SOIL SURVEY OF

Cape May County, New Jersey

United States Department of Agriculture
Soil Conservation Service
In cooperation with
New Jersey Agricultural Experiment Station
Cook College, Rutgers University
and the
New Jersey Department of Agriculture
State Soil Conservation Committee

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1966–69. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service; the New Jersey Agricultural Experiment Station, Rutgers University; the New Jersey Department of Agriculture, State Soil Conservation Committee; and the Board of Freeholders of Cape May County. It is part of the technical assistance furnished to the Cape-Atlantic Soil Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Cape May County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in Cape May County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Cover picture: Area of Coastal beach.

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CAPE MAY COUNTY forms the southern tip of New Jersey (fig. 1). It has an area of about 170,688 acres and has 58 miles of shoreline. The peninsula is about 9 miles wide and is wholly within the Coastal Plain province. The topography is characterized by gentle slopes, and the highest elevation in the county is 55 feet.

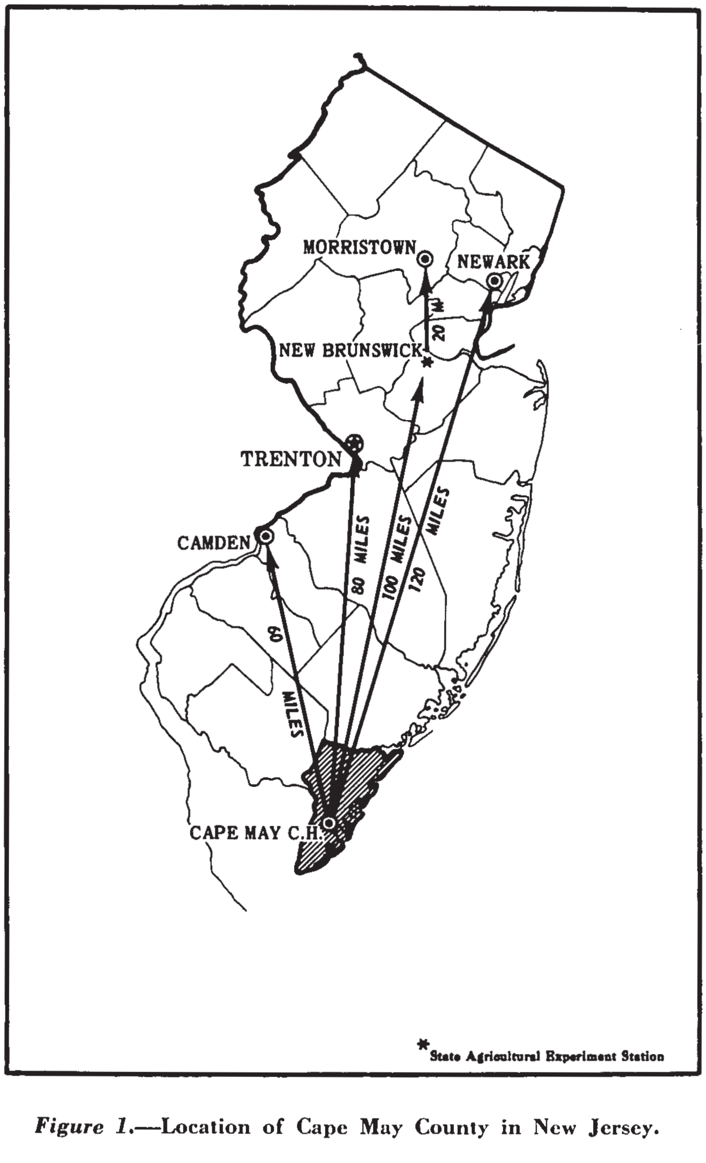

Figure 1.—Location of Cape May County in New Jersey.

About 45 percent of the county is woodland. The upland forests are mostly mixed oaks and pines. Atlantic white-cedar and red maples are in the swamps. Tidal flats that have native grass vegetation make up 27 percent of the county. A small part of these tidal lands has been developed into marina-type residential areas. Urban land, including residential, commercial, and industrial land, is about 15 percent of the county. Farms make up 9 percent, and municipal parks and golf courses are 4 percent. The main farm product is vegetables.

The county consists of two contrasting areas. The larger area, about 100,000 acres, is the upland part of the Cape. In this part of the county, population density ranges from 40 to 800 per square mile. About half of the permanent residents live in 8 percent of the area on the barrier islands adjacent to the beaches, and the population density ranges from 300 to 3,600 per square mile.

In 1970 the residential population of the county was 59,554. The summer population is estimated to be more than one-half million. The large summer population is a result of shore activities. In 1970 Ocean City, the largest town, had a population of 10,575. The county seat is at Cape May Court House.

The resort business is the main commercial activity in the county. This involves mainly businesses such as boating, sport fishing, campsites, mobile home sites, motels, hotels, restaurants, souvenir shops, and others. Industries in the county in addition to farming include sand and gravel quarrying, magnesium production, seafood and vegetable processing, commercial fishing, fabric processing, hunting, fur trapping, and a Coast Guard Training Center.

During the past 10 to 15 years, the camping business has grown markedly. In 1973, 43 private camps, covering more than 2,000 acres, contained 13,000 individual campsites.

In the last 100 years, considerable effort has been made to reduce the mosquito population in the county. Efforts first were made in ditching the tidal marshes to drain the ponded areas where breeding took place. Later, efforts also included extensive spraying. Years ago, the mosquito population was high enough to create a problem in obtaining farm workers to harvest crops in the fields.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Cape May County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, and many facts about the soils. They dug many holes to expose 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 that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Downer and Sassafras, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Downer sandy loam, 0 to 2 percent slopes, is one of several phases within the Downer series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Coastal beach-Urban land complex is an example.

In most areas surveyed there are places where the soil material is so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Tidal marsh and Muck are examples.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the properties of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Cape May County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the

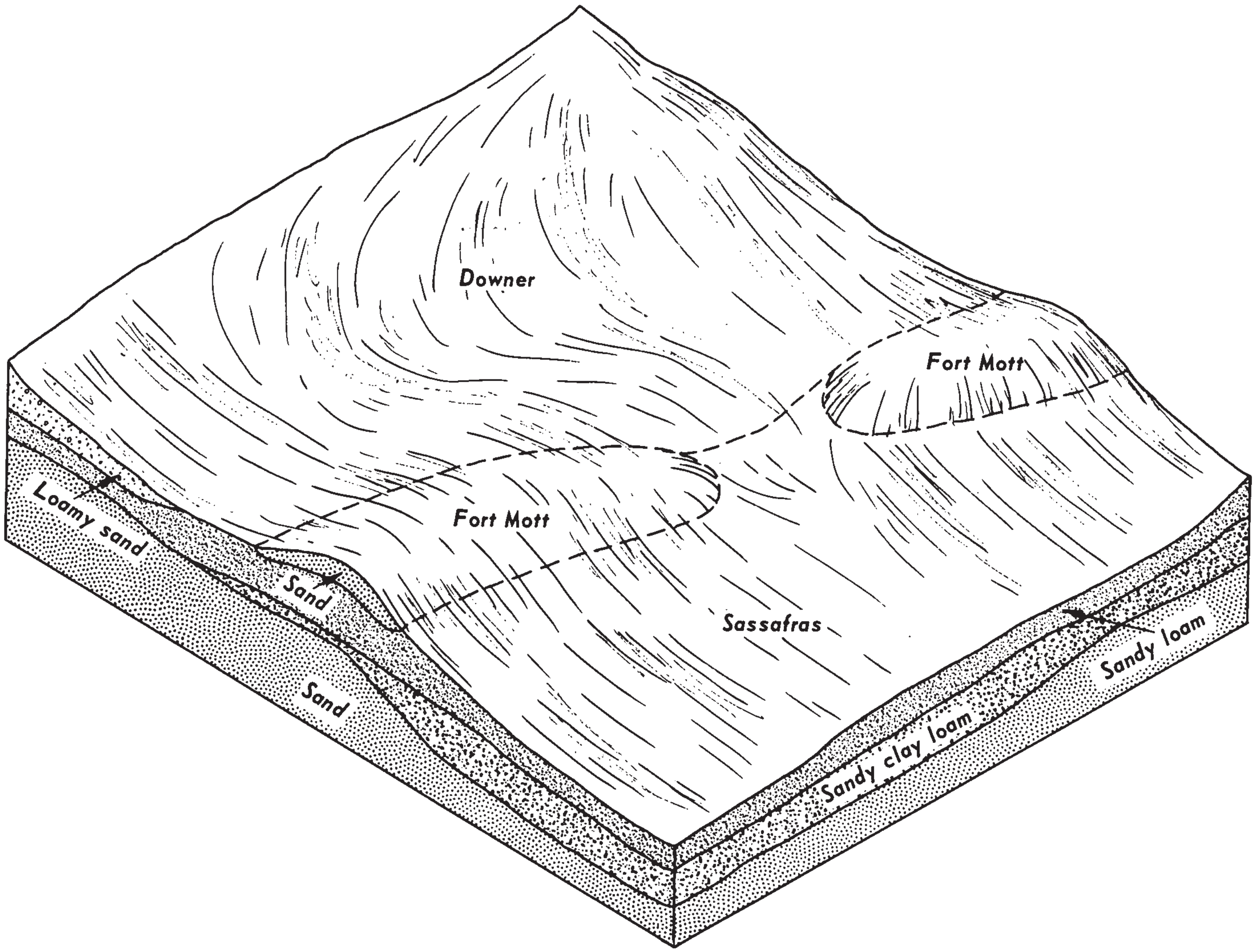

Figure 2.—Typical pattern of soils and underlying material in Downer-Sassafras-Fort Mott association.

management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Cape May County are described in the following pages.

1. *Downer-Sassafras-Fort Mott association*

Nearly level and gently sloping, well-drained soils that have a loamy subsoil and a dominantly loamy and sandy substratum

This association makes up 28 percent of the county. It is 43 percent Downer soils, 30 percent Sassafras soils, 12 percent Fort Mott soils, and 15 percent minor soils and land types (fig. 2). The major soils in this association are in relatively high positions on the landscape and generally are well drained, but a small acreage of the soils in the lowest positions has a water table that is seasonally within 2½ to 3½ feet of the surface.

Downer soils have a surface layer of sandy loam and loamy sand and a subsoil of sandy loam. Sassafras soils have a surface layer and subsoil of sandy loam. Fort Mott soils have a surface layer of sand and a subsoil of sandy loam.

The minor soils and land types are Evesboro soils; Fill land, sandy; pits, sand and gravel; and Aura, Hammonton, and Woodstown soils. These soils and land types are dominantly excessively drained or well drained, but a small acreage is somewhat poorly drained. Excavation in many of the gravel pits has been deep enough to reach the water table.

Most areas of this association have been cleared for farming. Uncleared areas are mainly in oak trees. The soils in this association are the most productive in the county. The soils that have a surface layer of loamy sand or sand are droughty and are subject to soil blowing. All high-value crops grown in this association are irrigated. Most cropped areas are used to produce lima beans for freezing.

The major soils of this association have the fewest

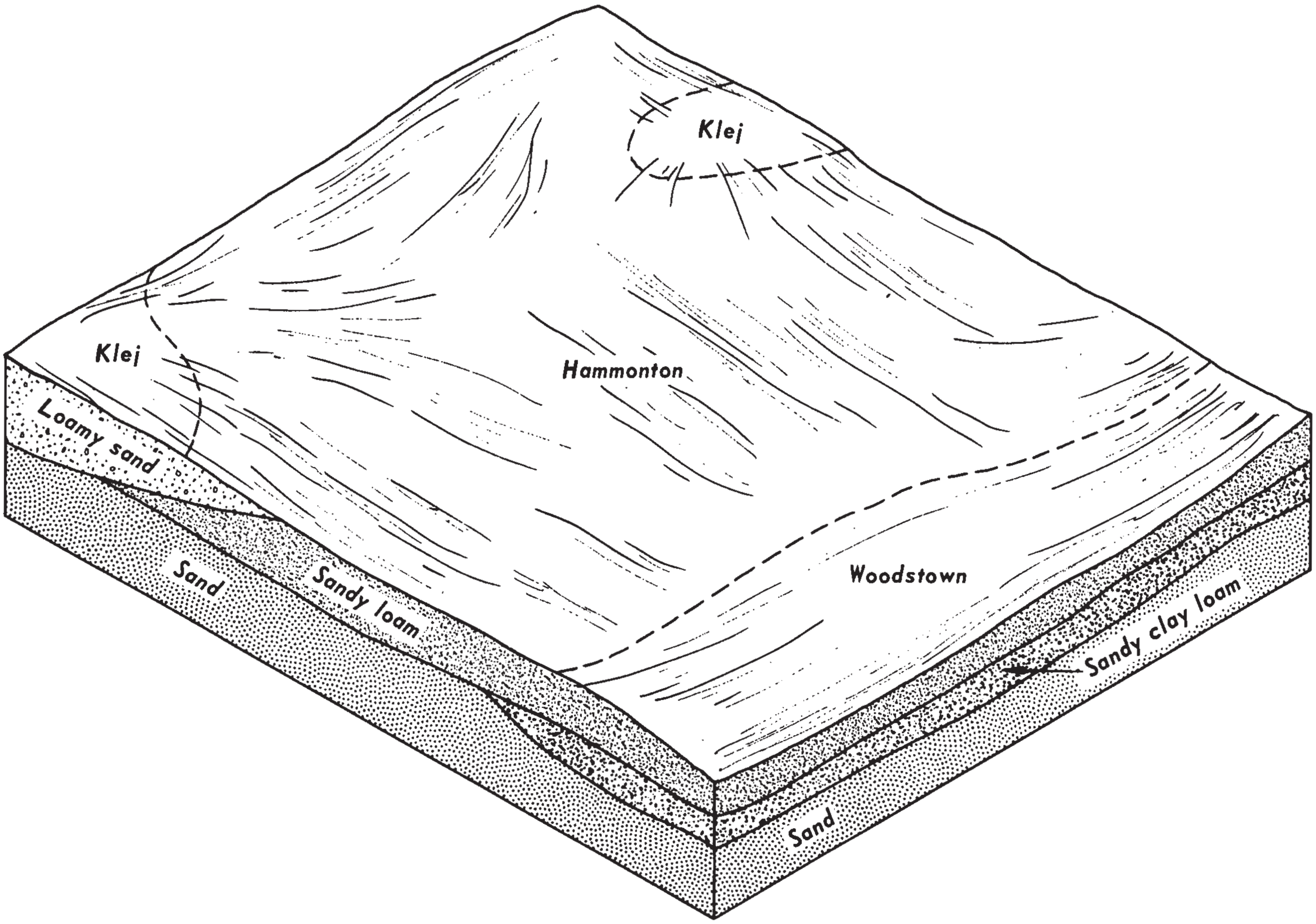

Figure 3.—**Typical pattern of soils and underlying material in Hammonton-Woodstown-Klej association.**

limitations in the county for farming; for residential, commercial, and industrial development, as well as for most other urban development; and for campsites.

2. *Hammonton-Woodstown-Klej association*

Nearly level, moderately well drained and somewhat poorly drained soils that have a dominantly loamy subsoil and a sandy substratum

This association makes up 23 percent of the county. It is 63 percent Hammonton soils, 14 percent Woodstown soils, 6 percent Klej soils, and 17 percent minor soils and land types (fig. 3). The association is on intermediate positions on the landscape. The water table of the major soils fluctuates and is seasonally moderately high. It ranges from a depth of 1 to 3 feet at the highest to 4 feet or more in summer.

Hammonton soils have a surface layer of loamy sand or sandy loam and a subsoil of sandy loam. Woodstown soils have a surface layer of sandy loam and a subsoil of sandy clay loam. Klej soils have a surface layer of loamy sand and are underlain at a depth of about 18 inches by sand.

The minor soils and land types are Downer soils; Sassafras soils; Fill land, sandy; Evesboro soils; sand and gravel pits; and Pocomoke soils. Pocomoke soils are very poorly drained, and the rest are well drained or excessively drained.

Less than half of this association has been cleared for cultivation. Uncleared areas are mainly in oak trees. Drainage improvement is needed if high-value crops are grown.

This association has some limitations if farmed, and the fluctuating water table is a limitation for many other uses, such as residential foundations, septic-tank effluent disposal, sanitary landfills, road construction, and campsites.

3. *Pocomoke-Muck association*

Nearly level, very poorly drained soils that have a loamy subsoil and a sandy substratum and soils that are organic throughout

This association makes up 14 percent of the county. It is 70 percent Pocomoke soils, 25 percent Muck, and 5 percent minor soils (fig. 4). The association is in

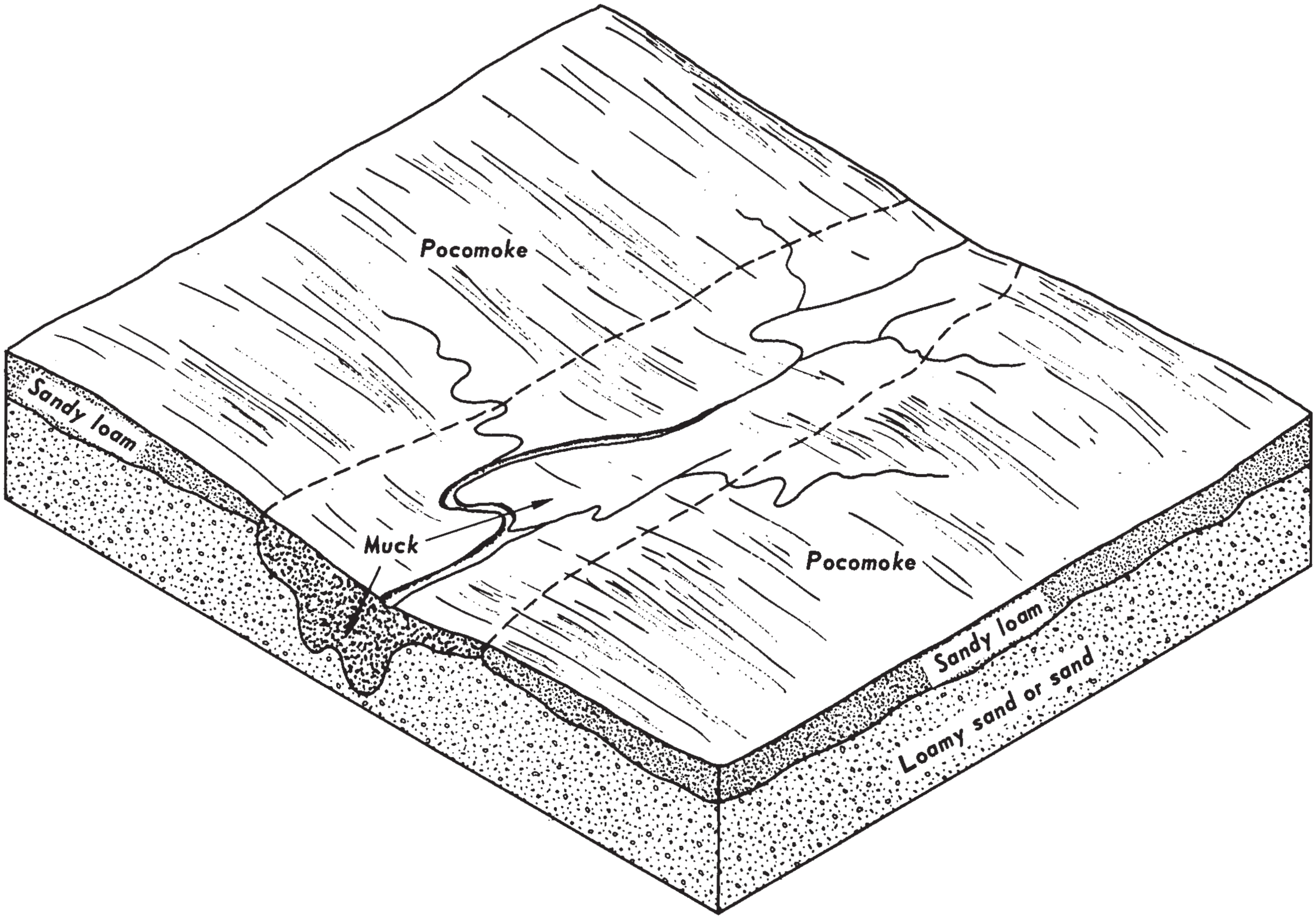

Figure 4.—Typical pattern of soils and underlying material in Pocomoke-Muck association.

the lowest positions on the landscape drained by freshwater.

Pocomoke soils have a surface layer and a subsoil of sandy loam. Muck is highly organic. Both Pocomoke soils and Muck have a water table that is at the surface in winter, and if saturated both have low bearing capacity.

The minor soils are Berryland, Klej, Hammonton, and Woodstown soils. Berryland soils are very poorly drained, and the others are moderately well drained or somewhat poorly drained.

Only a small acreage of Pocomoke soils and none of Muck have been cleared for farming. Uncleared areas of Pocomoke soils are in red maples, sweetgums, or pitch pines. In most places Muck has a stand of Atlantic white-cedar. Drainage of the association is difficult and expensive, and in places the difference in elevation is not sufficient to obtain drainage improvement. If the soils are drained, late-season vegetables, corn, or soybeans can be grown.

The high water table limits this association for most urban uses. The association is well suited to groundwater pond excavations.

4. Tidal marsh association

Nearly level, very poorly drained silty or mucky tidal flats that are subject to daily flooding

This association makes up 28 percent of the county. It is 96 percent Tidal marsh and 4 percent Muck and Fill land, sandy organic substratum.

Tidal marsh supports a stand of salt-tolerant grasses. A few shrubs are on the higher positions. Formerly these tidal flats were grazed and extensively cut for salt hay, but now only a small acreage is cut for hay. Several shallow-water ponds have been constructed near Tuckahoe by the New Jersey Fish and Game Department. These ponds show how wildlife habitat can be improved and made more productive for both waterfowl and muskrat. These areas are extensively used for waterfowl hunting.

Firm foundations for buildings generally are difficult to provide. Pilings are used where the use of fill material is not practical. Some areas are used for marina-type residential developments. In these areas, channels are dredged and the marsh is filled with the excavated material. Community water and sewage plants are essential. The fill from channel excavation, generally only a few feet, provides only slight protection from coastal storms.

5. Coastal beach-Urban land association

Nearly level to strongly sloping barrier beaches and areas developed for residential and commercial uses

This association makes up 7 percent of the county. It is 70 percent Coastal beach-Urban land complex and 30 percent minor soils and land types.

Formerly Coastal beach consisted of bare beach and partly vegetated dunes. Near Avalon dunes are 10 to 48 feet high, and moving sand covers trees in places. Now many dunes have been leveled. Extensive areas have been developed for residential and commercial uses, and development continues at a rapid rate.

The dominant land type is Fill land, sandy organic substratum. It is mainly Tidal marsh that has been filled to aid development and construction.

The lower elevations in this association are subject to severe coastal storms that wash away or deposit sand, depending on the force and direction of the storm. Many buildings are destroyed when the coastal storms are severe. Large sections of the barrier beaches became isolated because roads are covered with water. Substantial money is expended in efforts to maintain the wide beaches. Some areas of the dunes have been planted to American beachgrass in an effort to stabilize the drifting sand.

Descriptions of the Soils

In this section the soils of Cape May County are described in detail and their use and management are described. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to unweathered underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Muck and Tidal marsh, for example, do not belong to a soil series but, nevertheless, are listed in alphabetic order along with the soil series.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Aura sandy loam, 0 to 5 percent slopes	650	0.4
Berryland sand	950	.6
Coastal beach-Urban land complex	8,700	5.1
Downer loamy sand, 0 to 3 percent slopes	10,500	6.2
Downer loamy sand, water table, 0 to 2 percent slopes	950	.6
Downer sandy loam, 0 to 2 percent slopes	3,950	2.3
Downer sandy loam, 2 to 5 percent slopes	700	.4
Downer sandy loam, gravelly substratum, 0 to 5 percent slopes	5,300	3.1
Evesboro sand, 0 to 5 percent slopes	3,400	2.0
Fill land, sandy	3,400	2.0
Fill land, sandy organic substratum	4,350	2.5
Fort Mott sand, 0 to 5 percent slopes	6,700	3.9
Hammonton loamy sand, 0 to 3 percent slopes	11,400	6.7
Hammonton sandy loam, 0 to 3 percent slopes	13,400	7.9
Klej loamy sand, 0 to 3 percent slopes	2,600	1.5
Muck	6,400	3.8
Pocomoke sandy loam	16,900	9.9
Sassafras sandy loam, 0 to 2 percent slopes	8,800	5.2
Sassafras sandy loam, 2 to 5 percent slopes	1,950	1.1
Sassafras sandy loam, water table, 0 to 2 percent slopes	4,350	2.5
Tidal marsh, deep	37,400	21.9
Tidal marsh, moderately deep	6,200	3.6
Tidal marsh, shallow	2,950	1.7
Woodstown sandy loam, 0 to 2 percent slopes	5,800	3.4
Pits, sand and gravel	2,400	1.4
Made land, sanitary land fill	200	.1
Water areas less than 40 acres	388	.2
Total	170,688	100.0

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland suitability group in which the mapping unit has been placed. The page for the description of each mapping unit can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*12*).[1]

Soil test data for representative profiles of some of the soils of Cape May County have been published (*18*).

Aura Series

The Aura series consists of nearly level to gently sloping, well-drained soils that have a firm layer in the lower part of the subsoil. These soils are in high positions on the landscape.

In a representative profile the plow layer is dark

[1] Italic numbers in parentheses refer to Literature Cited, p. 46.

grayish-brown sandy loam 10 inches thick. The subsoil is 40 inches thick. The upper 14 inches is yellowish-brown and dark yellowish-brown sandy loam. The lower 26 inches is firm, yellowish-red gravelly sandy clay loam. The substratum, between depths of 50 and 72 inches, is stratified, yellowish-red gravelly sandy loam and gravelly loamy sand.

The native vegetation is oaks, hickories, and scattered pines. The understory is blueberry and mountain-laurel.

Available water capacity is moderate. Roots do not readily penetrate the firm lower part of the subsoil. They are concentrated in the cracks. Permeability is moderately slow in the firm part of the subsoil, but it is faster below that. Organic-matter content is moderate, and natural fertility is medium.

Most areas of Aura soils are farmed. Unless limed, these soils are very strongly acid or extremely acid. They compact readily if they are worked when wet. Irrigation is needed for high-value crops. The soils are suited to vegetables and fruits commonly grown in the county.

Representative profile of Aura sandy loam, 0 to 5 percent slopes, on the New Jersey State Colony Farm at Woodbine:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, granular structure; friable; many roots; 5 percent rounded quartzose pebbles; strongly acid; abrupt, smooth boundary.

B21—10 to 15 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine, subangular blocky structure; friable; many roots; 5 percent rounded quartzose pebbles; strongly acid; gradual, irregular boundary.

B22t—15 to 24 inches, dark yellowish-brown (10YR 4/4) heavy sandy loam; moderate, medium, subangular blocky structure; friable; common roots; 5 percent rounded quartzose pebbles; thin discontinuous clay films on ped faces; strongly acid; gradual, irregular boundary.

IIB2t—24 to 50 inches, yellowish-red (5YR 5/8) gravelly sandy clay loam; massive; firm when dry, friable when moist; few fine roots, mostly in vertical cracks; all sand grains coated with clay; clay films on pebbles; 20 percent rounded quartzose pebbles; very strongly acid; abrupt, clear boundary.

IIC—50 to 72 inches, yellowish-red (5YR 5/6), stratified gravelly sandy loam and gravelly loamy sand; friable; 25 percent rounded quartzose pebbles; very strongly acid.

The solum ranges from 3 to 5 feet in thickness. Depth to the firm layer in the subsoil ranges from 20 to 30 inches but is most commonly 24 inches. Rounded quartzose pebbles are in most horizons. They range from a few to 15 percent in the upper part of the profile, from 10 to 30 percent in the lower part of the B horizon, and from 0 to 50 percent in the stratified C horizon.

The B horizon ranges from sandy loam to sandy clay loam or their gravelly analogs. The IIB2t horizon is firm to very firm. The C horizon is similar to the IIB2t horizon in color. It is friable in most places but contains some firm strata in places. Crossbedding is common in the C horizon.

Aura soils are near Sassafras, Downer, and Woodstown soils. Aura soils are firmer in the lower part of the subsoil than any of these soils. They lack the mottles that are common in Woodstown soils. They are finer textured in the subsoil than Downer soils.

Aura sandy loam, 0 to 5 percent slopes (ArB).—This soil is dominantly in the northern part of the county at an elevation of more than 35 feet. Included in mapping are areas of soils that have a surface layer of gravelly loam.

In farmed areas this soil crusts readily if organic-matter content is low. As a result, runoff and erosion increase, especially in irrigated areas. Well-managed cover crops maintain organic-matter content. Capability unit IIs–9; woodland suitability group 3o1.

Berryland Series

The Berryland series consists of nearly level, very poorly drained, sandy soils. These soils are in very low positions on the landscape.

In a representative profile the surface layer is very dark gray sand 9 inches thick. The subsoil is 29 inches thick. The upper 8 inches is dark reddish-brown, weakly cemented sand. The next 13 inches is mottled, gray sand. The lower 8 inches is dark reddish-brown sand. The substratum, between depths of 38 and 60 inches, is gray sand and thin bands of greenish-gray sandy clay loam.

The native vegetation is pitch pines, red maples, sweetgums, blackgums, and scattered Atlantic white-cedars. The understory is a dense stand of high-bush blueberry, inkberry, sweet pepperbush, sheep laurel, and greenbriar.

If these soils are drained, available water capacity is low. The water table is at or near the surface for more than 6 months of the year in undrained areas and drops to a depth of 2 to 3 feet in summer. Plants can obtain additional water from the water table throughout the year. Permeability is moderately rapid. Organic-matter content is high, but the natural fertility is low.

Most areas of Berryland soils are wooded. Unless limed, these soils are strongly acid or extremely acid. The weakly cemented subsoil does not restrict root penetration markedly. Drainage improvement is needed if these soils are farmed, but it is generally costly because ditches must be deep to obtain sufficient fall for an outlet of the water. The soils are suited to blueberries if water level controls are installed. They are generally good sites for ground-water ponds because recharge rates are rapid unless the soils are underlain by clay.

Representative profile of Berryland sand, ¾ mile east of Cedar Swamp Creek on Tuckahoe Road, ½ mile south along powerline:

A1—0 to 9 inches, very dark gray (10YR 3/1) sand; single grained; loose; many fine and medium roots; pores are mostly filled with organic matter; 3 percent rounded quartzose pebbles; extremely acid; abrupt, wavy boundary.

B2h—9 to 17 inches, dark reddish-brown (5YR 3/2) sand; massive; friable when moist, slightly firm when dry, weakly cemented; many fine pores; about all sand grains coated with organic stains; extremely acid; gradual, irregular boundary.

B3g—17 to 30 inches, gray (5Y 6/1) sand; common, medium, faint, pale-yellow (5Y 8/3) mottles; single grained; loose; few roots; 5 percent rounded quartzose pebbles as much as 1½ inches in diameter; extremely acid; clear, wavy boundary.

Bh—30 to 38 inches, dark reddish-brown (5YR 2/2) sand; very dark brown (10YR 2/2) stains along roots; massive; weakly cemented to loose; many fine and medium roots; 15 percent rounded quartzose pebbles; extremely acid; abrupt, wavy boundary.

C—38 to 60 inches, stratified gray (5YR 6/1) sand; thin bands of greenish-gray (5GY 6/1) sandy clay loam beginning at a depth of 42 inches; thick strata of sand are single grained, thin strata of sandy clay loam are massive; thick strata loose, thin strata friable; very strongly acid.

The solum ranges from 28 to 40 inches in thickness. Rounded quartzose pebbles are normally less than 5 percent of the solum but range to as much as 15 percent in some strata of the C horizon.

The A horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1). In places, several Bh horizons are at various depths below the first B2h horizon. The B2h and Bh horizons range from dark reddish brown (5YR 3/2) to very dark brown (10YR 2/2). The consistence ranges from very firm to loose, but very large areas have loose consistence. In places no mottling occurs.

Berryland soils are near Muck and Tidal marsh and Klej and Hammonton soils. Berryland soils lack the thick organic deposits common to Muck. They are much sandier than Tidal marsh. They lack the yellowish-brown colors common to Klej and Hammonton soils.

Berryland sand (Bp).—Berryland soils are mostly in swamps in the northern part of the county.

Included with this soil in mapping are areas of soils that have a mucky surface layer 6 to 12 inches thick and many areas where the surface layer is very dark gray sand and is less than 9 inches thick. Also included are areas that have a finer textured substratum below a depth of 40 inches. In these areas, the recharge rate of ground-water ponds is slower. In places the upper layer of the subsoil is less than 8 inches thick.

Because this soil is in such low positions, it receives runoff from slopes above. It is subject to stream overflow in some places, especially where it is adjacent to areas of Muck. Where it is adjacent to Tidal marsh, it is subject to tidal flooding and salt spraying. Capability unit Vw–26; woodland suitability group 3w1.

Coastal Beach-Urban Land Complex

Coastal beach-Urban land complex (CU) consists of undeveloped coastal beaches and of coastal beach areas used for residential or commercial purposes. The percentage of each is about equal, but Urban land dominates in areas such as Ocean City and Wildwood.

Coastal beach soils are on a chain of long, narrow barrier beach islands east of the mainland and on less extensive narrow strips of beach along Delaware Bay. The islands are 600 feet to 1 mile wide and about 7 miles long. They are separated from the mainland by tidal marshes, creeks, and bays 2 to 5 miles wide. The elevation of the islands ranges from about 7 feet above mean sea level in the northern part to 12 feet in the southern part. Sand dunes, a few feet to 48 feet high, occur where the islands have not been developed. Development of these barrier beaches continues at a rapid rate. During development, fill is added in many places.

The native vegetation on the undeveloped islands is controlled by the very low fertility of the soils, the effect of wave and tidal forces, and the effect of salt spray and wind action (*17*). The primary dunes, the ones nearest to the ocean, mainly support American beachgrass, coastal panicgrass, bitter panicum, seaside bluestem, seaside goldenrod, saltmeadow cordgrass, sea rocket, sandbur, and prickly saltwort. The troughs between dunes generally have a cover of bayberry, beach plum, greenbriar, beach pea, beach heather, Japanese honeysuckle, grapes, and other shrubs. The dunes that are farthest from the ocean have a forest cover of American holly, redcedar, sassafras, black cherry, shadbush, smooth sumac, persimmon, and willows. In many places trees and shrubs become shaped by the wind. In places the drifting sand covers the vegetation. Extensive areas have been planted to American beachgrass to stabilize the drifting sand (fig. 5).

Natural drainage is excessive, and permeability is rapid. Available water capacity is very low. Organic-matter content and natural fertility are very low. Capability unit VIIIs–31; woodland suitability group unassigned.

Downer Series

The Downer series consists of nearly level to gently sloping, well-drained soils. These soils are in high positions on the landscape.

In a representative profile the plow layer is dark grayish-brown loamy sand about 10 inches thick. The subsurface horizon is yellowish-brown loamy sand about 8 inches thick. The subsoil is strong-brown sandy loam about 18 inches thick. The substratum, between depths of 36 and 60 inches, is stratified layers of yellowish-brown loamy sand and gravelly sandy loam.

The native vegetation is oaks, hickories, and scattered pines. The understory is blueberry and mountain-laurel.

Available water capacity is low or moderate. Permeability is moderately rapid in the subsoil. Organic-matter content is low, and the natural fertility is low or medium.

Most areas of Downer soils are wooded, but some areas are farmed. Unless limed, these soils are very strongly acid or extremely acid. Applications of fertilizer and lime leach rapidly. High-value crops need irrigation. The soils are easily worked. They are well suited to almost all vegetables grown in the county.

Representative profile of Downer loamy sand, 0 to 3 percent slopes, on the Swainton Plant Material Center Farm, 300 feet north of irrigation pond:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loamy sand; weak, fine, granular structure; very friable; many fine roots; strongly acid; abrupt, smooth boundary.

A2—10 to 18 inches, yellowish-brown (10YR 5/6) loamy sand; very weak, fine, granular structure; very friable; common fine roots; strongly acid; gradual, wavy boundary.

B2t—18 to 36 inches, strong-brown (7.5YR 5/6) light sandy loam; weak, medium to coarse, subangular blocky structure; friable when moist, slightly sticky when wet; few fine roots; sand grains strongly bridged with clay; strongly acid; gradual, wavy boundary.

IIC—36 to 60 inches, yellowish-brown (10YR 5/6) stratified loamy sand and gravelly sandy loam; massive; very friable; few fine roots; 10 percent fine pebbles in gravelly stratum; very strongly acid.

The solum ranges from 18 to 36 inches in thickness but is most commonly about 28 inches. Rounded quartzose pebbles make up as much as 5 percent of the solum and as much as 40 percent of some parts of the IIC horizon. Unplowed areas have a sequence of A1, A2, and Bh horizons that ranges from 1 inch to 5 inches in thickness.

The Ap horizon is dark grayish brown (10YR 4/2), brown (10YR 4/3), or grayish brown (10YR 5/2). It is sandy loam or loamy sand. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. In most places it is sandy loam, but in some places it contains thin layers of loamy sand between thicker layers of sandy loam. The stratified C horizon is dominantly loamy sand or sand and

***Figure 5.*—American beachgrass planted and snow fences installed to slow drifting sand.**

generally contains thin strata of sandy loam, some of which are weakly cemented.

Downer soils are near Hammonton, Fort Mott, Sassafras, Evesboro, Klej, and Aura soils. Downer soils lack the mottles common to Hammonton and Klej soils. They lack the thick, sandy A horizon common to Fort Mott soils. They have a finer textured B horizon than is common to Evesboro soils. Their B horizon is coarser textured than that of Aura and Sassafras soils.

Downer loamy sand, 0 to 3 percent slopes (DoA).—This soil has the profile described as representative of the series. Available water capacity is moderate, and natural fertility is low.

Included with this soil in mapping are small areas of soils that have slopes of more than 3 percent and areas of Klej soils that have a fluctuating water table and need drainage in places. Also included are areas of Fort Mott and Evesboro soils that are more droughty than this Downer soil.

This soil is subject to soil blowing, but cover crops, windstrips, and windbreaks can reduce this concern.

This soil is suited to early vegetables, fruit, and specialty crops (figs. 6 and 7). Because the available water capacity is low, irrigation is needed if high-value crops are grown. Capability unit IIs–6; woodland suitability group 3o1.

Downer loamy sand, water table, 0 to 2 percent slopes (DpA).—This soil has a profile similar to the one described as representative of the series, but the substratum is somewhat paler. Available water capacity and natural fertility are low. Elevation is generally less than 20 feet.

The ground water rises late in winter or in periods of heavy rain to a depth of about 30 to 36 inches, but in the growing season the ground water generally is at a depth of more than 4 feet and does not adversely affect crops. It does, however, cause wet basements and can cause seasonal failure of septic effluent disposal systems. Also, it produces a severe hazard of groundwater pollution.

Because the water table drops in spring, this soil needs irrigation if high-value crops are grown. Well-managed cover crops control soil blowing and maintain tilth. Capability unit IIs–6; woodland suitability group 3o1.

Downer sandy loam, 0 to 2 percent slopes (DrA).—This soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam. It generally has higher organic-matter content, is less subject to soil blowing, and does not warm quite so early in spring. Available water capacity is moderate, and natural fertility is medium.

This soil is well suited to lima beans and most vegetables and fruit grown in the county. Irrigation is needed if high-value crops are grown. Cover crops that are planted early and fertilized protect this soil in winter and also maintain tilth. Capability unit I–5; woodland suitability group 3o1.

Downer sandy loam, 2 to 5 percent slopes (DrB).—

Figure 6.—Area of Downer loamy sand. This soil is easily bedded for planting of specialty crops.

This soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam. It has higher organic-matter content and is less subject to soil blowing. This soil is subject to water erosion. Available water capacity is moderate, and natural fertility is medium.

Because slopes are not long, well-managed cover crops generally protect this soil in winter and also maintain tilth. Capability unit IIe–5; woodland suitability group 3o1.

Downer sandy loam, gravelly substratum, 0 to 5 percent slopes (DsB).—This soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam, the subsoil is not so thick, and the gravel content of the substratum is much higher (fig. 8). The depth to the gravelly substratum averages 24 inches but ranges from 18 to 30 inches. The substratum is at least 2 feet thick and is 20 to 40 percent gravel. This soil has moderate available water capacity. It dries early in the season, and plant growth is slow unless rainfall is abundant. Included in mapping are areas of soils where the surface layer and subsoil are more than 20 percent gravel.

This soil is a source of gravel and fill material. The gravel is dominantly less than 1 inch in diameter and is hard, rounded quartzose. Capability unit IIs–5; woodland suitability group 3o1.

Evesboro Series

The Evesboro series consists of deep, loose, excessively drained, sandy soils. These soils are in high positions on the landscape. They are nearly level to gently sloping.

In a representative profile the plow layer is grayish-brown sand about 10 inches thick. The subsurface layer is yellowish-brown sand about 10 inches thick. The subsoil is yellowish-brown sand about 12 inches thick. The substratum, between depths of 32 and 72 inches, is yellow sand.

The native vegetation is oaks and scattered pitch, Virginia, and shortleaf pines. The understory is mostly blueberry and brackenfern.

Available water capacity is low. Permeability is rapid. Organic-matter content and natural fertility are low.

Less than half of the acreage of Evesboro soils is farmed. Many areas revert to woodland if left idle. Unless limed, these soils are very strongly acid. Applications of fertilizer leach rapidly. If left bare, the soils blow easily. Young plants are damaged by sand blasting. The soils warm early in spring and are easily worked. In summer they get so hot that tomatoes and peppers are sometimes scalded by heat reflected from the sand. The soils are too droughty for most crops.

Figure 7.—**American beachgrass on Downer loamy sand is used to produce foundation stock for distribution to commercial nurseries.**

They are best suited to early vegetables and drought-resistant sweet potatoes, cantaloups, and pumpkins. Irrigation is needed for almost all crops, and intervals between irrigations are short.

Representative profile of Evesboro sand, 0 to 5 percent slopes, in the eastern part of the Plant Material Center Farm in Swainton:

Ap—0 to 10 inches, grayish-brown (10YR 5/2) sand; single grained; loose; many fine roots; very strongly acid; abrupt, wavy boundary.

A2—10 to 20 inches, yellowish-brown (10YR 5/6) sand; single grained; loose; common fine roots; sand grains are clean; very strongly acid; diffuse, wavy boundary.

B—20 to 32 inches, yellowish-brown (10YR 5/6) sand; massive; friable; sand grains are coated; few fine roots; very strongly acid; diffuse, wavy boundary.

C—32 to 72 inches, yellow (10YR 7/6) sand; single grained; loose; few fine roots; very strongly acid.

The solum ranges from 24 to 48 inches in thickness but is commonly about 30 inches. Rounded quartzose pebbles are in some places, especially in the C horizon. They are as much as 15 percent of some horizons, but these horizons generally are not thick.

Most wooded, unplowed areas have a thin sequence of A1, A2, and Bh horizons that is generally less than 6 inches thick combined. In these areas, the A1 horizon is black and is 1 or 2 inches thick. The next 2 to 3 inches is dominantly gray but contains many black grains and has a salt-and-pepper appearance. In places a thin brown Bh horizon also occurs. All of these horizons are mixed into the plow layer when the soils are farmed.

The Ap horizon has hue of 10YR, value of 4 to 5, and chroma of 2. Grayish colors are confined to the thin, undisturbed microsequence horizons. The B horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 6 to 8. It is sand or loamy sand. In places, the B horizon has thin lamellae. The C horizon has hue of 10YR or 7.5YR, value of 4 to 8, and chroma of 4 to 8. Below a depth of 40 inches in places, it is sandy loam or sandy clay loam.

Evesboro soils are near Klej, Fort Mott, Hammonton, and Downer soils. Evesboro soils lack the mottles common to Klej and Hammonton soils and do not have the sandy loam B horizon common to Fort Mott and Downer soils.

Evesboro sand, 0 to 5 percent slopes (EvB).—This soil is dominantly in the northern part of the county. Included in mapping are areas of Fort Mott and Downer soils. Also included are areas of Evesboro soils that have slopes of more than 5 percent. These slopes generally are not more than 200 feet long, and the hazard of erosion is slight.

Windbreaks and cover crops can be used to control soil blowing. Narrow strips of the cover crop can be left to provide some protection against blowing if the soil needs to be plowed early in the season. Windbreaks can be planted if crops are harvested so late that cover crops cannot protect the soil from blowing. Capability unit VIIs-7; woodland suitability group 3s1.

Fill Land

Fill land consists of areas that have fill material an

Figure 8.—**Area of Downer sandy loam, gravelly substratum, that has an uncommon amount of gravel on the surface.**

average of several feet in thickness. It is mapped as Fill land, sandy, and Fill land, sandy organic substratum.

Fill land, sandy, (FL) consists mostly of areas on the mainland that have several feet of fill material. These areas are quite sandy, are infertile, and have low available water capacity. Permeability is rapid, and the organic-matter content is low. Unless topsoil is brought in, vegetation that is not tolerant to sandy, droughty sites is difficult to establish.

Included in mapping are areas of soils that have been excavated to a depth that exposes the substratum. Also included are some residential developments where much of the soil material was disturbed by construction. Capability unit and woodland suitability group not assigned.

Fill land, sandy organic substratum, (FM) is mostly on the western edge of the barrier beach along the ocean. Most of it was originally so low in elevation that it was covered by tidal water daily. At that time, it consisted mostly of silt loam high in content of organic matter and was covered with salt-tolerant grasses and shrubs. Now most areas have been altered by diking, dredging, and filling. The dredged material ranges from fine sand to coarse sand and gravel as much as 2 inches in diameter. The fill material ranges from 1 to 20 feet in thickness and averages about 3 to 5 feet. Permeability is rapid, and available water capacity is low. The organic-matter content and natural fertility are low.

Most areas of this land type have little or no vegetation. Some areas are sparsely covered with bayberry or phragmites.

Many areas of Fill land, sandy organic substratum, on the barrier beach have been developed for residential or commercial uses. Because of the variable properties of the fill material, the thickness of fill, and the properties of the underlying material, special foundations are generally needed for all structures (fig. 9). Capability unit and woodland suitability group not assigned.

Fort Mott Series

The Fort Mott series consists of well-drained soils. These soils are in high positions on the landscape and are nearly level to gently sloping.

In a representative profile the surface layer is dark grayish-brown sand about 6 inches thick. The subsurface layer is yellowish-brown loamy sand about 18 inches thick. The subsoil is brown heavy sandy loam about 16 inches thick. The substratum, between depths of 40 and 60 inches, is pale-brown and yellowish-brown loose sand.

The native vegetation is mixed hardwoods and an understory of blueberry plants. Scattered pines are numerous and produce nearly pure pine stands if fields are left idle.

Available water capacity is moderate. Permeability is moderately rapid in the subsoil and is rapid in the surface layer and substratum. Organic-matter content and natural fertility are low.

Figure 9.—**Driving pile into an area of Fill land, sandy organic substratum, to provide a more stable foundation for structures.**

Most areas of Fort Mott soils are wooded. Unless limed, these soils are very strongly acid or extremely acid. Soil blowing is severe if the soils are left bare. In places, sand blowing has damaged young plants. These soils are droughty because the surface layer is thick. Irrigation is needed for almost all crops. The soils warm early and are well suited to early crops. The main crops are lima beans and cantaloups. Cover crops prevent soil blowing in winter, and windstrips protect young seedlings in spring.

Representative profile of Fort Mott sand, 0 to 5 percent slopes, in a wooded area, ½ mile east of Bay Shore Road, near Del Haven, north side of Fishing Creek Meadow:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) sand; single grained; loose; many fine and coarse roots; upper 2 inches consists of thin sequence of A1, A2, and Bh horizons; very strongly acid; gradual, wavy boundary.

A2&A3—6 to 24 inches, yellowish-brown (10YR 5/4) loamy sand; dark reddish-brown (5YR 3/3) stains along root channels; single grained; very friable; many fine roots; many fine pores; 3 percent rounded quartzose pebbles as much as ½ inch in diameter; very strongly acid; gradual, smooth boundary.

B2t—34 to 40 inches, brown (7.5YR 4/4) heavy sandy loam; moderate, coarse, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; many fine and medium pores; strong clay bridging on sand grains; 2 percent rounded quartzose pebbles; very strongly acid; clear, smooth boundary.

C1—40 to 50 inches, pale-brown (10YR 6/3) sand; brownish-yellow (10YR 6/8) bands 2 to 4 millimeters thick; single grained; loose; 2 percent rounded quartzose pebbles; very strongly acid.

C2—50 to 60 inches, yellowish-brown (10YR 5/6) sand; few, thin, strong-brown (7.5YR 5/8) bands; single grained; loose; few, fine and medium roots; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Rounded quartzose pebbles are generally less than 10 percent of the solum and substratum but are as much as 15 percent of the substratum in places.

The Ap horizon is dark grayish brown and is about 10 inches thick. It has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 to 4. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is sandy loam or light sandy clay loam. The C horizon has hue of 2.5Y, 10YR, and 7.5YR, value of 5 or 6, and chroma of 3 to 8. It is sand or loamy sand and has strata containing varying amounts of quartzose pebbles.

Fort Mott soils are near Downer, Evesboro, Klej, and Hammonton soils. Fort Mott soils have thicker sandy horizons than Downer soils. They have distinct clay accumulation in their subsoil, which Evesboro soils lack. They lack the mottles common to Klej and Hammonton soils.

Fort Mott sand, 0 to 5 percent slopes (FrB).—This soil is in high positions on the landscape. Included in mapping are areas of Evesboro, Downer, Klej, and Hammonton soils and areas of Fort Mott soils that have a surface layer of loamy sand. The included Klej and Hammonton soils have a fluctuating water table that is highest late in winter and early in spring. These included areas need drainage in places.

Cover crops, windstrips, or windbreaks can be used to reduce soil blowing. Capability unit IIIs–6; woodland suitability group 3o1.

Hammonton Series

The Hammonton series consists of nearly level, moderately well drained or somewhat poorly drained soils. In Cape May County these soils are dominantly moderately well drained. They are on intermediate positions on the landscape. In places the soils are in enclosed depressions, but typically they are on broad terraces several feet above dominantly wet areas.

In a representative profile the plow layer is very dark grayish brown loamy sand about 10 inches thick. The subsurface layer is yellowish-brown loamy sand about 8 inches thick. The subsoil is mottled, yellowish-brown sandy loam about 10 inches thick. The substratum, between depths of 28 and 60 inches, is stratified layers of pale-brown loamy sand and sandy loam that has brownish-yellow mottles.

The native vegetation is oaks, hickories, and scattered pines. Sour-gum is common in the forest stand. The lowest positions support lowland oaks, such as willow oak, and southern red oak. The understory includes sheep laurel and inkberry.

Available water capacity is moderate, but plants can draw additional water from the water table before it drops in summer. Deep-rooted plants can benefit from the water table even in summer. The water table is at a depth of 1½ to 3 feet in winter and early in spring and drops to a depth of 5 feet in summer. Permeability is moderately rapid. Organic-matter content is low, and natural fertility is low or medium.

Most areas of Hammonton soils are wooded, but some areas are farmed. Unless limed, these soils are very strongly acid or extremely acid. Applications of fertilizer and lime leach rapidly. The soils are easily worked, but tillage is delayed at times because of the seasonal high water table. Drainage is needed if high-value crops are grown. Irrigation is needed for high-value summer crops. If drained, the soils are better suited to fruits and vegetables than to most other uses.

Representative profile of Hammonton loamy sand, 0 to 3 percent slopes, north of Low Township High School and east of the Atlantic City Electric Transmission right-of-way:

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

A2—10 to 18 inches, yellowish-brown (10YR 5/4) loamy sand; very weak, fine, granular structure; very friable; common roots; medium acid; gradual, wavy boundary.

B2t—18 to 28 inches, yellowish-brown (10YR 5/4) sandy loam; common, medium, distinct, light brownish-gray (2.5Y 6/2) mottles; weak, medium, subangular blocky structure; friable; common fine roots; sand grains bridged with clay; few spheroidal concretions as much as ¼ inch in diameter; strongly acid; abrupt, smooth boundary.

IIC—28 to 60 inches, stratified pale-brown (10YR 6/3) loamy sand and thin lamellae of sandy loam; few, medium, distinct, brownish-yellow (10YR 6/8) mottles; single grained; loose; few fine roots; 5 percent rounded quartzose pebbles; very strongly acid.

The solum ranges from 20 to 40 inches in thickness but is commonly about 26 inches. The content of rounded quartzose pebbles generally is less than 10 percent in the solum and less than 20 percent in the C horizon, but in some profiles the C horizon is as much as 40 percent pebbles.

Unplowed areas have a thin sequence of A1, A2, and Bh horizons that ranges from 1 to 6 inches in thickness. Material from these horizons is mixed into the plow layer when the soils are farmed.

The Ap horizon has hue of 2.5Y to 10YR, value of 3 to 5, and chroma of 2 to 3. It is sandy loam or loamy sand. The B horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 3 to 6. In some profiles a thin lower B horizon has chroma of 2. Mottles vary widely in number, size, and contrast. The C horizon has hue of 5Y to 10YR, value of 5 to 7, and chroma of 2 to 8. Mottles, where present, range from few to many and from faint to prominent. The C horizon is dominantly loamy sand or sand and thin lamellae of sandy loam. In places strata of sandy loam or sandy clay loam are below a depth of 40 inches.

Hammonton soils are near Downer, Fort Mott, Sassafras, Evesboro, Pocomoke, and Klej soils. Hammonton soils have mottles that distinguish them from Downer, Sassafras, Fort Mott, and Evesboro soils. They have more clay in the B horizon than Klej soils. They have a B horizon that is not so gray as that of Pocomoke soils.

Hammonton loamy sand, 0 to 3 percent slopes (HaA).—This soil has the profile described as representative of the series. In some places the surface layer and subsurface layer are more than 20 inches thick. Included in mapping are areas of Klej, Downer, and Fort Mott soils.

This soil needs drainage, either underdrains or open ditches, if high-value crops are grown. Windbreaks, cover crops, or windstrips can be used to control soil blowing in farmed areas. Good cover-crop management that includes fertilization maintains the organic-matter content. Capability unit IIw–15; woodland suitability group 2o1.

Hammonton sandy loam, 0 to 3 percent slopes (HbA).—This soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam. Included in mapping are small areas of Hammonton loamy sand, Woodstown sandy loam, and Downer soils.

This soil needs drainage, either underdrains or ditches, if high-value crops are grown. Good cover-crop management maintains organic-matter content and tilth. Capability unit IIw–14; woodland suitability group 2o1.

Klej Series

The Klej series consists of nearly level, moderately well drained or somewhat poorly drained, sandy soils. In Cape May County these soils are dominantly moderately well drained. They are mainly in intermediate positions on the landscape.

In a representative profile the surface layer is dark grayish-brown loamy sand about 12 inches thick. The subsurface layer is brown loamy sand about 6 inches thick. The substratum, between depths of 18 and 60 inches, is light yellowish-brown and brownish-yellow sand.

The native vegetation is mostly oaks, hickories, blackgums, sweetgums, and scattered pines. The understory is mostly blueberry and dogwood, but in the lower positions sheep laurel, bayberry, inkberry, and greenbriar are also common.

Available water capacity is low, but deep-rooted plants can draw additional water seasonally from the water table. The depth to the seasonal high water table ranges from 1 foot to 4 feet late in winter and drops below 5 feet in summer. Permeability is rapid. Organic-matter content and natural fertility are low.

Most areas of Klej soils are farmed, but some areas are wooded. These soils are easily worked. Unless limed, they are very strongly acid or extremely acid. Added fertilizers leach readily. If left bare, the soils are subject to blowing. In the higher positions the soils warm early in spring. In the lower positions the seasonally high water table delays farming in places in spring. Drainage is needed if high-value crops are grown. The main crops are early vegetables, cantaloups, and pumpkins. Irrigation is needed for almost all crops.

Representative profile of Klej loamy sand, 0 to 3 percent slopes, ½ mile south and ¼ mile west of Villas on North Cape May Road:

Ap—0 to 12 inches, dark grayish-brown (10YR 4/2) loamy sand; weak, fine, granular structure; very friable; common fine roots; strongly acid; abrupt, smooth boundary.

A2—12 to 18 inches, brown (10YR 4/3) loamy sand; very weak, fine, granular structure; very friable; few fine roots; sand grains are coated; very strongly acid; clear, wavy boundary.

C1—18 to 32 inches, light yellowish-brown (10YR 6/4) sand; few, fine, faint, light brownish-gray (10YR 6/2) and light-gray (10YR 7/2) mottles; single grained; loose; some sand grains are coated; few spheroidal concretions as much as ¼ inch in diameter; very strongly acid; clear, wavy boundary.

C2—32 to 45 inches, light yellowish-brown (10YR 6/4) sand; common, medium, faint, light-gray (10YR 7/2) and yellowish-brown (10YR 5/8) mottles; single grained; loose; few roots; very strongly acid; clear, wavy boundary.

C3—45 to 60 inches, brownish-yellow (10YR 6/6) sand; common, medium, distinct, light brownish-gray (10YR 6/2) and light-gray (10YR 7/2) mottles; single grained; loose; very strongly acid.

The C horizon is as much as 20 percent pebbles in some places. In the lower positions on the landscape, the lower part of the C horizon has matrix colors with low chroma. A IIC horizon that ranges from sandy loam to sandy clay loam occurs in places. This horizon is commonly below a depth of 40 inches.

Klej soils are near Evesboro, Fort Mott, Hammonton, and Berryland soils. Klej soils have mottles that distinguish them from Evesboro and Fort Mott soils. They lack the finer textured subsoil common to Hammonton soils. They are not so gray as the Berryland soils.

Klej loamy sand, 0 to 3 percent slopes (KmA).—This soil is in intermediate positions on the landscape. Included in mapping are small areas of soils that have a bleached subsurface layer more than 6 inches thick. Also included are areas of Hammonton loamy sand and Hammonton sandy loam. These soils have a slightly higher available water capacity than this Klej soil.

Extensively farmed areas need either winter cover crops or windbreaks to reduce movement of sand and damage to plants and crops. Drainage is needed if high-value crops are grown. Organic-matter content can be maintained by use of cover crops. Capability unit IIIw–16; woodland suitability group 3s1.

Muck

Muck (MU) consists of areas where the water table is constantly high and organic matter accumulates at the surface. It is generally several feet thick but ranges from 16 inches to 10 feet or more. The areas are in very low positions on the landscape, often serving as the transition between Tidal marsh and uplands.

All areas are in forest. Atlantic white-cedar predominates, but some areas are mostly red maple, bay magnolia, and pitch pine (fig. 10). In places, the white-cedar has been killed by recent tidal flooding, and Tidal marsh is encroaching on the forest. Sphagnum moss is common in the cedar forests.

***Figure 10.*—Dense stands of Atlantic white-cedar on Muck.**

Muck is commonly extremely acid but in some areas ranges to medium acid. Drained areas of Muck subside severely. Permeability is rapid, and available water capacity is high. Organic-matter content is very high, and natural fertility is medium. The water table is at the surface almost all year, except in years of prolonged drought. It drops only a foot or two in summer. Muck has a low bearing capacity, and corduroy roads constructed from cedar treetops generally are made to bring the logs out of the swamp.

No areas have been cleared for farming. Because of wetness, subsidence when drained, and acidity, the use of Muck as farmland is severely limited. Capability unit VIIw–30; woodland suitability group 4w1.

Pocomoke Series

The Pocomoke series consists of nearly level, very poorly drained soils. The soils are in very low positions on the landscape.

In a representative profile the surface layer is very dark gray light sandy loam about 8 inches thick. The subsurface layer is gray loamy sand about 4 inches thick. The subsoil is gray sandy loam about 15 inches thick. The substratum, between depths of 27 and 60 inches, is light brownish-gray sand that contains rounded quartzose gravel.

The native vegetation is pitch pines and scattered sweetgums and red maples. The understory is a very dense stand of highbush blueberry, sweet pepper bush, and greenbriars.

Available water capacity is moderate, but additional water is available from the high water table. Permeability is moderately rapid. Organic-matter content is high, and natural fertility is medium. Unless these soils are drained, the water table is at the surface in winter and late in spring and is at a depth of 2 to 4 feet in summer.

Unless limed, Pocomoke soils are very strongly acid or extremely acid. These soils need drainage if they are farmed, and open ditches or underdrains can be used. In many places, however, outlets are difficult to obtain and are likely to be quite costly. The soils drain slowly in spring, and they warm slowly because they are wet. If adequately drained, the soils are suited to soybeans, corn, pasture, blueberries, and late-planted vegetables. These soils are well suited as sites for excavated ponds.

Representative profile of Pocomoke sandy loam, 5/8 mile east of New Jersey Route 47 and 400 yards north of Goshen-Swainton Road:

A1—0 to 8 inches, very dark gray (10YR 3/1) light sandy loam; very weak, medium, granular structure; friable; many fine to coarse roots; 2 percent rounded quartzose pebbles; extremely acid; clear, wavy boundary.

A2g—8 to 12 inches, gray (10YR 5/1) loamy sand; single grained; loose; common fine and medium roots; 2 percent rounded quartzose pebbles; very strongly acid; clear, wavy boundary.

B2tg—12 to 27 inches, gray (N 6/0) sandy loam; weak, medium, subangular blocky structure; friable; many fine and medium roots; many fine pores; sand grains are bridged with clay; very strongly acid; clear, wavy boundary.

IICg—27 to 60 inches, light brownish-gray (2.5Y 6/2) sand; single grained; loose; 10 percent fine rounded quartzose pebbles; very strongly acid.

The solum ranges from 22 to 36 inches in thickness. Rounded quartzose pebbles are generally few in the solum but range to as much as 10 percent in places. In the C horizon the content of pebbles is as much as 20 percent in some places.

The A1 and Ap horizons are black or very dark gray. The B horizon is neutral or has hue of 10YR to 5Y, value of 4 to 6, and chroma of 0 to 2. Where present, mottles have chroma of 3 to 8. The C horizon is similar to the B horizon in color, but below a depth of 40 inches some strata have higher chroma. It is stratified layers of mostly sand and gravelly sand, but below a depth of 40 inches it is sandy loam and sandy clay loam in places.

The Pocomoke soils in Cape May County are a few degrees cooler than is defined as within the range for the series, but this difference does not alter their use or behavior.

Pocomoke soils are near Hammonton and Woodstown soils and Muck. Pocomoke soils have a B horizon matrix of low chroma, which Hammonton and Woodstown soils lack. They lack the thick organic surface layer common to Muck.

Pocomoke sandy loam (Ps).—This soil is in very low positions on the landscape. Included in mapping are areas of soils that have a surface layer of loamy sand. In some areas, the dark surface layer is less than 6 inches thick, and the lower part of the subsoil has browner colors than described in the representative profile.

This soil is saturated for 6 months or more, which severely limits its use. Drainage is needed for most uses. Capability unit IIIw-24; woodland suitability group 3w1.

Sassafras Series

The Sassafras series consists of nearly level to gently sloping, well-drained soils. These soils generally are in high positions on the landscape. Elevation ranges from 10 to 45 feet above sea level.

In a representative profile the surface layer is dark grayish-brown sandy loam about 10 inches thick. The subsurface layer is yellowish-brown light sandy loam about 4 inches thick. The subsoil is brown and strong-brown sandy loam about 20 inches thick. The substratum, between depths of 34 and 60 inches, is stratified layers of yellow and yellowish-brown sand and sandy loam.

The native vegetation is oaks, hickories, and scattered pines. Abandoned fields generally seed in with pitch pine and shortleaf pine. Shrubs are blueberry and mountain-laurel.

Available water capacity is high, and permeability is moderate. In most places the water table is 5 feet below the surface. In this county, however, where elevations are all below 50 feet, some areas of Sassafras soils at lower elevations have a seasonal water table that is not reflected in the properties of the upper part of the soil. The water table is at a depth of 2½ to 3½ feet frequently between January and April. These areas were mapped separately as Sassafras sandy loam, water table, 0 to 2 percent slopes. Organic-matter content is moderate. Natural fertility is medium, but response of crops to fertilization is high.

Most areas of Sassafras soils are farmed. Unless limed, these soils are strongly acid or extremely acid. They are easily worked. They are suited to nearly all crops grown locally, especially vegetables and fruit. They have few limitations for farming and respond well to high-value management. The soils have few limitations for many nonfarm uses.

Representative profile of Sassafras sandy loam, 0 to 2 percent slopes, about 100 feet east of Bay Shore Road on the south bank of the Cape May County Canal:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) light sandy loam; weak, fine and medium, granular structure; very friable, many fine roots; medium acid; abrupt, smooth boundary.

A2—10 to 14 inches, yellowish-brown (10YR 5/4) light sandy loam; massive; very friable; many fine roots; many very fine and fine pores; few, fine, rounded quartzose pebbles; strongly acid; clear, smooth boundary.

B2t—14 to 30 inches, brown (7.5YR 4/4) heavy sandy loam; moderate, very coarse, subangular blocky structure; friable when moist, slightly plastic when wet; many fine roots; many fine and coarse pores; many clay bridges; few, fine, rounded quartzose pebbles; very strongly acid; clear to gradual, wavy boundary.

B3—30 to 34 inches, strong-brown (7.5YR 5/6) light sandy loam; thin streaks of brownish yellow (10YR 6/6); weak, medium, subangular blocky structure; very friable when moist, slightly sticky when wet; few fine roots; many, fine and coarse, well-rounded quartz pebbles; very strongly acid; gradual, irregular boundary.

IIC—34 to 60 inches, stratified yellow (10YR 7/6) and yellowish-brown (10YR 5/8) sand and sandy loam; single grained; loose; very strongly acid.

The solum ranges from 30 to 40 inches in thickness. The content of rounded quartzose pebbles is highest in the C horizon and ranges from 0 to about 20 percent. Most forested areas have a sequence of A1, A2, and Bh horizons in the upper 4 inches. Material from the horizons is mixed into the plow layer when the soils are farmed.

The Ap horizon commonly has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is sandy loam or sandy clay loam. The C horizon commonly has hue of 10YR or 7.5YR, value of 5 to 8, and chroma of 6 to 8. The IIC horizon is sand and gravelly sand in places and generally contains thin strata of sandy loam. These thin, finer textured strata generally affect the permeability of the C horizon.

Sassafras soils are near Downer, Fort Mott, Aura, and Woodstown soils. Sassafras soils contain more clay in the subsoil than Downer soils. They have a thinner surface layer than Fort Mott soils. They lack the firm subsoil layer of Aura soils and lack the mottled subsoil common to Woodstown soils.

Sassafras sandy loam, 0 to 2 percent slopes (SaA).—This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of soils that have a moderately high water table and areas that are sandier than this Sassafras soil. The areas that have a high water table affect septic-tank operation. The sandier areas are more droughty than Sassafras soils.

This soil is well suited to farming and most other uses. Runoff is slow. The hazard of erosion is slight, but deep excavations are a concern. Capability unit I-5; woodland suitability group 3o1.

Sassafras sandy loam, 2 to 5 percent slopes (SaB).—These soils are in high positions on the landscape. Included in mapping are soils that are sandier than this

Figure 11.—**Muskrat house on Tidal marsh.**

Sassafras soil and small areas of soils that have slopes of more than 5 percent. The sandier soils are more droughty than Sassafras soils, and the more sloping soils are more subject to erosion.

This soil is well suited to most crops grown in the county. Runoff is moderate, and the hazard of erosion is moderate. Erosion-control practices and good management are needed to maintain crop production on this soil. Capability unit IIe–5; woodland suitability group 3o1.

Sassafras sandy loam, water table, 0 to 2 percent slopes (SbA).—This soil formed at lower elevations, and the water table is higher than in most other Sassafras soils. When rainfall is normal, the water table is at a depth of 2½ to 3½ feet from January to April and drops below a depth of 5 feet in summer.

The water table is not high enough to adversely affect crop production but is high enough to seriously affect the functioning of septic-tank effluent disposal systems and excavation in winter. House basements built in areas of this soil need special treatment to keep them dry. Capability unit I–5; woodland suitability group 3o1.

Tidal Marsh

Tidal marsh consists of very poorly drained, silty or mucky flats that are flooded twice daily by tides. They are almost constantly saturated and have a low bearing capacity. The surface layer is generally silt loam, but in places it is muck. Below this are layers of soft silt loam and organic material. This soft material is dominantly more than 8 feet thick but ranges from 1 foot to more than 10 feet in thickness. Underlying the soft material in most places are layers of firm sand and gravel, but in a few places, clay.

Available water capacity is high. Organic-matter content is high. Methane gas is often produced by the decaying underlying organic material. In most places the reaction of recently excavated material is slightly acid to moderately alkaline. In some places where sulfur is present, reaction of the excavated material upon drying and oxidizing is extremely acid (as low as pH 2 in places). This prevents the growth of vegetation in these areas.

The natural vegetation consists of grasses and sedges that are tolerant to saltwater flooding. Originally the marshes were grazed, and in some areas the grasses were mown to harvest the salt hay. This material was extensively used for mulching strawberries and new grass seedings and as a cover for curing cement paving.

In the past 50 years, the mosquito commission has constructed many ditches to speed the drainage of flooded land and reduce the mosquito breeding pools.

Tides that flood the marsh are commonly 2 to 3 feet high, but during coastal storms they are as high as 8 to 12 feet.

Tidal marsh is valuable as habitat for waterfowl, mammals, and crustaceans. These areas provide the best waterfowl hunting and muskrat trapping areas

Figure 12.—**Marina-type residential development in area of Tidal marsh.**

in the county (fig. 11). Some areas have been converted to marina-type residential developments (fig. 12).

Tidal marsh, deep, (TD) is that part of Tidal marsh where the soft silt loam and organic layers are more than 8 feet deep. Removal of the organic deposit is extremely costly. Special foundation design is needed for all structures. The hazard of storm-tide flooding is severe. Capability unit VIIIw–29; woodland suitability group not assigned.

Tidal marsh, moderately deep, (TM) is that part of Tidal marsh that has soft silt loam and organic layers over a firmer layer that is commonly sand. The sand is between depths of 3 and 8 feet. Special foundation design is needed for roads and buildings. The hazard of storm-tide flooding is severe. Capability unit VIIIw–29; woodland suitability group not assigned.

Tidal marsh, shallow, (TS) is that part of Tidal marsh that has soft silt loam and organic layers over a firmer layer. This layer is generally sand and is less than 3 feet below the surface. Tidal marsh, shallow, has fewer limitations for building construction than areas of Tidal marsh which have thicker deposits of soft silt loam and organic materials. Special foundation design is needed for buildings. The hazard of storm-tide flooding is severe. Capability unit VIIIw–29; woodland suitability group not assigned.

Woodstown Series

The Woodstown series consists of moderately well drained, nearly level soils. The soils are on intermediate positions on the landscape.

In a representative profile the surface layer is dark grayish-brown sandy loam about 10 inches thick. The subsurface layer is pale-brown sandy loam about 5 inches thick. The upper part of the subsoil is distinctly mottled, dark yellowish-brown sandy clay loam about 14 inches thick. The lower part of the subsoil is mottled, dark yellowish-brown sandy loam about 5 inches thick. The substratum, between depths of 34 and 60 inches, is mottled, strong-brown loamy sand.

The native vegetation is mostly oaks, hickories, blackgums, sweetgums, and scattered pines. The understory is lowbush blueberry, sheep laurel, and inkberry.

Available water capacity is high, but deep-rooted plants can draw additional water from the water table early in the season. The seasonal high water table is at a depth of 1½ to 4 feet late in winter and early in spring and drops below a depth of 5 feet in summer. Permeability is moderate. Organic-matter content is moderate, and natural fertility is medium.

Most areas of Woodstown soils are farmed. Unless limed, these soils are very strongly acid or extremely acid. Soil preparation and planting are generally delayed in spring because of excessive soil moisture. Drainage improvement is needed for high-value crops. Subsurface drainage or open ditching is used in places to drain excess water. When drained, the soils are suited to most vegetable crops grown in the county but are ready for working a little later in spring than

Figure 13.—**Temporary ponding in depressional area of Woodstown sandy loam, 0 to 2 percent slopes. Ponding kills lima beans planted in area.**

well-drained soils. Irrigation is needed for high-value summer crops in places.

Representative profile of Woodstown sandy loam, 0 to 2 percent slopes, 1/4 mile south of intersection of Bay Shore Road and Town Bank Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; neutral; abrupt, smooth boundary.

A2—10 to 15 inches, pale-brown (10YR 6/3) sandy loam; weak, fine, granular structure; very friable; common fine roots; strongly acid; clear, wavy boundary.

B2t—15 to 29 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable; few fine roots; common thin clay films on all ped faces and in root channels; strongly acid; clear, wavy boundary.

B3—29 to 34 inches, dark yellowish-brown (10YR 4/4) sandy loam; common, medium, distinct, light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) mottles; weak, medium, subangular blocky structure; very friable; few fine roots; few thin clay films on some ped faces; strongly acid; gradual, wavy boundary.

C—34 to 60 inches, strong-brown (7.5YR 5/8) loamy sand; common, medium, distinct light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) mottles; single grained; loose; few roots; strongly acid.

The solum ranges from 24 to 40 inches in thickness. The content of rounded quartzose pebbles ranges from 0 to 10 percent in the solum and is as much as 20 percent in some parts of the C horizon.

The A horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 2 or 3. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 4 to 6. Mottles are low in chroma and range from few to many, fine to medium, and faint to prominent. The B horizon is sandy loam or sandy clay loam. The C horizon is mainly loamy sand, but common thin lamellae of sandy loam are present in places.

Woodstown soils are near Sassafras, Aura, Downer, and Pocomoke soils. Woodstown soils have mottling that distinguishes them from Sassafras, Aura, and Downer soils. Their subsoil is not so gray as those of the Pocomoke soils.

Woodstown sandy loam, 0 to 2 percent slopes (WmA).—This soil is in intermediate positions on the landscape. Included in mapping are small areas of Hammonton and Sassafras soils. Also included are areas of somewhat poorly drained soils that are in somewhat lower positions. These soils are similar to Woodstown soils, but they are slightly wetter.

Drainage is needed if this soil is used for high-value crops (fig. 13). Good management of cover crops following vegetable crops should provide sufficient organic-matter content to maintain good tilth. Capability unit IIw–14; woodland suitability group 2o1.

Use and Management of the Soils

The soils of Cape May County are used mainly for woodland, crops, and pasture. This section explains how the soils can be managed for those purposes, and it rates the soils according to their productivity for the principal crops. It also discusses the soils in relation to wildlife management, woodland management, engineering, town and country planning, and landscape plantings.

This section is a general guide for managing the soils and does not suggest specific management for individual soils. Detailed information about managing the soils can be obtained from the local offices of the Soil Conservation Service, the Agricultural Extension Service, or the New Jersey Agricultural Experiment Station, Cook College, Rutgers University.

Management for Crops and Pasture

In Cape May County there was 15,863 acres of farmland in 1969. Of this, 10,361 acres was in crops. The main crop is lima beans. Other important crops are sweet corn, snap beans, tomatoes, corn, soybeans, and hay. About 2,500 acres is irrigated (*5*).

The main concerns in managing the soils for crops and pasture are maintaining fertility, providing drainage, and controlling erosion. Practices that are suitable for crops and pasture are discussed in the section "Descriptions of the Soils."

On all soils in the county that are farmed, additions of lime and fertilizer are needed. The amount to be used depends on the natural content of lime and plant nutrients, on past crops and level of management, on the need of the crops, and on the level of production desired. Fields should be limed and fertilized according to the needs indicated by soil tests and in accordance with current recommendations of the Agricultural Extension Service and the New Jersey Agricultural Experiment Station.

The soils of Cape May County range from low to high in content of organic matter. This content can be maintained or increased by proper management of residue, including plowing under cover crops, growing a sod crop in the cropping system, and returning crop residue to the soils. Commercial fertilizer is beneficial to all crops. On soils subject to rapid leaching, such as Evesboro and Klej soils, it is more effective to add fertilizer in more than one application during the growing season.

Tillage is needed to prepare a seedbed and to control weeds, but it should be kept to a minimum because it generally tends to break down the structure of the soil. Also helpful in preventing a breakdown of structure are adding organic matter and growing sod crops, cover crops, and green-manure crops.

All of the sloping soils in the county are susceptible to erosion and to loss of organic matter and plant nutrients from the surface layer if farmed. Because most erosion occurs while the cultivated crop is growing, or soon after the crop has been harvested, a cropping system should be selected that keeps the loss of soil and water to a minimum. Farming on the contour, using minimum tillage, using crop residue, planting cover crops, and applying fertilizer and lime when needed are beneficial.

In Cape May County many of the soils are wet because the water table fluctuates close to the surface. Berryland, Muck, and Pocomoke soils are examples. The water table can be lowered by using either open ditches or underdrains. If tile drainage is practical, it generally provides better drainage than open ditches. For drainage by either system, suitable outlets are required.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to blueberries, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed 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, defined as follows:

Class I soils have few 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, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

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 some parts of

TABLE 2.—*Estimated average yield ratings of principal crops under two levels of management*

[Ratings are from 1, the lowest, to 10, the highest. Yield equivalents for ratings are listed in Table 3. Ratings in columns A are for common management; those in columns B are for the best current management. Absence of a rating indicates crop generally is not grown on this soil]

Soil name	Lima beans		Sweet corn		Corn		Wheat		Alfalfa		Mixed hay	
	A	B	A	B	A	B	A	B	A	B	A	B
Aura sandy loam, 0 to 5 percent slopes	4	6	5	7	4	6	5	7	3	5	3	5
Berryland sand												
Coastal beach-Urban land complex												
Downer loamy sand, 0 to 3 percent slopes	3	5	3	5	2	4	3	5	2	4	2	4
Downer loamy sand, water table, 0 to 2 percent slopes	3	5	3	5	2	4	3	5	2	4	2	4
Downer sandy loam, 0 to 2 percent slopes	5	7	5	7	4	6	5	7	4	6	4	6
Downer sandy loam, 2 to 5 percent slopes	5	7	5	7	4	6	5	7	4	6	4	6
Downer sandy loam, gravelly substratum, 0 to 5 percent slopes	3	6	4	6	3	5	5	7	3	5	3	5
Evesboro sand, 0 to 5 percent slopes	3	4	2	4								
Fill land, sandy												
Fill land, sandy organic substratum												
Fort Mott sand, 0 to 5 percent slopes	3	5	2	4			3	5	3	5	3	5
Hammonton loamy sand, 0 to 3 percent slopes	2	5	2	5	3	5	4	6	3	5	3	5
Hammonton sandy loam, 0 to 3 percent slopes	3	6	4	7	4	7	4	7	5	7	5	7
Klej loamy sand, 0 to 3 percent slopes	2	5	2	4	2	5	4	6	3	5	3	5
Muck												
Pocomoke sandy loam					2	5					3	8
Sassafras sandy loam, 0 to 2 percent slopes	8	10	7	9	6	8	7	9	7	9	7	9
Sassafras sandy loam, 2 to 5 percent slopes	8	10	7	9	6	8	7	9	7	9	7	9
Sassafras sandy loam, water table, 0 to 2 percent slopes	8	10	7	9	6	8	6	9	6	8	6	8
Tidal marsh, deep												
Tidal marsh, moderately deep												
Tidal marsh, shallow												
Woodstown sandy loam, 0 to 2 percent slopes	5	8	4	7	5	8	5	8	6	9	6	9

the United States but not in Cape May County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-5 or IIIw-16. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

Suggestions for the use and management of the soils are given in the descriptions of the mapping units. Because capability units are assigned for all of the soils in the Coastal Plain geologic province, the units in Cape May County are not consecutive. For additional information on the system of capability grouping, see Land-Capability Classification, Agriculture Handbook No. 210 (*14*).

Estimated yields

Estimated indexes, or ratings, of yields of the principal crops grown on each soil in Cape May County are given in table 2. Ratings are given for yields expected at two levels of management. The lowest rating is 1, and the highest is 10. Table 3 shows how each rating is converted to yield.

Ratings in columns A are based on yields expected under the management used by most farmers in the county. Ratings in columns B are based on yields expected under the best current management for the crop on that soil. The ratings in columns B do not

TABLE 3.—*Conversion of ratings given in table 2 to yields per acre*

Rating	Lima beans (shelled)	Sweet corn	Corn	Wheat	Alfalfa	Mixed hay
	Cwt	*Tons*	*Bu*	*Bu*	*Tons*	*Tons*
1[1]	12	1	50	10	1.0	1.2
2	14	2	60	15	1.5	1.5
3	16	3	70	20	2.0	1.8
4	18	4	80	25	2.5	2.0
5	20	5	90	30	3.0	2.2
6	22	6	100	35	3.5	2.5
7	24	7	110	40	4.0	2.8
8	26	8	120	45	4.5	3.0
9	28	9	130	50	5.0	3.2
10	30	10	140+	55+	5.5+	3.5+

[1] Yields for this rating may be lower than those indicated.

represent maximum yields obtained under ideal conditions. They are based on averages of yields obtained over a period of at least 4 years after allowing for exceptional weather and for pests and diseases. The differences between columns A and columns B for any crop may be the result of a single factor or a combination of factors. In general, all factors must be favorable to obtain yields represented by the ratings in columns B.

Details of the practices that are recommended to obtain high yields change somewhat from year to year. Current detailed recommendations are published each year in bulletins of the Agricultural Extension Service. The following are some recommended practices.

1. Select varieties of crops that are suited to the soils and climate and are resistant to the common pests and diseases.
2. Treat seed by sterilizing or inoculating when appropriate.
3. Plant seed at the proper rate and maintain the proper number of plants per acre.
4. Apply fertilizer after choosing the formula, amount per acre, and time of application in relation to the soil, crop, plant population, and amount of available water in the soil.
5. Apply lime according to the soil tests and needs of the crop.
6. Take measures to control pests, diseases, and weeds.
7. Install drainage if the water table interferes with growth of crops.
8. Irrigate lima beans, tomatoes, and other high-value crops.
9. Apply practices to control runoff, water erosion, and soil blowing.
10. Plant crops in an appropriate sequence, grow cover crops, and use minimum tillage where applicable.
11. Keep the soil in good tilth.

Estimated yields on soils for which records are not available are based on yields from similar soils. The county agricultural agent and other agricultural leaders helped make all the estimates.

Woodland

This section contains information about the suitability of the soils of the county as woodland.

Except for Tidal marsh, all of Cape May County was originally woodland. Woodland presently totals more than 76,000 acres.

The well drained and moderately well drained soils support upland forest of northern red oak, scarlet oak, chestnut oak, black oak, white oak, southern red oak, pitch pine, Virginia pine, shortleaf pine, hickory, and a number of less valuable trees. Black walnut and black locust are planted and are not native to the area.

Poorly drained soils support lowland forests of pin oak, willow oak, swamp white oak, holly, sweetgum, pitch pine, loblolly pine, and red maple. The gum trees seed readily and occupy a site for 50 to 100 years until the oaks become established. Timber has been harvested a number of times since the county was settled.

Very poorly drained soils in low areas support only pitch pine, loblolly pine, and Atlantic white-cedar. White-cedar grows best on Muck, a highly organic soil that is almost constantly saturated.

Woodland suitability groups

The soils of the county have been placed in woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group is made up of soils that are suited to the same kinds of trees, that need about the same management where the vegetation on them is similar, and that have the same potential production.

Each woodland group is identified by a three-part symbol, such as 2o1 or 3o1. The potential productivity of the soils in the group is indicated by the first number in the symbol: 1, very high; 2, high; 3, moderately high, and 4, moderate. The ratings are estimates based on field determination of average site index in other survey areas. Site index of a given soil is the height, in feet, that the dominant and codominant trees of a given species reach in a natural, essentially unmanaged stand in 50 years. Site index can be converted into approximate expected growth

TABLE 4.—*Woodland productivity and management*

[Coastal beach-Urban land (CU), Fill land (FL, FM), and Tidal marsh (TD, TM, TS) were not assigned to a woodland suitability group]

Woodland suitability groups, soil series, and map symbols	Estimated site index	Suitable species—		Management hazard or limitation			
		To favor in existing stands	For planting	Seedling mortality	Plant competition	Equipment restrictions	Windthrow hazard
Group 2o1: Hammonton: HaA, HbA. Woodstown: WmA.	76–85	Upland oaks, shortleaf pine.	Pitch pine, white pine.	Slight	Moderate	Slight	Slight.
Group 3o1: Aura: ArB. Downer: DoA, DpA, DrA, DrB, DsB. Fort Mott: FrB. Sassafras: SaA, SaB, SbA.	66–75	Upland oaks, Virginia pine.	Pitch pine, white pine.	Slight	Moderate	Slight	Slight.
Group 3s1: Evesboro: EvB. Klej: KmA.	66–75	Shortleaf pine, pitch pine.	Pitch pine, white pine.	Moderate	Moderate	Slight	Slight.
Group 3w1: Berryland: Bp. Pocomoke: Ps.	66–75	Pitch pine	Pitch pine	Severe	Severe	Severe	Moderate.
Group 4w1: Muck: MU.	46–55	Atlantic white-cedar.[1]	Not feasible	Severe	Severe	Severe	Severe.

[1] Site index curves for Atlantic white-cedar have not been published. Site index shown is best estimate available.

and yield per acre in cords and board feet. For Cape May County, conversions of average site index into volumetric growth and yield are based on research on upland oaks (*9*).

The second part of the symbol identifying a woodland group is a small letter. In this county, *w*, *s*, and *o* are used. Except for the *o*, the small letter indicates an important soil property that imposes a hazard or limitation in managing the soils of the group for trees. The letter *o* shows that the soils have few limitations that restrict their use for trees. The letter *w* means excessive wetness, either seasonal or all year. The soils have restricted drainage or have high water tables. The letter *s* stands for sandy soils that have little or no difference in texture between surface layer and subsoil. These soils are moderately restricted to severely restricted for woodland use. They have low available water capacity and are low in available plant nutrients.

The last part of the symbol, another number, differentiates woodland suitability groups that have identical first and second parts in their identifying symbol.

Table 4 lists suitable species to favor in existing stands and suitable species for planting. The estimated site index in table 4 is the height, in feet, that the dominant and codominant trees reach at 50 years of age on the soils of each group. The relationship between site index and yield is given in table 5.

In table 4 each woodland suitability group in the county is rated for various management hazards or limitations. These ratings are slight, moderate, or severe, and they are described in the following paragraphs.

Seedling mortality refers to mortality of naturally occurring or planted tree seedlings, as influenced by kinds of soil or topographic conditions when plant competition is assumed not to be a factor. A rating of *slight* means an expected loss of 0 to 25 percent; *moderate* means expected loss of 25 to 50 percent; and *severe* means an expected loss of more than 50 percent of the seedlings.

Plant competition is the degree to which undesirable plants invade openings in the tree canopy. A rating of *slight* means that plant competition does not prevent adequate natural regeneration and early growth or interfere with seedling development; *moderate* means that competition delays natural or artificial establishment and growth rate, but does not prevent the development of fully stocked normal stands; *severe* means that competition prevents adequate natural or artificial regeneration unless the site is prepared properly and maintenance practices are used.

Equipment restrictions depend on soil characteristics that restrict or prohibit the use of harvesting equipment, either seasonally or continually. A rating of *slight* means no restrictions in the kind of equipment or time of year it is used; *moderate* means that use of equipment is restricted for 3 months of the year or less; *severe* means that special equipment is needed and that its use is severely restricted for more than 3 months of the year.

Windthrow hazard depends on the soil characteristics that enable trees to resist being blown down by wind. A rating of *slight* means that most trees withstand the wind; *moderate* means that some trees are expected to blow down during excessive wetness and high wind; *severe* means that many trees are expected to blow down during periods when the soil is wet and winds are moderate or high.

Because demand for woodland products and value change from time to time, current information on what

TABLE 5.—*Yields per acre from upland oaks and Virginia pine in even-aged, fully stocked, natural stands*

[All numbers are rounded to the nearest whole number. Dashes indicate that data were not available or do not apply]

Site index	Age of stand	Merchantable volume of— Upland oaks		Virginia pine
	Years	*Cords*[1]	*Bd ft*[2]	*Cords*[3]
40	30	3	100	------------
	50	12	1,400	------------
	70	21	4,250	------------
50	30	6	350	[4]11
	50	19	3,250	[4]18
	70	30	8,150	------------
60	30	10	850	19
	50	26	6,300	31
	70	39	12,800	------------
70	30	15	1,750	33
	50	33	9,750	54
	70	47	17,700	------------
80	30	20	3,350	57
	50	41	13,750	93
	70	56	23,100	------------

[1] Unpeeled volume of merchantable stems to a top diameter of 4 inches, outside bark.

[2] According to International rule, 1/8 inch, for stems to a top diameter of 5 inches, inside bark.

[3] Merchantable volume of all stems 4 inches or more in diameter breast high and to a top diameter of 4 inches, outside bark, in stands of 100-percent density. Based on a conversion factor of 85 cubic feet equals 1 standard cord.

[4] Extrapolated value.

trees to plant or how to manage woodland should be obtained from the local office of the Soil Conservation Service.

Wildlife[2]

The welfare of a wildlife species depends largely on the amount and distribution of food, shelter, and water (*1*). If any of these elements is missing, inadequate, or inaccessible, the species is absent or scarce. The kinds of wildlife that live in a given area and the number of each kind are closely related to use of the soils, to the resulting kinds and patterns of vegetation, and to the supply and distribution of water. These, in turn, are generally related to the kinds of soil.

Habitat for wildlife normally can be created or improved by planting suitable vegetation, by properly managing the existing plant cover, by fostering the natural establishment of desirable plants, or by using a combination of these measures.

In table 6 the soils of Cape May County are rated according to their suitability for seven elements of wildlife habitat and for three kinds of wildlife. The ratings can be used as an aid in—

1. Planning the broad use of parks, refuges, nature-study areas, and other recreational developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific kinds of wildlife habitat elements.
3. Determining the relative intensity of management needed for individual habitat elements.
4. Eliminating sites that would be difficult or not feasible to manage for specific kinds of wildlife.

[2] EUGENE WHITAKER, biologist, Soil Conservation Service, assisted in the preparation of this section.

TABLE 6.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood and coniferous trees
Aura: ArB	Fair	Good	Good	Fair
Berryland: Bp	Very poor	Poor	Fair	Poor
Coastal beach-Urban land complex: CU. Coastal beach part only.	Very poor	Poor	Poor	Poor
Downer:				
DoA, DpA	Poor	Fair	Good	Fair
DrA, DrB, DsB	Good	Good	Good	Good
Evesboro: EvB	Poor	Poor	Fair	Poor
Fill land: FL, FM	Poor	Poor	Fair	Poor
Fort Mott: FrB	Poor	Fair	Fair	Poor
Hammonton:				
HaA	Poor	Fair	Good	Fair
HbA	Fair	Good	Good	Fair
Klej: KmA	Poor	Fair	Fair	Poor
Muck: MU	Very poor	Poor	Poor	Poor
Pocomoke: Ps	Very poor	Poor	Poor	Poor
Sassafras: SaA, SaB, SbA	Good	Good	Good	Good
Tidal marsh: TD, TM, TS	Very poor	Poor	Very poor	Very poor
Woodstown: WmA	Good	Good	Good	Good

5. Determining areas that are suitable for acquisition for use by wildlife.

Each rating under "Kinds of Wildlife" in table 6 is based on the ratings listed for the elements of wildlife habitat in the first part of the table. For open-land wildlife the rating is based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. The rating for woodland wildlife is based on the ratings listed for grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. For wetland wildlife the rating is based on the ratings shown for wetland food and cover plants and shallow water developments.

The meanings of the ratings given in table 6 are as follows.

On soils rated *good,* habitat generally is easily created, improved, or maintained. There are few or no soil limitations in habitat management, and satisfactory results are well assured.

On soils rated *fair,* habitat commonly can be created, improved, or maintained, but the soils have moderate limitations that affect the creation, improvement, or maintenance of the habitat. A moderate intensity of management and fairly frequent attention is required to assure satisfactory results in places.

On soils rated *poor,* habitat generally can be created, improved, or maintained, but there are rather severe soil limitations. Habitat management is difficult and expensive and requires intensive effort. Satisfactory results are questionable.

On soils rated *very poor,* it is impractical to create, improve, or maintain habitat because of the very severe soil limitations. Unsatisfactory results are probable.

Not considered in the ratings are present use of the soils, the location of a soil in relation to other soils, and the mobility of wildlife.

The seven elements of wildlife habitat rated in table 6 are described in the following paragraphs.

Grain and seed crops are seed-producing annual plants, such as corn, sorghum, wheat, barley, oats, millet, soybeans, sunflowers, and other plants commonly grown for grain or for seed. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, slope, and texture of the surface layer and subsoil.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are established by planting and that furnish cover and food for wildlife. Among the plants are bluegrass, fescue, brome, timothy, orchardgrass, reed canarygrass, clover, and alfalfa. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, slope, and texture of the surface layer and subsoil.

Wild herbaceous plants are native or introduced perennial grasses and weeds that generally are established naturally. They include bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, and dandelion. They provide food and cover principally to upland forms of wildlife. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, ponding, texture of the surface layer and subsoil, and tidal flooding.

Hardwood trees are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs for browse, or foliage that wildlife eat. They are generally established naturally but can be planted. Among the native kinds are oak, cherry, maple, apple, hawthorn, dogwood, persimmon, sumac,

of wildlife habitat and kinds of wildlife

Elements of wildlife habitat—Continued		Kinds of wildlife		
Wetland plants	Shallow-water areas	Open-land	Woodland	Wetland
Poor	Very poor	Good	Fair	Very poor.
Poor	Good	Poor	Fair	Fair.
Poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Fair	Fair	Very poor.
Poor	Very poor	Good	Good	Very poor.
Very poor	Very poor	Poor	Poor	Very poor.
Very poor	Very poor	Poor	Fair	Very poor.
Poor	Very poor	Fair	Poor	Very poor.
Poor	Poor	Fair	Fair	Poor.
Poor	Poor	Good	Fair	Poor.
Poor	Poor	Fair	Poor	Poor.
Good	Good	Poor	Poor	Good.
Good	Good	Poor	Poor	Good.
Poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Good.
Poor	Poor	Good	Good	Poor.

sassafras, black walnut, hickory, sweetgum, bayberry, blueberry, huckleberry, blackhaw, virburnum, grape, and briers. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, and tidal flooding. Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky cornel dogwood are some of the shrubs that generally are available and can be planted on soils that are rated good. Hardwoods that are not available commercially can commonly be transplanted successfully.

Coniferous trees are cone-bearing evergreen trees and shrubs that are used by wildlife mainly as cover. Some of them also furnish browse, seeds, or fruitlike cones. Among them are Norway spruce, Virginia pine, loblolly pine, shortleaf pine, pitch pine, Scotch pine, redcedar, and Atlantic white-cedar. Generally the plants are established naturally in areas where cover of weeds and sod is thin, but they can also be planted. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, texture of the surface layer and subsoil, and tidal flooding.

Wetland plants are wild, herbaceous, annual and perennial plants that grow on moist to wet sites; they do not include submerged or floating aquatics. These plants produce food and cover mostly for wetland wildlife. They include smartweed, wild millet, bulrush, sedges, duckweed, duckmillet, arrow-arum, pickerelweed, waterwillow, wetland grasses, wildrice, and cattails. The major soil properties affecting this habitat element are natural drainage, frequency of flooding or ponding, slope, and texture of the surface layer and subsoil.

Shallow-water areas are impoundments or excavations that provide areas of shallow water, generally not exceeding 5 feet in depth, near food and cover for wetland wildlife. Examples of such developments are shallow dugouts, level ditches, blasted potholes, and devices that keep the water 6 to 24 inches deep in marshes. The major soil properties affecting this habitat element in Cape May County are natural drainage, slope, hazard of flooding, and permeability. Farm ponds of the impounded type are not considered in this habitat element; however, they can be important for recreational activities such as fishing and can, in addition, be a source of water for wildlife. If stocked with fish, such impoundments should be at least 6 feet deep over a large part of the area.

The kinds of wildlife rated in table 6 are described in the following paragraphs.

Open-land wildlife includes quail, pheasant, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their home in areas of crops, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, and shrubs. About 26 percent of Cape May County provides good habitat for open-land wildlife.

Woodland wildlife consists of birds and mammals that prefer woodland. Examples are ruffed grouse, woodcock, thrush, vireo, scarlet tanager, gray and red squirrels, gray fox, white-tailed deer, and raccoon. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants. About 18 percent of Cape May County provides good habitat for woodland wildlife.

Wetland wildlife consists of ducks, geese, rails, herons, shore birds, muskrat, and other birds and mammals that normally make their home in wet areas, such as ponds, marshes, and swamps. About 41 percent of Cape May County provides good habitat for wetland wildlife.

Engineering Uses of the Soils[3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning boards, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage, shrink-swell potential, grain size, plasticity, reaction, and depth to the water table. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds, small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of existing structures with the pertinent properties of the soils on or of which they are built, for the purpose of predicting performance of structures on or constructed of the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 7, 8, and 9, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 8 and 10, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works. Inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of

[3] DONALD W. HASLEM, engineer, Soil Conservation Service, assisted in the preparation of this section.

other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*19*), used by the SCS engineers, Department of Defense, and others, and the AASHO system (*2*), adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 9; the estimated classification, without group index numbers, is given in table 7 for all soils mapped in the survey area.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 7. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 7.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 7 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey. Textures shown in the USDA texture column are those of the representative profile described for the soil series. The full range of textures for the main horizons are given following the description of the representative profile in the section "Descriptions of the Soils."

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 7, but in table 9 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 7 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Engineering interpretations

The estimated interpretations in table 8 are based on the engineering properties of soils shown in table 7, on test data for soils in this survey area and in others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Cape May County. In table 8, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage of cropland and pasture, irrigation, ponds and reservoirs, embankments, and terraces and diversions. For these particular uses, table 8 lists those soil features not to be overlooked in planning, installation, and maintenance.

Topsoil is used to topdress an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic

TABLE 7.—*Estimated soil properties*

[Absence of data indicates the soil is too variable to be rated or that no estimate

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHO
	Feet	*Inches*			
Aura: ArB	>5	0–24	Sandy loam	SM, SC	A-2, A-4
		24–50	Gravelly sandy clay loam [3]	SC, GC	A-2, A-4
		50–72	Stratified gravelly sandy loam and gravelly loamy sand.	SM, SC, GW-GM	A-2, A-4
Berryland: Bp	0	0–60	Sand	SP, SP-SM	A-3
Coastal beach-Urban land complex: CU. Properties are for Coastal beach part only.	0–3	0–60	Sand	SP	A-3
Downer: DoA, DpA, DrA, DrB, DsB	>5 (3 in DpA)	0–18	Loamy sand [3]	SM, SC	A-2, A-4
		18–36	Sandy loam	SM, SC	A-2, A-4
		36–60	Stratified loamy sand and gravelly sandy loam.	SP-SM, SM, GM, SW-SM	A-1, A-2, A-3
Evesboro: EvB	>5	0–72	Sand	SP, SP-SM, SM	A-2, A-3
Fill land: Fl, Fm. Properties too variable to estimate.					
Fort Mott: FrB	>5	0–24	Sand, loamy sand	SP-SM, SM	A-2
		24–40	Sandy loam	SM, SC	A-2
		40–60	Sand	SP-SM, SM	A-2, A-3
Hammonton: HaA, HbA	1½–4	0–18	Loamy sand	SC, SM	A-2
		18–28	Sandy loam	SM, SC	A-2, A-4
		28–60	Loamy sand	SP-SM, SM	A-2
Klej: KmA	1½–4	0–60	Loamy sand, sand	SP, SP-SM, SM, SW-SM	A-2, A-3
Muck: MU	0	0–40	Muck	Pt	
		40–60	Variable		
Pocomoke: Ps	0	0–27	Sandy loam, loamy sand	SC, SM	A-2, A-4
		27–60	Sand	SP-SM, SM	A-2
Sassafras: SaA, SaB, SbA	>5 (3 in SbA)	0–34	Sandy loam	SM, SC	A-2, A-4
		34–60	Sand and sandy loam	SP-SM, SM	A-2
Tidal marsh:					
TD	0				
TM	0				
TS	0				
Woodstown: WmA	1½–2½	0–34	Sandy loam, sandy clay loam	SM, SC	A-2, A-4
		34–60	Loamy sand	SP-SM, SM	A-2, A-3

[1] Reaction is for unlimed soil.

[2] NP means nonplastic.

[3] Texture shown in the Dominant USDA texture column is that of the representative profile described for the soil series. Other textures are listed in the mapping units or in the paragraph following the description of the representative profile for each soil

significant to engineering

was made. The symbol > means greater than; the symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction [1]
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				Pct		*In per hr*	*In per in of soil*	*pH*
90–100	75–100	50–70	25–45	20–30	[2] NP–10	0.2–2.0	0.14–0.18	<4.5
70–100	55–80	40–80	30–50	25–35	5–10	0.2–0.6	0.08–0.12	4.5–5.0
50–100	35–100	35–70	10–40	[4] NL–30	NP–10	0.6–6.0	0.10–0.12	4.5–5.0
95–100	75–100	50–90	2–10	NL	NP	>2.0	[5] 0.06–0.10	<5.0
100	100	75–100	0–5	NL	NP	>6.0	0.02–0.05	6.6–7.8
95–100	90–100	50–90	15–40	NL–25	NP–10	0.6–6.0	0.10–0.16	<4.5
95–100	90–100	50–90	25–40	15–25	NP–10	2.0–6.0	0.12–0.16	4.5–5.0
60–100	45–100	40–90	5–20	NL	NP	>2.0	0.05–0.10	4.5–5.0
80–100	75–100	60–90	0–15	NL	NP	>6.0	0.05–0.10	<5.0
100	85–100	50–100	10–20	NL	NP	>6.0	0.05–0.10	<5.0
100	85–100	50–100	25–35	15–30	NP–10	0.6–2.0	0.12–0.16	4.5–5.0
100	75–100	50–100	5–25	NL	NP	>6.0	0.05–0.10	4.5–5.0
95–100	85–100	50–90	15–35	NL–30	NP–5	2.0–6.0	[5] 0.10–0.16	<5.0
95–100	85–100	50–90	25–40	20–30	5–10	0.6–6.0	0.10–0.14	4.5–5.0
80–100	65–100	70–100	10–25	NL	NP	>2.0	0.05–0.10	4.5–5.0
80–100	70–100	60–90	0–20	NL	NP	>6.0	[5] 0.05–0.10	<5.0
------	------	------	------	------	------	>6.0	[5] 0.35–0.70	<5.0
------	------	------	------	------	------	------	------	4.5–5.0
90–100	85–100	75–90	20–40	NL–25	NP–10	0.6–2.0	[5] 0.14–0.18	<5.0
80–100	70–100	50–90	10–40	NL	NP	>6.0	0.06–0.10	4.5–5.0
90–100	80–100	60–100	30–40	20–30	5–10	0.6–2.0	0.14–0.18	<5.0
80–100	70–100	50–100	10–25	NL	NP	>2.0	0.06–0.10	4.5–5.0
------	------	------	------	------	------	------	------	[6] 4.5–7.5
------	------	------	------	------	------	------	------	[6] 5.0–7.5
------	------	------	------	------	------	------	------	[6] 5.0–7.5
90–100	80–100	50–100	25–45	20–30	5–15	0.6–2.0	[5] 0.12–0.16	<5.0
80–100	70–100	30–80	8–25	NL	NP	>2.0	0.06–0.10	4.5–5.0

series in the section "Description of the Soils." The Unified and AASHO classifications reflect the range in texture, if any, that is referred to in the paragraph following the representative profile.

[4] NL means nonliquid.

[5] The presence of the water table within rooting depth makes additional water available during most growing seasons.

[6] Where sulfides are present, pH drops to as low as 2 when these soils are drained and are oxidized.

TABLE 8.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Pond reservoir areas
Aura: ArB	Fair: gravelly in places.	Poor for sand in upper 5 feet. Fair to good for gravel between depths of 2 and 5 feet; variable below a depth of 5 feet.	Good: SM, GM, SC, and GC material.	Moderately slow permeability in lower part of subsoil.
Berryland: Bp	Poor: low fertility; high content of sand.	Good for sand below a depth of 2 feet. Poor for gravel: small amounts in unpredictable areas.	Good: SP or SM material.	Seasonal high water table at surface; rapid or moderately rapid permeability.
Coastal beach-Urban land complex: CU. Coastal beach part only.	Poor: high content of sand.	Good for sand. Poor for gravel.	Fair: SP material; needs binder.	Hazard of flooding during storms.
Downer: DoA, DpA, DrA, DrB, DsB	Fair for DrA, DrB, and DsB. Poor for DpA, DoA: high content of sand.	Fair for sand below a depth of 30 inches. Good for gravel below a depth of 24 inches in DsB. Poor for gravel in DoA, DrA, and DrB.	Good: SP and SM material.	Rapid permeability in substratum.
Evesboro: EvB	Poor: high content of sand.	Good for sand. Poor for gravel.	Good: SP and SM material; may need binder.	Rapid permeability permits seepage losses.
Fill land: FL, FM	Unsuitable: none present.	Unsuitable: supply limited.	Unsuitable: supply limited.	Rapid permeability permits seepage losses.
Fort Mott: FrB	Poor: high sand content.	Fair for sand below depth of 3½ feet;[1] unsuitable for gravel.	Good: SP and SM material.	Rapid permeability in substratum permits seepage losses.
Hammonton: HaA, HbA	Fair for HbA. Poor for HaA: high sand content.	Fair for sand below a depth of 2½ feet.[1] Poor for gravel: limited amounts in unpredictable places.	Good: SP and SM material; seasonal high water table between depths of 1½ and 4 feet.	Rapid permeability in substratum permits seepage losses.
Klej: KmA	Poor: high sand content.	Good for sand. Poor for gravel: small amounts in unpredictable places.	Good: SP and SM material; seasonal high water table between depths of 1½ and 4 feet.	Rapid permeability permits seepage losses in summer.
Muck: MU	Poor: constantly high water table.	Unsuitable for sand and gravel.	Unsuitable: highly organic material.	Constantly high water table.

engineering properties of the soils

Soil features affecting—continued					
Embankments	Excavated ponds	Drainage	Irrigation	Grassed waterways	Shallow excavations
Good stability and compaction characteristics; good resistance to piping.	Low water table	Not needed	Moderate to moderately slow intake rate and permeability; moderate available water capacity.	All conditions favorable.	Firm in lower part of subsoil.
Low cohesion; rapid permeability; fair stability.	Seasonal high water table; rapid recharge rate.	Seasonal high water table at surface; rapid or moderately rapid permeability; ditchbanks slough readily.	Needs drainage before irrigation; low available water capacity; low natural fertility.	Not needed	Seasonal high water table at surface; sidewalls slough readily.
Low cohesion	Hazard of flooding during storms.	Not needed	Low available water capacity and fertility.	Low available water capacity and fertility.	Sidewalls slough readily.
Low cohesion; moderately rapid permeability.	Low water table	Not needed	Moderate available water capacity; moderate or moderately rapid intake rate.	All conditions favorable.	Sidewalls slough readily.
Low cohesion; rapid permeability; fair to poor stability.	Low water table	Not needed	Low available water capacity; rapid intake rate.	Low available water capacity and fertility.	Sidewalls slough readily.
Unsuitable: low cohesion; rapid permeability.	Unsuitable	Not needed	Low available water capacity; rapid intake rate; low fertility.	Low available water capacity and fertility.	Sidewalls slough readily.
Moderately slow permeability when compacted.	Low water table	Not needed	Low available water capacity to depth of 24 inches, moderate to depth of 40 inches; rapid intake rate.	Low fertility and available water capacity in surface layer.	Sidewalls slough readily.
Low cohesion; moderately slow permeability when compacted.	Seasonal high water table between depths of 1½ and 4 feet, which drops to depth below 5 feet in summer.	Seasonal high water table between depths of 1½ and 4 feet, which drops to depth below 5 feet in summer.	Moderate available water capacity; moderately rapid intake rate.	Low fertility and available water capacity.	Sidewalls slough readily.
Low cohesion; rapid permeability; fair to poor stability.	Seasonal high water table between depths of 1½ and 4 feet, which drops below 5 feet in summer.	Seasonal high water table between depths of 1½ and 4 feet, which drops below 5 feet in summer.	Low available water capacity; rapid intake rate.	Low fertility and available water capacity.	Sidewalls slough readily.
Unsuitable: highly organic material.	Constantly high water table.	Constantly high water table; severe subsidence when drained.	Constantly high water table.	Not needed	Sidewalls slough readily.

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Pond reservoir areas
Pocomoke: Ps	Poor: seasonal high water table.	Fair for sand below a depth of 2½ feet;[1] high water table hinders extraction.	Poor: seasonal high water table hinders extraction.	Seasonal high water table at surface.
Sassafras: SaA, SaB, SbA	Good: natural fertility medium.	Fair for sand below 3 feet.[1] Poor for gravel: small supply.	Good: SM or SC material.	Rapid permeability in substratum may permit seepage losses.
Tidal marsh: TD, TM, TS	Poor: daily flooding; material becomes extremely acid upon drying in places.	Poor for sand: 2 to 8 feet of organic silt overburden.	Unsuitable: highly organic material.	Little seepage
Woodstown: WmA	Good: moderately high seasonal water table may hinder extraction.	Fair for sand below 3 feet.[1] Poor for gravel: small amounts in unpredictable places.	Good: SM or SC material.	Rapid permeability in substratum may permit seepage losses.

[1] Washing is assumed to be necessary where there is an excessive amount of fines.

to plants. Texture of the soil material and its content of gravel are characteristics that affect suitability, but also considered in rating is damage that will result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit. Washing of sand is assumed necessary where the fines are excessive.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability.

Embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of organic material in a soil is a factor that is unfavorable.

Excavated ponds are constructed by excavating and permitting ground water to fill the excavation.

Drainage is affected by such soil properties as permeability, texture, and structure; depth to layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; texture; rate of water intake at the surface; permeability of soil layers below the surface layer or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table.

Grassed waterway layout and construction are affected by such soil properties as texture, depth, and erodibility of the soil material and the steepness of slopes. Other factors affecting grassed waterways are seepage, natural drainage, available water capacity, susceptibility to siltation, and the ease of establishing and maintaining vegetation.

Shallow excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries are those that generally require digging or trenching to a depth of less than 6 feet. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, and freedom from flooding.

properties of the soils—Continued

Soil features affecting—continued					
Embankments	Excavated ponds	Drainage	Irrigation	Grassed waterways	Shallow excavations
Surface layer high in organic matter; subsoil has low cohesion; rapid permeability in substratum.	Seasonal high water table at surface.	Seasonal high water table at surface; moderate permeability.	Needs drainage before irrigation; moderate available water capacity when drained.	Not needed	Seasonal high water table at surface; sidewalls slough readily.
Moderately slow compacted permeability; low cohesion below depth of 34 inches.	Low water table	Not needed	High available water capacity; moderate intake rate.	All features favorable.	Sidewalls slough readily.
Poor stability; severe piping.	Constantly high water table; subject to storm flooding.	Material becomes extremely acid on drying in places.	Constantly high water table.	Not needed	Constantly high water table; poor trafficability; low bearing capacity.
Moderately slow compacted permeability; low cohesion below depth of 34 inches.	Seasonal high water table between depths of 1½ and 2½ feet, which drops below depth of 5 feet in summer.	Seasonal high water table between depths of 1½ and 2½ feet, which drops below depth of 5 feet in summer.	High available water capacity; moderate intake rate.	Seasonal high water table between depths of 1½ and 2½ feet.	Seasonal high water table between depths of 1½ and 2½ feet; sidewalls slough readily.

Test data

All engineering test data in this survey are from sampling and testing by the College of Engineering, Rutgers University (*7, 8*). Table 9 contains engineering test data for some of the major soil series in Cape May County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material.

Moisture-density or compaction data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Town and Country Planning

This section is mainly for planners, developers, zoning officials, landowners, and prospective landowners. It indicates the degree and kind of limitations of each soil in the county for various community developments (*10*). Planners and zoning officials who are interested in comparing the limitations of soils for town and country planning to their suitability for use in farming will be interested in the section "Capability grouping." Readers needing more information about the soil mapping units should refer to the section "Descriptions of the Soils."

In table 10 the soils are rated according to their degree of limitations for the various uses. For moderate and severe ratings in the table, the main cause of the limitation is listed.

The uses rated in table 10 are dwellings, with and without basements; septic tank absorption fields; sanitary landfills; local roads and streets; lawns, landscaping plantings, and golf fairways; athletic fields; picnic and play areas; campsites; and paths and trails.

Limitations that affect community developments are rated slight, moderate, or severe. A rating of *slight* means there are few or no significant limitations. *Moderate* means there is one limitation or more that can normally be overcome at moderate cost by careful design and construction. *Severe* means that there is one limitation or more that cannot be overcome without considerable cost. A severe limitation does not imply that the soil is unsuitable, but rather that development costs are abnormally high.

TABLE 9.—*Engineering*

[Tests made by Engineering Department, Rutgers University.

Soil	Sampling site			Depth from surface	Test data				
					Sieve analysis				
					Cumulative percentage passing sieve—				
	Number	Latitude	Longitude		¾ inch	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)
				Inches					
Coastal beach-Urban land complex. (Modal)	39	39°09′50″	74°41′03″	0–14	100	100	100	100	2
				14–42	100	100	100	99	5
				42–50	100	100	100	99	2
Downer loamy sand. (Subsoil coarser textured than modal)	27	39°12′58″	74°50′26″	0–18	100	100	99	70	19
				18–32	100	98	96	69	22
				32–56	98	79	66	45	6
Downer sandy loam, gravelly substratum. (Surface layer thinner and coarser textured than modal. Subsoil coarser textured than modal)	10	39°13′44″	74°46′15″	0–5	100	94	87	59	14
				5–24	99	85	73	49	20
				24–40	100	84	62	39	5
				40–80	100	92	78	64	5
Downer sandy loam, gravelly substratum. (Modal)	30	39°12′00″	74°51′17″	0–12	94	78	71	51	30
				12–30	90	81	74	55	36
				30–50	98	81	68	24	9
Evesboro sand. (Modal)	25	39°13′18″	74°42′02″	0–8	100	100	100	71	11
				8–28	100	97	94	66	10
				28–84	100	100	99	71	2
Woodstown sandy loam. (Modal)	29	38°59′09″	74°55′02″	0–18	100	100	99	86	37
				18–30	100	99	98	89	44
				30–48	100	98	98	83	16
				48–60	100	100	98	88	9

[1] Based on AASHO Designation T 88–49 (*2*).
[2] Based on AASHO Designation T 89–49 (*2*).
[3] Based on AASHO Designation T 91–49 (*2*).

Listed in the following paragraphs are the uses for which the soils are rated in table 10 and the major soil properties affecting the uses.

Dwellings with basements.—Important soil properties include slope, natural soil drainage, and hazard of flooding.

Dwellings without basements.—Important soil properties are the same as for dwellings with basements, but the limitations are not so severe.

Septic tank absorption fields.—Important soil properties are permeability rate, natural soil drainage, slope, and hazard of flooding (*15, 20*). Pollution of streams or wells is a hazard in rapidly permeable soils (*6*), but this hazard was not included in the rating of these interpretations. It is not intended that the ratings eliminate the need for percolation tests. The soil map and the ratings give a basis for making and interpreting the tests. The soil map shows, for example, the areas in which ground water is likely to prevent free drainage of a septic field during part of the year. In such an area, a percolation test in summer, when the water table is deep, does not give the information needed to judge the site.

Sanitary landfills.—The primary factors in rating limitations of soils for this use are slope, natural soil drainage, hazard of flooding, texture of the soil, and permeability of the substratum. Deep onsite investigations are needed to determine limitations below a depth of 5 feet. Soils that have a rapidly permeable substratum have poor filtering properties and are rated severe because of the hazard of stream and well pollution.

Local roads and streets.—The main factors in rating the limitations are the depth to water table, slope, and hazard of flooding.

Lawns, landscaping plantings, and golf fairways.—The main factors in rating limitations are natural fertility, available water capacity, natural soil drainage, and slope.

Athletic fields.—The main factors in rating limitations are slope, natural drainage, and texture.

Picnic and play areas.—Picnic and play areas are *test data*

Absence of data indicates the determination was not made]

Test data—continued						Classification		
Hydrometer analysis [1]						AASHO		
0.05–0.005 mm	0.005 mm	Liquid limit [2]	Plasticity index [3]	Maximum density [4]	Optimum moisture content [4]	Group	Group index	Unified
Percent	*Percent*	*Percent*		*Lb per cu ft*	*Percent*			
—	—	[5] NL	[6] NP	—	—	A–3	0	SP
—	—	NL	NP	112	13	A–3	0	SP–SM
—	—	NL	NP	105	13	A–3	0	SP
—	—	NL	NP	—	—	A–2–4	0	SM
—	—	NL	NP	—	—	A–2–4	0	SM
—	—	NL	NP	—	—	A–1–b	0	SP–SM
—	—	NL	NP	—	—	A–2–4	0	SM
—	—	17	1	—	—	A–1–b	0	SM
—	—	NL	NP	—	—	A–1–b	0	SP–SM
—	—	NL	NP	—	—	A–3	0	SP–SM
—	—	NL	NP	—	—	A–2–4	0	SM
18	6	23	8	119	10	A–4	0	SC
—	—	NL	NP	118	11	A–1–b	0	SW–SM
—	—	NL	NP	—	—	A–2–4	0	SP–SM
—	—	NL	NP	118	11	A–3	0	SP–SM
—	—	NL	NP	111	11	A–3	0	SP
—	—	18	1	—	—	A–4	1	SM
—	—	17	4	121	11	A–4	2	SM
—	—	NL	NP	123	10	A–2–4	0	SM
—	—	NL	NP	112	12	A–3	0	SP–SM

[4] Based on AASHO Designation T 99–49 (*2*).
[5] NL means nonliquid.
[6] NP means nonplastic.

listed together because they have similar soil requirements. The primary factors in rating the limitations of soils for these uses are depth to the water table, slope, and texture.

Campsites.—The features important are flooding hazard, depth to water table, texture of the surface layer, and slope.

Paths and trails.—Important features used for rating paths and trails are depth to water table, hazard of flooding, and texture of the surface layer.

Landscape Plantings

This section gives information about some of the trees and shrubs suitable for landscape plantings. In planning landscape plantings, consideration should be given to the need for providing wind protection, screening unsightly areas, and enhancing the general appearance of neighborhoods.

Trees and shrubs of different species vary widely in their suitability for use on different soils and to their adaptability to site conditions. The soils in the county are placed in four landscape planting groups, mainly on the basis of their tolerance to wetness from the seasonal high water table and the available water capacity of the soils.

Each of the soils in a specific group has similar suitability for tree and shrub plantings. The landscape planting group of each soil is listed in the "Guide to Mapping Units" at the back of this survey. No landscape planting group has been assigned to Coastal beach-Urban land complex, Fill land, or Tidal marsh.

The plants named in table 11 are only a partial list of the plants suited to soils in the county (*16, 17*). Plants that are particularly subject to disease, insects, or other problems are not included in the list. Many of the plants serve a dual purpose of landscaping and of providing food and cover for wildlife. If more detail is needed and pertinent landscaping plans are desired, landowners and others should contact local landscape specialists.

In the following paragraphs the landscape planting

TABLE 10.—*Degree and kind of limitations of*

Soil series and map symbols	Limitations of soil for— Dwellings: With basements	Dwellings: Without basements	Septic tank absorption fields	Sanitary landfills [1]
Aura: ArB	Slight	Slight	Moderate: moderately slow permeability in subsoil; may require deep ditches.	Slight
Berryland: Bp	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.
Coastal beach-Urban land complex: CU. Coastal beach part only.	Severe: low areas subject to flooding during severe storms.	Severe: low areas subject to flooding during severe storms.	Severe: water table too near surface in most places; rapid permeability permits ground water pollution.	Severe: rapid permeability permits ground water pollution.
Downer: DoA	Slight	Slight	Slight: permeability of substratum may permit ground water pollution.	Severe: moderately rapid permeability in substratum permits ground water pollution.
DpA	Moderate: moderately high seasonal water table.	Slight	Moderate: moderately high seasonal water table.[2]	Severe: moderately high seasonal water table.
DrA, DrB, DsB	Slight	Slight	Slight: permeability in substratum may permit ground water pollution.	Severe: moderately rapid permeability in substratum permits ground water pollution.
Evesboro: EvB	Slight	Slight	Slight: rapid permeability permits ground water pollution.	Severe: rapid permeability permits ground water pollution.
Fill land: FL	Slight where fill is more than 6 feet in thickness.[3]	Slight where fill is more than 3 feet in thickness.[3]	Slight where fill is more than 6 feet in thickness; rapid permeability is pollution hazard.[3]	Severe: rapid permeability permits ground water pollution.
FM	Slight where fill is more than 8 feet in thickness. Severe where fill is less than 8 feet in thickness.[3]	Slight where fill is more than 3 feet in thickness. Severe where fill is less than 3 feet in thickness.[3]	Severe where fill is less than 6 feet in thickness.[3] Slight where fill is more than 6 feet in thickness.	Severe: rapid permeability permits ground water pollution.
Fort Mott: FrB	Slight	Slight	Slight: moderate permeability may permit ground water pollution.	Severe: rapid permeability permits ground water pollution.
Hammonton: HaA	Moderate: seasonal water table moderately high.	Slight	Moderate: seasonal water table moderately high.[2]	Severe: seasonal water table moderately high.
HbA	Moderate: seasonal water table moderately high.	Slight	Moderate: seasonal water table moderately high.[2]	Severe: seasonal water table moderately high.

the soils for town and country use

Limitations of soil for—continued					
Local roads and streets	Lawns, landscaping, plantings, and golf fairways	Athletic fields	Picnic and play areas	Campsites	Paths and trails
Slight	Slight	Moderate: slope; gravelly in places.	Slight	Slight	Slight.
Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: water table within 20 inches of surface during season of use.	Severe: water table within 20 inches of surface during season of use.	Severe: water table within 20 inches of surface during season of use.
Slight	Severe: very low fertility and available water capacity.	Severe: loose sand	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Slight	Moderate: low available water capacity and fertility; dusty.	Severe: low available water capacity and fertility; dusty.	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Moderate: moderately high seasonal water table.	Moderate: low available water capacity and fertility.	Severe: low available water capacity.	Moderate: dusty	Moderate: dusty	Moderate: dusty.
Slight	Slight	Slight for DrA. Moderate for DrB and DsB: gently sloping.	Slight	Slight	Slight.
Slight	Severe: low fertility and available water capacity.	Severe: low fertility and available water capacity.	Severe: loose sand is severe dust hazard.	Severe: loose sand is severe dust hazard.	Severe: loose sand is severe dust hazard.
Slight	Severe: low fertility and available water capacity.	Severe: low fertility and available water capacity; dust hazard.	Severe: dust hazard.	Severe: dust hazard.	Severe: dust hazard; poor trafficability.
Moderate where fill is more than 5 feet in thickness. Severe where fill is less than 5 feet in thickness.	Severe: low fertility and available water capacity.	Severe: loose sand; low available water capacity.	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Slight	Severe: low fertility and moderate available water capacity.	Severe: low fertility and moderate available water capacity.	Severe: loose sand is severe dust hazard.	Severe: loose sand is severe dust hazard.	Severe: loose sand is severe dust hazard.
Moderate: seasonal water table moderately high.	Moderate: seasonal water table moderately high.	Moderate: seasonal water table moderately high.	Slight	Slight	Slight.
Moderate: seasonal water table moderately high.	Moderate: seasonal water table moderately high.	Moderate: seasonal water table moderately high.	Moderate: dust hazard.	Moderate: loose surface layer is dust hazard.	Moderate: loose surface layer is dust hazard.

TABLE 10.—*Degree and kind of limitations of*

Soil series and map symbols	Limitations of soil for—			
	Dwellings		Septic tank absorption fields	Sanitary landfills [1]
	With basements	Without basements		
Klej: KmA	Moderate: seasonal water table moderately high.	Slight	Moderate: seasonal water table moderately high.[2]	Severe: seasonal water table moderately high.
Muck: MU	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.
Pocomoke: Ps	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.
Sassafras: SaA, SaB	Slight	Slight	Slight	Moderate: small amount of filterable material in substratum.
SbA	Moderate: seasonal water table moderately high.	Slight	Moderate: seasonal water table moderately high.[2]	Severe: seasonal water table moderately high.
Tidal marsh: TD, TM, TS	Severe: subject to tidal flooding; low bearing capacity.	Severe: subject to tidal flooding; low bearing capacity.	Severe: subject to tidal flooding.	Severe: subject to tidal flooding.
Woodstown: WmA	Moderate: seasonal high water table at a depth of 1½ to 2½ feet.	Slight	Moderate: seasonal water table moderately high.[2]	Severe: seasonal high water table at a depth of 1½ to 2½ feet.

[1] On-site investigations needed to determine soil and water characteristics below a depth of 5 feet.

[2] Deep drainage or filling is needed.

groups are named and the properties of the soils in each group that are important to the growth of plants are given.

Landscape planting group 1.—The soils in this group are poorly drained or very poorly drained. They have a high water table and are ponded at times during the year. They are nearly level and depressional.

Landscape planting group 2.—The soils in this group are somewhat poorly drained or moderately well drained. They have a seasonal water table that is highest in winter and spring but is moderately deep or deep in summer.

Landscape planting group 3.—The soils in this group are well drained and have moderate or high available water capacity. The water table normally is below a depth of 4 feet.

Landscape planting group 4.—The soils in this group are very sandy and have low available water capacity.

Formation, Morphology, and Classification of the Soils

In this section, the formation, morphology, and classification of the soils in the county are discussed. The first part deals with the factors of soil formation, the second part explains the development of soil horizons, and the third part deals with soil classification.

Factors of Soil Formation

Five important factors have influenced the formation of soils and soil characteristics in Cape May County. These factors are parent material, climate and relief, plant and animal life, and time. A discussion of each of these follows.

the soils for town and country use—Continued

Limitations of soil for—continued					
Local roads and streets	Lawns, landscaping, plantings, and golf fairways	Athletic fields	Picnic and play areas	Campsites	Paths and trails
Moderate: seasonal water table moderately high.	Severe: low natural fertility, available water capacity, and organic-matter content.	Severe: dust hazard; low natural fertility and available water capacity.	Moderate: dust hazard.	Severe: dust hazard.	Moderate: dust hazard; moderate trafficability.
Severe: seasonal high water table at surface; low bearing capacity.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface; severe dust hazard if drained.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface; severe dust hazard if drained.
Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: water table above a depth of 20 inches for 1 month or more during season of use.	Severe: water table above a depth of 20 inches for 1 month or more during season of use.	Severe: water table above a depth of 20 inches for 1 month or more during season of use.
Slight	Slight	Slight for SaA. Moderate for SaB: gentle slopes.	Slight	Slight	Slight.
Slight	Slight	Slight	Slight	Slight	Slight.
Severe: subject to tidal flooding; low bearing capacity.	Severe: subject to tidal flooding.	Severe: subject to tidal flooding.	Severe: subject to tidal flooding.	Severe: subject to tidal flooding.	Severe: subject to tidal flooding.
Severe: seasonal high water table at a depth of 1½ to 2½ feet.	Moderate: seasonal high water table at a depth of 1½ to 2½ feet.	Moderate: seasonal high water table at a depth of 1½ to 2½ feet.	Slight: water table below a depth of 20 inches during season of use.	Slight: water table below a depth of 20 inches during season of use.	Slight: water table below a depth of 20 inches during season of use.

[3] On-site investigations needed.

Parent material

Nearly all of the soils of Cape May County formed in unconsolidated geologic deposits, in reworked unconsolidated deposits, or in organic deposits. The deposits are believed to be of Pleistocene age (*4*). Although the glaciers did not reach so far south as Cape May County, melt water from the glaciers probably covered almost all of the county and mixed the materials of the older marine deposits. Rounded quartzose gravel, believed to be of Pleistocene age, can be found in all parts of the county, including the highest elevations. In extensive areas this gravel is not abundant, but it is present in small amounts.

During the Pleistoceneoge the climate of the county was much colder than it is now and the sea level fluctuated greatly. When the water level was low, much erosion by wind and water reworked the original soil deposits. Except for this mixing, the soils of the county are closely related to the parent material from which they formed.

Climate and relief

The factors of climate and relief are so interrelated in Cape May County that they are discussed together. The climatic changes during and after the ice age had considerable effect on the soils of Cape May County. Melt water was responsible for the mixing of soil materials. High winds during this period were probably responsible for the sand deposits in the Fort Mott soils.

During the time that the soils were forming, water covered the low areas of the county. In the soils of these areas, accumulation of organic matter is apparent in the dark surface layer. Also, the gray colors in the subsoil indicate that iron oxides could not form in the flooded areas. The soils that formed in high positions on the landscape generally were well drained. Iron oxides formed freely in these soils. Table 12 shows the texture of the subsoil, natural drainage, and other characteristics of the soil series in the county.

TABLE 11.—*Guide for landscape plantings*

[The letter "x" indicates that the species is desirable for the feature indicated]

LARGE AND MEDIUM DECIDUOUS TREES

Common and botanical names	Landscape planting group	Ornamental features					Growth rate	Potential height
		Shape of mature tree	Flower	Fruit	Shade	Autumn foliage		
								Ft
Ash:								
White (*Fraxinus americana*)	2,3	Round			X	X	Rapid	50 +
Green (*F. pennsylvanica*)	2,3	Round			X	X	Moderate	40–60
Beech:								
American (*Fagus grandifolia*)	2,3	Round	X		X		Slow	50 +
European (*F. sylvatica*)	2,3	Round			X		Moderate	50 +
Birch:								
Cutleaf European (*Betula pendula*)	2,3	Conical			X		Rapid	50
Gray (*B. populifolia*)	2,3,4	Conical			X	X	Moderate	15–25
Crabapple, flowering (*Malus spp.*)	3	Round	X	X		X	Moderate	15–25
Crapemyrtle (*Lagerstroemia indica*)	2,3	Round	X				Moderate	20–35
Dogwood, flowering (*Cornus florida*)	2,3	Round	X	X		X	Slow	25
Ginko (male) (*Ginkgo biloba*)	3	Oval			X	X	Moderate	50 +
Golden chain tree (*Laburnum anagyroides*).	3	Round	X				Moderate	30
Goldenrain tree (*Koelreuteria paniculata*).	3	Flat topped	X				Slow	20–40
Gum, black or sour (*Nyssa sylvatica*)	1,2,3	Oval	X	X	X	X	Moderate	25–50
Hawthorn, red-haw (*Crategus mollis*)	3	Variable	X	X			Moderate	20–30
Honeylocust, thornless (*Gleditsia triacanthos forma inermis*).	2,3	Round			X		Moderate	40–70
Hornbeam:								
American (*Carpinus caroliniana*)	2,3,4	Round			X	X	Moderate	25–35
European (*C. betulas*)	3	Round			X		Slow	50 +
Horsechestnut, red (*Aesculus carnea*).	2,3	Round	X				Moderate	30–40
Ironwood (*Ostrya virginiana*)	2,3,4	Round			X		Slow	20–50
Japanese pagoda tree (*Sophora japonica*).	2,3	Round	X				Moderate	50 +
Kalopanax (*Kalopanax pictus*)	3	Round	X	X			Moderate	50 +
Katsura (*Circidiphyllum japonicum*)	3	Round		X	X		Rapid	50–75
Larch, European (*Larix decidua*)	1,2	Conical					Moderate	50 +
Linden (basswood):								
American (*Tilia americana*)	2,3	Round			X		Rapid	50 +
Littleleaf (*T. cordata*)	2,3	Pyramidal			X		Slow	30
Magnolia, sweetbay (*Magnolia virginiana*).	1,2,3	Erect	X				Moderate	15–25
Maple:								
Norway (*Acer platanoides*)	2,3	Round			X	X	Moderate	40–80
Named varieties	2,3	Variable			X	X	Moderate to rapid	15–70
Red (*A. rubrum*)	1,2,3	Round			X	X	Moderate	40–80
Sugar (*A. saccharum*)	2,3	Round			X	X	Moderate	60–75
Mimosa, or silk tree (*Albizia julibrissin*).	2,3,4	Flat topped	X		X		Rapid	25–40
Mountain ash, American (*Sorbus americana*).	2,3	Oval	X	X	X		Rapid	25–50
Oak:								
Northern red (*Quercus borealis*)	2,3	Round			X	X	Rapid	50 +
Pin (*Q. palustris*)	1,2,3	Pyramidal			X	X	Moderate	50 +
Scarlet (*Q. coccinea*)	2,3	Pyramidal			X	X	Moderate	50 +
Shingle (*Q. imbricaria*)	2,3	Round			X		Moderate	75 +
Southern red (*Q. rubra*)	2,3	Round			X		Moderate	50 +
Turkey (*Q. falcata*)	2,3,4	Round			X		Moderate	75 +
White (*Q. alba*)	1,2,3	Round			X		Slow	50 +
Willow (*Q. phellos*)	1,2,3	Round			X		Moderate	50 +
Pear, Bradford (*Pyrus calleryana*)	2,3	Conical	X			X	Rapid	40–50
Plum (*Prunus spp.*)	3	Round	X			Variable	Moderate	15–40
Silverbell (*Halesia carolina*)	3	Round	X			X	Rapid	50 +
Shadbush (*Amelanchier canadensis*).	2,3	Upright	X	X	X		Moderate	20–35
Sweetgum (*Liquidambar styraciflua*).	1,2,3	Conical			X	X	Rapid	50 +
Yellow-poplar, or tulip (*Liriodendron tulipifera*).	2,3	Oval	X		X	X	Rapid	50 +

TABLE 11.—*Guide for landscape plantings*—Continued

LARGE AND MEDIUM DECIDUOUS TREES

Common and botanical names	Landscape planting group	Ornamental features: Shape of mature tree	Ornamental features: Flower	Ornamental features: Fruit	Ornamental features: Shade	Ornamental features: Autumn foliage	Growth rate	Potential height
								Ft
Yellowwood (*Cladrastis lutea*)	3	Round			X		Rapid	50 +
Zelkova (*Zelkova serrata*)	3,4	Round			X		Rapid	50 +

EVERGREEN TREES

Common and botanical names	Landscape planting group	Uses: Ornamental	Uses: Windbreak	Uses: Screen	Uses: Critical area	Growth rate	Potential height
							Ft
Arborvitae:							
American or northern white-cedar (*Thuja occidentalis*).	2,3	X	X	X	X	Slow	50 +
Oriental (*T. orientalis*)	2,3	X	X	X		Slow	50 +
Cedar:							
Atlas (*Cedrus atlantica*)	3	X				Slow	50 +
California incense (*Calocedrus decurrens*).	3	X				Slow	50–90
Cedar of Lebanon (*Cedrus libani*)	3	X				Moderate	50–80 +
Eastern redcedar (*Juniperus virginiana*).	2,3		X	X		Moderate	30 +
Cryptomeria (*Cryptomeria japonica*)	3	X		X		Moderate	80–100 +
Fir, white (*Abies concolor*)	3	X				Moderate	50–100
Hemlock, Canadian (*Tsuga canadensis*).	2,3	X		X		Moderate	50–90
Holly, American (*Ilex opaca*)	1,2,3	X	X	X		Slow	30–50
Magnolia, southern (*Magnolia grandiflora*).	3	X				Moderate	50 +
Pine:							
Austrian (*Pinus nigra, var. austriaca*).	2,3,4	X	X	X	X	Moderate	50 +
White (*P. strobus*)	2,3,4	X	X	X	X	Moderate	50–100
Privet, glossy (*Ligustrum lucidum*)	2,3	X	X	X		Fast	30–40
Spruce:							
Colorado blue (*Picea pungens*)	3	X				Slow	50 +
Norway (*P. abies*)	2,3	X	X	X		Moderate	50 +
White (*P. glauca*)	1,2,3	X	X	X		Moderate	50 +

SMALL DECIDUOUS TREES AND SHRUBS

Common and botanical names	Landscape planting group	Uses: Wildlife food	Uses: Ornamental	Uses: Autumn foliage	Uses: Screen	Uses: Windbreak	Uses: Critical area	Potential height
								Ft
Arrowwood (*Viburnum dentatum*)	1,2,3	X	X	X	X			10–15
Autumn-olive (*Flaeagnus umbellata*)	3,4	X	X		X		X	10–15
Azalea, flame (*Rhododendron calendulaceum*).	3	X	X					10–15
Bayberry (*Myrica caroliniensis*)	2,3	X	X					6–10
Blackhaw (*Viburnum prunifolium*)	2,3	X						15–20
Coralberry (*Symphoricarpos orbiculatus*).	2,3	X					X	2–6

TABLE 11.—*Guide for landscape plantings*—Continued

SMALL DECIDUOUS TREES AND SHRUBS

Common and botanical names	Landscape planting group	Uses: Wildlife food	Uses: Ornamental	Uses: Autumn foliage	Uses: Screen	Uses: Windbreak	Uses: Critical area	Potential height
								Ft
Cranberry, highbush (*Viburnum trilobum*).	2,3	X	X		X	X		10–15
Dogwood, red-osier (*Cornus stolonifera*).	1,2,3	X	X	X	X			10
Firethorn, Laland (*Pyracantha coccinea lalandi*).	3	X	X					10–20
Forsythia (*Forsythia spp.*)	3		X		X		X	10–15
Franklin tree (*Franklinia alatamaha*).	3		X	X				15–20
Hawthorns (*Crataegus spp.*)	3	X	X					12–20
Honeysuckle:								
Amur (*Lonicera maackii*)	3	X	X		X			10–15
Tatarian (*L. tatarica*)	3	X	X		X		X	10–15
Maple (*Acer spp.*)	2,3	X	X	Variable				12–25
Privet, Amur (*Ligustrum amurense*)	3	X	X		X	X	X	15–20
Winterberry (*Ilex verticillata*)	1,2,3	X	X					10
White fringe tree (*Chionanthus virginicus*).	1,2,3		X					12–15

EVERGREEN SHRUBS

Common and botanical names	Landscape planting group	Uses: Wildlife food	Uses: Ornamental	Uses: Autumn foliage	Uses: Screen	Uses: Windbreak	Uses: Critical area	Potential height
								Ft
Azalea (*Rhododendron spp.*)	3		X	X				5–10
Hollies:								
Chinese (*Ilex cornuta*)	3	X	X		X	X		10
Japanese (*I. crenata var.*)	3	X	X					Variable
Junipers (*Juniperus spp.*)	2,3	X	X					Variable
Laurel, mountain (*Kalmia latifolia*)	2,3		X					5–15
Pine, mugo (*Pinus mugo*)	3		X					10
Rhododendron (*Rhododendron maximum*).	2,3		X		X			10–15
Yew, Japanese (*Taxus cuspidata var.*).	3		X		X	X		Variable

Plant and animal life

Plants, micro-organisms, earthworms, and other forms of life that live on and in the soil are active in the soil-forming processes. The changes they bring about depend mainly on the kind of life processes peculiar to each. The kinds of plants and animals are determined by the climate, parent material, and age of the soil and by other organisms.

Most soils in Cape May County formed under forests of hardwood trees. The principal trees now growing in the area consist of various kinds of oak, hickory, sweetgum, red maple, redcedar, and Atlantic white-cedar. Similar trees probably made up the original forests.

In soils that form under forests, organic matter is added to the soil in the form of decayed leaves, twigs, roots, and entire plants. Most of this material accumulates on the surface. There it is acted on by micro-organisms, earthworms, termites, and other forms of life and by direct chemical reaction brought about by the effects of climate. The plant nutrients released by this decomposition are available for the growth of plants.

On the Coastal Plain, especially in the sandy soils, the content of organic matter is low, and organic mat-

TABLE 12.—*Soil series according to subsoil texture and natural drainage*

Dominant subsoil texture and other features	Natural drainage				
	Excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Very poorly drained
Sand or loamy sand	Evesboro		Klej	Klej	Berryland.
Sandy loam		Downer	Hammonton	Hammonton	Pocomoke.
Sandy loam or sandy clay loam; subsurface layer more than 20 inches thick		Fort Mott			
Heavy sandy loam or sandy clay loam		Sassafras	Woodstown		
Heavy sandy loam or sandy clay loam; firm, red gravelly sandy clay loam in lower part of subsoil		Aura			

ter remains concentrated in the upper few inches until the soils are plowed. Earthworms are rare in undisturbed sandy soils.

Land clearing, cultivation, the introduction of new plants, and artificial drainage affect the formation of soils. So far, the most apparent widespread results of these activities of man are alteration of the surface layer by tillage, reduction of acidity, and raising of the fertility level by additions of lime and fertilizers.

In some local areas, man has made drastic changes in the soils. He has removed the original soil or so mixed it in the process of recent construction that soil formation is now beginning in the rearranged materials.

Time

Most soils in the county are old enough to have been so thoroughly leached of the more soluble bases that they are either extremely acid or very strongly acid.

Considerably more time is required for the fine clay particles to move from the surface layer to the subsoil than is required for leaching. The subsoil in Evesboro soils is very weakly formed and contains only 1 to 3 percent more clay than the surface layer. Sassafras soils that formed on the next older terrace have 10 to 15 percent more clay in the subsoil than in the surface layer. The clay content of the subsoil is also related to the clay content of the parent material.

Melt water from the glaciers covered all of these old geologic deposits and, except on the steepest slopes, spread mixed sandy material on them.

Morphology

In Cape May County, as in most other parts of the Coastal Plain province, soil formation began with the physical weathering of parent material. Physical weathering is the processes of freezing and thawing, wetting and drying, and heating and cooling, which reduce the parent material to smaller particles. These processes are responsible for the formation of soil structure, especially in the finer textured soils. In Cape May County these processes began before the marine and melt-water deposits were laid down.

In Cape May County the processes of soil formation most responsible for developing horizons are accumulation of organic matter; leaching of carbonates and salts more soluble than calcium carbonate; chemical weathering of the primary materials of the parent material into silicate clay minerals; translocation of the silicate clay minerals, and probably of some silt-sized particles, from one horizon to another; oxidation, reduction, hydrolysis, hydration, and other chemical changes; and the transfer of iron. In most soils several or all of these processes are operating at the same time. A minimum of horizon differences occur in very sandy soils.

Made land consisting of material recently dredged from the inland waterway has the least accumulation of organic matter in the surface layer. Sandy soils, such as the Evesboro and Klej soils, have an accumulation of organic matter that is less than 1 percent. Sassafras soils have 1 to 4 percent. Pocomoke and Berryland soils have a 5 to 10 percent accumulation of organic matter in the surface layer.

Except for Tidal marsh and Coastal beach, leaching of carbonates has been so severe in all soils that they are naturally extremely acid or very strongly acid. Heavy liming of the farmed fields has changed these soils to a depth of 3 to 4 feet.

Translocation of the clay minerals from one layer to another occurs in Sassafras soils. They have 10 to 15 percent more clay in the subsoil than in either the surface layer or the underlying layer.

Various chemical changes and iron transfer are common to many soils of Cape May County. The effects of oxidation and iron transfer are probably most striking in the Sassafras soils, which have a dark grayish-brown surface layer and a brown subsoil.

Iron is transferred in the wet soils where iron is segregated in the mottles. Iron concentrations are common in the Klej and Hammonton soils. Iron is reduced in soils that are wet for long periods. Most of these soils are gray because the iron is reduced instead of being oxidized. Examples are Berryland and Pocomoke soils, which are gray in the lower part of the subsoil.

Classification

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see

TABLE 13.—*Classification of soils* [1]

Soils	Family	Subgroup	Order
Aura	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Berryland	Sandy, siliceous, mesic	Typic Haplaquods	Spodosols.
Coastal beach		Quartzipsamments	Entisols.
Downer	Coarse-loamy, siliceous, mesic	Typic Hapludults	Ultisols.
Evesboro	Mesic, coated	Typic Quartzipsamments	Entisols.
Fill land		Udorthents	Entisols.
Fort Mott	Loamy, siliceous, mesic	Arenic Hapludults	Ultisols.
Hammonton	Coarse-loamy, siliceous, mesic	Aquic Hapludults	Ultisols.
Klej	Mesic, coated	Aquic Quartzipsamments	Entisols.
Muck		Medisaprists and Medihemists	Histosols.
Pocomoke	Coarse-loamy, siliceous, thermic [2]	Typic Umbraquults	Ultisols.
Sassafras	Fine-loamy, siliceous, mesic	Typic Hapludults	Ultisols.
Tidal marsh		Sulfihemists and Sulfaquents	Entisols and Histosols.
Woodstown	Fine-loamy, siliceous, mesic	Aquic Hapludults	Ultisols.

[1] Urban land was not classified according to taxonomy.

[2] Temperatures are a few degrees cooler than is defined as within the range for the series.

their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*13*). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.[4]

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 13, the soils of Cape May County are placed in some categories of the current system. Some of the classes of the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

SUBORDER: Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu* meaning water or wet, and *ent*, from Entisol).

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquents (*Hapl*, meaning simple horizons, *aqu* for wetness or water, and *ent*, from Entisols).

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplaquents (a typical Haplaquent).

FAMILY: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties

[4] See the unpublished document "Selected Chapters from the Unedited Text of the Soil Taxonomy," available in the SCS State office, Somerset, New Jersey.

considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on that are used as family differentiae.

General Nature of the County

This section contains general information about the climate, geology, water supply, and farming in Cape May County.

Climate[5]

Cape May County has a humid and temperate climate that is influenced substantially by the ocean to the east and the Delaware Bay to the west. This influence is greatest in the peninsular part of the county and least in the northern part. Because the county has no other physiographic features that influence the climate, the climate is fairly uniform throughout the county, except for the coastal influence.

Temperature and precipitation data are given in table 14. Generally, these data are for 10-year periods, and variations should be expected depending on the 10-year-period selected. Temperature records are from Cape May, the most southern city in the county and one that is subject to coastal influence. In the northern part of the county, temperatures are higher in summer and lower in winter, averaging about 2 degrees lower than in Cape May. Freezing occurs about 30 days earlier in fall and 30 days later in spring in Belleplain than in Cape May. The highest temperature recorded for Cape May is 100° F and for Belleplain is 106°.

The lowest temperature recorded for Cape May is −3°, and for Belleplain it is −22°. Temperatures do not remain low for long periods. The soils freeze for short periods, especially where they are bare, but they are frozen less than half of the time in winter. Temperatures generally are not low long enough to make frost-action potential a concern in this county. The soils do not freeze to a depth of more than ½ to 1 foot.

Coastal storms occur in Cape May County at a rate of 1.27 storms per year, based on a 57-year record (*11*). They are a result of hurricanes and northeastern storms. Average tides are 2 feet above and below mean sea level. The record high tides are about 8 feet above mean sea level. When tides are at that level, 78,500 acres of the county is flooded. As a rule tides remain high for 1 or 2 cycles. During the storm of March 1962, however, tides remained high for 5 cycles. When tides are at a record high, waves as high as 12 feet batter the coastal fronts. Tidal height is determined by disregarding wave height.

During these storms, floodwater commonly covers many roads and highways. Bridges are high enough, but approaches to the bridges are flooded at times. In 1962, Ludlam Beach was evacuated when water, sewer, electric, and gas services failed. In the storms of March 1962, there was considerable damage to the barrier islands by removal or breaching of the protective dunes.

Rainfall records are from Belleplain in the northern

[5] By DONALD V. DUNLAP, climatologist for New Jersey, National Weather Service, U.S. Department of Commerce.

TABLE 14.—*Temperature and precipitation*

[Temperature data are from Cape May, precipitation data from Belleplain, and snow data from Cape May Court House]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Days with snow cover of 1.0 inch or more	Average depth of snow on days with snow cover
			Maximum temperature higher than—	Minimum temperature lower than—		Less than—	More than—		
	°F	*°F*	*°F*	*°F*	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	42	29	52	14	3.5	1.6	6.2	4	3
February	42	29	55	13	3.2	1.9	5.1	4	4
March	46	35	62	26	4.4	2.2	6.7	2	4
April	58	44	72	35	3.5	1.8	5.4	(1)	1
May	67	53	83	42	3.8	.9	7.5	0	0
June	77	62	89	53	3.4	1.3	6.0	0	0
July	81	67	92	61	4.8	1.6	8.0	0	0
August	80	67	89	58	5.8	2.2	10.5	0	0
September	75	62	86	50	3.9	.9	7.3	0	0
October	66	52	77	40	3.7	1.4	6.5	0	0
November	55	41	67	31	4.0	1.6	6.7	(1)	1
December	44	32	57	20	3.7	1.1	7.0	2	3
Year	61	48	[2] 94	[3] 10	47.6	35.1	58.9	12	3

[1] Less than one-half day.

[2] Average annual maximum.

[3] Average annual minimum.

part of the county. Rainfall on the peninsula is less than at Belleplain and is least at Cape May Point and the city of Cape May. Rainfall at Cape May Court House averages about 43 inches and at Cape May averages about 38 inches. Monthly averages for Cape May are lower than monthly averages for Belleplain. The highest annual rainfall recorded at Cape May was 57 inches, and the lowest was 26 inches. The highest annual rainfall at Belleplain was 67 inches, and the lowest was 32 inches. Monthly rainfall averages throughout the county indicate rather even distribution, with the highest monthly rainfall in July and August. Much of the rain comes from thunderstorms. Nearly every year, however, there are periods when rainfall is not enough for high-value crops. Irrigation is used on almost all high-value crops. At Cape May the maximum rainfall in 1 hour is 1.58 inches, in 6 hours is 3.45 inches, and in 24 hours is 3.77 inches.

Winds affect crops in the county. In winter and early in spring, the wind generally blows from the northwest. Late in spring and in summer the wind blows frequently out of the southeast. These shifting wind directions create a concern in stabilizing coastal beach sand dunes. On uplands, the critical period for soil blowing is from November to April. On the average, duration and velocity of the wind are greatest in March. By this time, most cover crops are plowed down in fields that are to be used for early crops. Sand blown by high winds cuts young corn and similar unprotected plants. High winds also remove organic matter, a valuable part of sandy soils.

The length of the growing season is about 196 days. The average date of the last killing frost in spring is April 17, and that of the first in fall is November 3. Probabilities for the last damaging cold temperature in spring and the first in fall are listed in table 15.

Geology

All geological material exposed at the surface in Cape May County is unconsolidated, nonglacial deposits of the Quaternary Period (*4*). The most extensive is the Cape May Formation, which rests over the Cohansey Formation. Both are composed of deposits of dominantly sand and gravel with smaller amounts of silt and clay. Clay lenses near the surface in the Cape May Formation are rare. The thickness of the Cape May Formation in Cape May County ranges from a few feet to 130 feet.

Water Supply

All of the county's water supply is taken from the ground by either shallow or deep wells within the county. The number of permanent residents and visitors is increasing so rapidly that demand for water will soon exceed the supply. The problem is most severe in the communities on the barrier islands, where saltwater has started to contaminate the wells in the Kirkwood aquifer at about 500 to 650 feet.

It is estimated that the winter population uses about 10 percent of the rainfall that can replenish the ground water taken from most shallow wells (*3*). The summer population uses 20 percent, but because there are clay layers between the surface and the water-producing strata, water percolating from the surface cannot reach the aquifers that are supplying most of the water now taken from deep wells. Some of the wells in the southern part of the county have been abandoned, and new wells are being developed in the northern part of the county.

Farming

The number of farms in the county in 1969 was 111. Farms occupied 15,863 acres, or 9.3 percent of the total acreage. The average farm size was 142.9 acres. Crops were on 10,361 acres, of which about 2,472 acres was irrigated. The dominant crop is lima beans grown under contract for freezing. Other significant crops are sweet corn, snap beans, tomatoes, and cantaloups. Several firms grow nursery stock, and several farms grow corn, small grain, soybeans, hay, and pasture.

Literature Cited

(1) Allan, Philip F., Garland, Lloyd E., and Dugan, R. Franklin. 1963. Rating northeast soils for their suitability for wildlife habitat. Wildlife Management Institute. 15 pp., illus.

(2) American Association of State Highway Officials. 1961. Standard specifications for highway materials and methods of sampling and testing. Ed. 8, 2 v., illus.

TABLE 15.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Cape May]

Probability	Dates for given probability and temperatures				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 3	March 12	March 20	April 3	April 17
2 years in 10 later than	February 21	March 1	March 12	March 24	April 8
5 years in 10 later than	February 5	February 21	March 5	March 19	March 31
Fall:					
1 year in 10 earlier than	December 1	November 26	November 20	November 12	November 3
2 years in 10 earlier than	December 7	December 1	November 26	November 18	November 10
5 years in 10 earlier than	December 24	December 16	December 9	November 30	November 17

(3) Cape May County Planning Board. 1962. Fresh water resources—management and conservation. 45 pp., illus.
(4) Kummel, Henry B. 1940. The geology of New Jersey. New Jersey Department of Conservation and Development. Bull. 50, 203 pp., illus.
(5) New Jersey Agricultural Experiment Station. (n.d.) Sprinkler irrigation in New Jersey. Bull. 815, 63 pp.
(6) New Jersey State Department of Health. 1963. Standards for construction of sewage facilities for realty improvements. 19 pp.
(7) Rogers, Franklyn C. 1950. Engineering soil survey of New Jersey. Report No. 15, Cape May County, College of Engin., Rutgers Univ.
(8) ——— 1955. Engineering soil survey report No. 1, soil environment and methods of research. Col. of Engin., Rutgers Univ., 144 pp., illus.
(9) Schnur, G. Luther. 1937. Yield, stand, and volume table for even-aged upland oak forests. U.S. Dept. Agr. Tech. Bull. No. 560, 87 pp., illus.
(10) Soil Surveys and Land Use Planning. 1966. Soil science society of America and American society of agronomy. 196 pp., illus.
(11) United States Army, Corps of Engineers. 1968. Flood plain information. Tidal Lands of Cape May County. 69 pp., illus.
(12) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dept. Agr. Handbook 18, 503 pp., illus. [Supplement issued in 1962]
(13) ——— 1960. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. [Supplements issued in March 1967 and in September 1968]
(14) ——— 1961. Land-capability classification. Agr. Handbook No. 210, 21 pp.
(15) ——— 1971. Guide for interpreting engineering uses of soils. 87 pp., illus.
(16) ——— 1972. Shade trees for the home. Agricultural Research Service, U.S. Dept. Agr. Handbook 425, 48 pp., illus.
(17) ——— 1973. Seacoast plants of the Carolinas for conservation and beautification. 206 pp., illus.
(18) ——— 1974. Soil survey laboratory data and descriptions for some soils in New Jersey. SSIR No. 26, 103 pp.
(19) United States Department of Defense. 1968. Unified soil classification system for roads, airfields, embankments and foundations. MIL-STD-619B, 30 pp., illus.
(20) United States Department of Health, Education, and Welfare. 1963. Manual of septic tank practice. Public Health Service Pub. 526, 85 pp., illus.

Glossary

Acidity. See Reaction, soil.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

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.

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 and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Gravel. Small rock fragments ranging in size from 2 millimeters (0.079 inch) to 80 millimeters (about 3 inches).

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sequioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

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

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Percolation. The downward movement of water in a wet soil, generally expressed in minutes per inch. Percolation tests also include lateral movement of water.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *slow, moderately slow, moderate, moderately rapid,* and *rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Quartzose. A term applied to material that is composed mainly of quartz but also contains other minerals.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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 other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit, woodland group, or wildlife group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 6.
Estimated yields, table 2, page 21.
Wildlife, table 6, page 24.
Engineering uses of the soils, tables 7, 8, and 9, pages 28 through 35.
Town and country planning, table 10, page 36.

Map symbol	Mapping unit	Page	Capability unit	Woodland suitability group	Ornamental planting group
			Symbol	Symbol	Number
ArB	Aura sandy loam, 0 to 5 percent slopes-----------	7	IIs-9	3o1	3
Bp	Berryland sand------------------------------------	8	Vw-26	3w1	1
CU	Coastal beach-Urban land complex-----------------	8	VIIIs-31	---	---
DoA	Downer loamy sand, 0 to 3 percent slopes---------	9	IIs-6	3o1	3
DpA	Downer loamy sand, water table, 0 to 2 percent slopes--	9	IIs-6	3o1	3
DrA	Downer sandy loam, 0 to 2 percent slopes---------	9	I-5	3o1	3
DrB	Downer sandy loam, 2 to 5 percent slopes---------	9	IIe-5	3o1	3
DsB	Downer sandy loam, gravelly substratum, 0 to 5 percent slopes--------------------------------	10	IIs-5	3o1	3
EvB	Evesboro sand, 0 to 5 percent slopes-------------	11	VIIs-7	3s1	4
FL	Fill land, sandy---------------------------------	12	----------	---	---
FM	Fill land, sandy organic substratum--------------	12	----------	---	---
FrB	Fort Mott sand, 0 to 5 percent slopes------------	13	IIIs-6	3o1	4
HaA	Hammonton loamy sand, 0 to 3 percent slopes------	14	IIw-15	2o1	2
HbA	Hammonton sandy loam, 0 to 3 percent slopes------	14	IIw-14	2o1	2
KmA	Klej loamy sand, 0 to 3 percent slopes-----------	15	IIIw-16	3s1	2
MU	Muck---	15	VIIw-30	4w1	1
Ps	Pocomoke sandy loam------------------------------	16	IIIw-24	3w1	1
SaA	Sassafras sandy loam, 0 to 2 percent slopes------	16	I-5	3o1	3
SaB	Sassafras sandy loam, 2 to 5 percent slopes------	16	IIe-5	3o1	3
SbA	Sassafras sandy loam, water table, 0 to 2 percent slopes--------------------------------	17	I-5	3o1	3
TD	Tidal marsh, deep--------------------------------	18	VIIIw-29	---	---
TM	Tidal marsh, moderately deep---------------------	18	VIIIw-29	---	---
TS	Tidal marsh, shallow-----------------------------	18	VIIIw-29	---	---
WmA	Woodstown sandy loam, 0 to 2 percent slopes------	19	IIw-14	2o1	2

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