetgum, yellow-poplar.
						Sweetgum	86	
						Southern red oak	76	
						Water oak	76	
						Yellow-poplar	90	
30: State	1o	Slight	Slight	Slight	Slight	Southern red oak	86	Black walnut, yellow-poplar, loblolly pine.
						Yellow-poplar	100	
						Virginia pine	85	
						Loblolly pine	95	
31B: Suffolk	3o	Slight	Slight	Slight	Slight	Loblolly pine	82	Loblolly pine.
						Shortleaf pine	72	
						Southern red oak	70	
						Virginia pine	---	
32: Tetotum	2w	Slight	Moderate	Slight	Slight	Loblolly pine	88	Loblolly pine.
						Sweetgum	85	
						Southern red oak	76	
33: Tomotley	2w	Slight	Severe	Severe	Moderate	Loblolly pine	94	Loblolly pine, sweetgum, American sycamore.
						Sweetgum	90	
34B, 34C: Uchee	3s	Slight	Moderate	Moderate	Slight	Loblolly pine	82	Loblolly pine.
						Shortleaf pine	---	
						Virginia pine	---	
38: Yemassee	2w	Slight	Moderate	Slight	Slight	Loblolly pine	90	Loblolly pine, American sycamore, yellow-poplar.
						Sweetgum	95	
						Southern red oak	---	
						White oak	---	
						Yellow-poplar	95	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--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
1----- Altavista	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
2----- Augusta	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
3----- Axis	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: excess sulfur, ponding, flooding.
4*. Beaches					
5----- Bethera	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.
6----- Bohicket	Severe: flooding, ponding, percs slowly.	Severe: ponding, excess salt.	Severe: ponding, flooding.	Severe: ponding.	Severe: excess salt, excess sulfur, ponding.
7----- Bojac	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: droughty.
8B----- Caroline	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight-----	Slight.
9----- Chickahominy	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
10B----- Craven	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight-----	Slight.
10C----- Craven	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.
11B*:					
Craven-----	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight-----	Slight.
Uchee-----	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: droughty.
11C*:					
Craven-----	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
11C*: Uchee	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
12 Dogue	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: small stones, wetness.	Moderate: wetness.	Moderate: wetness.
13 Dragston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
14B Emporia	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Slight.
14C, 15D* Emporia	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
15E* Emporia	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
15F* Emporia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
16 Izagora	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: erodes easily.	Slight.
17* Johnston	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
18B Kempsville	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
19B*: Kempsville	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Emporia	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Slight.
20B Kenansville	Slight	Slight	Slight	Slight	Moderate: droughty.
21 Levy	Severe: flooding, ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: ponding, flooding, too clayey.
22 Munden	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
23 Newflat	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
24 Nimmo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
25B Norfolk	Slight	Slight	Moderate: slope.	Slight	Slight.
26B* Pamunkey	Slight	Slight	Moderate: slope.	Slight	Slight.
27 Peawick	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness.
28 Seabrook	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Severe: droughty.
29A Slagle	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: small stones, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
29B Slagle	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Moderate: wetness.	Moderate: wetness.
30 State	Slight	Slight	Slight	Slight	Slight.
31B Suffolk	Slight	Slight	Moderate: slope.	Slight	Slight.
32 Tetotum	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
33 Tomotley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
34B Uchee	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
34C Uchee	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
35. Udorthents					
36*: Udorthents.					
Dumps.					
37*. Urban land					
38 Yemassee	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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
1-------------------- Altavista	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
2-------------------- Augusta	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
3-------------------- Axis	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
4*. Beaches										
5-------------------- Bethera	Very poor.	Very poor.	Poor	Fair	Poor	Good	Good	Very poor.	Fair	Good.
6-------------------- Bohicket	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
7-------------------- Bojac	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
8B------------------- Caroline	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
9-------------------- Chickahominy	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
10B------------------ Craven	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
10C------------------ Craven	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11B*: Craven--------------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Uchee---------------	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
11C*: Craven--------------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Uchee---------------	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
12------------------- Dogue	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
13------------------- Dragston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
14B------------------ Emporia	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
14C, 15D*------------ Emporia	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
15E*----------------- Emporia	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

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
15F*: Emporia	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
16: Izagora	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
17*: Johnston	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
18B: Kempsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
19B*:										
Kempsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Emporia	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
20B: Kenansville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
21: Levy	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
22: Munden	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
23: Newflat	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
24: Nimmo	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
25B: Norfolk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
26B*: Pamunkey	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
27: Peawick	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
28: Seabrook	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
29A: Slagle	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
29B: Slagle	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
30: State	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
31B: Suffolk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
32: Tetotum	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
33: Tomotley	Very poor.	Very poor.	Poor	Fair	Fair	Good	Good	Very poor.	Poor	Good.
34B: Uchee	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

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
34C----------------- Uchee	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
35. Udorthents										
36*: Udorthents.										
Dumps.										
37*. Urban land										
38----------------- Yemassee	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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 and 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
1----------------- Altavista	Severe: wetness, cutbanks cave.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
2----------------- Augusta	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
3----------------- Axis	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: excess sulfur, ponding, flooding.
4*. Beaches						
5----------------- Bethera	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: low strength, ponding, wetness.	Severe: ponding, wetness.
6----------------- Bohicket	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: excess salt, excess sulfur, ponding.
7----------------- Bojac	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
8B---------------- Caroline	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
9----------------- Chickahominy	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
10B--------------- Craven	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
10C--------------- Craven	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.
11B*:						
Craven-----------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
Uchee------------	Severe: cutbanks cave.	Slight---------	Moderate: wetness, shrink-swell.	Moderate: slope.	Slight---------	Moderate: droughty.
11C*:						
Craven-----------	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 9.--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
11C*: Uchee	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, shrink-swell, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
11C*: Uchee	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, shrink-swell, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty,
12 Dogue	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
13 Dragston	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
14B Emporia	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: low strength.	Slight.
14C, 15D* Emporia	Moderate: slope, wetness.	Moderate: slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Moderate: slope, low strength.	Moderate: slope.
15E*, 15F* Emporia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
16 Izagora	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Slight.
17* Johnston	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
18B Kempsville	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
19B*: Kempsville	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
Emporia	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: low strength.	Slight.
20B Kenansville	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Slight	Moderate: droughty.
21 Levy	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding, too clayey.
22 Munden	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
23 Newflat	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
24 Nimmo	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 9.--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
25B----------------- Norfolk	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Slight---------	Slight.
26B*----------------- Pamunkey	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength.	Slight.
27----------------- Peawick	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
28----------------- Seabrook	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: droughty.
29A----------------- Slagle	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
29B----------------- Slagle	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Moderate: wetness.
30----------------- State	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: low strength.	Slight.
31B----------------- Suffolk	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
32----------------- Tetotum	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
33----------------- Tomotley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
34B----------------- Uchee	Severe: cutbanks cave.	Slight---------	Moderate: wetness, shrink-swell.	Moderate: slope.	Slight---------	Moderate: droughty.
34C----------------- Uchee	Severe: cutbanks cave.	Moderate: slope.	Moderate: wetness, shrink-swell, slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
35. Udorthents						
36*: Udorthents.						
Dumps.						
37*. Urban land						
38----------------- Yemassee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "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 and 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
1 Altavista	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: wetness.
2 Augusta	Severe: wetness.	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: wetness.
3 Axis	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
4*. Beaches					
5 Bethera	Severe: ponding, wetness, percs slowly.	Severe: ponding, wetness.	Severe: ponding, wetness, too clayey.	Severe: ponding, wetness.	Poor: too clayey, hard to pack, wetness.
6 Bohicket	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
7 Bojac	Moderate: wetness.	Severe: seepage.	Severe: wetness, seepage.	Severe: seepage.	Fair: thin layer.
8B Caroline	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
9 Chickahominy	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
10B Craven	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
10C Craven	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
11B*:					
Craven	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Uchee	Severe: wetness, percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
11C*:					
Craven	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Uchee	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.

See footnote at end of table.

TABLE 10.--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
12 Dogue	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
13 Dragston	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: wetness, thin layer.
14B Emporia	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
14C, 15D* Emporia	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Moderate: slope, wetness, too clayey.	Moderate: slope.	Fair: slope, too clayey, wetness.
15E*, 15F* Emporia	Severe: slope, wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
16 Izagora	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness, thin layer.
17* Johnston	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, ponding.
18B Kempsville	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
19B*:					
Kempsville	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Emporia	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
20B Kenansville	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Fair: too sandy.
21 Levy	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
22 Munden	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness, thin layer.
23 Newflat	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
24 Nimmo	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

See footnote at end of table.

TABLE 10.--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
25B------------------ Norfolk	Moderate: wetness.	Moderate: seepage.	Slight-----------	Slight-----------	Good.
26B*----------------- Pamunkey	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Good.
27------------------- Peawick	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
28------------------- Seabrook	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
29A, 29B------------- Slagle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: wetness.
30------------------- State	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Moderate: wetness.	Fair: thin layer.
31B------------------ Suffolk	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Fair: thin layer.
32------------------- Tetotum	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey.
33------------------- Tomotley	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
34B------------------ Uchee	Severe: wetness, percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
34C------------------ Uchee	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
35. Udorthents					
36*: Udorthents.					
Dumps.					
37*. Urban land					
38------------------- Yemassee	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition and does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1-----Altavista	Fair: wetness, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
2-----Augusta	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
3-----Axis	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
4*. Beaches				
5-----Bethera	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
6-----Bohicket	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
7-----Bojac	Good-----	Probable-----	Improbable: too sandy.	Good.
8B-----Caroline	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
9-----Chickahominy	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
10B, 10C-----Craven	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
11B*:				
Craven-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Uchee-----	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
11C*:				
Craven-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Uchee-----	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
12-----Dogue	Poor: low strength.	Probable-----	Improbable: too sandy.	Poor: thin layer.
13-----Dragston	Fair: wetness.	Probable-----	Improbable: too sandy.	Fair: thin layer.
14B-----Emporia	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
14C, 15D*: Emporia	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
15E*: Emporia	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
15F*: Emporia	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
16: Izagora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
17*: Johnston	Poor: wetness.	Improbable: excess fines.	Improbable: too sandy.	Poor: wetness.
18B: Kempsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
19B*:				
Kempsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Emporia	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
20B: Kenansville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
21: Levy	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
22: Munden	Fair: wetness.	Probable	Improbable: too sandy.	Fair: thin layer.
23: Newflat	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
24: Nimmo	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
25B: Norfolk	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
26B*: Pamunkey	Fair: low strength.	Improbable: thin layer.	Improbable: thin layer, too sandy.	Good.
27: Peawick	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
28: Seabrook	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
29A, 29B: Slagle	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
30 State	Good	Probable	Improbable: too sandy.	Good.
31B Suffolk	Good	Probable	Improbable: too sandy.	Good.
32 Tetotum	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
33 Tomotley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
34B Uchee	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
34C Uchee	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
35. Udorthents				
36*:				
Udorthents.				
Dumps.				
37*. Urban land				
38 Yemassee	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[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 evaluated. The information in this table indicates the dominant soil condition and does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1 Altavista	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water.	Favorable	Wetness	Favorable.
2 Augusta	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Favorable	Wetness	Wetness.
3 Axis	Moderate: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, flooding, excess sulfur.	Ponding	Wetness, excess salt, droughty.
4*. Beaches						
5 Bethera	Slight	Severe: ponding, wetness.	Severe: slow refill.	Ponding, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
6 Bohicket	Slight	Severe: hard to pack, ponding, excess salt.	Severe: slow refill, salty water.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Wetness, excess salt, percs slowly.
7 Bojac	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Soil blowing	Droughty.
8B Caroline	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
9 Chickahominy	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.
10B Craven	Slight	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly	Erodes easily, wetness.	Erodes easily, percs slowly.
10C Craven	Slight	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
11B*: Craven	Slight	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly	Erodes easily, wetness.	Erodes easily, percs slowly.
Uchee	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy	Droughty.
11C*: Craven	Slight	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
Uchee	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy.	Slope, droughty.
12 Dogue	Moderate: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Favorable	Erodes easily, wetness.	Erodes easily.
13 Dragston	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, soil blowing.	Wetness, droughty.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
14B: Emporia	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Soil blowing, percs slowly.	Percs slowly.
14C, 15D*, 15E*, 15F*: Emporia	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Slope, percs slowly.
16: Izagora	Moderate: seepage.	Moderate: piping, wetness.	Severe: slow refill.	Favorable	Erodes easily, wetness.	Erodes easily.
17*: Johnston	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, flooding, cutbanks cave.	Ponding	Wetness.
18B: Kempsville	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Soil blowing	Favorable.
19B*:						
Kempsville	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Soil blowing	Favorable.
Emporia	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Soil blowing, percs slowly.	Percs slowly.
20B: Kenansville	Severe: seepage.	Moderate: seepage.	Severe: cutbanks cave.	Deep to water	Favorable	Droughty.
21: Levy	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Wetness, percs slowly.
22: Munden	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy, soil blowing.	Favorable.
23: Newflat	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.
24: Nimmo	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy.	Wetness, droughty.
25B: Norfolk	Moderate: seepage.	Slight	Severe: deep to water.	Deep to water	Favorable	Favorable.
26B*: Pamunkey	Severe: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Favorable	Favorable.
27: Peawick	Slight	Severe: hard to pack.	Severe: no water.	Percs slowly	Wetness, percs slowly.	Percs slowly.
28: Seabrook	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy, soil blowing.	Droughty.
29A: Slagle	Moderate: seepage.	Moderate: wetness.	Severe: no water.	Deep to water	Wetness, percs slowly.	Percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
29B----------------- Slagle	Moderate: seepage, slope.	Moderate: wetness.	Severe: no water.	Deep to water	Wetness, percs slowly.	Percs slowly.
30------------------ State	Moderate: seepage.	Moderate: thin layer, piping.	Severe: cutbanks cave.	Deep to water	Soil blowing---	Favorable.
31B----------------- Suffolk	Moderate: seepage, slope.	Severe: piping, thin layer.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
32------------------ Tetotum	Moderate: seepage.	Severe: wetness.	Severe: cutbanks cave.	Favorable------	Wetness---------	Favorable.
33------------------ Tomotley	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Favorable------	Wetness, soil blowing.	Wetness.
34B----------------- Uchee	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy------	Droughty.
34C----------------- Uchee	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy.	Slope, droughty.
35. Udorthents						
36*: Udorthents.						
Dumps.						
37*. Urban land						
38------------------ Yemassee	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Favorable------	Wetness, soil blowing.	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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	
1. Altavista	0-13	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	95-100	90-100	65-99	35-60	<23	NP-7
	13-53	Clay loam, sandy clay loam, loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-7	0	95-100	95-100	60-99	45-75	20-45	5-28
	53-65	Variable	---	---	0	---	---	---	---	---	---
2. Augusta	0-17	Fine sandy loam	SM, SM-SC	A-2, A-4	0	90-100	75-100	50-80	30-50	<25	NP-7
	17-56	Sandy clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	75-100	75-95	51-80	20-45	5-25
	56-70	Sandy loam, loam, loamy sand.	SM, SP-SM, ML, SM-SC	A-2, A-4, A-1	0	75-100	55-100	30-90	10-70	<25	NP-5
3. Axis	0-14	Very fine sandy loam.	CL, CL-ML	A-4	0	100	100	80-95	60-80	16-28	4-10
	14-50	Sandy loam, loam, very fine sandy loam.	CL-ML, SC, SM-SC, CL	A-4	0	100	100	75-95	45-75	16-28	4-10
	50-70	Sandy loam, loam, sandy clay loam, very fine sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-95	45-65	<25	NP-7
4*. Beaches											
5. Bethera	0-7	Silt loam	CL	A-4, A-6	0	100	95-100	85-95	60-75	30-37	8-14
	7-65	Clay, silty clay loam, silty clay, clay loam.	CL, CH, ML, MH	A-6, A-7	0	100	98-100	93-100	55-95	37-55	12-30
6. Bohicket	0-6	Muck	Pt	A-8	0	---	---	---	---	---	---
	6-16	Silty clay	CH	A-7	0	100	99-100	90-100	80-100	60-100	15-60
	16-80	Silty clay, clay.	CH, MH	A-7	0	100	99-100	80-100	70-95	50-100	16-60
7. Bojac	0-25	Sandy loam	ML, CL-ML, SM, SM-SC	A-2, A-4	0	95-100	95-100	55-100	30-60	<25	NP-7
	25-53	Fine sandy loam, loam, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	55-100	20-60	<35	NP-10
	53-71	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
8B. Caroline	0-13	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2, A-4	0	90-100	85-100	60-85	30-55	<25	NP-5
	13-47	Clay loam, clay, sandy clay.	CL, CH	A-7	0	90-100	85-100	80-100	60-90	41-70	18-40
	47-72	Clay loam, clay, fine sandy loam.	SM-SC, SC, CL, CH	A-4, A-6, A-7	0	85-100	70-100	55-95	35-90	20-70	5-40
9. Chickahominy	0-7	Silt loam	SM, SC, CL-ML	A-4	0	95-100	90-100	75-95	45-90	<25	NP-8
	7-13	Clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	85-100	65-90	30-55	12-30
	13-85	Clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	70-90	40-75	15-45
10B, 10C. Craven	0-9	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-100	45-90	<35	NP-7
	9-30	Clay, silty clay, silty clay loam.	CH	A-7	0	100	100	90-100	65-98	51-70	24-43
	30-72	Sandy clay loam, sandy loam, loamy sand.	SM, SM-SC, SC	A-2, A-4, A-6	0	100	95-100	50-100	15-49	<35	NP-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
11B*, 11C*:											
Craven----------	0-9	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-100	45-90	<35	NP-7
	9-30	Clay, silty clay, silty clay loam.	CH	A-7	0	100	100	90-100	65-98	51-70	24-43
	30-72	Sandy clay loam, sandy loam, loamy sand.	SM, SM-SC, SC	A-2, A-4, A-6	0	100	95-100	50-100	15-49	<35	NP-15
Uchee-----------	0-24	Loamy fine sand	SM	A-2, A-1-B	0	90-100	80-100	40-70	15-30	---	NP
	24-36	Sandy loam, sandy clay loam.	SC, SM-SC	A-2, A-4, A-6	0	90-100	80-100	50-80	25-50	20-40	6-20
	36-56	Sandy clay loam, sandy clay, clay.	MH, CH, CL, SC	A-7	0	90-100	80-100	65-90	40-70	41-70	18-38
	56-65	Sandy loam, sandy clay loam, sandy clay.	MH, CH, CL, SC	A-6, A-7, A-2-6, A-2-7	0	85-100	80-100	50-80	30-65	35-65	15-35
12--------------- Dogue	0-11	Loam-------------	ML, CL, SM, SC	A-4	0	95-100	75-100	60-100	40-85	<30	NP-10
	11-43	Clay loam, clay, sandy clay loam.	CL, CH, SC	A-6, A-7	0	95-100	75-100	65-100	40-90	35-60	16-40
	43-60	Stratified sand to sandy clay loam.	SM, SC, SP-SM, SM-SC	A-2, A-4, A-1	0	80-100	60-100	35-100	10-40	<30	NP-10
13--------------- Dragston	0-17	Fine sandy loam	SM, SC, SM-SC	A-2, A-4	0	100	95-100	60-85	30-60	<20	NP-8
	17-54	Fine sandy loam, sandy loam, loam.	SM, SC, SM-SC	A-2, A-4	0	100	95-100	60-85	30-60	<25	NP-10
	54-72	Sand, loamy fine 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
14B, 14C--------- Emporia	0-13	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	13-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-58	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	58-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
15D*------------- Emporia	0-11	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	11-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-54	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	54-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
15E*------------- Emporia	0-9	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	9-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-50	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	50-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

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	
15F*: Emporia	0-6	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	6-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-45	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	45-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
16: Izagora	0-13	Loam	CL, CL-ML, ML	A-4	0	95-100	95-100	85-100	60-90	<30	NP-10
	13-36	Loam, clay loam, silty clay loam.	CL	A-4, A-6, A-7	0	95-100	95-100	85-100	60-95	25-45	8-25
	36-78	Clay loam, clay	CL, CH	A-6, A-7	0	95-100	95-100	90-100	70-95	35-60	20-40
17*: Johnston	0-8	Silt loam	ML, SM	A-2, A-4	0	100	100	60-100	18-65	<35	NP-10
	8-49	Stratified fine sandy loam to silty clay loam.	SM, ML	A-2, A-3	0	100	100	60-100	18-65	<35	NP-10
	49-60	Stratified sand to sandy clay loam.	SM, ML	A-2, A-4	0	100	100	50-100	25-49	<35	NP-10
18B: Kempsville	0-14	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0-2	90-100	75-100	45-85	25-65	<18	NP-7
	14-20	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4	0-2	90-100	80-100	50-90	30-70	<22	NP-10
	20-55	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-2, A-6	0-2	90-100	80-100	55-95	30-75	25-40	10-20
	55-68	Stratified loamy sand to sandy clay loam.	SC, SM, SM-SC	A-1, A-2, A-4, A-6	0-5	85-100	75-100	35-85	15-50	<30	NP-15
19B*:											
Kempsville	0-14	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0-2	90-100	75-100	45-85	25-65	<18	NP-7
	14-20	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4	0-2	90-100	80-100	50-90	30-70	<22	NP-10
	20-55	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-2, A-6	0-2	90-100	80-100	55-95	30-75	25-40	10-20
	55-68	Stratified loamy sand to sandy clay loam.	SC, SM, SM-SC	A-1, A-2, A-4, A-6	0-5	85-100	75-100	35-85	15-50	<30	NP-15
Emporia	0-13	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	13-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-58	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	58-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
20B: Kenansville	0-25	Loamy fine sand	SM	A-1, A-2	0	100	95-100	45-60	10-25	<25	NP-3
	25-43	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4	0	100	95-100	50-75	20-40	<30	NP-10
	43-78	Sand, loamy sand	SP-SM, SM, SP	A-1, A-2, A-3	0	100	95-100	40-60	5-30	---	NP

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

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	
21---------------- Levy	0-18	Silty clay-------	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	85-100	30-65	12-35
	18-80	Silty clay, clay, silty clay loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	85-100	35-65	15-35
22---------------- Munden	0-11	Loamy fine sand	SM, SM-SC	A-2, A-4	0	100	98-100	55-85	15-45	<18	NP-7
	11-48	Sandy loam, loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	98-100	60-95	30-75	<30	NP-15
	48-80	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	98-100	50-90	5-35	<18	NP-7
23---------------- Newflat	0-8	Silt loam--------	SM, SC, CL-ML	A-4	0	95-100	90-100	75-95	45-90	<25	NP-8
	8-11	Loam, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	85-100	65-90	30-55	12-30
	11-80	Clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	70-90	40-75	15-45
24---------------- Nimmo	0-11	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	95-100	60-85	36-60	<22	NP-10
	11-36	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	NP-15
	36-60	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
25B--------------- Norfolk	0-17	Fine sandy loam	SM, SM-SC, SC	A-2	0	95-100	95-100	50-91	15-33	<25	NP-14
	17-39	Sandy loam, sandy clay loam, clay loam.	SC, SM-SC, CL, CL-ML	A-2, A-4, A-6	0	95-100	91-100	70-96	30-55	20-38	4-15
	39-72	Sandy clay loam, clay loam, sandy clay.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7-6	0	100	98-100	65-98	36-72	20-45	4-22
26B*-------------- Pamunkey	0-14	Sandy loam-------	SM, ML, SP-SM, SM-SC	A-2, A-4	0	80-100	75-100	50-85	12-55	<20	NP-7
	14-43	Sandy clay loam, clay loam, loam.	CL, SC	A-2, A-6	0-2	80-100	75-100	70-95	30-75	30-40	10-20
	43-75	Stratified sandy loam to sand.	SW, SM, SW-SM, SM-SC	A-1, A-2, A-3	0-5	50-100	50-95	25-70	2-35	<20	NP-6
27---------------- Peawick	0-7	Silt loam--------	SM, SC, CL-ML	A-4	0	90-100	75-100	50-100	40-90	15-30	NP-8
	7-99	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	90-100	75-100	70-100	70-95	35-80	12-50
28---------------- Seabrook	0-9	Loamy fine sand	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-99	5-25	---	NP
	9-72	Loamy fine sand, fine sand, sand.	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-100	5-25	---	NP
29A, 29B---------- Slagle	0-9	Fine sandy loam	SM, SC, ML, CL	A-2, A-4, A-6	0-3	95-100	90-100	55-95	30-75	<35	NP-15
	9-25	Fine sandy loam, sandy clay loam, loam.	SC, SM-SC, CL, CL-ML	A-2, A-4, A-6	0-2	95-100	90-100	65-85	35-60	20-40	5-20
	25-60	Sandy clay loam, loam, clay loam.	SC, CL	A-4, A-6, A-7	0-2	95-100	90-100	75-95	40-75	25-50	8-30
30---------------- State	0-11	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	95-100	95-100	65-100	40-85	<28	NP-7
	11-52	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	75-100	35-80	24-40	8-22
	52-97	Stratified sand to fine sandy loam.	SM, SM-SC, SP-SM	A-1, A-2, A-3, A-4	0	85-100	75-100	40-90	5-50	<25	NP-7

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
31B--------------- Suffolk	0-14	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	90-100	50-80	25-60	<20	NP-7
	14-40	Sandy clay loam, clay loam, sandy loam.	SC, CL	A-2, A-6	0	95-100	90-100	50-95	25-75	20-40	10-25
	40-64	Loamy fine sand, fine sandy loam, sand.	SP, SM, SM-SC	A-1, A-2, A-3, A-4	0	75-100	60-100	30-80	3-50	<18	NP-7
32--------------- Tetotum	0-10	Silt loam--------	SM, SC, ML, CL	A-4, A-6	0	85-100	80-100	65-95	45-85	<30	NP-15
	10-51	Sandy clay loam, clay loam, silty clay loam.	SC, CL	A-6, A-7	0-2	85-100	80-100	60-95	35-85	30-45	10-20
	51-65	Stratified sandy clay loam to loamy fine sand.	SM, SC, ML, CL	A-2, A-4, A-6	0-2	80-100	75-100	50-95	15-75	<30	NP-15
33--------------- Tomotley	0-8	Fine sandy loam	SM	A-2, A-4	0	98-100	95-100	75-98	25-50	<30	NP-7
	8-50	Fine sandy loam, sandy clay loam, clay loam.	SM-SC, SC, CL-ML, CL	A-2, A-4, A-6	0	98-100	95-100	75-98	30-70	20-40	6-18
	50-68	Stratified loamy sand to fine sandy loam.	SM, SM-SC	A-2, A-3, A-4	0	85-100	75-100	40-90	15-50	<25	NP-7
34B, 34C--------- Uchee	0-24	Loamy fine sand	SM	A-2, A-1-B	0	90-100	80-100	40-70	15-30	---	NP
	24-36	Sandy loam, sandy clay loam.	SC, SM-SC	A-2, A-4, A-6	0	90-100	80-100	50-80	25-50	20-40	6-20
	36-56	Sandy clay loam, sandy clay, clay.	MH, CH, CL, SC	A-7	0	90-100	80-100	65-90	40-70	41-70	18-38
	56-65	Sandy loam, sandy clay loam, sandy clay.	MH, CH, CL, SC	A-6, A-7, A-2-6, A-2-7	0	85-100	80-100	50-80	30-65	35-65	15-35
35. Udorthents											
36*: Udorthents.											
Dumps.											
37*. Urban land											
38--------------- Yemassee	0-11	Fine sandy loam	SM	A-2, A-4	0	100	100	75-100	25-50	<30	NP-7
	11-51	Sandy clay loam, clay loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	0	100	100	75-100	30-70	16-38	4-18
	51-63	Sandy clay loam, fine sandy loam, sandy clay.	SC, SM, CL-ML, SM-SC	A-2, A-4, A-6	0	100	100	75-100	25-55	<35	NP-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--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 "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	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm				Pct
1----------------- Altavista	0-13	10-24	1.30-1.50	2.0-6.0	0.12-0.20	4.5-6.0	<2	Low----------	0.20	4	.5-2
	13-53	18-35	1.30-1.50	0.6-2.0	0.12-0.20	4.5-6.0	<2	Low----------	0.24		
	53-65	---	---	---	---	---	<2	-------------	----		
2----------------- Augusta	0-17	5-20	1.30-1.50	2.0-6.0	0.10-0.15	4.5-6.0	<2	Low----------	0.15	4	.5-2
	17-56	20-35	1.30-1.50	0.6-2.0	0.12-0.18	4.5-6.0	<2	Low----------	0.24		
	56-70	3-18	1.30-1.50	2.0-6.0	0.06-0.12	4.5-6.0	<2	Low----------	0.24		
3----------------- Axis	0-14	15-25	1.30-1.50	0.6-2.0	0.10-0.18	5.6-8.4	4-8	Low----------	0.10	5	4-8
	14-50	8-15	1.30-1.50	0.6-2.0	0.10-0.18	5.6-8.4	4-8	Low----------	0.10		
	50-70	8-25	1.30-1.50	0.6-2.0	0.10-0.18	5.6-8.4	2-4	Low----------	0.10		
4*. Beaches											
5----------------- Bethera	0-7	10-20	1.20-1.40	0.6-2.0	0.11-0.16	3.6-5.5	<2	Low----------	0.28	5	1-2
	7-65	35-50	1.30-1.50	0.06-0.2	0.14-0.18	3.6-5.5	<2	Moderate-----	0.32		
6----------------- Bohicket	0-6	2-5	0.10-0.60	0.06-2.0	0.22-0.26	6.1-8.4	>8	Low----------	---	---	5-25
	6-16	30-60	1.20-1.40	0.06-0.2	0.14-0.18	6.1-8.4	>8	High---------	0.32	5	
	16-80	35-60	1.30-1.60	<0.06	0.12-0.16	6.1-8.4	>8	High---------	0.24		
7----------------- Bojac	0-25	3-8	1.20-1.50	2.0-6.0	0.10-0.18	3.6-6.5	<2	Low----------	0.28	3	.5-2
	25-53	11-16	1.35-1.55	2.0-6.0	0.08-0.17	3.6-6.5	<2	Low----------	0.28		
	53-71	1-8	1.30-1.50	>6.0	0.02-0.07	4.5-6.0	<2	Low----------	0.28		
8B---------------- Caroline	0-13	10-20	1.35-1.45	0.6-6.0	0.08-0.15	3.6-5.5	<2	Low----------	0.43	5	.5-2
	13-47	35-55	1.40-1.50	0.2-0.6	0.14-0.22	3.6-5.5	<2	Moderate-----	0.32		
	47-72	15-45	1.40-1.55	0.2-0.6	0.13-0.20	3.6-5.5	<2	Moderate-----	0.32		
9----------------- Chickahominy	0-7	10-25	1.20-1.30	0.6-2.0	0.10-0.17	3.6-5.0	<2	Low----------	0.37	4	.5-2
	7-13	27-40	1.25-1.35	0.2-0.6	0.12-0.19	3.6-5.0	<2	Moderate-----	0.37		
	13-85	35-60	1.30-1.50	<0.06	0.10-0.19	3.6-5.0	<2	High---------	0.24		
10B, 10C---------- Craven	0-9	6-20	1.30-1.55	0.6-2.0	0.12-0.18	3.6-5.5	<2	Low----------	0.37	3	.5-2
	9-30	35-60	1.30-1.45	0.06-0.2	0.12-0.15	3.6-5.5	<2	Moderate-----	0.32		
	30-72	5-35	1.35-1.60	0.2-6.0	0.08-0.14	3.6-5.5	<2	Low----------	0.32		
11B*, 11C*:											
Craven-----------	0-9	6-20	1.30-1.55	0.6-2.0	0.12-0.18	3.6-5.5	<2	Low----------	0.37	3	.5-2
	9-30	35-60	1.30-1.45	0.06-0.2	0.12-0.15	3.6-5.5	<2	Moderate-----	0.32		
	30-72	5-35	1.35-1.60	0.2-6.0	0.08-0.14	3.6-5.5	<2	Low----------	0.32		
Uchee------------	0-24	3-10	1.30-1.60	6.0-20	0.05-0.10	4.5-5.5	<2	Low----------	0.20	5	.5-1
	24-36	8-30	1.30-1.45	0.6-2.0	0.10-0.15	4.5-5.5	<2	Low----------	0.24		
	36-56	25-50	1.30-1.50	0.2-0.6	0.10-0.16	4.5-5.5	<2	Moderate-----	0.28		
	56-65	15-40	1.30-1.50	0.2-2.0	0.10-0.16	4.5-5.5	<2	Moderate-----	0.28		
12---------------- Dogue	0-11	5-15	1.30-1.45	0.6-2.0	0.14-0.20	3.6-5.5	<2	Low----------	0.37	4	.5-1
	11-43	35-50	1.45-1.60	0.2-0.6	0.12-0.19	3.6-5.5	<2	Moderate-----	0.28		
	43-60	5-30	1.30-1.50	0.6-6.0	0.05-0.14	3.6-5.5	<2	Low----------	0.17		
13---------------- Dragston	0-17	4-12	1.20-1.50	2.0-6.0	0.08-0.15	4.5-5.5	<2	Low----------	0.17	4	.5-1
	17-54	10-18	1.25-1.45	2.0-6.0	0.08-0.16	4.5-5.5	<2	Low----------	0.17		
	54-72	2-12	1.35-1.55	>6.0	0.04-0.10	4.5-6.5	<2	Low----------	0.17		
14B, 14C---------- Emporia	0-13	7-18	1.30-1.40	2.0-6.0	0.10-0.17	4.5-5.5	<2	Low----------	0.28	4	.5-2
	13-37	18-35	1.35-1.45	0.2-2.0	0.10-0.18	4.5-5.5	<2	Low----------	0.28		
	37-58	21-40	1.45-1.60	0.06-0.6	0.10-0.16	4.5-5.5	<2	Moderate-----	0.20		
	58-75	5-40	1.45-1.60	0.06-2.0	0.08-0.18	4.5-5.5	<2	Moderate-----	0.20		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF 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	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm				Pct
15D*: Emporia	0-11	7-18	1.30-1.40	2.0-6.0	0.10-0.17	4.5-5.5	<2	Low	0.28	4	.5-2
	11-37	18-35	1.35-1.45	0.2-2.0	0.10-0.18	4.5-5.5	<2	Low	0.28		
	37-54	21-40	1.45-1.60	0.06-0.6	0.10-0.16	4.5-5.5	<2	Moderate	0.20		
	54-75	5-40	1.45-1.60	0.06-2.0	0.08-0.18	4.5-5.5	<2	Moderate	0.20		
15E*: Emporia	0-9	7-18	1.30-1.40	2.0-6.0	0.10-0.17	4.5-5.5	<2	Low	0.28	4	.5-2
	9-37	18-35	1.35-1.45	0.2-2.0	0.10-0.18	4.5-5.5	<2	Low	0.28		
	37-50	21-40	1.45-1.60	0.06-0.6	0.10-0.16	4.5-5.5	<2	Moderate	0.20		
	50-75	5-40	1.45-1.60	0.06-2.0	0.08-0.18	4.5-5.5	<2	Moderate	0.20		
15F*: Emporia	0-6	7-18	1.30-1.40	2.0-6.0	0.10-0.17	4.5-5.5	<2	Low	0.28	4	.5-2
	6-37	18-35	1.35-1.45	0.2-2.0	0.10-0.18	4.5-5.5	<2	Low	0.28		
	37-45	21-40	1.45-1.60	0.06-0.6	0.10-0.16	4.5-5.5	<2	Moderate	0.20		
	45-75	5-40	1.45-1.60	0.06-2.0	0.08-0.18	4.5-5.5	<2	Moderate	0.20		
16: Izagora	0-13	10-20	1.30-1.40	2.0-6.0	0.16-0.22	4.5-5.5	<2	Low	0.37	3	.5-2
	13-36	18-30	1.30-1.50	0.6-2.0	0.12-0.20	4.5-5.5	<2	Low	0.32		
	36-78	35-55	1.30-1.50	0.06-0.2	0.16-0.20	4.5-5.5	<2	Moderate	0.32		
17*: Johnston	0-8	5-18	1.30-1.55	2.0-6.0	0.10-0.20	4.5-5.5	<2	Low	0.20	5	4-8
	8-49	2-12	1.55-1.75	0.6-2.0	0.02-0.07	4.5-5.5	<2	Low	0.17		
	49-60	5-20	1.45-1.65	0.6-2.0	0.06-0.12	4.5-5.5	<2	Low	0.17		
18B: Kempsville	0-14	5-18	1.30-1.40	2.0-6.0	0.10-0.16	4.5-5.5	<2	Low	0.32	3	.5-2
	14-20	12-24	1.30-1.45	2.0-6.0	0.12-0.18	4.5-5.5	<2	Low	0.24		
	20-55	18-35	1.35-1.65	0.6-2.0	0.12-0.18	4.5-5.5	<2	Low	0.24		
	55-68	5-30	1.30-1.60	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	0.24		
19B*:											
Kempsville	0-14	5-18	1.30-1.40	2.0-6.0	0.10-0.16	4.5-5.5	<2	Low	0.32	3	.5-2
	14-20	12-24	1.30-1.45	2.0-6.0	0.12-0.18	4.5-5.5	<2	Low	0.24		
	20-55	18-35	1.35-1.65	0.6-2.0	0.12-0.18	4.5-5.5	<2	Low	0.24		
	55-68	5-30	1.30-1.60	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	0.24		
Emporia	0-13	7-18	1.30-1.40	2.0-6.0	0.10-0.17	4.5-5.5	<2	Low	0.28	4	.5-2
	13-37	18-35	1.35-1.45	0.2-2.0	0.10-0.18	4.5-5.5	<2	Low	0.28		
	37-58	21-40	1.45-1.60	0.06-0.6	0.10-0.16	4.5-5.5	<2	Moderate	0.20		
	58-75	5-40	1.45-1.60	0.06-2.0	0.08-0.18	4.5-5.5	<2	Moderate	0.20		
20B: Kenansville	0-25	3-10	1.50-1.70	6.0-20	0.04-0.10	4.5-5.5	<2	Low	0.15	5	.5-2
	25-43	5-18	1.30-1.50	2.0-6.0	0.10-0.15	4.5-5.5	<2	Low	0.15		
	43-78	1-10	1.50-1.70	6.0-20	<0.05	4.5-5.5	<2	Low	0.10		
21: Levy	0-18	27-50	0.50-1.00	0.06-0.2	0.16-0.22	4.5-5.5	<2	High	0.32	5	3-15
	18-80	35-60	0.25-1.10	0.06-0.2	0.16-0.22	4.5-6.0	<2	High	0.32		
22: Munden	0-11	3-12	1.20-1.35	2.0-6.0	0.06-0.10	4.5-5.5	<2	Low	0.20	4	.5-1
	11-48	8-18	1.20-1.35	0.6-2.0	0.08-0.17	4.5-5.5	<2	Low	0.17		
	48-80	2-12	1.35-1.55	>2.0	0.04-0.08	4.5-5.5	<2	Low	0.17		
23: Newflat	0-8	10-25	1.20-1.30	0.6-2.0	0.10-0.17	3.6-5.0	<2	Low	0.37	4	.5-1
	8-11	25-40	1.25-1.35	0.2-0.6	0.12-0.19	3.6-5.0	<2	Moderate	0.37		
	11-80	35-60	1.30-1.50	<0.06	0.10-0.19	3.6-5.0	<2	High	0.24		
24: Nimmo	0-11	4-14	1.20-1.35	2.0-6.0	0.06-0.15	3.6-5.5	<2	Low	0.17	4	2-3
	11-36	8-18	1.20-1.35	0.6-2.0	0.08-0.17	3.6-5.5	<2	Low	0.17		
	36-60	1-8	1.35-1.55	>2.0	0.04-0.08	3.6-5.5	<2	Low	0.17		
25B: Norfolk	0-17	5-18	1.45-1.65	2.0-6.0	0.10-0.15	4.5-5.5	<2	Low	0.17	5	.5-2
	17-39	18-35	1.35-1.45	0.6-2.0	0.10-0.15	4.5-5.5	<2	Low	0.24		
	39-72	20-40	1.30-1.40	0.6-2.0	0.10-0.15	4.5-5.5	<2	Low	0.24		
26B*: Pamunkey	0-14	3-10	1.35-1.55	2.0-20	0.06-0.15	4.5-6.5	<2	Low	0.28	4	.5-2
	14-43	20-35	1.35-1.65	0.6-2.0	0.13-0.19	4.5-7.3	<2	Low	0.28		
	43-75	4-18	1.40-1.65	2.0-20	0.04-0.12	4.5-7.3	<2	Low	0.28		
27: Peawick	0-7	10-25	1.20-1.30	0.6-2.0	0.10-0.17	3.6-5.0	<2	Low	0.37	4	.5-2
	7-99	35-60	1.30-1.50	<0.06	0.10-0.17	3.6-5.0	<2	High	0.24		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF 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	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm				Pct
28---------------- Seabrook	0-9	2-12	1.30-1.60	6.0-20	0.05-0.11	4.5-5.5	<2	Low----------	0.10	5	.5-2
	9-72	2-12	1.30-1.60	6.0-20	0.02-0.09	4.5-6.0	<2	Low----------	0.10		
29A, 29B--------- Slagle	0-9	8-22	1.30-1.45	2.0-6.0	0.10-0.17	3.6-5.5	<2	Low----------	0.24	3	.5-1
	9-25	12-35	1.30-1.45	0.6-2.0	0.10-0.18	3.6-5.5	<2	Low----------	0.24		
	25-60	18-40	1.35-1.60	0.06-0.6	0.12-0.18	3.6-5.5	<2	Moderate----	0.24		
30---------------- State	0-11	5-15	1.25-1.40	0.6-6.0	0.10-0.20	4.5-5.5	<2	Low----------	0.28	4	.5-2
	11-52	18-34	1.35-1.50	0.6-2.0	0.14-0.19	4.5-5.5	<2	Low----------	0.28		
	52-97	2-15	1.35-1.50	>2.0	0.02-0.10	4.5-6.0	<2	Low----------	0.17		
31B--------------- Suffolk	0-14	6-18	1.35-1.45	2.0-6.0	0.12-0.15	3.6-5.5	<2	Low----------	0.28	4	.5-2
	14-40	10-33	1.40-1.50	0.6-2.0	0.12-0.20	3.6-5.5	<2	Low----------	0.28		
	40-64	4-10	1.40-1.50	2.0-20	0.04-0.10	3.6-6.0	<2	Low----------	0.17		
32---------------- Tetotum	0-10	10-22	1.20-1.35	0.6-2.0	0.14-0.19	3.6-5.5	<2	Low----------	0.32	4	.5-2
	10-51	18-35	1.25-1.45	0.6-2.0	0.14-0.19	3.6-5.5	<2	Low----------	0.32		
	51-65	5-30	1.25-1.45	0.6-20	0.06-0.15	3.6-5.5	<2	Low----------	0.24		
33---------------- Tomotley	0-8	5-20	1.30-1.60	2.0-6.0	0.10-0.15	3.6-5.5	<2	Low----------	0.20	5	1-2
	8-50	18-35	1.30-1.50	0.6-2.0	0.12-0.18	3.6-5.5	<2	Low----------	0.20		
	50-68	2-15	1.35-1.50	>2.0	0.04-0.10	3.6-5.5	<2	Low----------	0.17		
34B, 34C---------- Uchee	0-24	3-10	1.30-1.60	6.0-20	0.05-0.10	4.5-5.5	<2	Low----------	0.20	5	.5-1
	24-36	8-30	1.30-1.45	0.6-2.0	0.10-0.15	4.5-5.5	<2	Low----------	0.24		
	36-56	25-50	1.30-1.50	0.2-0.6	0.10-0.16	4.5-5.5	<2	Moderate----	0.28		
	56-65	15-40	1.30-1.50	0.2-2.0	0.10-0.16	4.5-5.5	<2	Moderate----	0.28		
35. Udorthents											
36*: Udorthents.											
Dumps.											
37*. Urban land											
38---------------- Yemassee	0-11	10-20	1.30-1.60	2.0-6.0	0.10-0.15	3.6-5.5	<2	Low----------	0.20	5	.5-2
	11-51	18-35	1.30-1.50	0.6-2.0	0.11-0.18	3.6-5.5	<2	Low----------	0.20		
	51-63	12-40	1.30-1.50	0.6-2.0	0.11-0.17	3.6-5.5	<2	Low----------	0.20		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
1----------------- Altavista	C	None---------	---	---	1.5-2.5	Apparent	Dec-Mar	>60	---	Moderate	Moderate.
2----------------- Augusta	C	None---------	---	---	1.0-2.0	Apparent	Jan-May	>60	---	High-----	Moderate.
3----------------- Axis	D	Frequent----	Very brief	Jan-Dec	+1-1.0	Apparent	Jan-Dec	>60	---	High-----	High.
4**. Beaches											
5----------------- Bethera	D	None---------	---	---	+1-1.5	Apparent	Dec-Apr	>60	---	High-----	High.
6----------------- Bohicket	D	Frequent----	Very brief	Jan-Dec	+2-0	Apparent	Jan-Dec	>60	---	High-----	High.
7----------------- Bojac	B	None---------	---	---	>4.0	Apparent	Nov-Apr	>60	---	Low------	High.
8B---------------- Caroline	C	None---------	---	---	>6.0	---	---	>60	---	High-----	High.
9----------------- Chickahominy	D	None---------	---	---	0-0.5	Apparent	Nov-Apr	>60	---	High-----	High.
10B, 10C---------- Craven	C	None---------	---	---	2.0-3.0	Apparent	Dec-Apr	>60	---	High-----	High.
11B**, 11C**:											
Craven------------	C	None---------	---	---	2.0-3.0	Apparent	Dec-Apr	>60	---	High-----	High.
Uchee-------------	A	None---------	---	---	3.5-5.0	Perched	Jan-Apr	>60	---	Low------	High.
12---------------- Dogue	C	None---------	---	---	1.5-3.0	Apparent	Jan-Mar	>60	---	High-----	High.
13---------------- Dragston	C	None---------	---	---	1.0-2.5	Apparent	Nov-Apr	>60	---	Low------	High.
14B, 14C, 15D**, 15E**, 15F**----- Emporia	C	None---------	---	---	3.0-4.5	Perched	Nov-Apr	>60	---	Moderate	High.
16---------------- Izagora	C	None---------	---	---	2.0-3.0	Apparent	Dec-Mar	>60	---	Moderate	High.
17**-------------- Johnston	D	Frequent----	Brief to long.	Nov-Jul	+1-1.5	Apparent	Nov-Jun	>60	---	High-----	High.
18B--------------- Kempsville	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
19B**:											
Kempsville--------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
Emporia-----------	C	None---------	---	---	3.0-4.5	Perched	Nov-Apr	>60	---	Moderate	High.
20B--------------- Kenansville	A	None---------	---	---	4.0-6.0	Apparent	Dec-Apr	>60	---	Low------	High.
21---------------- Levy	D	Frequent----	Very long	Jan-Dec	+2-+1	Apparent	Jan-Dec	>60	---	High-----	High.

See footnotes at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
22----------------- Munden	B	None---------	---	---	1.5-2.5	Apparent	Dec-Apr	>60	---	Low-------	High.
23----------------- Newflat	D	None---------	---	---	0.5-1.5	Apparent	Nov-Apr	>60	---	High------	High.
24----------------- Nimmo	D	None---------	---	---	0-0.5	Apparent	Dec-Apr	>60	---	Low-------	High.
25B---------------- Norfolk	B	None---------	---	---	4.0-6.0	Perched	Jan-Mar	>60	---	Moderate	High.
26B**-------------- Pamunkey	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
27----------------- Peawick	D	None---------	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	High------	High.
28----------------- Seabrook	C	None---------	---	---	2.0-4.0	Apparent	Dec-Mar	>60	---	Low-------	Moderate.
29A, 29B----------- Slagle	C	None---------	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	Moderate	High.
30----------------- State	B	None---------	---	---	4.0-6.0	Apparent	Dec-Jun	>60	---	Moderate	High.
31B---------------- Suffolk	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High.
32----------------- Tetotum	C	None---------	---	---	1.5-2.5	Apparent	Dec-Apr	>60	---	High------	High.
33----------------- Tomotley	B/D	None---------	---	---	0-1.0	Apparent	Dec-Mar	>60	---	High------	High.
34B, 34C----------- Uchee	A	None---------	---	---	3.5-5.0	Perched	Jan-Apr	>60	---	Low-------	High.
35**. Udorthents											
36**: Udorthents.											
Dumps.											
37**. Urban land											
38----------------- Yemassee	C	None---------	---	---	1.0-1.5	Apparent	Dec-Mar	>60	---	High------	High.

* A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Altavista	Fine-loamy, mixed, thermic Aquic Hapludults
Augusta	Fine-loamy, mixed, thermic Aeric Ochraquults
Axis	Coarse-loamy, mixed, nonacid, thermic Typic Sulfaquents
Bethera	Clayey, mixed, thermic Typic Paleaquults
Bohicket	Fine, mixed, nonacid, thermic Typic Sulfaquents
Bojac	Coarse-loamy, mixed, thermic Typic Hapludults
*Caroline	Clayey, mixed, thermic Typic Paleudults
Chickahominy	Clayey, mixed, thermic Typic Ochraquults
*Craven	Clayey, mixed, thermic Aquic Hapludults
Dogue	Clayey, mixed, thermic Aquic Hapludults
Dragston	Coarse-loamy, mixed, thermic Aeric Ochraquults
Emporia	Fine-loamy, siliceous, thermic Typic Hapludults
Izagora	Fine-loamy, siliceous, thermic Aquic Paleudults
*Johnston	Coarse-loamy, siliceous, acid, thermic Cumulic Humaquepts
Kempsville	Fine-loamy, siliceous, thermic Typic Hapludults
Kenansville	Loamy, siliceous, thermic Arenic Hapludults
Levy	Fine, mixed, acid, thermic Typic Hydraquents
Munden	Coarse-loamy, mixed, thermic Aquic Hapludults
Newflat	Clayey, mixed, thermic Aeric Ochraquults
Nimmo	Coarse-loamy, mixed, thermic Typic Ochraquults
Norfolk	Fine-loamy, siliceous, thermic Typic Paleudults
Pamunkey	Fine-loamy, mixed, thermic Ultic Hapludalfs
Peawick	Clayey, mixed, thermic Aquic Hapludults
Seabrook	Mixed, thermic Aquic Udipsamments
Slagle	Fine-loamy, siliceous, thermic Aquic Hapludults
State	Fine-loamy, mixed, thermic Typic Hapludults
Suffolk	Fine-loamy, siliceous, thermic Typic Hapludults
Tetotum	Fine-loamy, mixed, thermic Aquic Hapludults
Tomotley	Fine-loamy, mixed, thermic Typic Ochraquults
Uchee	Loamy, siliceous, thermic Arenic Hapludults
Udorthents	Udorthents
*Yemassee	Fine-loamy, siliceous, thermic Aeric Ochraquults

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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