SOIL SURVEY
MONTGOMERY COUNTY
Pennsylvania

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
THE PENNSYLVANIA STATE UNIVERSITY
College of Agriculture and Agricultural Experiment Station
and
PENNSYLVANIA DEPARTMENT OF AGRICULTURE
State Soil and Water Conservation Commission

Major fieldwork for this soil survey was done in the period 1959 to 1963. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1963. This survey was made cooperatively by the Soil Conservation Service, The Pennsylvania State University College of Agriculture and Agricultural Experiment Station, the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission, and the Montgomery County Commissioners; it is part of the technical assistance furnished to the Montgomery County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Montgomery County, Pa., contains information that can be applied in managing farms; in selecting sites for roads, buildings, ponds, or other structures; in managing woodland; and in appraising the value of tracts of land for agriculture, industry, or recreation.

Locating Soils

All the soils of Montgomery County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown 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, Capability Units, and Community Development Groups" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit and community development group in which the soil has been placed.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. 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 in the soil descriptions and in the discussions of the capability groups.

Foresters and persons concerned with commercial woodland and community plantings can refer to the subsection "Use of the Soils for Commercial Woodland and Community Plantings," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others concerned with wildlife will find information about soils and wildlife in the subsection "Soils and Wildlife."

Community planners and others concerned with community developments can read about the soil properties that affect the choice of homesites, industrial sites, commercial sites, and sites for institutions, schools, and parks in the subsection "Soils and Community Developments."

Engineers and builders will find in the subsection "Engineering Properties of the Soils" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

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

Students, teachers, and others will find information about soils and their management in various parts of the text, depending on their particular interest.

Newcomers in Montgomery 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 section "General Nature of the County," which gives additional information about the county.

Cover picture: Aerial view of a typical area in the southern part of Montgomery County.

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NOTICE TO LIBRARIANS

Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued April 1967

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas and Eldorado Valleys Area, Nev.
Series 1958, No. 34, Grand Traverse County, Mich.
Series 1959, No. 42, Judith Basin Area, Mont.
Series 1960, No. 31, Elbert County, Colo. (Eastern Part)
Series 1961, No. 42, Camden County, N.J.
Series 1962, No. 13, Chicot County, Ark.
Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF MONTGOMERY COUNTY, PENNSYLVANIA

FIELD SURVEY BY ROBERT V. SMITH, JACK S. LEVITAN, LESTER L. SEGLIN, EDWARD A. TOMPKINS, AND JOHN ZARICHANSKY, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT BY ROBERT V. SMITH, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE AND AGRICULTURAL EXPERIMENT STATION, AND THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE, STATE SOIL AND WATER CONSERVATION COMMISSION

MONTGOMERY COUNTY is in the southeastern part of Pennsylvania (fig. 1) northwest of the city of Philadelphia. The Schuylkill River, the major waterway in the county, forms the lower part of its southwestern boundary, and the city of Philadelphia lies along its southern end. The county occupies an area of 491 square miles and had a population of about 517,000 in 1960. Norristown, the largest borough and the county seat, had a population of about 39,000 in 1960.

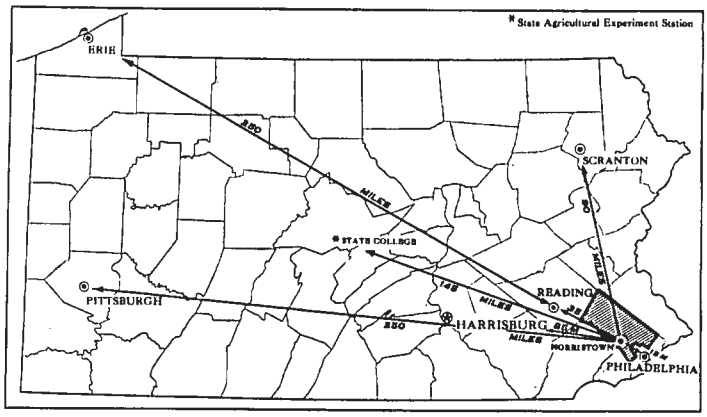

Figure 1.—**Location of Montgomery County in Pennsylvania.**

The county is predominantly an undulating plain with scattered low hills and ridges. It is in the Piedmont Province of the Appalachian Highlands Division of the United States. Three main physiographic areas, the Piedmont Upland, the Triassic Lowland, and the Limestone Lowland, are in the county. The Piedmont Upland occupies the southern third of the county, and the Triassic Lowland occupies most of the northern two-thirds. The Limestone Lowland, sometimes called the limestone valley, consists of a narrow, poorly defined valley that separates the Piedmont Upland and the Triassic Lowland. It extends from Valley Forge State Park to just west of Willow Grove. The county is drained by the Schuylkill River and by a number of smaller streams and their tributaries.

The predominant soils in the county are moderately deep or deep and are gently sloping. They are generally acid, have moderate natural fertility, and have moderately slow internal drainage. Crops grown on them respond well to applications of lime and fertilizer.

The county was formerly important for agriculture. Now, residential and industrial developments are rapidly expanding into most of the remaining farmland. In 1959, about 35 percent of the county was in farms and about 18 percent of the population lived on farms. The agriculture is diversified, but dairy farms and poultry farms are predominant.

The rapid expansion of industrial development and residential communities, with their associated shopping centers, into areas that were formerly rural has led to many problems relating to the use of the soils. This soil survey was made, in part, to determine the characteristics of the soils, how the soils respond to various uses, and what inherent soil properties limit a particular kind of use. Because the areas of each kind of soil are shown on a map of the county, it is possible to anticipate the qualifications of a site for a specific use, whether it be for growing corn, building a superhighway, or constructing a residential development.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Montgomery County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; 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 roots of plants.

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. Now to use this survey efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

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. Abbottstown and Beltsville, 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 go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Lansdale loam and Lansdale silt loam are two soil types in the Lansdale series. The difference in texture of their surface layers is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Lansdale silt loam, 0 to 3 percent slopes, moderately eroded, is one of several phases of Lansdale silt loam, a soil type that ranges from nearly level to moderately steep.

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 woodland, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this survey was prepared from the aerial photographs.

The delineated areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. 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 other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soil in it, for example, Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded. Also, on most soil maps, areas are shown where the soils have been disturbed by roadwork or other construction activities to such an extent that the original characteristics of the soils have been obliterated. These areas are shown on a soil map like other mapping units, but they are given a descriptive name, such as Made land, limestone materials, and are called land types rather than soils.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, public officials, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey. On basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test these groups by further study and by consultation with farmers, agronomists engineers, and others. Then, the scientists 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 present methods of use and management.

General Soil Map

After studying the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this survey. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic, although not strictly uniform.

The soils within any one association are likely to differ greatly among themselves in some properties for example, slope, depth, stoniness, or natural drainage. Thus, the general map does not show the kind of soil at any particular place, but a pattern that has in it several kinds of different soils.

The soil associations are named for the major soil series in them, but as already noted, soils of other series may also be present. The major soil series of one soil association may also be present in other associations, but in a different pattern.

The general map showing patterns of soils is useful to people who want a general idea of the soils, who want to compare different parts of the county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

The eleven soil associations in Montgomery County are discussed in the following pages. More detailed information about the soils is given in the section "Descriptions of the Soils."

1. Made Land-Glenelg-Chester Association

Deep and moderately deep, well-drained soils underlain by schist and gneiss; on undulating uplands

This association consists of broad, undulating uplands occupied mainly by towns, housing developments, and large homes. It includes patches of farmland. Scattered open spaces occupied by golf courses, cemeteries, institutions, and large estates provide the major break in the pattern of residential, commercial, and industrial developments (fig. 2).

The association is in the southern third of the county, adjacent to the city of Philadelphia and Delaware County. It is dissected by transportation routes that radiate northward from the city of Philadelphia to all parts of the county. Within the boundaries of this association are Ardmore, Narberth, Jenkintown, Willow Grove, and other important communities. The association is drained by Pennypack, Tacony, and Mill Creeks.

About 50 percent of this association is occupied by Made land. In the areas where Made land occurs, the original soils in many places can no longer be recognized, because they have been changed by grading and construction work. Moderately deep Glenelg soils occupy about 25 percent of the association, and deep Chester soils occupy about 15 percent (fig. 3). The Glenelg and Chester soils are well drained and are mainly nearly level or gently sloping. They have a yellowish-brown, friable subsoil that is easily eroded if the soils are disturbed.

Included in this association are Manor, Glenville, Codorus, and Hatboro soils. The Manor soils, near drainageways in the more sloping areas, are moderately deep or deep to bedrock and are well drained. They contain many small stones and pieces of rock. The Glenville soils, in depressions, are moderately well drained or somewhat poorly drained. They have a yellowish-brown, firm subsoil that is mottled with gray in the lower part. The Codorus and Hatboro soils are on nearly level flood plains in the southeastern part of the county. The Codorus soils are moderately well drained or somewhat poorly drained, and the Hatboro soils are poorly drained. The Codorus and Hatboro soils have a seasonal high water table and are subject to flooding.

The soils of this association are deep over hard bedrock and are mostly nearly level or gently sloping. They are easy to till and are predominantly well drained, but they retain a large amount of moisture for the use of plants. Limitations to use of these soils for agriculture and for developments are slight to moderate.

Figure 2.—**Typical residential area, industrial park, and cloverleaf on the Pennsylvania Turnpike at Fort Washington in the southern part of the county.**

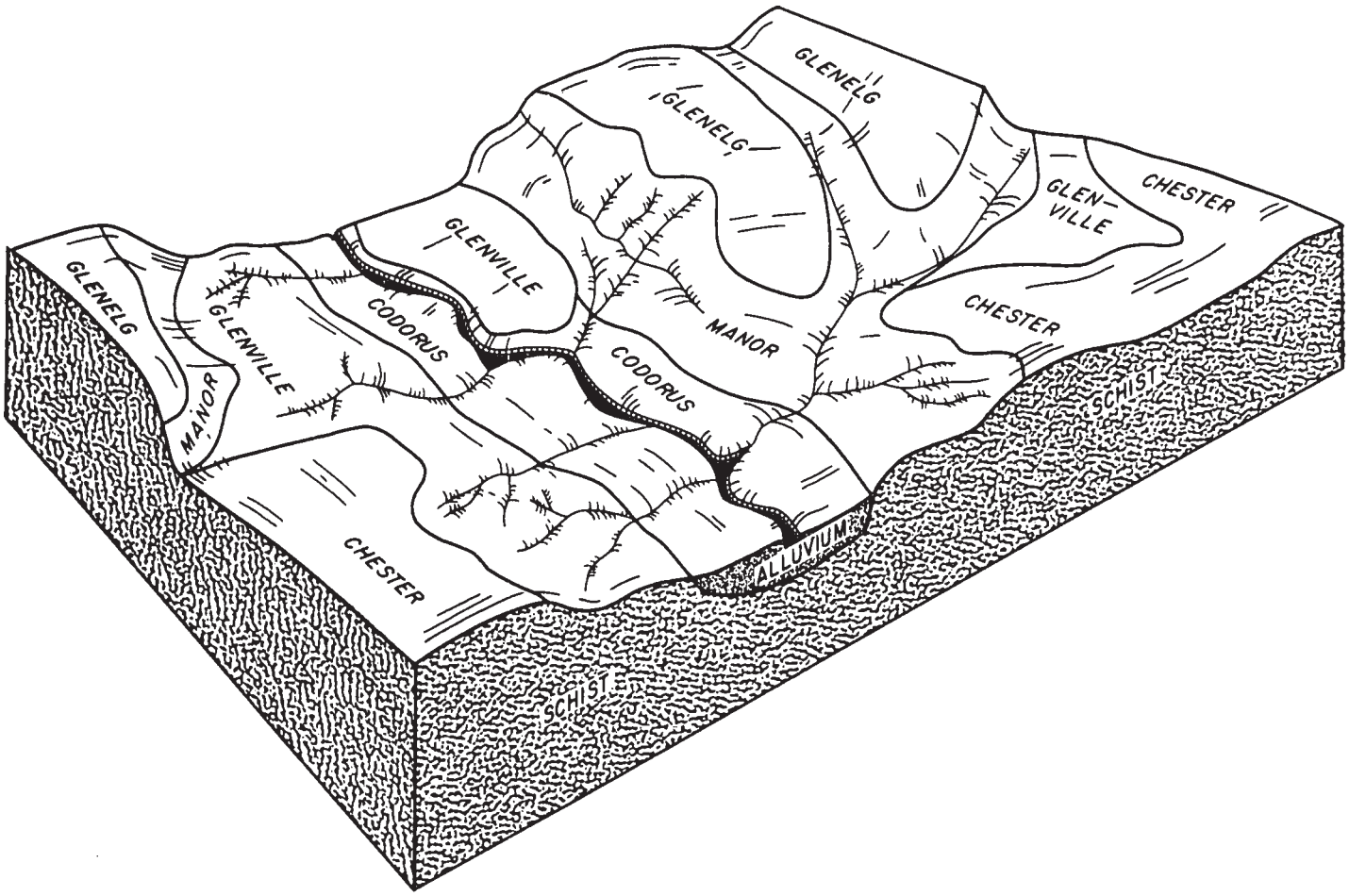

Figure 3.—**Typical landscape in the southern part of Montgomery County, showing the pattern of soils formed on schist and the relationship of the soils in the pattern.**

The main areas used for agriculture are within the large estates in the eastern part of the county. The rest of the association is mainly in towns and developments.

2. Made Land-Duffield-Lawrenceville Association

Deep, well-drained soils underlain by limestone; on undulating uplands

This association consists of an undulating valley, 2 miles or less wide, extending across the county from Valley Forge State Park to Willow Grove. It is bounded on the north and south by low hills and ridges. The soils in this valley are underlain by limestone, and those on the low hills and ridges are underlain by quartzite, schist, gneiss, and sandstone. Within the association are mainly industrial establishments, quarries, and towns, but scattered open areas are occupied by parks, golf courses, and farms or large estates. The largest population centers are King of Prussia, Flourtown, and Oreland.

About 50 percent of the association is occupied by Made land. In the areas where Made land occurs, the original soils have been so altered by engineering operations, construction work, and quarrying that the individual soils can no longer be identified. Deep, well-drained Duffield soils, underlain by limestone bedrock, occupy about 30 percent of the association. They are gently sloping to moderately sloping. Deep, silty, moderately well drained Lawrenceville soils make up 10 to 15 percent of the association. In the lower part of their subsoil, they have a thick, dense layer, called a fragipan, that has moderately slow permeability. The Lawrenceville soils developed in windblown silty deposits in depressions, on flats, and on gently sloping uplands.

Soils developed in colluvial and alluvial material occupy minor areas in this association. Among these are the Murrill soils, near the edges of the valley where soil material has eroded from the hills and ridges and has been deposited over the limestone. The Murrill soils are deep and well drained. They contain more gravel and pieces of rock than the Duffield soils. Moderately well drained Codorus soils and small areas of poorly drained Hatboro soils are on the narrow flood plains. The Codorus and Hatboro soils formed in alluvium.

In the southwestern part of the county near Conshohocken, other minor areas of this association are occupied by the Howell and Beltsville soils. The Howell soils are well drained. The Beltsville soils are moderately well drained or somewhat poorly drained, and

they have a firm, slowly permeable layer, or fragipan, in the subsoil. The Howell and Beltsville soils formed in old marine deposits of sand, silt, clay, or gravel.

The soils of this association are deep and easy to till, and their relief is generally somewhere between nearly level and moderately sloping. The Duffield soils are well drained. The drainage of the Lawrenceville soils is affected by the moderately slow permeability of their subsoil, and they have a high water table during winter and early in spring.

In some places the limestone bedrock contains solution channels that cause sinks. These sinks interfere with the building of roads, and the areas are not suitable for use as a foundation for heavy structures. Also, the underground water can be contaminated by sewage effluent that has passed directly into the solution channels.

The industries in this association are concentrated in the western half of the valley. Steel-manufacturing plants and other heavy industries are along the Schuylkill River. A commercial and residential center is King of Prussia, in the western part of the association (fig. 4). Other commercial and residential centers are scattered throughout the eastern half of the valley. There are several large limestone quarries that are active.

Nursery stock and vegetables are grown, to a small extent, on the soils of this association. On a few large estates, general field crops are grown and beef cattle and racehorses are raised. Expanding residential, commercial, and industrial areas, however, are rapidly taking over the areas. In the near future, Valley Forge State Park and several large golf courses are likely to be the only open areas left in this association.

3. Lansdale-Penn-Readington Association

Deep and moderately deep, well drained and moderately well drained soils underlain by shale and sandstone; on rolling uplands

This association is made up of densely populated areas surrounded by farms. It consists mainly of low hills that have broad, rounded summits and short, steep side slopes. The association occupies areas of irregular shape between the Schuylkill River and the Bucks County line in the south-central part of the county. It is drained by the Schuylkill River and its tributaries, Perkiomen and Wissahickon Creeks. The principal towns are Norristown, Ambler, and Hatboro.

About 60 percent of the association is occupied by well-drained Lansdale and Penn soils (fig. 5). The relief of these soils ranges from nearly level to steep, but it is somewhere between gently sloping and moderately steep in most places. The Lansdale soils are brown or yellowish brown, and they have a profile that is sandy in the lower part. They formed in material weathered from sandstone and conglomerate, and they are shallow to deep over those underlying rocks. The Penn soils

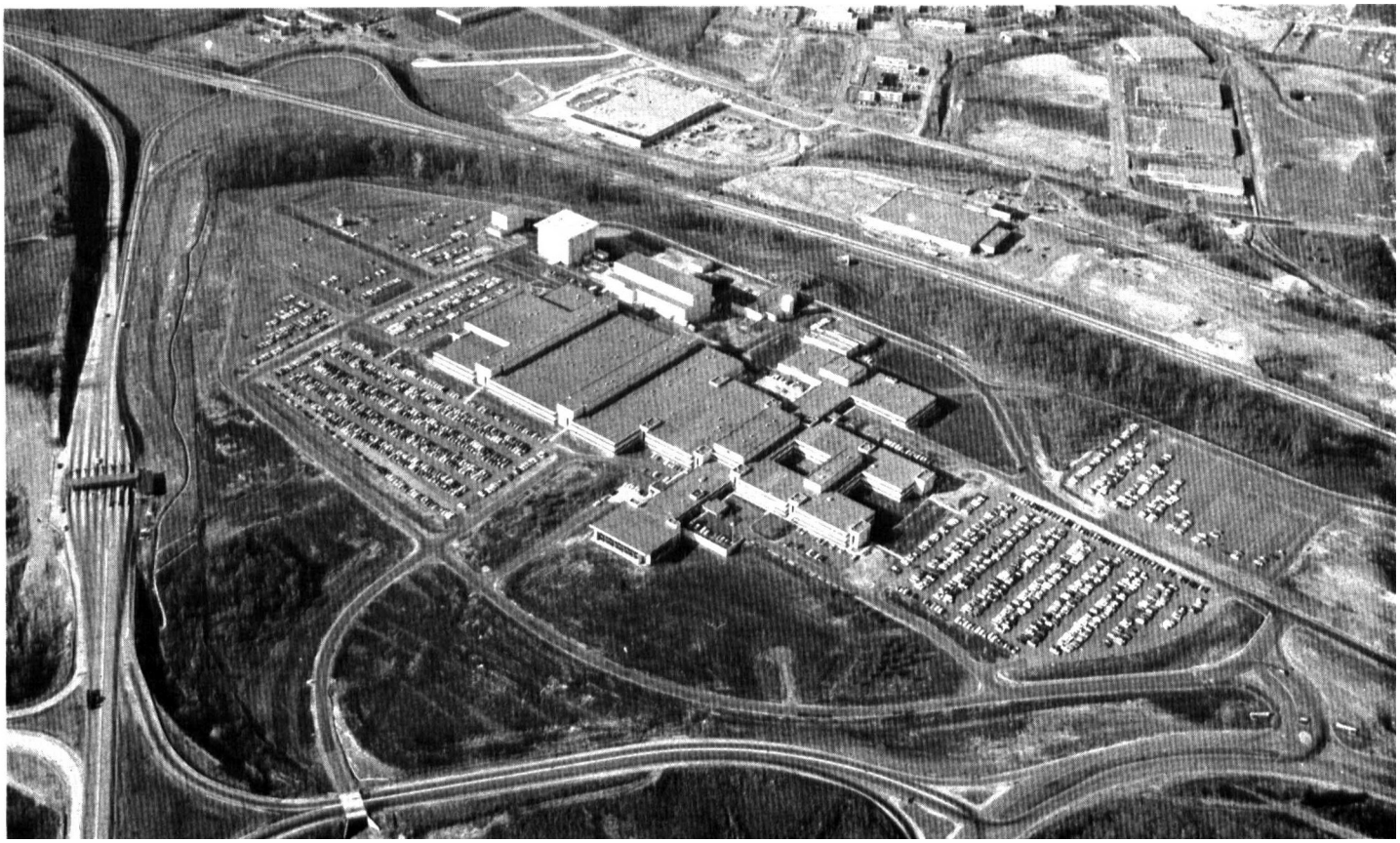

Figure 4.—King of Prussia along the Pennsylvania Turnpike. This view is typical of the new industrial parks developing around the main highway interchanges in the southern part of the county. Duffield and Lawrenceville soils and Made land, limestone materials, are in this association.

Figure 5.—**Area of association 3 near King of Prussia. The steeper areas and the areas occupied by houses are Lansdale and Penn soils. Readington and Abbottstown soils are in the drainageways in the pasture in the foreground.**

are reddish brown, and they have shaly material in the lower part of their subsoil. They formed in material weathered from shale and fine-grained sandstone. Readington soils occupy about 20 percent of the association. They are moderately well drained and are nearly level or gently sloping.

A minor part of the association is made up of a few narrow areas of steep, shaly, very shallow Klinesville soils and small areas of poorly drained Croton and somewhat poorly drained Abbottstown soils in depressions and drainageways. Also included are areas of moderately well drained or somewhat poorly drained Rowland soils on narrow flood plains.

The soils of this association are friable and retain a moderate amount of moisture for the use of plants. They have few limitations to use for agriculture and moderate limitations for residential developments. The main limitations are the short, steep, eroded slopes and bedrock near the surface. Also, some areas contain occasional flats or depressions in which the permeability of the subsoil is moderately slow. In those areas there is a temporary high water table in fall, in winter, and early in spring.

Agriculture is diversified in this association. Dairying and the growing of fruit, vegetables, and nursery stock are the dominant enterprises. Horses, sheep, and beef cattle are raised on the large estates in the central and eastern parts of the association. Full-time farming is most common west of Norristown. Housing developments and other facilities to take care of the expanding population are rapidly changing the rural aspect of the areas around the cities and towns. Several golf courses, parks, summer camps, and tracts of woodland occupy the steeper slopes along the Schuylkill River and Perkiomen and Wissahickon Creeks.

4. Manor-Glenelg-Made Land Association

Moderately deep and deep, well-drained soils underlain by schist and gneiss; micaceous soils on hilly uplands

This is a hilly association containing steep, wooded slopes, residential developments, and large estates. It is in the southern third of the county, along streams that have deeply dissected the uplands. Winding, tree-lined roads follow these natural depressions. They connect the areas along the streams with the network of streets and highways on the ridgetops. The Schuylkill River and the Pennypack, Tacony, and Mill Creeks drain the association.

About 50 percent of the association is occupied by Manor soils. Moderately deep Glenelg soils occupy another 20 percent, and Made land, about 25 percent. The Manor soils contain more coarse fragments of stone than the Glenelg. Both the Manor and the Glenelg soils are well drained to somewhat excessively drained and are gently sloping to steep. They formed in deeply weathered schist and gneiss. Made land occurs where excavating and leveling by construction equipment have altered and mixed the original soils.

A minor part of the association consists of Glenville, Codorus, and Hatboro soils. The Glenville soils, in depressions, are less well drained than the surrounding soils. The Codorus and Hatboro soils are on flood plains in narrow valleys. They have a seasonal high water table and are subject to flooding. The Codorus soils are moderately well drained or somewhat poorly drained, and the Hatboro soils are poorly drained.

The soils of this association are not well suited to intensive use for agriculture, and they have limitations that affect their use for developments. They are suited to parks and to open spaces reserved for public use. The major limitations of the soils are the steep slopes, the stones and smaller pieces of rock that make tillage difficult, the moderate to low available moisture capacity, and the varying depths to bedrock.

Much of this association is wooded, but cropland, pastures, small orchards, nurseries, and golf courses are scattered throughout the sloping and moderately steep areas. Residential development is increasing throughout the association and is already extensive in the eastern part. Homeowners have made good use of the natural beauty of the area in choosing their homesites, especially in the areas west of the Schuylkill River.

5. Edgemont-Manor Association

Moderately deep and deep, well-drained soils underlain by quartzite and quartz schist; soils mainly on ridges

This association consists of long, narrow ridges that have residential developments on their summits and trees on their side slopes. It is in an interrupted strip north and south of the limestone valley described in the introduction to the survey and under association 2. Roads extend along the ridgetops and cross the areas at points where natural depressions occur.

The wooded tracts of Valley Forge State Park and Fort Washington State Park are within this association. Also, there are several scattered golf courses, nurseries, and a few active stone quarries. Residential and commercial development has been extensive in the eastern part. In other areas development consists mainly of homes along the roads on the ridgetops.

Edgemont soils occupy about 75 percent of the association, and Manor soils, about 10 percent. The Edgemont and Manor soils are well drained and contain stones and smaller pieces of quartzite and quartz schist. The Edgemont soils are moderately deep or deep and

are gently sloping to steep. The Manor soils are moderately deep or deep over weathered rock.

A minor part of this association is made up of Glenville soils and areas of Made land. The Glenville soils are deep and are moderately well drained or somewhat poorly drained. In some places they are in depressions on the ridgetops, and in other places they are in drainageways or on the lower slopes. The areas of Made land are near stone quarries, cities and towns, and housing developments that have been recently established.

The soils of this association are not well suited to agriculture, and the high content of stones, steep slopes, bedrock near the surface, and excessive drainage also limit their use for residential developments. Some new housing developments have been established, however, on the steep side slopes. In those areas earthmoving has been extensive.

6. Reaville-Penn-Klinesville Association

Shallow to moderately deep, well-drained to somewhat poorly drained soils underlain by shale; soils on rolling uplands

This association is the largest in the county and is the most important for agriculture. It consists of rolling farmland dissected by many streams and drainageways that are bordered by short, steep slopes. The main part of the association is in a belt 3 to 8 miles wide that extends across the north-central part of the county. Small agricultural communities are scattered throughout the association, especially at intersections of roads. Housing developments have expanded outward from the larger communities of Pottstown, Lansdale, Collegeville, and Souderton. Much of the road frontage is occupied by individual homes on small lots. This association is drained by Perkiomen, Skippack, and Towamencin Creeks.

The major soils in this association are reddish brown, as they developed in material weathered from red shale (fig. 6). The Reaville soils occupy 35 to 40 percent of the association, the Penn soils about 25 percent, and the Klinesville soils 15 to 20 percent. The Reaville soils, on nearly level to moderately sloping uplands, are moderately deep and contain shale fragments. They are wet in spring and late in fall, but they are droughty in summer. The Penn soils are moderately deep to shallow over bedrock and are well drained. The shallow to moderately deep, well-drained, neutral substratum phases of Penn soils are scattered throughout the northern part of the association. They formed in material weathered

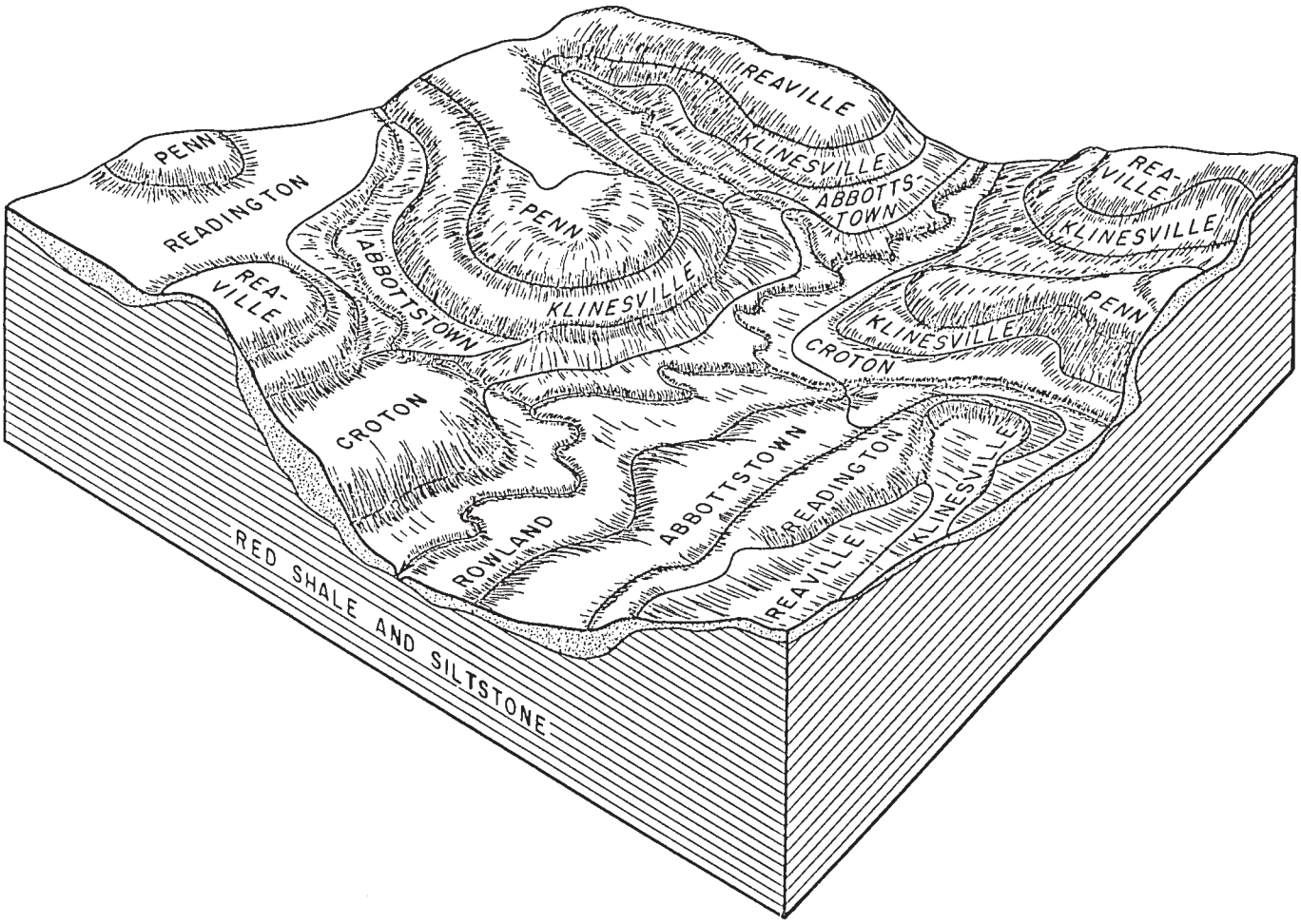

Figure 6.—Typical landscape in the northern part of Montgomery County, showing the relationship of the soils formed on red shale and siltstone.

from red shale and have been influenced by lime. The Klinesville soils are on the steeper slopes and on narrow ridgetops. They are droughty and shallow, and they also contain shale.

Common in this association, but less extensive than the Reaville, Penn, and Klinesville soils, are areas of the Readington, Croton, Abbottstown, Rowland, and Bowmansville soils. The Readington soils are on nearly level to sloping uplands and are deep and moderately well drained. The Croton soils are on flats and in depressions and are poorly drained. The Abbottstown soils are on flats, in depressions, and on the gentle lower slopes, and they are somewhat poorly drained. Moderately well drained Rowland and poorly drained Bowmansville soils are the principal soils on the flood plains.

The soils of this association have many limitations to use for agriculture and residential developments. Their natural drainage ranges from good to poor, their slopes range from nearly level to steep, and depth to bedrock ranges from less than 10 inches to more than 3 feet. Severe erosion has removed all of the original surface layer in a large part of the association.

Dairy farming is the most important type of farm enterprise, but beef cattle and poultry are also raised, and fruit, vegetables, and grain are grown on some farms. In rural areas where houses are located, the problem of adequately disposing of the effluent from the septic tanks is acute because of the distance from a central disposal system, the slow permeability of the subsoil or substratum in the Reaville soils, and the bedrock near the surface of the Penn and Klinesville soils. Several golf courses are within this association. Also, establishments for light industry are located near the main transportation routes.

7. Lehigh-Brecknock-Croton Association

Moderately deep and deep, poorly drained to well-drained soils underlain by metamorphosed shale; on uplands

This association consists of grayish soils on low, but prominent, hills and ridges. Throughout the association are areas of farmland where small rectangular fields are bordered by cedars (fig. 7). Areas of idle land overgrown with young trees and weeds are also extensive. The association is in the northern third of the county. It is in long, narrow bands that border the areas of Neshaminy, Mount Lucas, and Watchung soils of association 8 (fig. 8).

Figure 7.—Small, rectangular fields bordered by cedars in association 7. Gently sloping Lehigh soils are in the foreground and in the cornfield in the background. Also in the background are steep, stony, wooded areas. Nearly level Croton soils are in the field between the two areas of Lehigh soils.

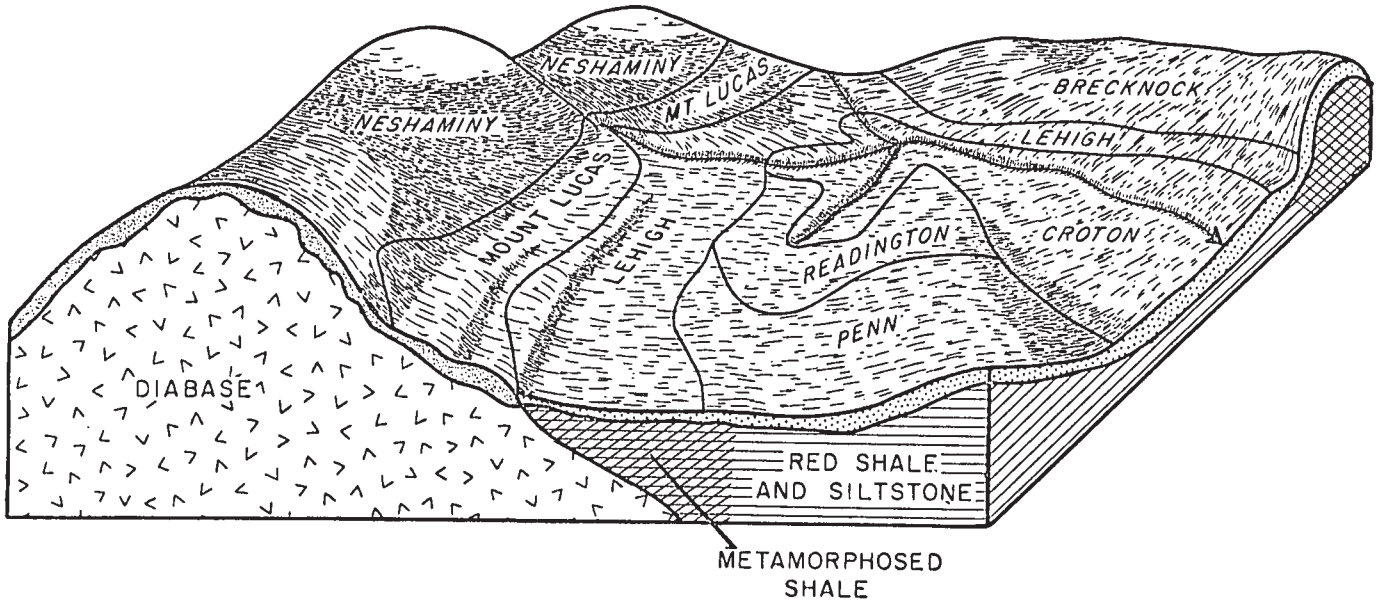

Figure 8.—Typical landscape in association 7 showing the pattern of soils and their relationship to the underlying material. Some of the major soils in association 8 are also included.

The soils of this association are moderately deep to deep over bedrock and are channery or stony. They formed in material weathered from hard, black, fine-textured metamorphosed shale, called hornfels.

Lehigh soils occupy about 50 percent of the association. They are wet late in fall and early in spring, but they are generally droughty during the rest of the growing season. The Lehigh and Croton soils are nearly level to moderately steep. Brecknock soils occupy 15 to 20 percent of the association, and Croton soils about 20 percent. The Brecknock soils are well drained to excessively drained and are on narrow ridgetops and steep side slopes. The Croton soils have a subsoil that is slowly permeable. They are somewhat deeper and contain fewer coarse fragments than the Lehigh soils.

A minor acreage in the association is occupied by poorly drained Bowmansville soils. The Bowmansville soils are on flood plains along streams.

The soils in this association are not well suited to agriculture, and they have limitations that restrict their use for residential developments. These limitations are their steep slopes, high content of stones, bedrock near the surface, and low available moisture capacity. Also, the Lehigh and Croton soils have a high water table.

This association was formerly cleared and used extensively for dairying and general farming. Now, much of it is idle and is reverting to woodland. Summer camps and game refuges occupy part of this association. Small, scattered agricultural communities are the only population centers, but individual homes are located along roads on the broad hilltops.

8. Neshaminy-Mount Lucas-Watchung Association

Deep, well-drained to poorly drained soils underlain by diabase; on hills and ridges

This association is mainly in woods. It contains most of the large areas of woodland in the county, and also scattered small farms with rectangular fields bordered by stone walls and cedar trees. Near Pottstown, there are a few housing developments, but elsewhere in the association, new homes are widely scattered. In the eastern part, parks, camps, cottages, and other recreational areas are common. Hills and ridges make up a large part of the association, and large rounded boulders and stones are a distinctive part of the landscape in the wooded areas. The association winds through the northern half of the county. The major streams that provide drainage are the Unami, Perkiomen, and Swamp Creeks.

The soils in this association are moderately deep or deep and developed on dark-colored igneous rocks, called diabase (see fig. 8). Stones and boulders that range from less than 3 feet to more than 12 feet in diameter are common in all of the areas.

About 50 percent of the association is occupied by Neshaminy soils. The Neshaminy soils are brown or reddish brown, are well drained, and are gently sloping to steep. Mount Lucas soils occupy 25 to 30 percent. Except for gray mottling in the subsoil, they are brown, and they are nearly level to moderately steep. The Mount Lucas soils have a high water table late in fall and early in spring. Watchung soils occupy 15 to 20 percent of the association. They are poorly drained and have a gray, fine-textured subsoil. The Watchung soils are on gently sloping uplands, on flats, and in depressions.

A few minor areas of the association are occupied by steep Legore soils. The Legore soils are eroded and are moderately deep over bedrock.

The soils of this association are fairly well suited to agriculture, except where they are limited by stones, steep slopes, or wetness. These factors, in addition to remoteness from cities and transportation centers, also limit their use for residential developments. Fruit, milk, eggs, and general field crops are the chief agricultural products.

9. Abbottstown-Readington-Croton Association

Deep, moderately well drained to poorly drained soils underlain by shale and sandstone; on undulating uplands

This association is in undulating areas on the uplands and includes both rural areas and towns. It occupies many rather small areas of irregular shape in the central and northwestern parts of the county. The largest towns are Lansdale, Hatfield, Telford, Trooper, and Limerick. Residential, commercial, and industrial expansion has been rapid around the cities and towns. Most of the roads in the association are bordered by homes.

The soils of this association are nearly level or gently sloping. They formed in material weathered from red, black, and brown, hard shale, and they contain a few to a moderate number of coarse fragments. About 30 percent of the association is occupied by Abbottstown soils, which are deep and somewhat poorly drained. The Abbottstown soils have a brown or reddish-brown, slowly permeable subsoil that is mottled with gray just below the plow layer. Readington soils occupy about 30 percent of the association. They are reddish brown or brown and are deep and moderately well drained. The lower part of their subsoil is mottled with gray and has moderately slow permeability. Poorly drained Croton soils occupy about 25 percent of the association. They are predominantly gray, and they have a subsoil that is slowly permeable throughout.

A minor part of the association is made up of gently sloping or moderately sloping Reaville soils that are severely eroded in many places. These are moderately deep, shaly soils that are droughty in summer but are wet late in fall, in winter, and early in spring. Moderately well drained Rowland and poorly drained Bowmansville soils also make up a minor part of the association. Both the Rowland and Bowmansville soils are on narrow flood plains, but the Bowmansville soils are more extensive than the Rowland.

The major soils of this association have a moderate to high capacity to hold moisture available to plants. Their use is limited, however, by the slow or moderately slow permeability of their subsoil, the seasonal high water table, and the excess moisture as the result of seeps. The soils are well suited to pasture and hay. Yields of cultivated crops vary because the soils are wet in spring and after periods of heavy rainfall. Also, small grains grown in winter are subject to frost heaving and winterkill.

These soils have severe limitations for developments. The slow or moderately slow permeability of their subsoil prevents on-lot sewage disposal systems from operating efficiently. It also causes wetness in basements and causes the deterioration of paved surfaces.

Dairy farming is predominant in this association. Also, farmers who work off the farm part time grow corn, small grains, and soybeans as cash crops. In addition, fruit, vegetables, and nursery stock are grown.

10. Lawrenceville-Chalfont-Doylestown Association

Deep, moderately well drained to poorly drained soils formed in windblown silt deposits; on undulating uplands

This association, like association 9, is in undulating areas of the uplands. It occupies many tracts of irregular shape that form a triangle in the central part of the county. This triangular area is widest along the line between Bucks County and Montgomery County. The association is made up of both farmland and scattered housing developments. Typical of the association are large fields on broad, gentle slopes and flats, surrounded in many places by housing developments. Expansion of residential, industrial, and commercial developments has been extensive around the towns. Many housing developments, schools, and small industries now occupy areas that were formerly rural, and they are rapidly expanding into other rural areas. Several golf courses, airports, and summer camps are also within the association.

The principal soils of this association have formed in a thick mantle of silt deposited by wind over shale, sandstone, and other kinds of bedrock (fig. 9). They have a firm or brittle layer, called a fragipan, in the subsoil. Permeability is slow or moderately slow in the fragipan. In wet seasons, water accumulates above the fragipan and causes a seasonal high water table.

Moderately well drained Lawrenceville soils occupy about 40 percent of the association. They are yellowish brown and have gray mottling in the lower part of the subsoil. The fragipan in their subsoil is generally at a depth of about 30 inches. Somewhat poorly drained Chalfont soils occupy about 25 percent. They have brown and gray mottling in the subsoil and a fragipan at a depth of 2 feet or less. Poorly drained Doylestown soils, on the lower lying flats in many places, occupy about 15 percent. They have a predominantly gray color and contain a fragipan similar to that in the Chalfont soils.

A minor part of the association is made up of moderately well drained Readington soils, somewhat poorly drained Abbottstown soils, and poorly drained Croton soils. These soils formed in material weathered from the dark bedrock. Minor soils on the flood plains are the moderately well drained Rowland and poorly drained Bowmansville soils.

The soils of this association are nearly level or gently sloping, contain few coarse fragments, and are moderate to high in capacity to hold moisture available for plants. Their use for agriculture is limited, however, by their slow or moderately slow permeability and the seasonal

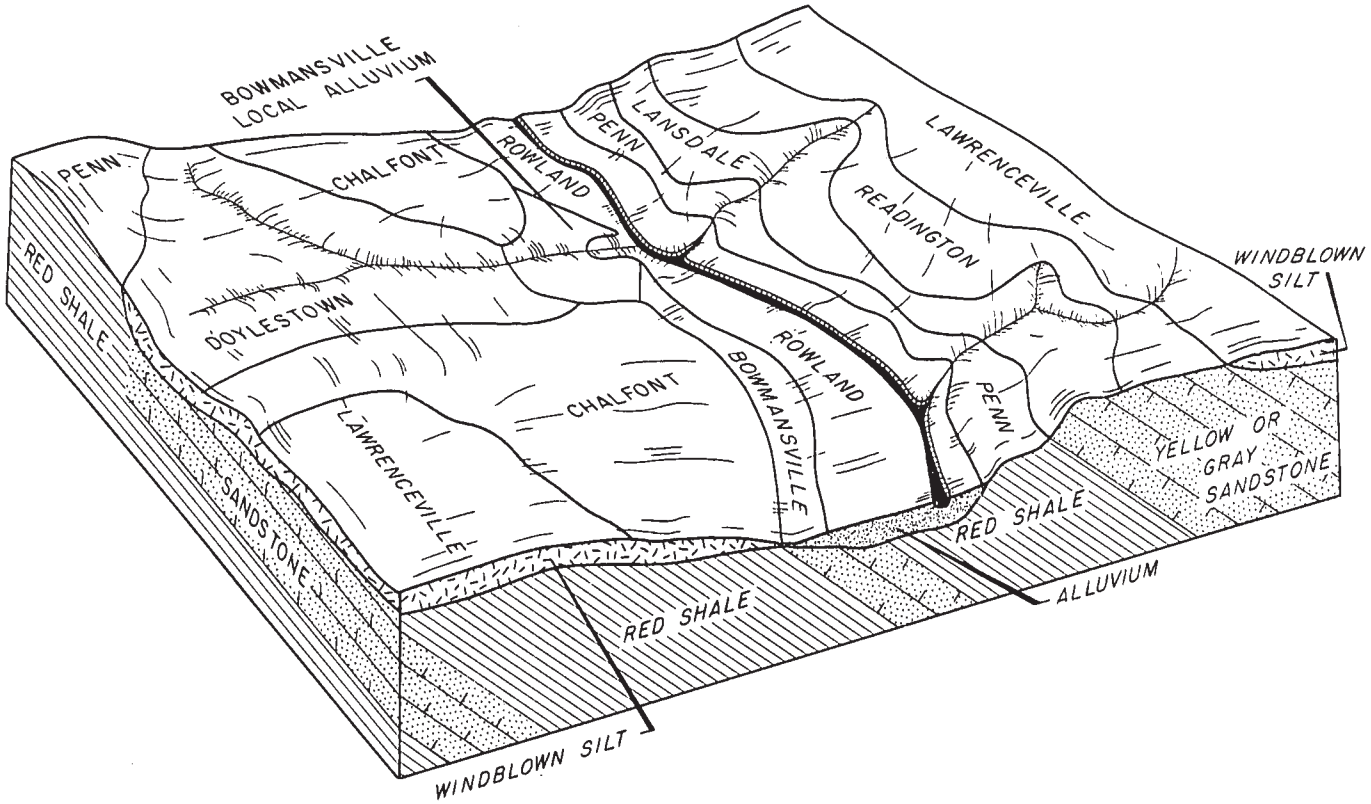

Figure 9.—Typical landscape in the south-central part of Montgomery County, showing the relationship of the soils, and the underlying material, relief, and position on the landscape.

high water table. These soils are better suited to hay and pasture than to general farming. Where cultivated crops are grown, yields are generally low because of the excess moisture. If the soils are used for developments, septic tanks do not operate satisfactorily, basements are wet, and erosion is severe after the soils are disturbed.

Farming is varied in this association. Milk is produced on many farms. Also, owners of large estates and persons who work off the farm and who operate the farm part time raise horses, beef cattle, and sheep. Greenhouses and nurseries are common, and small grains, corn, and soybeans are grown as cash crops on a large acreage.

11. Rowland-Birdsboro-Raritan Association

Deep, well-drained to somewhat poorly drained soils formed in old alluvial deposits; on flood plains and terraces

This association occupies flood plains and terraces near some of the major streams. The Rowland soils are nearly level. They are moderately well drained or somewhat poorly drained, have a seasonal high water table, and are subject to flooding. These Rowland soils formed in recent alluvium washed from uplands underlain by shale and sandstone. The Birdsboro and Raritan soils are on stream terraces and upland flats, and they formed in deep, old alluvial deposits. The Birdsboro soils are well drained. The Raritan soils are moderately well drained or somewhat poorly drained. They have a slowly permeable subsoil and a seasonal high water table.

The soils of this association are deep and easy to work, and they hold a good supply of moisture available for plants. The major limitations to their use are the seasonal high water table, slow permeability, and flooding.

Development for commercial, residential, and industrial purposes is important. Industrial development is especially extensive along the Schuylkill River. There are many sedimentation basins, used in dredging the river. Also, there are numerous sewage treatment plants that serve the nearby communities. The soils subject to flooding have severe limitations for use as residential developments. Farming is of minor importance. It is most common on the soils of the stream terraces in the northern half of the county. In that area dairy farming and grain farming are predominant.

Use and Management of the Soils

The soils of Montgomery County are used for cultivated crops and pasture, and they are also used extensively for community developments. This section explains how the soils may be managed for these main purposes. It places the soils in capability units, describes the management for each capability unit, and gives estimated productivity ratings for the principal crops grown under two levels of management. It also gives information about soils used for commercial woodland and community plantings, about providing habitats for wildlife, and about building highways, dams, and similar engineering structures.

Use and Management of the Soils for Agriculture

For many years, the trend in Montgomery County has been away from the rural way of life and toward life in cities and residential communities. Farming, however, still occupies an important place in the economy of the county. Many parts of the county have been farmed continuously for the last 150 to 200 years, and as a result, many of the soils are seriously eroded and the supply of organic matter is depleted. The deep gullies that formed in earlier days when the fields were plowed up and down the slope have been partly healed by the use of modern farm machinery and present-day techniques that conserve the soils. Most of the soils are much less acid to a depth of a foot or more than they formerly were, because farmers learned early the value of liming. Also, supplies of limestone and dolomite of good quality have always been near at hand.

The dominant problems of use and management vary somewhat in different parts of the county and on different soils. For general observations, however, the county can be divided into two major sections, the northern two-thirds and the southern one-third.

In the northern two-thirds of the county are deep, very silty soils and shallow to deep soils, largely underlain by shale and sandstone. The lower lying soils are generally deep, nearly level and gently sloping, and moderately well drained to poorly drained. The steeper soils are predominantly shallow and are shaly, channery, or stony. Wetness is a limitation of many of these soils late in fall, in winter, and in spring. Nearly all of the soils are droughty, however, in dry periods during the growing season. Droughtiness is caused mainly by a firm silty layer near the surface in the less than well-drained soils, or by underlying material near the surface in the well-drained soils.

With the possible exception of the stony wooded soils underlain by diabase, practically all areas of these soils are eroded; many of the moderately sloping to steep soils are severely eroded. The principal practices needed to conserve the soils are using a cropping system that consists of 1 year of a row crop followed by a small grain and several years of grass-legume hay of high quality; practicing contour stripcropping wherever feasible; installing diversion terraces (fig. 10) and grassed waterways in areas of the longer, gentle to moderately steep slopes; planting crops in graded rows or graded contour strips on the soils that are not well drained; installing tile drains; and installing open drains in soils of the flood plains and in depressions. All the soils ought to have lime and fertilizer added according to the needs indicated by the results of soil tests and the needs of the crop to be grown. Cover crops, crop residue, and manure ought to be incorporated into the soils because the supply of organic matter is generally inadequate.

The southern third of the county is underlain by limestone, schist, gneiss, and quartzite. The greater part of this area is in residential or industrial developments, and farming is limited to small commercial enterprises or to large estates. In this part of the county, the nearly level to moderately sloping soils are well drained and are moderately deep or deep. The steep soils are channery or stony and are shallow to moderately deep.

Figure 10.—A diversion terrace on a long, gentle slope. The terrace intercepts the surface water and carries it safely from the field. The back slopes are flat, so that farm machinery can be operated parallel to the ridge and channel. The man is in the channel area.

Erosion is the most serious problem where the soils are farmed. All of the soils in this part of the county, except the stony soils of wooded areas, are at least moderately eroded. The principal practices needed to conserve the soils are using a cropping system of medium intensity that consists of 1 or 2 years of row crops and 1 to 3 years of grass-legume hay; practicing field or contour stripcropping; installing diversion terraces and grassed waterways on the long, moderately sloping to moderately steep slopes; and installing random tile drains in drainage depressions and flats. All the soils ought to have lime and fertilizer added according to the needs indicated by the results of soil tests and the needs of the crop to be grown. Because the content of organic matter is especially low in the moderately sloping to steep soils, cover crops, crop residue, and manure should be incorporated into the plow layer of those soils.

Capability groups of soils

Capability classification is the grouping of soils that shows, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

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 grouping, are designated by Roman numerals I through VIII. As the numerals increase, they indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I. Soils that have few limitations that restrict their use.

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

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

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

Class V. Soils subject to little or no erosion but that have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

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

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, 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 only some parts of the United States, 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 subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, 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–4 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation, and the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph. The Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units of Montgomery County are described and suggestions for the use and management of the soils are given. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series appear in the unit. To find

the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units, Capability Units, and Community Development Groups" at the back of this survey.

CAPABILITY UNIT I-1

Only one soil, Bermudian silt loam, is in this capability unit. It is deep, well drained, and nearly level, and it occurs on flood plains. This soil formed in alluvium washed from areas underlain by shale and sandstone. Permeability is moderate, and the capacity to hold moisture available to plants is moderate to high. This soil is subject to occasional flooding, generally during winter and early in spring. It is in good tilth and has moderate to high natural fertility.

This soil is well suited to field crops, vegetables planted late in spring, and hay and pasture. Some vegetable crops planted early in spring, and winter small grains, may be damaged by occasional flooding. The commonly grown crops to which the soil is best suited are corn, alfalfa, orchardgrass, smooth bromegrass, ladino clover, red clover, and bluegrass. Row crops can be grown year after year if crop residue is conserved and a cover crop is grown to protect the soil.

Protecting this soil with crop residue or a cover crop reduces losses from erosion during the growing season and throughout the winter, when the danger of flooding is greatest. The crop residue should not be shredded or disked until danger of flooding is past, and then it ought to be plowed down. A large amount of fertilizer is not required, but the timing and frequency of the applications are important.

An excellent cropping system for this soil consists of 2 years of row crops, 1 year of a winter small grain, and at least 1 year of legume-grass hay. A cover crop should be grown the first year, after the row crop is harvested. The drainageways and streambanks ought to be kept in grass or trees.

CAPABILITY UNIT I-2

In this capability unit is Birdsboro silt loam, 0 to 3 percent slopes. This soil is deep, well drained, and nearly level. It is on stream terraces where it formed in old alluvium washed from uplands underlain by shale and sandstone. Permeability is moderate, and the capacity to hold moisture available to plants is moderate to high. The soil is easily worked and is only slightly susceptible to erosion. It has moderate natural fertility.

This soil is well suited to field crops, vegetables, hay, and pasture. Commonly grown crops that yield well are corn, winter small grains, soybeans, alfalfa, red clover, ladino clover, orchardgrass, smooth bromegrass, and bluegrass.

As a rule, the most intensive cropping system suited to this soil is 2 years of row crops, 1 year of a winter small grain, and at least 1 year of legume-grass hay. A cover crop should be grown the first year of the cropping system. All the crop residue ought to be conserved.

If planting and cultivation are done on the contour, row crops and small grains can be grown in rotation on this soil. A cover crop ought to be seeded in the row crop, however, if the row crop is not followed by a winter small grain, and the crop residue should not be removed. On long slopes all depressions and drainageways should be kept in grass, so that gullying will be reduced.

CAPABILITY UNIT IIe-1

In this capability unit are moderately deep and deep, well-drained, gently sloping, moderately eroded soils of the Duffield, Murrill, and Neshaminy series. These soils are on the uplands. They formed in material weathered from limestone and diabase, or in colluvium washed from acid rocks and deposited over limestone. Permeability is moderate to moderately slow, and the capacity to hold moisture available to plants is moderate to high. These soils are easily cultivated when their content of moisture is not too high. They are moderately eroded, but they have high natural fertility.

The soils of this unit are well suited to a number of different field crops and to hay and pasture. They are also well suited to most vegetables, but they are not well suited to potatoes and other root crops. Corn, winter small grains, alfalfa, orchardgrass, smooth bromegrass, ladino clover, red clover, and bluegrass yield well and are grown extensively.

In most sloping areas, field or contour stripcropping is needed to reduce runoff and erosion. If the crops are planted in field strips, the most intensive cropping system suggested is 2 years of row crops, 1 year of a small grain, and at least 2 years of legume-grass hay. If the crops are planted in contour strips, 1 year of hay is generally adequate. The first year of the cropping system, a cover crop ought to be grown. All the crop residue should be conserved, and depressions and waterways ought to be kept in grass.

CAPABILITY UNIT IIe-2

Deep and moderately deep, well-drained, nearly level and gently sloping, moderately eroded soils of the Birdsboro, Chester, Edgemont, Glenelg, Howell, and Lansdale series make up this capability unit. These soils are on uplands and terraces, and they formed in alluvial material and in material weathered from schist, gneiss, sandstone, shale, and quartzite. Permeability is moderate in their surface layer and moderate to rapid in their subsoil. The supply of moisture held available for plants is moderate to high. These soils still have 25 to 75 percent of their original surface layer, and they are in good tilth. Natural fertility is moderate.

The soils of this unit are well suited to a number of field crops and vegetables, and they are also suited to hay and pasture. The main crops are corn, winter small grains, alfalfa, orchardgrass, smooth bromegrass, ladino clover, red clover, and bluegrass. Crop yields are generally adequate, except in droughty seasons. Where facilities are available, supplemental irrigation is effective in maintaining good yields. Field or contour stripcropping is needed on most slopes to reduce erosion and excessive runoff.

If the crops are planted in field strips, the most intensive cropping system suggested consists of 2 years of row crops, 1 year of a small grain, and at least 2 years of grass-legume hay. If contour strips are used and the slopes are not too long or have less than 3 percent gradient, 1 year of hay is generally adequate. A cover crop should be planted during the first year of the row crop, and all the crop residue ought to be conserved. The cover crop and the crop residue reduce erosion and runoff during fall and winter. On some long slopes of more than 3 percent, diversion terraces and grassed waterways

may be needed to keep losses from erosion to a minimum. Depressions, waterways, and gullied areas ought to be kept in permanent grass.

CAPABILITY UNIT IIe-3

In this capability unit are moderately deep, gently sloping, moderately eroded soils of the Brecknock, Lansdale, and Penn series. These soils formed on uplands in material weathered from sandstone, shale, and hornfels. They have moderately rapid permeability in the surface layer and moderate or moderately rapid permeability in the subsoil. As much as three-fourths of their original surface layer has been removed through erosion, and the supply of available moisture is low to moderate. Natural fertility ranges from low to moderate.

These soils are well suited to winter small grains and to hay and pasture. They are only fair for corn, vegetables, alfalfa, and ladino clover. Crop yields are generally moderate, but they are severely reduced in dry years. Where facilities are available, supplemental irrigation helps to maintain good yields if the water is applied in frequent, moderate applications. Field or contour stripcropping is needed on most slopes to reduce erosion and runoff.

If the crops are planted in field strips, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a winter small grain, and 3 years of legume-grass hay. If contour strips are used, 2 years of hay are generally adequate . Crop residue ought to be returned to the soil to help reduce erosion and runoff. It also helps to maintain the content of organic matter, conserves moisture, and helps to keep the soil in good tilth. On some of the long slopes, especially where contour strips are impractical, diversion terraces and grassed waterways are required to keep losses from erosion to a minimum. Depressions, waterways, and gullied areas ought to be kept in grass.

CAPABILITY UNIT IIe-4

Only one soil, Manor channery silt loam, 3 to 8 percent slopes, moderately eroded, is in this capability unit. This soil is well drained and is gently sloping. It occurs on uplands and formed in material from deeply weathered schist and gneiss. Permeability is rapid in the plow layer and moderate to rapid in the subsoil. As much as three-fourths of the original surface layer has been removed through erosion, and the supply of available moisture is moderate to low. Natural fertility is low.

This soil is fairly well suited to winter small grains and to hay and pasture. It is only fair for corn, vegetables, alfalfa, and ladino clover. Crop yields are moderate during periods of normal or above-average rainfall, but they are severely reduced in dry seasons. Corn and similar crops that require a large amount of moisture do not yield well.

During dry summers supplemental irrigation helps to maintain good growth and the quality of the crop. Frequent applications of irrigation water may be needed because the moisture-holding capacity of this soil is limited.

Either field or contour stripcropping is needed on most slopes to reduce erosion and runoff. If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a winter small grain, and 3 years of clover-grass hay. If contour strips are used, 2 years of hay may be adequate. All the crop residue ought to be conserved. The depressions, waterways, severely eroded areas, and gullies should be kept in permanent grass.

CAPABILITY UNIT IIe-5

This capability unit consists of deep, moderately well drained or somewhat poorly drained, gently sloping, moderately eroded soils of the Beltsville, Glenville, Lawrenceville, Mount Lucas, Raritan, and Readington series. These soils are on uplands and stream terraces. Some of them formed in residual and alluvial material weathered from schist, gneiss, sandstone, shale, and diabase. Others formed in windblown silty deposits and in deep coastal plain deposits. Permeability is rapid to moderate throughout the surface layer and the upper part of the subsoil, but it is moderately slow or slow in the lower part of the subsoil. As much as three-fourths of the original surface layer has been lost through erosion. These soils are in good tilth, however, and they have moderate to high available moisture capacity. Natural fertility is moderate to high.

These soils are well suited to corn, soybeans, vegetables, spring grains, hay, and pasture. Yields of winter small grains are reduced by the high water table and frost heaving during winter. Alfalfa is satisfactory if it is grown in a short rotation. Field or graded stripcropping is needed on most slopes to reduce erosion and runoff.

If contour stripcropping is practiced, the most intensive cropping system suggested consists of 2 years of row crops and a cover crop to protect the soils during fall and winter, 1 year of a small grain, preferably planted in spring, and 2 years of grass-legume hay. If field strips are used, hay should be grown 3 years or more. Ladino clover, birdsfoot trefoil, and similar legumes do well in a long rotation. Alfalfa grown in a shorter rotation will be more beneficial to the soil, however, and will give higher yields. The crop residue should be conserved and incorporated in the soil. On long slopes diversion terraces and grassed waterways may be needed to keep losses from erosion to a minimum and to remove excess surface water. Random tile drains are effective in reducing wetness in depressions or on the lower slopes, and they also eliminate springs and seeps.

CAPABILITY UNIT IIw-1

In this capability unit are deep, moderately well drained or somewhat poorly drained, nearly level soils of the Codorus and Rowland series. These soils formed on flood plains, and in alluvium washed from areas underlain by shale, sandstone, schist, and gneiss. They have moderate permeability and moderate to high available moisture capacity. The water table is high during part of the year. All of these soils but the local alluvium phases of the Rowland soils are subject to occasional flooding. Surface erosion is slight, but these soils are subject to streambank erosion and slight deposition. The soils are in good tilth and have moderate to high natural fertility.

These soils are well suited to hay or pasture; the hazard of flooding and the size, shape, and location of the fields make them more suitable for those uses than for cultivated crops. The soils are especially well suited

to pastures of bluegrass-ladino clover or birdsfoot trefoil, but they are also suited to corn, soybeans, and spring-sown small grains. Winter grains and alfalfa are likely to be damaged by the high water table late in fall, in winter, and early in spring.

If cultivated crops are grown, the most intensive cropping system suggested is 2 years of row crops and a cover crop to provide protection in fall and winter, 1 year of a small grain, preferably seeded in spring, and 1 year or more of grass-legume hay. All the crop residue ought to be conserved, and it should be shredded or disked in spring when it is incorporated in the soil. In some places tile drains and graded rows are helpful for removing excess surface water and excess water in the soils. Drainageways and streambanks ought to be kept in grass or trees.

CAPABILITY UNIT IIw-2

In this capability unit are deep, moderately well drained and somewhat poorly drained, nearly level soils of the Glenville, Lawrenceville, Mount Lucas, Raritan, and Readington series. These soils are on uplands and stream terraces, and they formed in material weathered from schist, gneiss, shale, sandstone, or diabase, or in deep deposits of windblown silt. Permeability is rapid to moderate in the surface layer and upper part of the subsoil, but it is moderately slow or slow in the lower part of the subsoil. The water table is high during spring and winter. The hazard of erosion is slight to moderate. The supply of moisture held available for plants is high. These soils are in good tilth and have moderate to high natural fertility.

These soils are suited to the commonly grown field crops, spring-sown small grains, hay, and pasture (fig. 11). They are well suited to corn, soybeans, spring oats, ladino clover, alsike clover, birdsfoot trefoil, bluegrass, timothy, and field brome. Alfalfa and small grains planted in fall, however, are subject to winterkill because of the seasonal high water table and frost heaving.

Figure 11.—**A typical area of Readington silt loam, 0 to 3 percent slopes, used for corn, hay, and pasture.**

On short slopes where cultivation is across the slope, a suitable cropping system consists of 1 year of a row crop, 1 year of a spring grain, and 1 year of grass-legume hay. On the long slopes, however, field or graded stripcropping is needed to reduce losses from erosion. A suitable cropping system on the long slopes consists of 2 years of row crops, 1 year of a spring grain, and at least 1 year of clover-grass hay. A cover crop ought to be planted in the row crop for protection during fall and winter, and all of the crop residue should be conserved.

These soils need supplemental drainage for the best yields of tilled crops. Graded rows and grassed waterways are helpful in removing the excess surface water. Tile drains help to remove the excess water in depressions, on the lower slopes, and in areas near springs and seeps.

CAPABILITY UNIT IIs-1

Only Penn silt loam, 0 to 3 percent slopes, moderately eroded, is in this capability unit. This is a moderately deep, well-drained, nearly level soil of the uplands. It formed in material weathered from shale and fine-grained sandstone. Permeability is moderately rapid, and the supply of moisture held available for plants is low to moderate. This soil has lost as much as three-fourths of its original surface layer through erosion, and tilth ranges from good to poor. Natural fertility is moderate to low.

This soil is well suited to winter small grains, hay, and pasture, but it is only fair for corn, vegetables, and alfalfa. Yields are severely reduced in dry years. Where facilities are available, supplemental irrigation will help to maintain good yields. These soils respond well to frequent applications of moderate amounts of additional water.

Where cultivation is across the slope, the most intensive rotation suggested consists of 2 years of row crops, 1 year of a small grain, and at least 1 year of legume-grass hay. If cultivation is on the contour and the slopes are less than 400 feet long, row crops and small grains may be grown in rotation. A cover crop should be grown if the soil would otherwise be unprotected during winter. The crop residue ought to be conserved and incorporated in the soil. On the longer slopes, field or contour strips may be required and 1 or 2 years of grass-legume hay may be needed to reduce runoff and erosion. All waterways and gullied areas need to be kept in permanent grass. Where there are springs and seeps, the areas can be drained by installing tile drains if adequate outlets are available.

CAPABILITY UNIT IIIe-1

This capability unit consists of moderately deep or deep, well-drained, moderately sloping, moderately eroded soils of the Duffield and Neshaminy series. These soils are on uplands and formed in material weathered from limestone or diabase. Permeability is rapid to moderate in the surface layer and moderate to moderately slow in the subsoil. These soils have lost as much as three-fourths of their original surface layer through erosion, but they have high natural fertility. The supply of moisture held available for plants is moderate to high. These soils are in good tilth.

These soils are well suited to a number of field crops and to fruit, hay, and pasture. They are not well suited to potatoes and other root crops. Important crops that yield well are corn, winter small grains, apples, alfalfa, orchardgrass, smooth bromegrass, red clover, and bluegrass.

Field or contour stripcropping is needed on most slopes to reduce runoff and erosion. If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a winter small grain, and at least 3 years of deep-rooted legume-grass hay consisting of such crops as alfalfa and orchardgrass or smooth bromegrass. If contour strips are used, 2 years of hay may be adequate for protecting the soils. All of the crop residue should be conserved and incorporated in the soil.

On the long slopes, diversion terraces and grassed waterways further reduce losses from erosion and safely carry away the excess surface water. Depressions, gullied areas, and waterways need to be kept in grass.

CAPABILITY UNIT IIIe-2

This capability unit consists of moderately deep or deep, well-drained, moderately sloping, moderately eroded soils of the Edgemont, Glenelg, and Lansdale series. These soils are on uplands, and they formed in material weathered from quartzite, schist, gneiss, or sandstone. Permeability is moderate to rapid. As much as three-fourths of the original surface layer has been lost through erosion, tilth is moderate, and a moderate supply of moisture is held available for plants. Natural fertility is moderate to low.

These soils are well suited to a number of field crops and to hay and pasture. Crops grown extensively are corn, winter small grains, alfalfa, orchardgrass, smooth bromegrass, and red clover. Yields are considerably reduced by extended dry seasons. Where facilities are available, supplemental irrigation is effective in maintaining good yields. The water should be applied, as needed, to maintain enough moisture for the growth of crops.

Field or contour stripcropping is needed to reduce runoff and erosion. If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a small grain, and at least 3 years of deep-rooted grass-legume hay consisting of such crops as alfalfa and orchard-grass or smooth bromegrass. If contour strips are used, 2 years of hay may be adequate for protecting the soils. All the crop residue should be conserved and incorporated in the soil.

Long slopes may require diversion terraces and grassed waterways to reduce losses from erosion and to safely carry away surplus water. Depressions, badly eroded or gullied areas, and waterways need to be kept in grass.

CAPABILITY UNIT IIIe-3

In this capability unit are moderately deep to shallow, well-drained, gently sloping and moderately sloping, moderately eroded or severely eroded soils of the Brecknock, Lansdale, and Penn series. These soils are on the uplands where they formed in material weathered from sandstone, shale, or hornfels. Permeability is moderate to rapid, and the supply of moisture held available for plants is moderate to low. Some of the Lansdale and Penn soils are severely eroded and have lost all or nearly all of their original surface layer. The other soils are moderately eroded and have lost as much as three-fourths of their surface layer. Tilth is moderate to poor, and natural fertility is low to moderate.

These soils are well suited to hay and pasture (fig. 12) of drought-resistant grasses and legumes. They are only fair for cultivated crops and for winter small grains. In years of normal rainfall, crop yields are usually low to moderate, but they are poor in dry years. Applications of irrigation water, as needed to maintain adequate soil moisture, help to maintain fair yields and the quality of the crop. Field or contour stripcropping is needed to reduce runoff and erosion.

Figure 12.—**Moderately eroded and severely eroded Penn soils in pasture.**

If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a small grain, and 4 or more years of legume-grass hay. If contour strips are used, 3 years of hay may be adequate. The crop residue should be returned to the soils.

The long slopes require diversion terraces and grassed waterways to reduce erosion and to keep runoff to a minimum. Badly gullied areas, depressions, and waterways need to be kept in grass.

CAPABILITY UNIT IIIe-4

Only one soil, Manor channery silt loam, 8 to 15 percent slopes, moderately eroded, is in this capability unit. It is a well-drained, moderately sloping soil of the uplands, and it formed in material from deeply weathered schist and gneiss. Permeability is rapid to moderate, and the supply of moisture held available for plants is moderate to low. As much as three-fourths of the original surface layer of this soil has been removed through erosion. This soil is in moderate to poor tilth, and it has low natural fertility.

This soil is well suited to hay and pasture consisting of drought-resistant grasses and legumes, but it is only fair for corn and winter small grains. In years of normal rainfall, yields are generally low to moderate, but they are severely reduced in dry years. Supplemental irrigation, where the water is supplied in moderate or small, frequent applications, helps to increase the yield and quality of the crops. Either field or contour stripcropping is needed to reduce runoff and erosion. If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a small grain, and at least 4 years of legume-grass hay. If con-

tour strips are used, 3 years of hay may be adequate. The crop residue should be conserved and incorporated in the soil. Depressions, severely eroded or badly gullied areas, and waterways ought to be kept in grass.

CAPABILITY UNIT IIIe-5

This capability unit consists of only one soil, Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded. This soil is moderately deep to shallow, is well drained, and is gently sloping. It is on uplands and formed in material weathered from shale containing lime. Permeability is moderately rapid, and the supply of moisture held available for plants is low. As much as three-fourths of the original surface layer has been removed through erosion. This soil is in poor tilth and has moderate natural fertility.

This soil is well suited to hay and pasture consisting of drought-resistant grasses and legumes, but it is only fair for corn, fruit, and winter small grains. Crop yields are moderate in years when rainfall is normal in summer, but they are severely reduced in dry years. Either field or contour stripcropping is needed to reduce runoff and erosion. The most intensive cropping system suggested is 1 year of a cultivated crop, 1 year of a small grain, and 3 or 4 years of legume-grass hay. The crop residue should be conserved and incorporated in the soil. Severely eroded or badly gullied areas, depressions, and waterways need to be kept in grass.

CAPABILITY UNIT IIIe-6

This capability unit consists of deep, moderately well drained or somewhat poorly drained, moderately sloping, moderately eroded Mount Lucas and Readington soils of the uplands. These soils formed in material weathered from shale and sandstone or diabase. Their surface layer and the upper part of their subsoil is permeable, but permeability is moderately slow in the lower part of their subsoil. These soils have lost as much as three-fourths of their original surface layer through erosion. They hold a moderate amount of moisture available for plants. Tilth and natural fertility are moderate.

These soils are well suited to hay and pasture, but they are only fair for cultivated crops. In winter, small grains are damaged by a seasonal high water table and frost heaving. Because of wetness and frost heaving, alfalfa is unsuitable for long rotations. The crops to which these soils appear to be best suited are ladino clover, reed canarygrass, and birdsfoot trefoil. Field or graded stripcropping is needed on most slopes to reduce runoff and erosion.

If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a spring-sown small grain, and 4 years or more of grass-legume hay. If graded strips are used, 3 years of hay are usually adequate. The crop residue should be conserved and incorporated in the soil.

Diversion terraces and grassed waterways help to remove the excess surface water and carry it safely away. Random tile drains are effective in reducing wetness in depressions, on the lower slopes, and in areas near springs and seeps.

CAPABILITY UNIT IIIe-7

In this capability unit are moderately deep to shallow, moderately well drained and somewhat poorly drained, gently sloping and moderately sloping soils of the Lehigh and Reaville series. These soils are moderately eroded or severely eroded. They formed on uplands in material weathered from shale and hornfels. Permeability of the subsoil is slow or very slow, and the supply of moisture held available for plants is low. The Reaville soil is severely eroded; it has lost all or nearly all of the original surface layer through erosion. The Lehigh soil is moderately eroded; it has from one-half to three-fourths of the original surface layer remaining. These soils are in poor tilth and have low natural fertility.

These soils are fairly well suited to hay and pasture consisting of grasses and legumes that are both drought resistant and that are tolerant of wetness. They are fair to poor for corn, and the excess moisture makes them poorly suited to winter small grains and alfalfa. Graded contour strips are needed to reduce runoff and losses from erosion.

If these soils are cropped, the most intensive cropping system suggested is 1 year of a row crop, 1 year of a spring-planted small grain, and 4 years of legume-grass hay, such as birdsfoot trefoil and reed canarygrass. The row crop ought to be seeded to a cover crop that will protect the soils late in fall and during winter. The crop residue should be conserved and incorporated in the soil.

These soils are generally too shallow for tile drains to be practical, but diversion terraces and grassed waterways are useful in some places to intercept subsurface seepage and to safely remove the excess surface water. Perennial hay or permanent pasture consisting of birdsfoot trefoil, reed canarygrass, and other suitable legumes and grasses is a good use for these soils.

CAPABILITY UNIT IIIw-1

In this capability unit are deep, poorly drained, nearly level and gently sloping Bowmansville and Hatboro soils. These soils are on flood plains and in depressions, and they formed in alluvium weathered from schist, gneiss, shale, or sandstone. Permeability is moderate or moderately slow, but hillside seeps and a high water table keep the soils waterlogged for long periods. These soils are subject to stream gouging or scouring, and there is a slight hazard of surface erosion. Also, the soils are subject to occasional overflow. The supply of moisture held available for plants is moderate, and these soils have moderate tilth and moderate natural fertility.

These soils are suited to perennial hay or pasture. They are fair to poor for corn and are poorly suited or unsuited to small grains and alfalfa. They are fair for bluegrass, ladino clover, reed canarygrass, and birdsfoot trefoil. Drainage can be improved by installing open drains and tile drains if suitable outlets are available. Occasionally, a row crop may be grown in a cropping system of low intensity. The crop should be planted, however, after the water table has receded late in spring or early in summer.

CAPABILITY UNIT IIIw-2

In this capability unit are moderately deep and deep, somewhat poorly drained and moderately well drained, nearly level Abbottstown, Chalfont, and Lehigh soils on upland flats and in depressions. These soils formed in material weathered from shale and sandstone, in

hornfels, or in deep, windblown, silty deposits. Permeability is moderate in the surface layer and slow to very slow in the subsoil. The Chalfont and Abbottstown soils have a thick, very firm layer in the upper part of the subsoil that restricts the development of roots and the penetration of water. The hazard of erosion is slight to moderate, and the supply of moisture held available to plants is low to moderate. These soils are in fair tilth and have moderate to low natural fertility.

These soils are suited to limited cultivation if they are used mainly for hay or pasture. They are only fair for such cultivated crops as corn and soybeans, and they are generally unsuitable for winter grains and alfalfa. These soils are well suited to grasses and legumes that tolerate wetness, for example, birdsfoot trefoil, reed canarygrass, timothy, bluegrass, and ladino clover. If cultivated crops are grown, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a spring-seeded small grain, and at least 3 years of grass-legume hay of adapted varieties.

A cover crop should be seeded in the row crop to protect these soils in fall and during winter. Crop residue ought to be conserved and incorporated in the soil. Open drains will remove the excess surface water from level and ponded areas, but tile drains are generally not effective, because of the slow permeability of the subsoil.

CAPABILITY UNIT IIIw-3

In this capability unit are somewhat poorly drained, gently sloping, moderately eroded, shallow to deep soils of the Abbottstown, Chalfont, and Lehigh series. These soils are on uplands. They formed in material weathered from shale, sandstone, or hornfels, or in deep deposits of windblown silt. The soils have a moderately permeable surface layer and a slowly to very slowly permeable subsoil. The Chalfont and Abbottstown soils have a thick, very firm layer, called a fragipan, in the upper part of their subsoil, and this layer restricts the development of roots and the penetration of water. As much as three-fourths of the original surface layer has been removed through erosion, and the supply of moisture held available for plants is low to moderate. These soils are in fair tilth and have moderate to low natural fertility.

These soils are fair for corn, soybeans, and similar cultivated crops, but they are poor for winter small grains and alfalfa. They are well suited to birdsfoot trefoil, ladino clover, reed canarygrass, timothy, bluegrass, and other grasses and legumes that tolerate a large amount of moisture.

Field stripcropping or graded stripcropping is needed to reduce erosion and to safely remove excess surface water. If cultivated crops are grown, the most intensive cropping system suggested is 1 year of a row crop, 1 year of a small grain, preferably seeded in spring, and at least 3 years of grass-legume hay of adapted varieties. A cover crop should be seeded in the row crop to protect these soils in fall and during winter. Crop residue needs to be conserved and incorporated in the soils.

On long slopes, diversion terraces and sod waterways may be needed to reduce erosion caused by rapid runoff. They also intercept seepage in the subsoil and thus relieve wetness downslope. Tile drains usually are not effective in these soils, because the subsoil is slowly permeable.

CAPABILITY UNIT IIIw-4

Only one soil, Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded, is in this capability unit. This soil is moderately deep, moderately well drained or somewhat poorly drained, and nearly level. It is on upland flats, where it formed in material weathered from shale. Permeability is slow or very slow, and the supply of moisture held available for plants is very low. As much as three-fourths of the original surface layer has been removed through erosion. Tilth is fair to poor, and natural fertility is low.

This soil is fair to poor for cultivated crops, and wetness makes it unsuitable for winter small grains and alfalfa. Grasses and legumes that are both drought resistant and that tolerate wetness are desirable. This soil is fairly well suited to hay and pasture of birdsfoot trefoil, reed canarygrass, and tall fescue.

If cultivated crops are grown, the most intensive cropping system suggested is 1 year of a row crop, 1 year of a spring-seeded small grain, and at least 3 years of grass-legume hay of adapted varieties. A cover crop should be seeded in the row crop to protect this soil in fall and during winter. The crop residue needs to be conserved and incorporated in the soil.

Open drains may be needed to remove the excess surface water from level areas or depressions. Tile drains are not usually feasible, because the soil is too shallow. The amount of moisture in some spots near springs and seeps and in wet depressions can be reduced by tiling directly into the areas.

CAPABILITY UNIT IIIw-5

Only one soil, Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded, is in this capability unit. This soil is moderately deep and is somewhat poorly drained. It is on the uplands, where it formed in material weathered from shale. Permeability is slow or very slow, and the supply of moisture held available for plants is very low. As much as three-fourths of the original surface layer has been removed through erosion. This soil is in poor tilth and has low natural fertility.

This soil is fair to poor for cultivated crops and spring small grains, and wetness makes it unsuitable for winter small grains and alfalfa. Desirable grasses and legumes for seeding are ones that are drought resistant and that also tolerate wetness in winter and early in spring. This soil is fairly well suited to hay and pasture of birdsfoot trefoil, reed canarygrass, tall fescue, and similar plants.

Field stripcropping or graded stripcropping is needed to reduce runoff and erosion. If cultivated crops are grown, the most intensive cropping system suggested is 1 year of a row crop, 1 year of a spring-seeded small grain, and at least 3 years of grass-legume hay of adapted varieties. A cover crop should be seeded in the row crop to protect this soil in fall and during winter. Also crop residue ought to be conserved and incorporated in the soil.

Waterways, severely eroded or badly gullied areas, and depressions should be maintained in grass. Gen-

erally, tile drains are not feasible, because of the limited depth to bedrock.

CAPABILITY UNIT IVe-1

This capability unit consists of moderately deep or deep, well-drained, moderately sloping and moderately steep Duffield and Neshaminy soils of the uplands. These soils formed in material weathered from limestone or diabase. They are moderately or severely eroded, have moderate or moderately slow permeability in the subsoil, and hold a moderate supply of moisture available for plants. All or a large part of the original surface layer has been removed through erosion, but the soils are in fair to good tilth and have high natural fertility.

These soils are suited to occasional cultivation if they are used mainly for long-term hay or pasture. They are fair for cultivated crops, fruit, and winter small grains. Legumes and grasses to which they are well suited are alfalfa, orchardgrass, smooth bromegrass, birdsfoot trefoil, and bluegrass.

If these soils are used for cultivated crops, field stripcropping or contour stripcropping is needed to reduce runoff and erosion. If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a winter small grain, and at least 4 years of hay of deep-rooted grasses and legumes. If contour strips are used, at least 3 years of hay are needed. All the crop residue should be conserved and incorporated in the soil. Diversion terraces and grassed waterways help to reduce losses from erosion and safely dispose of runoff. The depressions, waterways, and gullies need to be kept in grass.

If these soils are used for pasture, they ought to be seeded to tall grasses and legumes. The pastures need to be clipped periodically to reduce infestations of weeds and to remove unpalatable forage. Rotating the pastures provides increased yields and forage of better quality.

CAPABILITY UNIT IVe-2

This capability unit consists of moderately deep or deep, well-drained, moderately steep, moderately eroded Edgemont and Glenelg soils of the uplands. These soils formed in material weathered from quartzite or from schist and gneiss. Permeability is moderate in the surface layer and upper part of the subsoil, and it is moderate to rapid in the lower part of the subsoil. The supply of moisture held available for plants is low to moderate. As much as three-fourths of the original surface layer has been lost through erosion. These soils are in fair tilth and have low to moderate natural fertility.

These soils are suited to occasional cultivation if they are used mainly for long-term hay or pasture. They are fair to poor for cultivated crops and winter small grains. Legumes and grasses to which they are well suited are orchardgrass, smooth bromegrass, birdsfoot trefoil, and reed canarygrass.

If these soils are used for cultivated crops, field stripcropping or contour stripcropping is needed to reduce runoff and erosion. If field strips are used, the most intensive cropping system suggested consists of 1 year of a row crop, 1 year of a winter small grain, and at least 4 years of hay made up of deep-rooted grasses and legumes. If contour strips are used, at least 3 years of hay are needed. All the crop residue should be conserved and incorporated in the soils. Diversion terraces and grassed waterways help to safely dispose of runoff and reduce losses from erosion. Depressions, waterways, gullies, and severely eroded areas need to be kept in grass.

If these soils are used for pasture, they should be seeded to tall grasses and legumes. The pastures need to be clipped periodically to reduce infestations of weeds and to remove unpalatable forage. Rotating the pastures provides the highest yields and forage of better quality.

CAPABILITY UNIT IVe-3

This capability unit consists of moderately deep to shallow, well-drained, gently sloping or moderately steep Brecknock, Lansdale, Legore, Manor, and Penn soils of the uplands. These soils are moderately eroded or severely eroded. They formed in material weathered from sandstone, shale, schist, gneiss, hornfels, and diabase. The soils that are severely eroded have lost all or nearly all of their original surface layer through erosion. In those areas a large part of the plow layer consists of material from the subsoil. The moderately eroded soils have lost as much as three-fourths of their original surface layer through erosion. They have moderate or moderately rapid permeability, and the supply of moisture they hold available for plants is low. Tilth is fair to poor, and natural fertility is low to moderate.

These soils are suited to occasional cultivation for perennial hay or pasture, but growing field crops and small grains is generally not profitable. The soils are fairly well suited to alfalfa, ladino clover, reed canarygrass, birdsfoot trefoil, orchardgrass, smooth bromegrass, fall fescue, and timothy.

Hayfields and pastures should be reseeded in alternate field strips or contour strips when necessary. Half the strips ought to be planted the first year, and the rest the following year. Diversion terraces may be needed on the long slopes. The pastures should be clipped to reduce weeds and unpalatable growth, and they ought to be rotated to obtain the highest yields and forage of the best quality.

CAPABILITY UNIT IVe-4

This capability unit consists of severely eroded, very shallow to moderately deep, moderately well drained or somewhat poorly drained, sloping soils of the Lehigh and Reaville series. These soils are on the uplands, where they formed in material weathered from shale and hornfels. Permeability is slow in the subsoil, and the supply of moisture held available for plants is low. These soils have lost all or nearly all of their original surface layer through erosion, and tillage is in the subsoil or substratum. Natural fertility is low, and these soils are in poor tilth.

These soils are suited to occasional cultivation if they are used mainly for perennial hay or pasture. In general, they are poorly suited to field crops and small grains and are poor for alfalfa, orchardgrass, and smooth bromegrass. Crops to which they are well suited are birdsfoot trefoil, reed canarygrass, tall fescue, and ladino clover. When necessary, hayfields and pastures should

be reseeded to alternate graded strips. Half the strips ought to be planted the first year, and the rest the following year. Diversion terraces may be needed on the long slopes. A light initial application of fertilizer and frequent topdressings are likely to be most effective.

Pastures ought to be clipped to remove unpalatable growth and to reduce the growth of weeds. Rotation grazing is needed to encourage the highest yields of good-quality forage.

CAPABILITY UNIT IVw-1

In this capability unit are deep, poorly drained, nearly level soils of the Croton and Doylestown series. These soils are on upland flats and in depressions. They formed in material weathered from shale or sandstone or in thick deposits of windblown silt. Permeability of the subsoil is slow or very slow. The soils have a thick, firm layer, called a fragipan, in the upper part of the subsoil, and that layer restricts the development of roots and the penetration of water. Surface drainage is very slow, and water is sometimes ponded on the surface. A low to moderate supply of moisture is held available to plants. Natural fertility is moderate to low.

These soils are suited to occasional cultivation if they are used mainly for perennial hay or pasture. Wetness generally makes them unsuitable for alfalfa and winter small grains. The soils are poor for plants that are sensitive to a high water table. They are better suited to reed canarygrass, birdsfoot trefoil, and other grasses and legumes that tolerate wetness than to other kinds of pasture plants. Open drains help to remove the excess surface water from flats and depressions, but tile drains are generally not suitable, because of the fine texture and slow permeability of the subsoil.

Pastures and hayfields should be reseeded when necessary. The pastures ought to be clipped to remove unpalatable growth and to reduce the growth of weeds. If grazing is rotated, higher yields of forage will be obtained, and the forage will be of higher quality. Small, very poorly drained areas are well suited to the propagation of wildlife. Trees, shrubs, and grasses should be planted to furnish cover and food for small game animals and birds.

CAPABILITY UNIT IVw-2

This capability unit consists of deep, poorly drained, gently sloping, moderately eroded soils of the Croton and Doylestown series. These soils are on uplands, where they formed in material weathered from sandstone and shale or in deep deposits of windblown silt. They have slow to very slow permeability. A thick, firm, dense layer, called a fragipan, is in the upper part of the subsoil, and this layer restricts the development of roots and the penetration of water. As much as three-fourths of the original surface layer has been removed by erosion. The supply of moisture held available for plants is low to moderate. These soils are in fair to poor tilth and have low to moderate natural fertility.

These soils are well suited to perennial hay or pasture. They are poor for corn and similar cultivated crops and are unsuitable for winter small grains. Wetness and the restrictive layer in the subsoil make them unsuitable for alfalfa and other deep-rooted plants. The soils are well suited to birdsfoot trefoil, reed canarygrass, and other shallow-rooted grasses and legumes that tolerate wetness.

Pastures and hayfields should be reseeded in graded strips, when necessary. Alternate strips ought to be seeded the first year, and the other strips should be seeded the following year. Diversion terraces help to control erosion and surface water.

The pastures need to be clipped to remove unpalatable growth and to reduce the growth of weeds. If grazing is rotated, higher yields are obtained and the forage is of better quality. Small, severely eroded, gullied, or very wet areas are well suited to wildlife propagation. Trees, shrubs, and grasses ought to be planted to furnish cover and food for small game animals and birds.

CAPABILITY UNIT IVs-1

The only soil in this capability unit is Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded. This soil is well drained and is very shallow over shaly material. It is on the uplands, and it formed in material weathered from shale. Permeability is rapid, and the supply of moisture held available for plants is very low. This soil has lost as much as three-fourths of its original surface layer through erosion, and it is in poor tilth. Natural fertility is low.

This soil is poorly suited to field crops and small grains, but it is better suited to perennial hay and pasture. It is fair for alfalfa, orchardgrass, tall fescue, and birdsfoot trefoil, but bluegrass grown on this soil produces little or no forage in summer. Where cultivated crops are grown, a cropping system no more intensive than 1 year of a row crop, 1 year of a winter grain, and 4 years of hay is suitable. Cultivated crops ought to be grown in strips run on the contour, and diversion terraces should be constructed on the long slopes. Light applications of fertilizer in frequent topdressings are likely to be most effective.

In areas used for hay or pasture, reseeding for renovation should be done in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The seedbed should be disked rather than plowed. The pastures need to be clipped to reduce the growth of weeds, and they should be rotated to encourage the highest yields and the best quality of the forage.

CAPABILITY UNIT Vw-1

In this capability unit is only one soil, Watchung silt loam, 0 to 3 percent slopes. This soil is deep, poorly drained, and nearly level. It is on upland flats and in depressions, where it formed in material weathered from diabase. This soil has slow or very slow permeability, and the supply of moisture it holds available for plants is moderate to high. The water table is high during much of the year. Surface drainage is very slow, and water is sometimes ponded on the surface. This soil is in poor tilth, but it has moderate to high natural fertility.

Extreme wetness makes this soil unsuitable for field crops or permanent hay. This soil is fairly well suited to pasture or trees, but it is more suitable for the propagation of wildlife. If the soil is used for pasture, plants that tolerate poor drainage are necessary. This soil is well suited to birdsfoot trefoil and reed canary-

grass for grazing, but at present, the pastures consist mainly of bluegrass and white clover. The pastures should not be grazed while the soil is saturated in spring and late in fall.

Tile drainage is not practical, because of the fine texture and very slow permeability of the subsoil. Open drains help to remove the excess surface water, but they require constant maintenance if they are to remain effective.

Plantings of white pine are likely to be most successful if this soil is used as woodland. The areas need protection from fire and grazing. The wettest areas are better suited to wildlife than to field crops or pasture. Trees, shrubs, and grasses for planting ought to be selected for their tolerance of excessive moisture and for their ability to provide food and cover for wildlife.

CAPABILITY UNIT VIe-1

This capability unit consists of moderately deep or shallow, well-drained, moderately sloping to steep soils of the Brecknock, Klinesville, Lansdale, Legore, and Penn series. Most of these soils are moderately or severely eroded. They occur on uplands, where they formed in material weathered from schist, gneiss, sandstone, shale, or hornfels. Surface drainage is rapid or very rapid, and permeability is moderate to rapid. The supply of moisture held available for plants is low. The severely eroded soils have lost all or nearly all of their original surface layer through erosion, and the moderately eroded soils have lost as much as three-fourths of their surface layer. Tilth is fair to poor, and natural fertility is moderate to low.

These soils are too steep or severely eroded to be suitable for field crops or permanent hay, but they are suited to pasture or trees. They are better suited to birdsfoot trefoil, orchardgrass, and reed canarygrass than to other kinds of legumes and grasses because those plants tolerate drought. Bluegrass grown on these soils does not provide much forage in summer. The steep slopes of some of the soils are a hazard to the safe operation of machinery.

New plantings or seedings for renovation ought to be made in alternate contour strips, and only half of the strips ought to be planted the first year. The pastures need protection from overgrazing. Also, rotating them produces better quality forage and better yields than where they are not rotated. The short, steep slopes and areas that are not needed for pasture are well suited to white pine or Virginia pine. The tree plantings need protection from fire and from grazing by livestock.

CAPABILITY UNIT VIw-1

Only Bowmansville silt loam, which is nearly level, deep, and poorly drained, is in this capability unit. This soil is on flood plains, where it formed in alluvium washed from areas underlain by shale and sandstone. It has moderate permeability and holds a moderate supply of moisture available for plants. Hillside seeps, a high water table, and slow surface drainage keep this soil waterlogged for long periods. Erosion is not a hazard, and this soil has moderate natural fertility. It has fair to poor tilth, however, and is subject to frequent flooding throughout the year.

This soil is not suitable for field crops and permanent hay, because of the high water table and hazard of flooding. It is better used for pasture or for wildlife habitats. Birdsfoot trefoil, reed canarygrass, bluegrass, and ladino clover are better suited than other pasture plants. Where a new pasture is to be established or an old one is to be renovated, seeding may be done in a spring-planted small grain. If flooding occurs, however, the small grain may be damaged.

Tile drains are sometimes successful in lowering the water table and reducing wetness caused by seepage from adjacent slopes. Open ditches help to remove excess surface water and water from flooding, but constant maintenance is necessary. The wetter areas of this soil are especially well suited to use as wildlife habitats. Grasses and shrubs suitable for food and shelter for birds and small game animals should be planted in those areas.

CAPABILITY UNIT VIw-2

Only Watchung silt loam, 3 to 8 percent slopes, is in this capability unit. It is a deep, poorly drained, gently sloping soil of the uplands. This soil formed in material weathered from diabase. It has slow or very slow permeability and a high water table during much of the year. Erosion is slight, and the supply of available moisture for plants is moderate to high. This soil has moderate natural fertility.

This soil is unsuitable for field crops or permanent hay, but it is better suited to pasture, trees, and wildlife habitats. If this soil is used for pasture, plants that tolerate poor drainage are necessary. Birdsfoot trefoil and reed canarygrass are better suited to pasture than other legumes and grasses. The present pastures consist mainly of bluegrass and ladino clover.

Tile drainage is not practical for these soils, because of the fine texture and very slow permeability of the subsoil. Removing obstructions and reshaping the waterways help to remove the excess surface water. Grazing should be delayed in spring until the water table has receded.

If this soil is used as woodland, plantings of white pine are likely to be most successful. Small areas are especially well suited to plantings of trees and shrubs for wildlife food and cover.

CAPABILITY UNIT VIs-1

This capability unit consists of very stony soils of the Mount Lucas and Neshaminy series. These soils are moderately deep or deep, well drained to somewhat poorly drained, and nearly level to moderately steep. They occur on the uplands, where they formed in material weathered from diabase. Permeability is moderate in the surface layer and upper part of the subsoil and moderately slow in the lower part of the subsoil. The supply of moisture held available for plants is moderate to high, and natural fertility is high. Erosion is generally not a problem.

These soils are unsuitable for field crops or permanent hay. They are fair for pasture and are suited to trees and wildlife habitats. Most of the acreage is wooded. The stands consist mainly of mixed oaks, tulip-poplar, beech, and hickory. Tulip-poplar, white oak, and red oak should be encouraged by selective and improvement

cutting. Open areas and areas where the stand is thin can be planted to white pine or Austrian pine. The woodland needs protection from fire and grazing. Logging operations are hindered by large stones and boulders.

These soils can be used for pasture, but removing the large diabase stones and boulders is generally not practical. Light farm machinery can be used in some areas, but hand seeding, liming, and fertilizing are required in others. Suitable forage grasses and legumes are Kentucky bluegrass, tall fescue, reed canarygrass, ladino clover, and birdsfoot trefoil. The pastures need protection from overgrazing.

CAPABILITY UNIT VIs-2

This capability unit consists of well-drained, nearly level to moderately steep, very stony soils of the Brecknock, Edgemont, Manor, and Penn series. These soils are on the uplands, where they formed in material weathered from sandstone, shale, quartzite, hornfels, schist, or gneiss. They have moderate to rapid permeability, and the supply of moisture held available for plants is moderate to low. The hazard of erosion is slight. Natural fertility is moderate to low.

These soils are not suitable for field crops or permanent hay. They are fair for pasture and are well suited to trees and wildlife habitats. Most of the acreage is wooded, and the stands consist mainly of mixed species of hardwoods, including ash, dogwood, and beech. The undesirable trees and brush should be removed, and open areas and areas where the stand is thin ought to be planted to white or Virginia pine. The woodland needs protection from fire and grazing. Some areas are well suited to wildlife habitats, especially if food and cover for wildlife are supplied by planting desirable shrubs and trees.

These soils can be used for pasture if they are cleared and if enough stones are removed to permit the use of farm machinery. Mowing of the pastures is generally not practical. Grasses and legumes suitable for planting for pasture are ladino clover, birdsfoot trefoil, orchardgrass, smooth bromegrass, and timothy. Bluegrass and other native grasses, however, provide little forage during summer. Plantings for pasture can be made in a small grain early in spring. The pastures need protection from overgrazing. If the pastures are rotated, forage of better quality and optimum yields are generally obtained.

CAPABILITY UNIT VIs-3

This capability unit consists of moderately deep to shallow, moderately well drained or somewhat poorly drained, nearly level to moderately steep, very stony Lehigh soils of the uplands. These soils formed in material weathered from hornfels. They are slowly permeable, and the supply of moisture they hold available for plants is low. Erosion is slight, and natural fertility is low.

These soils are not suited to field crops or permanent hay. They are fair for pasture and are suited to trees and wildlife habitats. Most of the acreage is wooded or is reverting to woodland. The stands are mixed and are poor and weedy.

Mixed oaks and ash are predominant in the present stands. Removing the undesirable species and brush and replanting with suitable conifers is suggested. White pine, larch, and Norway spruce are desirable trees for planting. The woodland needs protection from fire and grazing. These soils are good for wildlife habitats if areas where the stand is thin and if open areas are planted to shrubs and trees suitable for wildlife food and cover.

These soils can be used for pasture if they are cleared and if enough stones are removed to permit the use of farm machinery. In most places mowing of the pastures is not practical. Grasses and legumes suitable for planting in the pastures are timothy, reed canarygrass, bluegrass, and birdsfoot trefoil. Planting the pastures alone or in small grains is suggested. The pastures are wet early in spring, and grazing ought to be delayed until they dry out. Also, heavy grazing during dry summers is detrimental to the pastures, and rotational grazing is suggested.

CAPABILITY UNIT VIs-4

Only one soil, Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded, is in this capability unit. This soil is very shaly, very shallow over bedrock, and well drained. It is on the uplands, where it formed in material weathered from shale. Permeability is rapid, and the supply of moisture held available for plants is very low. This soil has lost all or nearly all of its original surface layer through erosion, and the plow layer now consists of material from the subsoil or substratum. The soil is in poor tilth and has low natural fertility.

This soil is not suitable for field crops or permanent hay, but it is suited to pasture, trees, and wildlife habitats. It is too droughty for good yields of even the best suited crops, such as birdsfoot trefoil, reed canarygrass, and orchardgrass. Bluegrass and other native grasses provide little or no forage in summer. Plantings for new pastures are usually seeded in a small grain. The present bluegrass pastures or weedy pastures can be renovated by seeding in alternate contour strips.

If this soil is used as woodland, white pine or Virginia pine ought to be planted and the areas should be protected from fire and grazing. Small areas or badly gullied areas could be planted to shrubs and trees that provide food and cover for wildlife.

CAPABILITY UNIT VIIs-1

Neshaminy extremely stony silt loam, 0 to 8 percent slopes, is the only soil in this capability unit. It is a deep, well-drained soil of the uplands. This soil formed in material weathered from diabase. It has moderately slow permeability and holds a moderate supply of moisture available for plants. Erosion is slight, and natural fertility is moderate to high.

This soil is unsuitable for field crops, permanent hay, or improved pasture. It is suited to trees or to wildlife habitats and can be used for recreational purposes. At present, all of the acreage is wooded, but in the past, areas of the more gently sloping soils were cleared and were used to a limited extent for pasture.

Hardwoods are predominant in the stand, and the oaks and tulip-poplars should be encouraged by selective and improvement cutting. White or Austrian pine ought to be planted where the stand is thin or weedy. The

many large stones and boulders severely hinder logging operations. The areas need protection from fire and grazing. Small areas that are too stony or steep for timber could be planted to trees and shrubs suitable for wildlife food and cover.

CAPABILITY UNIT VIIs-2

This capability unit consists of very shaly, droughty, moderately sloping to steep Klinesville soils that are shallow over shale. These soils are on the uplands, and they formed in partly weathered shale. Severe erosion has removed all or nearly all of the original surface layer, and tillage is in the shaly substratum in many places. Permeability is rapid, and the supply of moisture held available for plants is very low.

The soils of this unit are not suited to field crops, and they are not suitable for permanent hay or improved pasture. Limited grazing of native grasses, mainly bluegrass and white clover, is available in spring and fall. Only a small amount of forage is available during the summer.

These soils are fair for species of trees that resist drought. Plantings of white pine or Virginia pine reduce the risk of further erosion if the trees are protected from fire and grazing. Small areas can be planted to shrubs and grasses that provide food and shelter for wildlife.

CAPABILITY UNIT VIIs-3

This capability unit consists of deep, poorly drained, nearly level to gently sloping, very stony soils of the Croton and Watchung series. These soils are on upland flats and on the lower slopes. They formed in material weathered from shale, sandstone, or diabase. Permeability is slow or very slow, and the water table is high much of the time. The soils hold a moderate amount of moisture available for plants. Erosion is slight, and natural fertility is moderate. These soils are moderately acid to nearly neutral.

These soils are too wet and stony to be used for field crops or permanent hay, but the areas that have been cleared have limited use for grazing of native grasses. Pasture renovation and mowing are not practical. The more sloping areas have good surface drainage. Therefore, they are better for grazing.

Plantings of white pine are fairly well suited to these soils. The wooded areas should be kept in trees. Improvement cutting, selective logging, and replanting with suitable conifers improve the woodlots. Improvement operations during fall, winter, and spring, however, are hampered by wetness. The nearly level, more poorly drained areas are best used for providing food and cover for wildlife.

CAPABILITY UNIT VIIIs-1

Two land types, Bouldery alluvial land and Stony land, steep, are in this capability unit. Both of these land types contain many stones and boulders, mixed with alluvium or other soil material. Bouldery alluvial land is along streams in areas underlain by diabase, shale, or gneiss bedrock. It is subject to flooding several times a year. Stony land, steep, is in the more sloping parts of the county.

These land types are not suited to field crops, hay, pasture, or trees. The hazard of flooding in places, the large number of stones and boulders, and the steep slopes in some places restrict the use of these areas to wildlife habitats, water supply, or recreational or esthetic purposes. Trees and shrubs should be planted where feasible. The present vegetation ought to be managed to produce food and cover for wildlife, to reduce erosion, and to maintain the esthetic value of the areas.

Productivity ratings

Table 1 shows, by relative numbers, estimated productivity ratings of the soils in Montgomery County for specified crops. Each rating of relative productivity denotes comparative yields of the soil for a certain crop in relation to a standard index of 100. The standard index represents the average acre yield obtained on the most productive soils of the county under ordinary management. The acre yield represented by the standard index is given at the head of the column for each crop.

The productivity ratings are given for two levels of management. In columns A are ratings to be expected under the average management commonly practiced on most farms in the county. The ratings in columns B indicate yields that could be obtained if excellent management were practiced to increase production. This management consists of applying fertilizer and lime in the amounts indicated by the results of soil tests; using cropping systems based on the capabilities of the soil; using crop residue and cover crops wisely; planting adapted varieties of certified seed and using planting rates adjusted to the soils for optimum yields; controlling weeds, insects, and diseases; and using practices that control erosion and remove excess surface water and water in the soils. These ratings do not indicate the maximum yields that can be obtained, but rather they indicate average yields that can be obtained over a period of time. Irrigation is not considered in the ratings given.

At the top of the column for each crop listed is shown the average yield per acre obtained on the most productive soils of the county during the past 10 years under the A level of management. In the column for corn, for example, 100=80 bushels per acre is shown. Yields of common field crops are given in bushels per acre, yields of hay in tons per acre, and yields of pasture in cow-acre-days. Bluegrass-clover pasture is considered to be grazed continuously, but tall grass-legumes pasture is rotated.

The yields are based on records kept by farmers in the county, on census data, and on the observations and experiences of representatives of the Soil Conservation Service and the Extension Service. They are also based on the observations and experiences of other agricultural workers who have a knowledge of the soils and crops of the area.

For any soil in table 1, the actual estimated yield of a specified crop can be determined by multiplying the rating of relative productivity for the soil by the yield represented by 100 at the head of the crop column, and then dividing the product by 100. For example, Penn silt loam, 8 to 15 percent slopes, moderately eroded, under the B level of management, has a productivity rating of 110 for corn. By multiplying 110 by 80 (head of column for corn) and dividing by 100, we get 88.

TABLE 1.—*Estimated productivity ratings of soils for the specified*

[The ratings in columns A indicate productivity under the average management commonly practiced on most farms in the county; those rating is given, the soil is considered unsuitable

Soil	Corn (100=80 bu. per acre) [1]		Winter wheat (100=35 bu. per acre)	
	A	B	A	B
Abbottstown silt loam, 0 to 3 percent slopes	50	95	50	75
Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded	55	110	60	105
Beltsville silt loam, 2 to 6 percent slopes, moderately eroded	65	130	65	100
Bermudian silt loam	120	180	100	120
Birdsboro silt loam, 0 to 3 percent slopes	85	160	100	125
Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded	80	155	80	120
Bouldery alluvial land				
Bowmansville silt loam		90		
Bowmansville silt loam, local alluvium, 0 to 3 percent slopes		90		
Bowmansville silt loam, local alluvium, 3 to 8 percent slopes		100		
Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded	60	115	65	90
Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded	55	85	60	90
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded	35	60	40	60
Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes	35	55	50	70
Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes				
Brecknock very stony silt loam, 8 to 25 percent slopes				
Chalfont silt loam, 0 to 3 percent slopes	50	95	50	75
Chalfont silt loam, 3 to 8 percent slopes, moderately eroded	55	110	60	90
Chester silt loam, 0 to 3 percent slopes, moderately eroded	100	170	100	135
Chester silt loam, 3 to 8 percent slopes, moderately eroded	95	170	95	130
Codorus silt loam	80	160	50	100
Croton silt loam, 0 to 3 percent slopes		85		70
Croton silt loam, 3 to 8 percent slopes, moderately eroded		105		85
Croton very stony silt loam, 0 to 8 percent slopes				
Doylestown silt loam, 0 to 3 percent slopes		80		50
Doylestown silt loam, 3 to 8 percent slopes, moderately eroded		105		65
Duffield silt loam, 3 to 8 percent slopes, moderately eroded	100	170	100	130
Duffield silt loam, 8 to 15 percent slopes, moderately eroded	95	165	90	120
Duffield silt loam, 8 to 15 percent slopes, severely eroded	80	150	80	110
Edgemont channery loam, 3 to 8 percent slopes, moderately eroded	75	130	75	100
Edgemont channery loam, 8 to 15 percent slopes, moderately eroded	65	125	70	95
Edgemont channery loam, 15 to 25 percent slopes, moderately eroded	50	100	50	75
Edgemont very stony loam, 8 to 25 percent slopes				
Glenelg silt loam, 3 to 8 percent slopes, moderately eroded	60	120	80	100
Glenelg silt loam, 8 to 15 percent slopes, moderately eroded	55	110	65	90
Glenelg silt loam, 15 to 25 percent slopes, moderately eroded	55	105	55	85
Glenville silt loam, 0 to 3 percent slopes	80	130	65	100
Glenville silt loam, 3 to 8 percent slopes, moderately eroded	85	140	65	100
Hatboro silt loam		100		60
Howell silt loam, 3 to 8 percent slopes, moderately eroded	80	155	80	130
Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded				
Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded				
Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded				
Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded				
Lansdale loam, thin, 3 to 8 percent slopes, severely eroded	50	100	50	75
Lansdale loam, thin, 8 to 15 percent slopes, severely eroded	50	100	50	75
Lansdale loam, thin, 15 to 35 percent slopes, severely eroded				
Lansdale silt loam, 0 to 3 percent slopes, moderately eroded	100	160	100	125
Lansdale silt loam, 3 to 8 percent slopes, moderately eroded	95	155	90	120
Lansdale silt loam, 8 to 15 percent slopes, moderately eroded	75	150	80	115
Lawrenceville silt loam, 0 to 3 percent slopes	80	120	65	95
Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded	85	130	65	100
Legore clay loam, 8 to 15 percent slopes, severely eroded	50	75	55	85
Legore clay loam, 15 to 30 percent slopes, severely eroded				
Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded	40	95	50	80
Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded	45	100	60	90
Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded	35	70	50	85
Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded	45	85	55	85
Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded	30	65	35	70
Lehigh very stony silt loam, 0 to 8 percent slopes				
Lehigh very stony silt loam, 8 to 25 percent slopes				
Made land, diabase, gabbro materials				

See footnotes at end of table.

field crops, hay crops, and pasture under two levels of management

in columns B indicate productivity, applying the best practices now available to increase production, excluding irrigation. Where no for the crop and management level specified]

Winter barley (100=45 bu. per acre)		Soybeans (100=30 bu. per acre)		Hay				Pasture			
				Alfalfa-grass mixture (100=3 tons per acre)		Clover-grass mixture (100=2 tons per acre)		Bluegrass-clover (100=60 cow-acre-days)[2 3]		Tall grass-legume (100=110 cow-acre-days)[2 4]	
A	B	A	B	A	B	A	B	A	B	A	B
45	105	50	95			60	100	50	110	60	115
55	105	60	110			60	90	65	125	65	150
60	110	60	130	55	105	80	150	75	145	75	145
100	135	120	150	90	130	100	150	100	160	100	155
100	130	85	160	85	140	85	145	85	160	85	160
90	130	80	155	80	135	80	140	80	155	80	155
			80			35	100	90	125	100	145
			75				100	70	110	80	125
			100			50	100	115	150	125	160
55	105	60	115	80	125	65	135	55	120	70	130
50	100	60	100	55	105	65	130	45	115	50	125
45	60	35	65	55	95	60	115	45	110	50	115
45	70	40	70	50	90	55	100	30	80	40	90
								25	70	30	75
								50			
45	90	50	95			60	90	50	110	60	115
50	105	60	110			60	100	65	125	65	130
100	140	100	170	100	160	120	160	100	165	100	165
100	135	95	165	95	155	110	150	100	165	100	165
40	100	90	160	50	75	75	120	90	150	100	160
			85			50	85	35	90	55	100
			105			50	75	45	100	60	120
								40	80	60	120
			100			40	75	55	110	50	120
			105			50	70	50	110	50	120
100	145	100	170	100	165	100	165	100	165	100	165
90	135	90	155	85	145	95	140	95	160	95	160
80	120	80	140	75	135	85	120	85	150	85	150
80	125	80	155	65	110	80	120	75	140	75	145
70	120	60	150	55	95	80	120	70	140	70	140
65	100	50	100	50	90	70	100	60	115	60	115
								50	75		
85	110	60	115	75	125	80	135	85	140	85	145
75	100	55	110	70	120	75	130	75	125	80	135
65	95	55	105	55	110	60	125	60	120	65	125
60	110	70	130	50	100	80	145	75	145	75	145
60	110	70	130	60	110	80	150	75	150	75	150
	50		100			50	120	50	100	60	125
70	135	80	155	80	150	80	150	80	155	80	155
						20	40	15	20	25	50
						15	30	10	15	20	45
						15	30	10	20	20	40
						15	30	10	15	20	40
55	95	50	100	50	70	70	100	55	110	50	125
50	90	50	100	45	70	55	100	45	100	50	120
								35	90	40	110
100	140	100	160	95	150	100	160	85	160	85	160
95	135	90	155	90	150	95	155	80	155	80	155
75	125	70	145	75	145	75	145	75	145	75	145
50	100	70	130	65	100	90	135	75	135	75	145
60	110	75	135	70	105	90	150	75	145	75	145
55	95	60	100	60	95	65	105	70	120	70	125
								60	105		
45	95	40	65			55	110	55	110	60	115
50	100	60	110		70	60	125	55	100	65	110
45	90	50	105		50	50	85	40	85	50	100
50	80	35	90		55	50	90	45	90	55	105
40	75	25	50			35	75	30	80	40	90

TABLE 1.—*Estimated productivity ratings of soils for the specified field crops,*

Soil	Corn (100=80 bu. per acre) [1]		Winter wheat (100=35 bu. per acre)	
	A	B	A	B
Made land, land fill and sediment basins				
Made land, limestone materials				
Made land, schist and gneiss materials, sloping				
Made land, schist and gneiss materials, strongly sloping				
Made land, shale and sandstone materials, sloping				
Made land, shale and sandstone materials, strongly sloping				
Manor channery silt loam, 3 to 8 percent slopes, moderately eroded	60	90	80	110
Manor channery silt loam, 8 to 15 percent slopes, moderately eroded	50	85	75	105
Manor channery silt loam, 15 to 35 percent slopes, moderately eroded	35	50	50	80
Manor very stony silt loam, 0 to 8 percent slopes				
Manor very stony silt loam, 8 to 25 percent slopes				
Mount Lucas silt loam, 0 to 3 percent slopes	85	150	80	115
Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded	90	155	85	120
Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded	85	145	85	115
Mount Lucas very stony silt loam, 0 to 8 percent slopes				
Mount Lucas very stony silt loam, 8 to 25 percent slopes				
Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded	80	155	80	120
Neshaminy extremely stony silt loam, 0 to 8 percent slopes				
Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded	95	160	95	125
Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded	90	155	90	115
Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded	80	135	75	100
Neshaminy very stony silt loam, 0 to 8 percent slopes				
Neshaminy very stony silt loam, 8 to 25 percent slopes				
Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded	65	100	65	100
Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, severely eroded	50	80	50	85
Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded	35	50	40	55
Penn silt loam, 0 to 3 percent slopes, moderately eroded	65	125	75	110
Penn silt loam, 3 to 8 percent slopes, moderately eroded	75	115	70	100
Penn silt loam, 3 to 8 percent slopes, severely eroded	55	100	50	95
Penn silt loam, 8 to 15 percent slopes, moderately eroded	65	110	60	95
Penn silt loam, 8 to 15 percent slopes, severely eroded	45	85	50	75
Penn very stony silt loam, 8 to 25 percent slopes				
Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded				
Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded	60	115	80	110
Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded	55	100	50	75
Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded	55	110	65	110
Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded	45	80	50	80
Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded				
Raritan silt loam, 0 to 3 percent slopes	65	130	65	95
Raritan silt loam, 3 to 8 percent slopes, moderately eroded	65	130	65	100
Readington silt loam, 0 to 3 percent slopes	65	130	65	110
Readington silt loam, 3 to 8 percent slopes, moderately eroded	65	130	65	100
Readington silt loam, 8 to 15 percent slopes, moderately eroded	65	110	65	95
Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded	30	55	45	70
Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded	30	55	50	70
Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded	25		35	55
Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded	20		30	50
Rowland silt loam	80	130	60	115
Rowland silt loam, coal overwash	75	130	40	60
Rowland silt loam, local alluvium, 0 to 3 percent slopes	90	150	60	115
Rowland silt loam, local alluvium, 3 to 8 percent slopes	95	150	75	125
Stony land, steep				
Watchung silt loam, 0 to 3 percent slopes				
Watchung silt loam, 3 to 8 percent slopes				
Watchung very stony silt loam				

[1] If corn is used for silage, the standard yield is 16 tons per acre

[2] Cow-acre-days is the number of days 1 acre will graze 1 cow, steer, or horse, 5 hogs, or 7 sheep without injury to the pasture.

hay crops, and pasture under two levels of management—Continued

Winter barley (100=45 bu. per acre)		Soybeans (100=30 bu. per acre)		Hay				Pasture			
				Alfalfa-grass mixture (100=3 tons per acre)		Clover-grass mixture (100=2 tons per acre)		Bluegrass-clover (100=60 cow-acre-days) [2 3]		Tall grass-legume (100=110 cow-acre-days) [2 4]	
A	B	A	B	A	B	A	B	A	B	A	B
85	115	50	90	50	90	80	110	55	90	65	110
75	100	50	85	40	80	70	95	50	85	60	100
55	85	30	75	35	65	50	90	40	75	45	90
70	115	90	150	50	90	95	140	65	145	70	150
75	125	90	155	60	100	95	150	70	140	75	145
75	125	85	150	50	100	90	145	70	140	75	145
								65	125		
80	135	80	155	75	155	80	150	80	155	80	155
90	120	95	160	85	140	95	150	95	165	95	165
90	110	70	155	80	135	90	135	95	160	95	160
80	110	85	145	70	125	65	100	90	155	90	155
								80			
								75			
50	90	65	100	50	100	70	125	55	100	60	120
45	80	50	75	40	70	50	105	45	80	55	95
35	70	30	50	25	50	50	85	40	75	50	85
70	110	65	125	70	130	80	140	70	135	75	140
70	105	60	115	65	130	75	135	70	130	70	140
55	95	50	100	60	100	50	125	50	100	55	110
60	95	55	110	65	120	65	130	65	125	65	130
50	80	50	95	55	125	55	120	45	85	55	100
								55			
								35	90	50	90
70	105	60	115	65	130	65	135	70	130	70	140
55	95	50	100	45	90	50	125	50	100	55	120
60	95	55	110	65	100	65	130	65	125	65	130
50	90	50	95	30	50	55	100	45	85	55	100
								35	90	50	90
60	105	70	130	50	100	80	145	75	145	75	145
60	110	70	130	55	105	80	150	75	145	75	145
60	110	70	130	50	100	80	145	75	145	75	145
60	110	70	130	55	100	80	135	75	145	75	145
55	110	65	125	50	95	80	135	75	145	75	145
45	85	25	55		50	50	95	40	80	50	95
40	90	25	55		60	50	100	45	80	50	100
35	75	25	45		35	45	85	35	70	45	85
30	65	20	40			40	80	35	65	40	80
40	90	85	150	30	70	70	135	90	140	90	145
35	50	75	130			75	100	80	100	80	100
40	90	100	160	30	85	75	135	90	140	90	145
45	90	100	160	50	100	80	150	100	150	100	150
						30	70	50			
						50	75	70	115		
								45			

[3] Bluegrass-clover pasture is considered to be grazed continuously without rotation.
[4] Tall grass-legume pasture is considered to be grazed in rotation.

Therefore, the annual acre yield of corn on Penn silt loam, 8 to 15 percent slopes, moderately eroded, under the B level of management, is 88 bushels per acre.

Average yields do not always remain the same; they may increase, for example, because of the widespread acceptance of new and improved crop varieties, new machinery, or new management techniques. Or they may decrease because of an infestation of new diseases or insects or because of an unfavorable climatic cycle in which rainfall is above average or below average. However, the relative ability of one soil to produce, as compared to that of another soil under the same conditions and environment, generally remains constant. It is for this reason that the values shown in table 1 represent comparative estimates of productivity rather than estimated crop yields.

Use of the Soils for Commercial Woodland and Community Plantings [1]

This section contains information about the small areas of commercial woodland still remaining in Montgomery County. It also gives facts about the suitability of trees and shrubs for plantings in and around new communities that are spreading into the county from the margins of nearby metropolitan areas.

Montgomery County originally had a dense cover of trees. Commercial woodland, mainly second- and third-growth stands, now occupies only about 13 percent of the county, and this not in large areas. Consequently, the main interest in woodland is that of improving native stands or planting adapted species in small tracts for the purposes of landscaping, control of erosion, protection of desirable wildlife, and recreation.

Much of the essential information in this section is summarized in two tables. Table 2 lists the kinds of trees, shrubs, and vines that are suitable for small areas, mostly plantings of the sort needed around homes, in recreational areas, in isolated corners of old fields, at campsites, or as cover for wildlife. Of course, the table also can be used where community development requires weeding or thinning of existing woodland. The reader can select from this table those species appropriate for his purposes, after weighing their relative merits for shade, ornament, cover for wildlife, protection of streambanks, control of wind erosion, and similar purposes.

Table 3, in contrast to table 2, gives information about management of areas of woodland that now exist. In this table the soils of the county have been placed in 12 woodland groups, and information is furnished concerning trees to favor in the existing stands, trees to favor in planting, and the hazards of management to be expected.

Existing stands of woodland in this county may be managed for commercial sale of timber products, as a part of the environment in a growing community, or as a campground or some other recreational enterprise. Whatever the specific use, it is helpful to know the main kinds of woodland in the county, and the main kinds of hazards to be met in managing wooded tracts. The principal forest types in the county are listed as follows, and the 12 woodland groups in the county are then described.

	Percentage of total woodland in the county
Red oak—Northern red oak is predominant; associates are black oak, scarlet oak, chestnut oak, and tulip-poplar.	60
Ash-maple-elm—In different areas ash, maple, and elm occur in different proportions, but together these species are dominant over any other species that occurs in the mixture; associates are slippery elm, rock elm, yellow birch, blackgum, sycamore, and hemlock.	19
Eastern redcedar—This species occurs in pure stands or is predominant in the stand; associates are gray birch, red maple, sweet birch, quaking aspen, and bigtooth aspen.	18
Sugar maple-beech-yellow birch—Sugar maple, beech, and yellow birch are the major component species of this forest type; associates are varying admixtures of basswood, red maple, hemlock, northern red oak, white ash, cucumbertree, and tulip-poplar.	3

In general, although the soils of the county are capable of supporting a good growth of red oak, tulip-poplar, ash, red maple, and other species, the trees grow slowly on soils that are shallow or that are very poorly drained.

Woodland suitability groups

To help in planning the management of woodland, the soils of the county have been placed in woodland suitability groups. Each group consists of soils that have about the same suitability for trees, that require about the same management, and that have about the same potential productivity. All the soils in a group have about the same depth, drainage, and available moisture capacity. The 12 woodland suitability groups are described in table 3.

Site quality refers to the potential productivity of a site, that is, the amount of wood crops a soil can produce under a specified level of management. In table 3 the site quality is based on the site index for mixed stands of oak. The site index is the height attained by the average dominant and codominant oaks in a stand 50 years of age. The ratings given are for a well-stocked, unmanaged stand.

A rating of *excellent* means that the average site index for oak is 75 or better and that the potential yield is about 13,750 board feet per acre (International rule). A rating of *good* means that the site index for oak is 65 to 74 and that the potential yield is about 9,750 board feet per acre. A rating of *fair* means that the site index for oak is 55 to 64 and that the expected yield is about 6,300 board feet per acre. A rating of *poor* means that the site index for oak is 54 or less and that the expected yield is less than 3,250 board feet per acre.

[1] By V. C. Miles, woodland conservationist, Soil Conservation Service.

TABLE 2.—*Guide for making plantings in and around new communities*

[The letter "x" indicates species is suitable for shade or for ornamental purposes]

DECIDUOUS TREES

Common name	Botanical name	Species occurs in woodland suitability group—	Shade	Ornamental	Wildlife	Potential height	Growth rate
						Feet	
Ash, white	*Fraxinus americana*	1 to 7	x	x		50+	Rapid.
Basswood	*Tilia americana*	1 to 7	x		Food and cover	50+	Rapid.
Beech	*Fagus grandifolia*	1 to 7	x	x	Food and cover	50+	Slow.
Birch:							
Paper	*Betula papyrifera*	1 to 7		x	Food	50+	Rapid.
Yellow	B. *lutea*	1 to 7		x	Food	50+	Moderate.
Butternut	*Juglans cinerea*	1 to 6	x	x	Food	50+	Rapid.
Catalpa	*Catalpa speciosa*	1 to 7		x		50+	Moderate.
Chestnut, Chinese	*Castanea mollissima*	1 to 6		x	Food	25–50	Rapid.
Crabapple, flowering	*Malus* sp	1 to 6		x	Food	15–25	Moderate.
Cucumbertree	*Magnolia acuminata*	1 to 7	x	x	Food	50+	Moderate.
Dogwood, flowering	*Cornus florida*	1 to 7		x	Food	25	Slow.
Ginkgo [1]	*Ginkgo biloba*	1 to 6	x	x		50+	Moderate.
Hackberry	*Celtis occidentalis*	1 to 6	x	x	Food	25–50	Moderate.
Hawthorn [2]	*Crataegus oxyacantha* and C. *phaenopyrum.*	1 to 7		x	Food	15	
Honeylocust	*Gleditsia triacanthos*	1 to 6	x	x	Food and cover	50+	Rapid.
Horsechestnut	*Aesculus hippocastanum*	1 to 6	x	x		50+	Moderate.
Maple:							
Red	*Acer rubrum*	1 to 9	x	x		50+	Rapid.
Silver	A. *saccharinum*	1 to 9	x			50+	Rapid.
Sugar	A. *saccharum*	1 to 7	x	x	Cover	50+	Moderate.
Mountain-ash	*Sorbus* sp	1 to 7		x	Food	25–50	Rapid.
Mulberry, white	*Morus alba*	1 to 7		x	Food	25–50	Rapid.
Oak:							
Pin	*Quercus palustris*	1 to 9	x	x	Food	50+	Moderate.
Red	Q. *rubra*	1 to 7	x	x	Food	50+	Rapid.
Scarlet	Q. *coccinia*	1 to 7	x		Food	50+	Moderate.
Redbud [3]	*Cercis canadensis*	1 to 6		x	Food	25	Moderate.
Sassafras	*Sassafras albidum*	1 to 6	x	x	Food and cover	25–50	Moderate.
Serviceberry (Juneberry)	*Amelanchier canadensis*	1 to 7			Food	25–50	Moderate.
Sweetgum	*Liquidambar styraciflua*	1 to 7	x	x	Food	50+	Rapid.
Sycamore	*Platanus occidentalis*	1 to 7	x			50+	Moderate.
Tuliptree	*Liriodendron tulipifera*	1 to 7	x			50+	Rapid.
Walnut, black	*Juglans nigra*	1 to 6			Food	50+	Rapid.

EVERGREEN TREES

Common name	Botanical name	Woodland suitability group	Shade	Ornamental	Screen	Streambank	Windbreak	Critical area	Wildlife	Potential height	Growth rate
										Feet	
Arborvitae, American or oriental.	*Thuja occidentalis, orientalis.*	1 to 7		x	x	x	x		Cover	50+	Slow.
Hemlock (Eastern) Canadian.	*Tsuga canadensis*	1 to 7		x	x	x	x		Food and cover.	50+	Moderate.
Holly, American	*Ilex opaca*	1 to 7		x	x	x	x		Food and cover.	25–50	Slow.
Larch, European and Japanese.	*Larix decidua, leptolepis.*	1 to 6	x					x		50+	Rapid.
Pine:											
Austrian	*Pinus nigra*	1 to 6		x	x		x		Cover	50+	Rapid.
Virginia	P. *virginiana*	1 to 11						x	Food and cover.	25–50	Moderate.
White	P. *strobus*	1 to 11			x		x		Food and cover.	50+	Rapid.
Spruce:											
Norway	*Picea abies*	1 to 7		x	x	x	x		Cover	50+	Moderate.
White	P. *glauca*	1 to 9			x	x	x		Cover	50+	Moderate.

See footnotes at end of table.

TABLE 2.—*Guide for making plantings in and around new communities*—Continued

DECIDUOUS SHRUBS

Common name	Botanical name	Woodland suitability group	Ornamental	Barrier	Screen	Hedge	Windbreak	Critical area	Wildlife	Normal height
										Feet
Autumn-olive, cardinal	*Elaeagnus umbellata*	1 to 6	x	x	x		x	x	Food and cover.	10–15
Azalea:										
Swamp white	*Rhododendron viscosum*	5 to 9	x							10–15
Flame	*R. calendulaceum*	1 to 4	x							10–15
Wild honeysuckle	*R. nudiflorum*	1 to 4	x							5–10
Barberry, thunberg	*Berberis thunbergi*	1 to 6	x	x		x			Food	6–10
Bayberry	*Myrica caroliniensis*	1 to 6	x			x		x	Cover	6–10
Blackhaw	*Viburnum prunifolium*	1 to 7							Food	15–20
Cranberry, highbush	*V. trilobum*	1 to 7	x			x			Food	10–15
Firethorn, Lalands	*Pyracantha coccinea Lalandi.*	1 to 6	x	x	x				Food	10–20
Forsythia	*Forsythia* sp	1 to 6	x		x	x		x		10–15
Honeysuckle:										
Amur	*Lonicera maacki*	1 to 6	x		x			x	Food	10–15
Tatarian	*L. tatarica*	1 to 6	x		x			x	Food	10–15
Privet:										
Amur	*Ligustrum amurense*	1 to 6			x		x	x	Food	15–20
California	*L. ovalifolium*	1 to 6			x	x	x	x	Food	15–20
Glossy	*L. lucidium*	1 to 6			x	x	x		Food	20–30
Regal	*L. ibota*	1 to 6			x	x	x	x	Food	10–15

EVERGREEN SHRUBS

Azalea	*Rhododendron* sp	1 to 4	x						Cover	5–10
Barberry, Juliane	*Berberis julianae*	1 to 6	x	x	x	x	x		Cover	5–10
Holly, Japanese	*Ilex crenata*	1 to 6	x		x	x	x		Food	
Juniper, spreading	*Juniperus chinensis*	1 to 6	x		x	x	x	x	Food and cover.	
Rhododendron	*Rhododendron maximum*	1 to 7	x		x				Food and cover.	10–15
Virburnum leatherleaf	*Viburnum rhytidophyloum*	1 to 6	x		x				Food	5–10
Yew, English, Japanese, and medium.	*Taxus bacatta, cuspidata, media.*	1 to 4	x		x	x	x		Cover	(5)

VINES AND PLANTS FOR GROUND COVER

Common name	Botanical name	Woodland suitability group	Ornamental	Critical area	Wildlife	Normal height or length of vine	Normal height of plant used in ground cover
						Feet	*Feet*
Bittersweet, common, oriental.	*Celastrus scandens, orbiculata*	1 to 6		x	Food	3–15	
Ferns [6]		1 to 9	x	x		1–3	1–3
Ivy, English	*Hedera helix*	1 to 6		x			1+
Juniper, spreading	*Juniperus horizontalis*	1 to 7		x	Food		3
Myrtle	*Vinca minor*	1 to 6	x	x			¾
Pachysandra	*Pachysandra terminalis*	1 to 6	x	x			¾

[1] Plant male trees only.
[2] Also suitable for a screen.
[3] Does best on slightly acid to neutral soils.
[4] Select hardy varieties.
[5] Variable.
[6] Also have esthetic value.

TABLE 3.—*Potential productivity, suitable trees, and hazards of woodland suitability groups*

Woodland suitability group and map symbols	Quality of site for oak	Suitable species—		Seedling mortality	Plant competition	Equipment limitations	Hazard of—	
		To favor in natural stand	For planting				Erosion	Windthrow
Group 1: Deep, well-drained soil that has high available moisture capacity and is on flood plains (Bm).	Excellent.	Red oak, tulippoplar, ash, white pine, black walnut.	Larch, white pine, Norway spruce, Austrian pine.	Slight	Severe	Slight	Slight	Slight.
Group 2: Deep, well-drained soils that have high available moisture capacity, have slopes of as much as 25 percent, and are on uplands (BnA, BnB2, CgA2, CgB2, DuB2, DuC2, DuC3, HwB2, LdA2, LdB2, LdC2, MvB2, NeB, NhB2, NhC2, NhD2, NsB, NsD).	Excellent.	Red oak, tulippoplar, ash, black walnut, sugar maple, white pine.	Larch, white pine, Austrian pine, Norway spruce.	Slight	Severe	Slight to moderate.	Slight to moderate.	Slight.
Group 3: Deep, well-drained soils that have moderate available moisture capacity and moderate inherent fertility; the slopes are as much as 25 percent, and these soils are on uplands (EcB2, EcC2, EcD2, EsD, MhB2, MhC2, MhE2, MnB, MnD).	Good	Red oak, tulippoplar, sugar maple, ash, white pine, hemlock.	Larch, white pine, Austrian pine, Norway spruce.	Slight	Severe	Slight to moderate.	Slight to moderate.	Slight.
Group 4: Moderately deep, well-drained soils that have moderate available moisture capacity, have slopes of as much as 25 percent, and are on uplands (BsB2, BsC2, BsD2, BtC, BtD, BvD, GnB2, GnC2, GnD2, LgC3, LgD3, PaB2, PaB3, PaC3, PeA2, PeB2, PeB3, PeC2, PeC3, PfD, PlB2, PlB3, PlC2, PlC3, PlD3).	Good	Red oak, tulippoplar, white pine, black oak.	Larch, white pine, Austrian pine, Norway spruce.	Slight	Severe	Slight to moderate.	Slight to moderate.	Slight.
Group 5: Deep, moderately well drained and somewhat poorly drained soils that have high available moisture capacity, have slopes of as much as 8 percent, and are on flood plains (Ch, Rt, Ru, RwA, RwB).	Good	Red oak, tulippoplar, ash, white pine.	Larch, white pine, Norway spruce, Austrian pine.	Slight	Severe	Moderate	Slight	Slight to moderate.
Group 6: Deep, moderately well drained soils that contain a pan or are fine textured, that have moderate available moisture capacity, and that have slopes of as much as 15 percent and are on uplands (BlB2, GsA, GsB2, LeA, LeB2, RaA, RaB2, ReA, ReB2, ReC2).	Good	Red oak, tulippoplar, sugar maple, ash, white pine, hemlock.	Larch, white pine, Austrian pine, Norway spruce, white spruce.	Slight	Severe	Moderate	Slight to moderate.	Slight to moderate.

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TABLE 3.—*Potential productivity, suitable trees, and hazards of woodland suitability groups*—Continued

Woodland suitability group and map symbols	Quality of site for oak	Suitable species—		Seedling mortality	Plant competition	Equipment limitations	Hazard of—	
		To favor in natural stand	For planting				Erosion	Windthrow
Group 7: Deep, somewhat poorly drained soils that contain a pan or are fine textured, that have moderate available moisture capacity, and that have slopes of as much as 25 percent and are on uplands (AbA, AbB2, CfA, CfB2, LhA2, LhB2, LhB3, LhC2, LhC3, LsB, LsD, MoA, MoB2, MoC2, MuB, MuD).	Good	Red oak, tulippoplar, sugar maple, white pine.	White pine, white spruce, larch.	Slight	Severe	Moderate	Slight to moderate.	Slight to moderate.
Group 8: Deep, poorly drained, permeable soils that have high available moisture capacity, have slopes of as much as 8 percent, and are on flood plains (Bp, BrA, BrB, Ha).	Fair	White pine, hemlock, red maple, pin oak.	White pine, white spruce.	Moderate.	Severe	Severe	Slight	Moderate to severe.
Group 9: Deep, poorly drained soils that contain a pan or are fine textured, that have moderate available moisture capacity, and that have slopes of as much as 8 percent, and are on uplands (CrA, CrB2, CsB, DsA, DsB2, WaA, WaB, Wc).	Fair	Red oak, tulippoplar, sugar maple, white pine.	White pine, white spruce, larch.	Moderate.	Severe	Severe	Slight to moderate.	Moderate to severe.
Group 10: Moderately deep, somewhat poorly drained soils that contain a pan or are fine textured, that have low available moisture capacity, and that have slopes of as much as 15 percent, and are on uplands (RsA2, RsB2, RsB3, RsC3).	Poor	Virginia pine, white pine, red maple, black oak.	White pine, Virginia pine.	Moderate.	Moderate.	Slight to moderate.	Slight to moderate.	Moderate.
Group 11: Very shallow, well-drained soils that have low available moisture capacity, have slopes of as much as 25 percent, and are on uplands (KlB2, KsB3, KsC3, KsE3, LaB3, LaC3, LaE3, PkD3).	Poor	Pitch pine, Virginia pine, chestnut oak.	Virginia pine	Severe	Slight	Slight to moderate.	Slight to moderate.	Moderate.
Group 12: Soils and land types that may be suitable for growing commercial tree crops, but each site needs to be evaluated separately (Bo, Ma, Mb, Mc, MdB, MdD, MeB, MeD, StE); Bouldery alluvial land (Bo) and Stony land, steep (StE) are not suitable for growing commercial tree crops.								

In 35 percent of the wooded acreage in the county, the soils provide an excellent site for trees, in another 35 percent they provide a good site, in 24 percent they provide a fair site, and in 6 percent they provide a poor site. The returns from soils that provide an excellent or good site generally justify expending money for managing those areas. Consideration should be given, however, not only to the potential yield but also to the quality of the species growing on the site and the market potential.

From an economic standpoint, the returns from soils that provide a poor growing site generally will not justify managing the soils for the production of wood products. Woodland, however, is generally the most economical land use of those soils. Because of unfavorable soil characteristics, the soils that rate poor will likely not show a profitable return if they are used for field crops or grass. Although the returns may be slight to none where the soils are used for trees, this land use is the most economical.

Overcutting and repeatedly taking the best and leaving the poorest quality trees greatly reduces the economic value, protective quality, and esthetic worth of the woodland. The woodland should be kept productive by making periodic cuttings when it is economically feasible to do so. Also, the cuttings should be made in accordance with the overall aims of the landowner. If the woodland is properly managed, its economic, protective, and esthetic values can be sustained indefinitely.

Table 3 names species that are most suitable for planting. Also shown are the names of native trees that should be favored in managing an existing stand. The hazards named that ought to be considered in managing woodland are seedling mortality, plant competition, equipment limitations, erosion, and windthrow. For each of these, a rating of *slight*, *moderate*, or *severe* is given.

The ratings for *seedling mortality* refer to the expected loss of naturally occurring or planted seedlings as a result of unfavorable soil characteristics or topographic features, not as a result of competition from other plants. Seedling mortality is *slight* if the loss is less than 25 percent. It is *moderate* if the loss is between 25 and 50 percent. The mortality is *severe* if more than 50 percent of the seedlings die.

Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade areas of different kinds of soils when openings are made in the canopy. Plant competition is *slight* if it will not prevent adequate natural regeneration and early growth of the trees or interfere with adequate development of planted seedlings. It is *moderate* if it delays natural or artificial regeneration, both the rate at which trees are established and their growth, but it will not prevent the natural development of a fully stocked normal stand. Plant competition is *severe* if it prevents adequate natural or artificial regeneration without intensive preparation of the site and maintenance treatments, such as weeding.

Ratings in the column that shows *equipment limitations* refer to the characteristics of the soils and the topographic features that restrict or prohibit the use of equipment for harvesting trees or planting seedlings. In this county the steep slopes, large number of stones, and wetness are the principal limitations that restrict the use of equipment. Equipment limitations are *slight* if there is no restriction in the kind of equipment that can be used or in the time of year equipment is used. They are *moderate* if the content of stones and boulders is high, the slopes are moderately steep, or the soil is wet part of the year. Equipment limitations are *severe* if special equipment is needed and if its use is severely restricted because the soils are wet for long periods, are steep, or are stony. Track-type equipment is best for general use, and winches or similar special equipment may be needed.

Erosion hazard refers to the degree of potential soil erosion and indicates the amount or intensity of practices required to reduce or control erosion. A rating of *slight* means that the risk of erosion is slight when wood crops are harvested, and few if any practices are needed to control erosion. A rating of *moderate* means that measures are needed to control erosion on skid trails and logging roads immediately after a wood crop has been harvested. A rating of *severe* means that erosion, especially gullying, is likely to be severe where wood crops are harvested. Harvesting and other operations should be done across the slope wherever feasible. Skid trails and logging roads ought to be laid out on as slight a grade as feasible, and a system for disposing of water ought to be carefully maintained during logging. Measures that control erosion should be used on logging roads and skid trails immediately after logging is completed.

Windthrow hazard represents an evaluation of the factors that control the development of tree roots, and consequently, it shows the likelihood that trees will be uprooted by wind. The windthrow hazard is *slight* if normally no trees are blown down by wind. It is *moderate* if it is expected that some trees will be blown down if the soil is wet and the velocity of the wind is high. Windthrow hazard is *severe* if it is expected that many trees will be blown down during periods when the soil is wet and the velocity of the wind is moderate or high.

Soils and Wildlife [2]

Montgomery County has a large population of fish and wildlife. Small game birds and animals are abundant, deer are common, and many kinds of waterfowl inhabit areas near streams and lakes. Most of the fish are warm-water species, but some streams are stocked with trout.

Kinds of wildlife

The kind and abundance of wildlife depend, to a large extent, upon the type of habitat available under the present land use. They also depend upon the kinds of soils and upon man's influence in propagating and protecting or in hunting and destroying wildlife. Because of differences in land use between the northern and southern parts of the county, the kinds of wildlife differ, to some extent, in those areas. The major kinds of wildlife in the county and the areas they inhabit are

[2] By CLAYTON L. HEINEY, wildlife biologist, Soil Conservation Service.

discussed in the following paragraphs. The three major groups of wildlife are—

Open-land wildlife.—Birds and mammals that normally frequent cropped fields, pastures, meadows, lawns, and areas overgrown with grass, weeds, and shrubs. Examples are quail, pheasant, mourning doves, meadowlarks, rabbit, red fox, and groundhog.

Woodland wildlife.—Birds and mammals that normally frequent wooded areas. Examples are ruffed grouse, wild turkey, deer, squirrel, raccoon, wood thrushes, warblers, and vireos.

Wetland wildlife.—Birds and mammals that normally frequent wet areas, such as ponds, marshes, and swamps. Examples are duck, geese, heron, muskrat, mink, and beaver.

Ringneck pheasant is an abundant small game species in this county. These birds are everywhere throughout the northern part of the county, except in the most wooded areas in Salford, Marlborough, New Hanover, and Upper Frederick Townships. In those townships the very stony Neshaminy, Mount Lucas, and Watchung soils are dominant. Pheasant are also numerous in the densely populated southern part of the county. In that part of the county, they are on small farms and estates, in areas surrounding institutions, and in other large open areas. Common in those areas are soils of the Chester, Glenelg, Duffield, and Lawrenceville series.

The cottontail rabbit is another abundant small game species in this county. It is in the same areas as the pheasant and also inhabits some of the stony ridges in idle or wooded areas of Neshaminy, Mount Lucas, and Watchung soils of association 8, shown on the general soil map at the back of the survey. A few quail inhabit some parts of the county, but quail are not abundant.

White-tailed deer are fairly numerous in this county, although they are commonly considered to be a species native to more heavily forested areas. In the northern part of the county, they are most common near wooded areas of the Neshaminy, Penn, Brecknock, and Mount Lucas soils. In the southern part of the county, they frequent wooded ridges and ravines in areas of Manor, Glenelg, Edgemont, and Lansdale soils.

Opossum, raccoon, and skunk are abundant throughout both the agricultural areas and the towns and cities of this county. Groundhog inhabit backyards, even in the more densely populated areas. Gray squirrel inhabit the forests and woodlots in the northern part of the county and are especially numerous on estates and in residential areas in the southern half of the county. Fox are scattered throughout the county. Muskrat inhabit areas around ponds and along streams in areas of Rowland, Birdsboro, and Raritan soils of association 11 and of Codorus and Hatboro soils in associations 1 and 4.

The county has a large population of waterfowl. Mallards, wood ducks, black ducks, and Canada geese inhabit the valley of the Schuylkill River and areas near smaller streams and ponds, especially in the northern part of the county. Mourning doves are plentiful throughout the county, and woodcock are scattered along small streams and in marshy areas. Ducks and geese are attracted to the county during spring and fall migrations. They visit the Schuylkill River, Perkiomen and Skippack Creeks, and the Green Lane Reservoir.

The water in the Schuylkill River and in other parts of the county is warm enough for a number of kinds of fish. The Schuylkill River, other streams, and small ponds provide fishing for such species as largemouthed and smallmouthed bass, bluegill, carp, and eels. In a few streams and large lakes, the temperature of the water in spring and early summer is suitable for trout. Mill, Pennypack, and Ridge Valley Creeks, and the Northwest Branch of Perkiomen Creek, are stocked with trout and furnish more than 17 miles of fishing.

Numerous other nongame species of birds and animals inhabit the county. Many of these, for example, songbirds, are well suited to residential areas. Birdwatching is a popular pastime in this county.

Suitability of the soils for wildlife

Nearly all soils are capable of producing some kind of wildlife. The occurrence and abundance of wildlife are often related to the soils through the kind of plants that serve as food and cover. Some kinds of plants occur in patterns or combinations throughout an area, depending upon the distribution of the various kinds of soils. Although nearly any soil may be used for wildlife habitats if the owner so desires, generally such use is restricted to soils that have limitations for crops, forage, or other uses.

Table 4 shows the suitability of the soils of the county for wildlife habitats and for different kinds of wildlife. The ratings indicate only the potential suitability for developing, improving, or maintaining wildlife habitats and do not consider present land use, present vegetation, size or shape of areas of the soils, or economic conditions. The ratings are based on soil limitations if the soils are used for the kinds of plants, water development, and wildlife named.

In table 4 a rating of 1 means that the soils are *well suited* to the use stated, that is, habitats on soils so rated generally are easily created, improved, or maintained. There are few or no soil limitations to managing the soils for wildlife habitats, and satisfactory results are assured. A rating of 2 means that the soils are *suited* to the use stated, that is, habitats on the soils so rated generally can be created, improved, or maintained, but moderate soil limitations affect management of the habitat. Moderately intense management and fairly frequent attention may be required to assure satisfactory results. A rating of 3 means that the soils are *poorly suited* to the use stated, that is, habitats can be created, improved, or maintained on most areas of these soils, but soil limitations are rather severe. Managing the habitat may be difficult, it may require intensive effort, or it may be expensive. Results are questionable. A rating of 4 means that the soils are *not suited* to the use stated, that is, habitats cannot be created, improved, or maintained, or it is impractical to attempt to do so under the present soil conditions. Unsatisfactory results are probable.

In table 4 the soils of the county are rated according to their suitability for six kinds of wildlife food and cover,

TABLE 4.—*Suitability of soils for wildlife*

[1 denotes well suited; 2 denotes suited; 3 denotes poorly suited; and 4 denotes not suited]

Map symbol	Soil	Wildlife habitat elements								Kinds of wildlife		
		Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woodland plants	Coniferous woodland plants	Wetland plants for food and cover	Shallow water development	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
AbA	Abbottstown silt loam, 0 to 3 percent slopes.	2	2	2	2	3	2	2	2	2	2	2
AbB2	Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded.	2	2	2	2	3	3	4	4	2	2	4
BlB2	Beltsville silt loam, 2 to 6 percent slopes, moderately eroded.	2	1	1	1	3	4	4	3	1	1	4
Bm	Bermudian silt loam	1	1	1	1	3	4	4	4	1	1	4
BnA	Birdsboro silt loam, 0 to 3 percent slopes.	1	1	1	1	3	4	4	4	1	1	4
BnB2	Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
Bo	Bouldery alluvial land	4	4	4	4	4	4	4	4	4	4	4
Bp	Bowmansville silt loam	3	2	2	1	2	2	3	4	2	1	3
BrA	Bowmansville silt loam, local alluvium, 0 to 3 percent slopes.	2	1	1	1	3	3	3	3	1	1	3
BrB	Bowmansville silt loam, local alluvium, 3 to 8 percent slopes.	2	1	1	1	3	3	4	3	1	1	4
BsB2	Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
BsC2	Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
BsD2	Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded.	3	2	2	2	2	4	4	4	2	2	4
BtC	Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes.	4	3	3	3	1	4	4	4	4	3	4
BtD	Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes.	4	4	3	3	1	4	4	4	4	3	4
BvD	Brecknock very stony silt loam, 8 to 25 percent slopes.	4	3	2	2	2	4	4	4	3	2	4
CfA	Chalfont silt loam, 0 to 3 percent slopes.	2	2	2	2	3	2	2	2	2	2	2
CfB2	Chalfont silt loam, 3 to 8 percent slopes, moderately eroded.	2	2	2	2	3	3	4	4	2	2	4
CgA2	Chester silt loam, 0 to 3 percent slopes, moderately eroded.	1	1	1	1	3	4	4	4	1	1	4
CgB2	Chester silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
Ch	Codorus silt loam	2	1	1	1	3	3	3	3	1	1	3
CrA	Croton silt loam, 0 to 3 percent slopes.	3	2	2	2	2	1	1	1	2	2	1
CrB2	Croton silt loam, 3 to 8 percent slopes, moderately eroded.	3	2	2	2	2	3	4	4	2	2	4
CsB	Croton very stony silt loam, 0 to 8 percent slopes.	4	3	2	2	2	3	[1] 2	2	3	2	[1] 2
DsA	Doylestown silt loam, 0 to 3 percent slopes.	3	3	2	2	2	1	1	1	3	2	1
DsB2	Doylestown silt loam, 3 to 8 percent slopes, moderately eroded.	3	3	2	2	2	3	4	4	3	2	4
DuB2	Duffield silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4

See footnotes at end of table.

TABLE 4.—*Suitability of soils for wildlife*—Continued

Map symbol	Soil	Wildlife habitat elements								Kinds of wildlife		
		Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woodland plants	Coniferous woodland plants	Wetland plants for food and cover	Shallow water development	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
DuC2	Duffield silt loam, 8 to 15 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
DuC3	Duffield silt loam, 8 to 15 percent slopes, severely eroded.	3	2	1	1	3	4	4	4	2	2	4
EcB2	Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
EcC2	Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
EcD2	Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.	3	2	1	1	3	4	4	4	2	2	4
EsD	Edgemont very stony loam, 8 to 25 percent slopes.	4	3	1	1	3	4	4	4	3	1	4
GnB2	Glenelg silt loam, 3 to 8 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
GnC2	Glenelg silt loam, 8 to 15 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
GnD2	Glenelg silt loam, 15 to 25 percent slopes, moderately eroded.	3	2	2	2	2	4	4	4	2	2	4
GsA	Glenville silt loam, 0 to 3 percent slopes.	2	1	1	1	3	3	3	3	1	1	3
GsB2	Glenville silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
Ha	Hatboro silt loam	3	2	2	1	2	2	3	4	2	1	3
HwB2	Howell silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
KlB2	Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded.	3	3	2	2	2	4	4	4	3	2	4
KsB3	Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded.	3	3	2	2	2	4	4	4	3	2	4
KsC3	Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded.	3	3	2	2	2	4	4	4	3	2	4
KsE3	Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded.	4	3	2	2	2	4	4	4	3	2	4
LaB3	Lansdale loam, thin, 3 to 8 percent slopes, severely eroded.	2	2	1	1	3	4	4	4	1	1	4
LaC3	Lansdale loam, thin, 8 to 15 percent slopes, severely eroded.	3	2	1	1	3	4	4	4	2	1	4
LaE3	Lansdale loam, thin, 15 to 35 percent slopes, severely eroded.	4	3	1	1	3	4	4	4	3	1	4
LdA2	Lansdale silt loam, 0 to 3 percent slopes, moderately eroded.	1	1	1	1	3	4	4	4	1	1	4
LdB2	Lansdale silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
LdC2	Lansdale silt loam, 8 to 15 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
LeA	Lawrenceville silt loam, 0 to 3 percent slopes.	2	1	1	1	3	3	3	3	1	1	3

TABLE 4.—*Suitability of soils for wildlife*—Continued

Map symbol	Soil	Wildlife habitat elements								Kinds of wildlife		
		Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woodland plants	Coniferous woodland plants	Wetland plants for food and cover	Shallow water development	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
LeB2	Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	3	1	1	4
LgC3	Legore clay loam, 8 to 15 percent slopes, severely eroded.	3	2	1	1	3	4	4	4	2	1	4
LgD3	Legore clay loam, 15 to 30 percent slopes, severely eroded.	3	2	1	1	3	4	4	4	2	1	4
LhA2	Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded.	2	2	2	2	3	3	3	3	2	2	3
LhB2	Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
LhB3	Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded.	2	2	1	1	3	4	4	4	1	2	4
LhC2	Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
LhC3	Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded.	3	2	1	1	3	4	4	4	2	2	4
LsB	Lehigh very stony silt loam, 0 to 8 percent slopes.	4	3	1	1	3	4	[1] 2	2	3	2	[2] 2
LsD	Lehigh very stony silt loam, 8 to 25 percent slopes.	4	3	1	1	3	4	4	4	3	2	4
Ma	Made land, diabase, gabbro materials.	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
Mb	Made land, land fill and sediment basins.	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
Mc	Made land, limestone materials	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
MdB	Made land, schist and gneiss materials, sloping.	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
MdD	Made land, schist and gneiss materials, strongly sloping.	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
MeB	Made land, shale and sandstone materials, sloping.	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
MeD	Made land, shale and sandstone materials, strongly sloping.	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]
MhB2	Manor channery silt loam, 3 to 8 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
MhC2	Manor channery silt loam, 8 to 15 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
MhE2	Manor channery silt loam, 15 to 35 percent slopes, moderately eroded.	4	3	2	2	2	4	4	4	3	2	4
MnB	Manor very stony silt loam, 0 to 8 percent slopes.	4	3	2	2	2	4	4	4	3	2	4
MnD	Manor very stony silt loam, 8 to 25 percent slopes.	4	3	2	2	2	4	4	4	3	2	4
MoA	Mount Lucas silt loam, 0 to 3 percent slopes.	2	1	1	1	3	3	3	3	1	1	3
MoB2	Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
MoC2	Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
MuB	Mount Lucas very stony silt loam, 0 to 8 percent slopes.	4	3	1	1	3	3	[1] 3	3	3	2	[2] 3
MuD	Mount Lucas very stony silt loam, 8 to 25 percent slopes.	4	3	1	1	3	4	4	4	3	2	4

See footnotes at end of table.

TABLE 4.—*Suitability of soils for wildlife*—Continued

Map symbol	Soil	Wildlife habitat elements								Kinds of wildlife		
		Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woodland plants	Coniferous woodland plants	Wetland plants for food and cover	Shallow water development	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
MvB2	Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
NeB	Neshaminy extremely stony silt loam, 0 to 8 percent slopes.	4	4	1	1	3	4	4	4	3	2	4
NhB2	Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
NhC2	Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
NhD2	Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded.	3	2	1	1	3	4	4	4	2	2	4
NsB	Neshaminy very stony silt loam, 0 to 8 percent slopes.	4	3	1	1	3	4	4	4	3	2	4
NsD	Neshaminy very stony silt loam, 8 to 25 percent slopes.	4	3	1	1	3	4	4	4	3	2	4
PaB2	Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded.	3	3	2	2	2	4	4	4	3	2	4
PaB3	Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, severely eroded.	3	3	2	2	2	4	4	4	3	2	4
PaC3	Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded.	4	3	2	2	2	4	4	4	3	2	4
PeA2	Penn silt loam, 0 to 3 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
PeB2	Penn silt loam, 3 to 8 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
PeB3	Penn silt loam, 3 to 8 percent slopes, severely eroded.	2	2	2	2	2	4	4	4	2	2	4
PeC2	Penn silt loam, 8 to 15 percent slopes, moderately eroded.	2	2	2	2	2	4	4	4	2	2	4
PeC3	Penn silt loam, 8 to 15 percent slopes, severely eroded.	3	2	2	2	2	4	4	4	2	2	4
PfD	Penn very stony silt loam, 8 to 25 percent slopes.	4	3	2	2	2	4	4	4	3	2	4
PkD3	Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded.[4]	4	3	2	2	2	4	4	4	3	2	4
PlB2	Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded.[4]	2	2	2	2	2	4	4	4	2	2	4
PlB3	Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded.[4]	2	2	2	2	2	4	4	4	2	2	4
PlC2	Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded.[4]	2	2	2	2	2	4	4	4	2	2	4
PlC3	Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded.[4]	3	2	2	2	2	4	4	4	2	2	4
PlD3	Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded.[4]	4	3	2	2	2	4	4	4	3	2	4
RaA	Raritan silt loam, 0 to 3 percent slopes.	2	1	1	1	3	3	3	3	1	1	3
RaB2	Raritan silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
ReA	Readington silt loam, 0 to 3 percent slopes.	2	1	1	1	3	3	3	3	1	1	3
ReB2	Readington silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4

TABLE 4.—*Suitability of soils for wildlife*—Continued

Map symbol	Soil	Wildlife habitat elements								Kinds of wildlife		
		Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woodland plants	Coniferous woodland plants	Wetland plants for food and cover	Shallow water development	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
ReC2	Readington silt loam, 8 to 15 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
RsA2	Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded.	2	1	1	1	3	3	3	3	1	1	3
RsB2	Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded.	2	1	1	1	3	4	4	4	1	1	4
RsB3	Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded.	2	2	1	1	3	4	4	4	1	2	4
RsC3	Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded.	3	2	1	1	3	4	4	4	2	2	4
Rt	Rowland silt loam	2	1	1	1	3	3	3	3	1	1	3
Ru	Rowland silt loam, coal overwash.	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
RwA	Rowland silt loam, local alluvium, 0 to 3 percent slopes.	2	1	1	1	3	3	3	3	1	1	3
RwB	Rowland silt loam, local alluvium, 3 to 8 percent slopes.	2	1	1	1	3	3	3	3	1	1	4
StE	Stony land, steep	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
WaA	Watchung silt loam, 0 to 3 percent slopes.	3	3	2	2	2	1	1	1	3	2	1
WaB	Watchung silt loam, 3 to 8 percent slopes.	3	3	2	2	2	3	4	4	3	2	4
Wc	Watchung very stony silt loam	4	3	2	2	2	1	2	2	3	2	1

[1] Rating is 4 on all slopes of more than 3 percent.
[2] Rating is 4 if rating for shallow water development is 4.
[3] Not rated.
[4] Both soils in the complex have the same rating.

two kinds of water developments, and three groups of wildlife. The categories rated are described in the following paragraphs.

Grain and seed crops.—Domestic grains or seed-producing annual herbaceous plants, seeded to produce food for wildlife. Examples are corn, sorghum, wheat, millet, buckwheat, soybeans, and sunflowers.

Grasses and legumes.—Domestic perennial grasses and herbaceous legumes that are established by planting to furnish cover and food for wildlife. Examples are fescue, brome, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and sericea lespedeza.

Wildlife herbaceous upland plants.—Native or introduced perennial grasses or forbs (weeds) that provide food and cover, mainly for upland wildlife and that are established chiefly through natural processes. Examples are ragweed, wheatgrass, wildrye, oatgrass, pokeweed, strawberries, beggarweed, goldenrod, and dandelion.

Hardwood woodland plants.—Deciduous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs, and foliage that are used extensively as food for wildlife and that commonly are established through natural processes but also can be planted. Examples are oak, beech, cherry, hawthorn, dogwood, viburnum, holly, maple, birch, poplar, grape, honeysuckle, blueberry, briers, including greenbrier, raspberry, and rose.

Coniferous woodland plants.—Cone-bearing trees and shrubs, mainly important to wildlife as cover, but that also furnish food as browse, seeds, or fruit-like cones. They are commonly established through natural processes, but they also can be planted. Examples are pine, spruce, white-cedar, hemlock, fir, redcedar, juniper, and yew.

Wetland plants for food and cover.—Annual and perennial wild herbaceous plants, exclusive of submerged or floating aquatic plants, that produce food or cover used mainly by wetland kinds of wildlife. Examples are smartweed, wild millet, bulrush, sedge, wildrice, switchgrass, reed canarygrass, and cattail.

Shallow water developments.—Impoundments, excavated areas, and structures that control the level of the water so that the depth generally does not exceed 5 feet. Examples are low dikes and levees, shallow dugouts, level ditches, and devices for controlling the water level in marshy streams or channels.

Excavated ponds.—Dugout areas or combinations of dugout ponds and low dikes (dammed areas) that hold enough water of suitable quality and suitable depth to

support fish or wildlife. An example is a pond that has at least one-fourth of an acre surface area and that has a dependable high water table or other source of unpolluted water of low acidity.

Engineering Properties of the Soils [3]

This soil survey of Montgomery County, Pa., contains information that can be used by engineers, planners, and geologists to—

1. Make soil and land use studies that will aid in selecting and developing light industrial, commercial, institutional, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make reconnaissance surveys of soil and ground conditions that will aid in locating highways and airports and in planning detailed soil surveys for their intended locations.
4. Correlate pavement performance with types of soil and thus develop information that will be useful in designing and maintaining pavements.
5. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
6. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making soil maps and reports that can be used readily by engineers.
7. Estimate the nature of material encountered when excavating for buildings and other structures.
8. Determine the suitability of the soils for drainage and for septic tanks.

With the use of the soil map for identification, the engineering interpretations reported here can be used for many purposes. It should be emphasized, however, that these interpretations may not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of the layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some terms used by soil scientists may not be familiar to engineers, and other terms may have a special meaning in soil science. These terms are defined in the Glossary at the back of the survey.

Much of the information in this section is in tables. Table 5 gives engineering test data obtained when the samples of selected soil series were tested. Table 6 gives estimates of the physical properties of the soils, and table 7 provides engineering interpretations of these properties.

Engineering classification systems

Two systems of classifying soils are in general use among engineers. In table 6 the soils are classified according to both systems.

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (AASHO) (*1*).[4] In this system soil materials are classified in seven principal groups. The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clay having low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number, when it is used, is shown in parentheses, following the soil group symbol, for example, A–4(6).

Some engineers prefer to use the Unified soil classification system, which was established by the Waterways Experiment Station, Corps of Engineers (*11*). In this system soil materials are identified as coarse grained (eight classes), fine grained (six classes), or highly organic (one class). An approximate classification of soils by this system can be made in the field. Estimated classifications of major horizons of soils in Montgomery County under both systems are given in table 6.

Soil test data

To be able to make the best use of the soil maps and soil survey, the engineer should know the physical properties of the soil material and the in-place condition of the soil. After testing the soil material and observing its behavior in engineering structures, the engineer can develop design recommendations for the mapping units delineated on the soil maps.

Table 5 gives engineering test data for samples of some of the major soil types in the county. These samples were tested by the Pennsylvania Department of Highways according to standard procedures to help evaluate the soils for engineering purposes. The engineering classifications given in table 5 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. Percentages of clay obtained by the hydrometer method should not be used as a basis in naming U.S. Department of Agriculture textural classes of the soils.

The tests to determine liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture

[3] DONALD E. MCCANDLESS, JR., and THEODORE H. IFFT, engineers of the Soil Conservation Service, assisted in writing this section. The work was done in cooperation with the Pennsylvania Department of Highways.

[4] Italic numbers in parentheses refer to Literature Cited, p. 185.

content is further increased, the material changes from the plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the material passes 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 soil material is in a plastic condition.

Table 5 also gives compaction (*moisture density*) data for the tested soils. If a soil material is compacted at successively higher moisture content, assuming that the compactive effect remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed *maximum dry density*. Data that give moisture density are important in earthwork, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Soil properties and engineering interpretations

Table 6 gives the estimated engineering classifications and properties of the soils of this county. More information that is useful to engineers can be found in the sections "Descriptions of the Soils" and "Use and Management, of the Soils for Agriculture." Also, a typical soil profile for each soil series is described in detail in the section "Formation and Classification of Soils."

In the column that shows the depth to a seasonal high water table, the depth shown is that reached by the water table at least once a year. Depth from the surface is given in feet. The Bermudian, Codorus, and Hatboro soils and Rowland silt loam, coal overwash, are subject to occasional or periodic flooding, and Bouldery alluvial land and the Bowmansville soils are subject to frequent flooding. Rowland silt loam is frequently or occasionally flooded.

The column that shows depth to bedrock indicates a range of depths at which bedrock occurs in most areas of the soil specified. Bedrock is considered to be firm rock of relatively great thickness and extent that is in its natural location.

In the column titled "Depth from surface," the depth, in inches, is given from the top to the bottom of the major distinctive layers of the soil profile. This profile is generally the one described as typical for each series or phase in the section "Formation and Classification of Soils." The estimates in the succeeding columns are approximate average values given for the layer specified. Considerable variation from these average values should be anticipated. Estimates of some properties are not given for the surface layer, because the material from that layer is generally unsuitable for use in many engineering structures. This material is commonly used as a topdressing to promote the growth of plants on the shoulders and slopes along roads.

The column titled "Permeability" gives figures to show the rate of movement of water through the soil material in an undisturbed soil. Permeability depends largely on the texture, porosity, and structure of the soil. The coefficient of permeability, given in inches per hour, is the volume of flow of water through a unit area under a unit head of water pressure. A permeability rate of less than 0.2 inch per hour indicates *slow*, or *very slow* movement of water through the soil; of 0.2 to 0.63 inch, *moderately slow;* of 0.63 inch to 2.0 inches, *moderate;* of 2.0 to 6.3 inches, *moderately rapid;* and of more than 6.3 inches *rapid* or *very rapid*. Since actual rates for very slow and very rapid are not given in table 6, <0.2 is shown for the soils that have very slow permeability. A rating of 6.3+ would be shown if any of the soils had very rapid permeability.

The estimates of available water capacity, in inches per inch of soil depth, show the amount of water the soil can hold available for plants before permanent wilting occurs. The retention of water by the soil is related to the size of the particles and to the arrangement and size of the soil pores. Factors such as the texture, structure, and content of organic matter affect this capacity.

The column that shows reaction gives the degree of acidity or alkalinity of the soils. In this system of notations, pH 7.0 is neutral; lower values indicate acidity, and higher values indicate alkalinity. The pH of soils that have been cropped for a long time and that have received a large amount of lime over a period of years may be higher than the ranges shown in this column.

The estimates given for optimum moisture for compaction and for maximum dry density are for the part of the soil material that has passed a No. 4 sieve. If the total sample is compacted at the construction site, soils that contain a large amount of material greater than one-fourth of an inch in diameter have higher maximum dry density and lower optimum moisture for compaction than those for which estimates are given in the table.

Shrink-swell potential is a rating of the ability of soil material to change volume when the material is subjected to changes in moisture. The extent to which a soil changes volume is influenced by the amount and kind of clay in the soil material. Estimates are based on field experience with the same soils and on a limited amount of test data that indicate the relative amount and kind of clay. These test data are given in the section "Laboratory Data."

Table 7 rates the soils according to their suitability for winter grading and as a source of sand, gravel, and material for road fill and topsoil. It also names characteristics that affect suitability for the construction and location of highways, for the construction and maintenance of pipelines, and for agricultural engineering.

The ratings given for suitability for winter grading are based on winter conditions commonly encountered in this county.

TABLE 5.—*Engineering*

Soil name and location	Parent material	Pennsylvania report No.	Depth	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Abbottstown silt loam:						
0.25 mile S. of Heckler Road and 144 ft. NW. of Mt. Airy Road. (Modal profile).	Triassic siltstone of the Brunswick formation.	BF–11177	13–20	B21g-----	112	16
		BF–11178	39–48	C1g------	114	14
0.75 mile SW. of New Hanover Square and 2 miles NNE. of Fagleysville. (Modal profile, upland).	Triassic siltstone of the Brunswick formation.	BF–11185	16–23	B22g-----	112	16
		BF–11186	38–44	C1g------	118	13
0.5 mile N. of Fagleysville on the N. side of New Hanover Square Road. (Shallow profile).	Shale or siltstone of the Brunswick formation.	BJ–40589	14–22	B22g-----	109	17
		BJ–40590	22–35	C1-------	110	17
0.25 mile from Fairfield Road on the N. side of Penn Road extension in Black Horse. (Coarser textured than modal).	Triassic sandstone of the Stockton formation.	BJ–44119	20–36	IIB22x---	123	12
		BJ–44120	45–65	IIIC-----	121	12
Chalfont silt loam:						
1.5 miles N. of Eureka and 20 ft. S. of Kenas Road on County Line Road (Modal profile).	Eolian silt deposited on shale of the Lockatong formation.	BJ–46895	18–24	B22xg----	109	16
		BJ–46896	30–47	C2-------	114	15
1 mile E. of Montgomeryville and 0.5 mile NE. of Harsham Road. (Coarser textured than modal).	A thin layer of eolian silt over shale of the Lockatong formation.	BJ–41773	16–23	IIB2g----	108	16
		BJ–41774	31–41	IIC1-----	108	17
1.5 miles N. of Montgomeryville and 30 feet S. of County Line Road. (Finer textured than modal).	Eolian silt on Triassic shale of the Lockatong formation.	BJ–46897	11–22	B2g------	108	18
		BJ–46898	31–44	C2xg-----	113	15
Croton silt loam:						
70 ft. NW. of the second light pole S. of S. corner of churchyard on Limerick Center Road. (Modal profile).	Siltstone of the Brunswick formation.	BF–11181	18–24	B21g-----	102	19
		BF–11182	37–44	C1-------	112	15
0.75 mile S. of New Hanover Square and 435 ft. N. of New Road. (Modal profile).	Triassic shale and siltstone------	BF–11183	16–22	B21g-----	109	17
		BF–11184	34–38	C1-------	115	15
1 mile N. of Hickorytown and 275 ft. SE. of Walton Road. (Coarser textured than modal).	Sandstone, conglomerate, and arkose of the Stockton formation.	BJ–45065	16–25	B22g-----	116	14
		BJ–45066	32–40	C--------	119	11
0.75 mile SW. of New Hanover Square on the S. side of New Road. (Finer textured than modal).	Siltstone of the Brunswick formation.	BF–11187	13–28	B2-------	103	19
		BF–11188	32–40	C1-------	112	15
Doylestown silt loam:						
1 mile E. of Montgomeryville on the E. side of County Line Road. (Modal profile).	Eolian silt on siltstone or shale of the Lockatong formation.	BJ–46901	18–29	B22xg----	110	16
		BJ–46902	37–44	IIC2-----	109	17
1 mile N. of Hickorytown and 75 ft. S. of Walton Road. (Coarser textured than modal).	Eolian deposit over sandstone conglomerate of the Stockton formation.	BJ–45341	18–27	C1xg-----	113	15
		BJ–45342	27–44	IIC3-----	126	10
1.5 miles N. of Montgomeryville on County Line Road. (Finer textured than modal).	Eolian silt on Triassic shale of the Lockatong formation.	BJ–46899	14–20	B21g-----	112	16
		BJ–46900	32–42	IIC2-----	113	15

See footnotes at end of table.

test data [1]

Mechanical analysis [3]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [4]—					Percentage smaller than [4]—							
¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
97	94	92	90	87	86	61	33	24	28	7	A-4(8)	ML-CL.
95	93	92	91	87	86	60	27	18	26	5	A-4(8)	ML-CL.
----------	99	96	88	82	81	65	30	23	30	9	A-4(8)	ML-CL.
----------	100	94	66	55	54	40	21	16	25	7	A-4(4)	ML-CL.
98	88	81	72	65	64	60	28	19	30	5	A-4(6)	ML.
82	64	56	47	41	40	32	21	15	29	6	A-4(1)	GM-GC.
----------	99	95	77	53	51	35	20	16	28	6	A-4(4)	ML-CL.
100	99	98	88	35	31	24	16	13	21	0	A-2-4(0)	SM.
100	95	90	86	84	83	43	16	12	28	[7] NP	A-4(8)	ML.
----------	100	99	98	97	96	55	25	19	30	3	A-4(8)	ML.
68	62	58	56	54	53	36	19	13	31	6	A-4(4)	ML.
57	51	48	43	40	39	27	13	8	31	4	A-4(1)	GM.
----------	98	96	93	91	90	63	39	29	37	11	A-6(8)	[8] ML-CL.
99	96	93	91	89	88	57	31	22	30	4	A-4(8)	ML.
----------	----------	----------	100	97	95	80	47	39	41	19	A-7-6(12)	CL.
----------	100	99	99	92	89	68	38	29	29	7	A-4(8)	ML-CL.
----------	----------	----------	100	99	98	79	49	39	42	22	A-7-6(13)	CL.
98	97	97	94	87	85	67	33	25	29	10	A-4(8)	CL.
66	48	42	33	30	29	21	13	9	29	7	A-2-4(0)	GM-GC.
96	88	86	52	37	35	28	19	15	31	4	A-4(0)	SM.
----------	----------	----------	100	99	99	81	56	46	49	28	A-7-6(17)	CL.
----------	----------	100	99	99	98	69	33	24	29	10	A-4(8)	CL.
----------	99	98	96	93	92	65	39	32	40	17	A-6(11)	CL.
100	96	92	87	81	79	53	27	18	29	4	A-4(8)	ML.
----------	100	99	90	84	83	50	22	15	30	3	A-4(8)	ML.
97	92	88	61	37	35	24	13	10	26	3	A-4(0)	SM.
89	80	78	77	75	74	51	33	27	39	16	A-6(10)	CL.
80	60	54	50	45	43	30	19	15	36	11	A-6(2)	GM-GC.

TABLE 5.—*Engineering*

Soil name and location	Parent material	Pennsylvania report No.	Depth	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Klinesville shaly silt loam:						
1.25 miles E. of Royersford on the W. side of Mennonite Road. (Modal profile).	Triassic shale, siltstone, or sandstone.	BJ-44621	5-15	C	122	12
1.25 miles N. of Fagleysville on the N. side of Reifsnyder Road. (Coarser textured than modal).	Triassic shale, siltstone, or sandstone.	BJ-45058	0-6	Ap	110	15
1 mile N. of Fairview Village on the N. side of Stump Hall Road. (Finer textured than modal).	Triassic shale, siltstone, or sandstone.	BJ-45339	5-10	B2	118	14
		BJ-45340	10-25	C	122	14
Lansdale loam, thin:						
1.5 miles W. of Prospectville and 135 ft. W. of Horsham Road. (Modal profile).	Micaceous sandstone of the Stockton formation.	BF-11169	10-16	B2	112	14
		BF-11170	26-36	C21	110	14
120 ft. NE. of Johnson Blvd. at the intersection with Harding Blvd. (Modal profile).	Micaceous graywacke of the Stockton formation.	BF-11175	14-21	B2	117	14
		BF-11176	24-32	C1	112	15
1 mile E. of Black Horse on the N. side of Grayer Road. (Coarser textured than modal).	Arkose or feldspathic conglomerate of the Stockton formation.	BJ-44115	12-20	B2	127	10
		BJ-44116	20-30	C	126	10
1 mile NE. of Fairview Village on the S. side of Township Line Road. (Finer textured than modal).	Shale of the Brunswick or the Lockatong formation.	BJ-45063	9-18	B2	109	17
		BJ-45064	24-32	C	110	17
Lawrenceville silt loam:						
0.5 mile SW. of Morris Road and 220 yd. NW. of Lewis Lane. (Modal profile).	Silty windblown deposits over Triassic shale and sandstone of the Stockton formation.	BF-11173	19-27	B21g	106	18
		BF-11174	41-52	C1	106	17
1.5 miles SE. of Prospectville and 0.25 mile SW. of Horsham Road.	Silty windblown deposits over Triassic shale and sandstone of the Stockton formation.	BF-11171	25-32	B22g	106	16
		BF-11172	44-68	C1	106	16
400 ft. S. of the Woodlyn Avenue and Patricia Avenue intersection in Willow Manor. (Coarser textured than modal).	Windblown deposits over sandstone, gneiss, or schist.	BH-34037	13-28	B21	109	18
		BH-34042	46-72	IIC1	104	20
2 miles NE. of Fairview Village and 275 ft. SW. of Potshop Road on Church Road. (Finer textured than modal).	Windblown silt, Triassic shale, and sandstone.	BJ-41771	37-50	B22xg	106	17
		BJ-41772	66-83	IIC2	100	22
Lehigh channery silt loam:						
1.25 miles N. of Limerick on State Game Farm Road. (Modal profile).	Metamorphosed red shale of the Brunswick formation.	BJ-45055	13-21	B22	107	15
		BJ-45056	21-30	C	115	14
1.25 miles N. of Limerick on the SE. side of State Game Farm Road. (Coarser textured than modal).	Metamorphosed red shale of the Brunswick formation.	BJ-44632	17-22	B22	110	17
		BJ-44633	28-36	C	114	15
3 miles N. of Limerick on the S. side of Neiffer Road. (Finer textured than modal).	Metamorphosed red shale of the Brunswick formation.	BJ-45061	14-22	B2	111	15
		BJ-45062	22-29	C1	108	18

See footnotes at end of table.

test data [1]—Continued

Mechanical analysis [3]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [4]—					Percentage smaller than [4]—							
¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
100	75	55	38	32	31	25	14	10	29	4	A–2–4(0)	SM.
69	46	41	36	32	21	23	12	8	29	3	A–2–4(0)	GM.
98	68	53	39	35	34	27	18	14	31	8	A–2–4(0)	SM–SC.
97	62	46	33	29	28	23	15	11	30	7	A–2–4(0)	GM–GC.
100	99	98	94	70	67	53	30	20	27	6	A–4(7)	ML–CL.
		100	89	42	38	28	15	9	24	1	A–4(1)	SM.
91	90	89	87	54	51	37	24	20	25	6	A–4(4)	ML–CL.
86	82	81	73	38	35	26	18	14	27	3	A–4(1)	SM.
100	96	88	51	24	22	18	12	9	24	2	A–2–4(0)	SM.
70	64	61	33	15	14	11	8	6	23	1	A–1–b(0)	SM.
68	50	41	35	33	32	21	10	6	29	2	A–2–4(0)	GM.
	99	98	85	79	78	48	22	15	30	4	A–4(8)	ML.
			100	99	98	76	41	28	35	11	A–6(8)	ML–CL.
		100	99	96	95	63	28	20	32	7	A–4(8)	ML–CL.
		100	99	96	95	70	30	23	31	8	A–4(8)	ML–CL.
			100	98	97	60	16	11	25	2	A–4(8)	ML.
	99	97	91	80	78	62	35	24	36	10	A–4(8)	ML–CL.
100	98	94	80	46	41	30	17	9	39	NP	A–4(2)	SM.
100	98	98	97	95	94	67	35	25	36	9	A–4(8)	ML.
100	99	97	94	86	82	64	37	26	37	4	A–4(8)	ML.
58	50	47	44	43	42	33	18	11	29	4	A–4(2)	GM.
64	52	48	44	41	40	25	11	8	24	2	A–4(1)	GM.
96	84	77	70	64	63	43	24	19	31	7	A–4(6)	ML–CL.
72	55	49	41	37	36	27	16	12	29	8	A–4(0)	GM–GC.
96	83	78	74	67	66	49	25	16	31	4	A–4(6)	ML.
84	75	71	68	62	61	43	22	14	32	4	A–4(5)	ML.

TABLE 5.—*Engineering*

Soil name and location	Parent material	Pennsylvania report No.	Depth	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Mount Lucas very stony silt loam:						
1 mile W. of Upper Perkiomen Valley Park and 1,000 ft. N. of Finn Road on the E. side of Hildebrand Road. (Modal Profile).	Diabase of Triassic age.	BJ–44626	24–34	B22	110	17
		BJ–44627	54–106	C3	122	14
1.25 miles N. of Zieglersville and 0.12 mile N. of Simmons Road on the E. side of Rt. 29. (Coarser textured than modal).	Diabase of Triassic age.	BJ–45347	17–25	B21	107	19
		BJ–45348	48–58	C1	112	18
1 mile W. of Tylersport and 120 ft. W. of the Clubhouse. (Finer textured than modal).	Diabase of Triassic age.	BJ–45345	17–29	B22g	104	20
		BJ–45346	41–54	C	126	14
Neshaminy silt loam:						
2 miles W. of Upper Perkiomen Valley Park, 0.25 mile S. of Deep Creek Road and 275 ft. SE. of Hildebrand Road. (Modal profile).	Diabase of Triassic age.	BF–29888	24–33	B3	113	19
		BF–29889	39–49	C2	95	25
Neshaminy very stony silt loam:						
1.5 miles N. of Sumneytown and 140 ft. E. of Swamp Creek Road. (Modal profile).	Diabase of Triassic age.	BH–15269	21–29	B22	97	25
		BH–15270	39–52	B32	95	23
0.5 mile E. of Sumneytown on the N. side of Zepp Road. (Coarser textured than modal).	Diabase of Triassic age.	BJ–41775	15–25	B22	108	20
		BJ–41776	42–48	C2	120	16
0.25 mile N. of Mill on the W. side of Whites Mill Road. (Finer textured than modal).	Diabase of Triassic age.	BJ–41777	24–36	B21	99	24
		BJ–41778	56–64	B3	110	18
Penn silt loam:						
2 miles S. of Kulpsville and 365 feet NE. of Morris Road. (Modal profile).	Shale of the Brunswick formation.	BH–15263	14–20	B22	116	15
		BH–15264	24–32	C2	117	15
2 miles NW. of Collegeville	Siltstone of the Brunswick formation.	BH–15265	11–17	B2	114	13
		BH–15266	20–31	C1	126	11
1 mile S. of Limerick Center, on the W. side of Reed Road. (Coarser textured than modal).	Siltstone interbedded with sandstone (Brunswick formation).	BJ–40587	12–19	B21	113	15
		BJ–40588	37–47	IIIC2	113	15
1.5 miles W. of Center Point and 2.5 miles N. of Fairview Village, on the N. side of Krieble Mill Road. (Finer textured than modal).	Triassic shale and siltstone of the Brunswick formation.	BJ–40584	16–26	B22	112	16
		BJ–40585	30–41	C1	119	12
Penn shaly silt loam, neutral substratum:						
0.5 mile W. of Niantic and 330 ft. N. of Moser Road on Miller Road. (Modal profile).	Shale of the Brunswick formation.	BJ–44622	8–18	B2	107	17
		BJ–44623	18–31	C	112	16
0.33 mile NE. of Limerick on the E. side of Limerick Road. (Coarser textured than modal).	Shale and siltstone of Triassic age.	BJ–45057	0–6	Ap	107	18
1.25 miles N. of Niantic and 35 ft. NW. of Gehman Road. (Finer textured than modal).	Shale and siltstone of Triassic age.	BJ–44624	13–22	B22	116	14
		BJ–44625	25–35	C	117	13

See footnotes at end of table.

test data [1]—Continued

Mechanical analysis [3]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [4]—					Percentage smaller than [4]—							
¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
100	98	96	85	75	74	50	27	18	31	7	A–4(8)	ML–CL.
99	97	93	61	33	32	18	11	8	30	3	A–2–4(0)	SM.
100	98	96	88	72	69	48	32	24	40	13	A–6(9)	ML–CL.
99	93	87	65	46	44	31	21	16	32	9	A–4(2)	SM–SC.
	100	99	97	94	93	69	42	37	41	16	A–7–6(11)	ML–CL.
97	95	92	62	43	41	26	13	10	33	8	A–4(2)	ML–CL.
80	73	66	46	32	29	21	13	9	41	13	A–2–7(1)	SM.
100	96	94	77	55	51	37	24	20	51	19	A–7–5(9)	MH.
90	87	86	77	63	60	49	33	26	51	22	A–7–6(12)	MH–CH.
62	57	56	45	34	33	27	19	16	51	20	A–2–7(2)	GM.
55	52	52	40	29	28	20	13	10	46	15	A–2–7(1)	GM.
100	97	97	68	40	38	25	15	8	40	10	A–4(1)	SM.
83	79	78	69	57	55	42	30	24	45	17	A–7–6(8)	ML–CL.
81	72	70	59	43	41	26	15	9	33	9	A–4(2)	SM–SC.
95	79	67	53	48	46	37	22	15	28	8	A–4(3)	SC.
87	48	36	25	22	21	15	10	7	30	10	A–2–4(0)	GC.
98	92	82	68	62	60	48	26	17	31	8	A–4(5)	ML–CL.
93	80	66	46	36	35	26	15	10	24	3	A–4(0)	SM.
100	97	93	90	70	66	47	29	20	27	3	A–4(7)	ML.
	98	96	94	77	70	48	30	23	28	4	A–4(8)	ML–CL.
100	92	89	81	76	74	52	31	21	31	5	A–4(8)	ML.
100	75	66	59	51	49	32	19	14	27	4	A–4(3)	ML–CL.
68	54	48	44	40	39	28	14	8	27	3	A–4(1)	GM.
70	60	56	53	49	47	29	15	10	25	1	A–4(3)	GM.
67	38	30	26	23	22	16	8	5	41	7	A–2–5(0)	GM.
92	78	70	59	50	49	39	20	14	26	2	A–4(3)	SM.
78	66	58	49	40	39	26	15	10	25	3	A–4(1)	GM.

TABLE 5.—*Engineering*

Soil name and location	Parent material	Pennsylvania report No.	Depth	Horizon	Moisture-density[2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Readington silt loam:						
1.5 miles NE. of Fagleysville and 1.5 miles S. of New Hanover Square. (Modal profile).	Triassic shale and siltstone of the Brunswick formation.	BF–29886 BF–29887	20–29 33–40	B22g C1	110 111	17 17
1 mile WNW. of Limerick	Triassic shale and siltstone of the Brunswick formation.	BF–11179 BF–11180	27–36 46–54	B22g C1g	106 115	18 15
1 mile E. of Black Horse on the S. side of Grayer Road. (Coarser textured than modal).	Triassic coarse-grained arkose of the Stockton formation.	BJ–44117 BJ–44118	18–26 26–38	B22 C	122 118	10 10
0.75 mile W. of Schwenksville and 0.12 mile SW. of Cemetery Road, toward Reaville.	Siltstone and shale of the Brunswick formation.	BJ–41769 BJ–41770	9–17 19–22	B2 C1	109 112	17 16
Reaville shaly silt loam:						
1 mile NE. of Fagleysville and 1.75 miles SW. of New Hanover Square. (Modal profile).	Red shale of the Brunswick formation.	BF–29884 BF–29885	10–14 14–23	B2g C1	107 110	19 16
2 miles NW. of Trappe and 1.25 mile E. of Limerick. (Modal profile).	Red shale or siltstone of the Brunswick formation.	BH–15267 BH–15268	12–15 26–32	B21g C2	112 118	16 12
0.25 mile NE. of Limerick and 0.12 mile NW. of Sunset Road on Graterford Road. (Shallow profile).	Red shale or siltstone of the Brunswick formation.	BJ–40586	3–6	C	112	16
0.75 mile N. of Sanatoga on the N. side of Buckert Road. (Finer textured and thicker than modal).	Triassic red shale or siltstone of the Brunswick formation.	BJ–44113 BJ–44114	13–18 18–29	B2g C	110 114	15 15
Rowland silt loam:						
1.5 miles N. of Fagleysville and 45 ft. SE. of bridge over West Swamp Creek. (Modal profile).	Alluvium.	BJ–45059 BJ–45060	12–24 31–36	C1 IIC3	107 112	16 15
625 ft. S. of the bridge on Lafayette Road over Wissahickon Creek. (Coarser textured than modal).	Alluvium.	BJ–40582 BJ–40583	17–34 48–58	C2 IIIC4	110 116	15 13
1 mile E. of Fairview Village and 300 ft. NE. of Shultz Road. (Finer textured than modal).	Alluvium.	BJ–46904 BJ–46903	10–19 23–29	C1 C3	97 102	23 19
Watchung silt loam:						
1.75 miles NE. of Sumneytown on the S. side of Camp Delmont. (Modal profile).	Diabase of Triassic age.	BJ–45343 BJ–45344	15–28 40–50	B22g C2	108 118	19 15
1.5 mile W. of Tylersport and 3 miles E. of Green Lane. (Coarser textured than modal).	Diabase of Triassic age.	BJ–44628 BJ–44629	15–22 44–54	B21g C	104 124	20 12
1.75 miles NE. of Sumneytown on the S. side of Camp Delmont. (Finer textured than modal).	Diabase of Triassic age.	BJ–44630 BJ–44631	10–25 42–52	B2g C	96 112	21 16

[1] Tests performed by the Pennsylvania Department of Highways in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

[2] Based on the "Moisture-Density Relations of Soils Using a 5.5-lb. Rammer and a 12-in. Drop," AASHO Designation T 99–57, Method A (*1*).

[3] Mechanical analyses according to "Mechanical Analysis of Soils," AASHO Designation T 88–57 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

test data [1]—Continued

Mechanical analysis [3]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve [4]—					Percentage smaller than [4]—							
¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
90	88	86	82	77	76	57	35	27	35	13	A–6(9)	ML–CL.
---	99	97	89	81	80	62	37	32	34	12	A–4(9)	ML–CL.
---	---	---	100	97	96	75	44	32	33	10	A–4(8)	ML–CL.
100	92	87	78	72	71	49	24	17	27	7	A–4(7)	ML–CL.
---	99	94	58	35	33	26	20	17	35	12	A–2–6(0)	SM–SC.
94	78	64	32	12	10	8	7	6	24	13	A–1–b(0)	SW–SM.
93	84	75	63	53	51	39	23	16	30	2	A–4(4)	ML.
71	61	55	43	34	33	25	15	11	31	5	A–2–4(0)	GM.
86	83	81	79	77	76	62	39	30	39	17	A–6(11)	CL.
75	68	66	62	59	58	47	34	27	34	13	A–6(6)	CL.
---	99	98	94	89	86	68	41	31	32	12	A–6(9)	CL.
98	69	58	44	39	38	31	18	13	28	9	A–4(1)	GC.
89	60	51	41	38	37	28	14	9	28	2	A–4(1)	GM.
100	96	94	92	90	89	65	38	28	31	8	A–4(8)	ML–CL.
100	92	88	81	77	76	56	31	23	29	8	A–4(8)	ML–CL.
---	---	100	99	83	79	55	32	21	33	7	A–4(8)	ML.
---	---	100	92	60	55	37	22	16	29	4	A–4(5)	ML.
---	---	100	89	37	34	25	13	8	NP	NP	A–4(0)	SM.
100	82	74	51	26	25	20	11	7	24	NP	A–2–4(0)	SM.
---	---	---	100	97	96	72	36	22	41	9	A–5(8)	ML.
---	---	---	100	97	95	72	36	22	38	9	A–4(8)	ML.
100	97	96	89	81	79	61	41	33	47	22	A–7–6(14)	CL.
98	95	93	81	69	67	43	19	9	26	4	A–4(7)	ML–CL.
84	79	77	72	68	67	48	27	19	35	11	A–6(7)	ML–CL.
94	78	67	50	41	41	22	11	7	26	2	A–4(1)	SM.
---	---	---	100	99	98	75	51	44	(9)	(9)	A–7–6(18)	(9)
---	---	100	95	88	86	55	27	18	29	5	A–4(8)	ML–CL.

[1] Based on sample as received in laboratory. Laboratory test data not corrected for amount retained on 3-inch sieve.

[5] Based on "Standard Specifications for Highway Materials and Methods of Sampling and Testing" (Pt. 1, Ed. 8): "The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes," AASHO Designation M 145–49 (*1*).

[6] Based on the Unified Soil Classification System, Tech. Memo. No. 3–357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953 (*11*).

[7] NP=Nonplastic.

[8] Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification. Examples of borderline classifications are ML–CL, GM–GC, and SM–SC.

[9] Data not submitted.

TABLE 6.—*Estimated*

[Absence of a figure indicates that estimates

Soil series or types and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Classification: Dominant USDA texture
	Feet	*Feet*	*Inches*	
Abbottstown (AbA, AbB2)	½–1½	3–8	0–10	Silt loam
			10–27	Silt loam or silty clay loam
			27–48	Loam to shaly silt loam
Beltsville (BlB2)	1–2½	6–30	0–11	Silt loam
			11–38	Silty clay loam or clay loam
			38–72	Sandy clay loam
Bermudian (Bm)	2–3	4–8	0–58	Silt loam or loam
Birdsboro (BnA, BnB2)	4+	4–8	0–8	Silt loam
			8–38	Silty clay loam or clay loam
			38–60	Sandy loam to silt loam
Bouldery alluvial land (Bo)	0–1	0–3	(1)	(1)
Bowmansville (Bp, BrA, BrB)[2]	0–½	3–8	0–10	Silt loam
			10–40	Silt loam
Brecknock (BsB2, BsC2, BsD2, BtC, BtD, BvD)	3+	2–5	0–8	Channery silt loam
			8–34	Channery silt loam or silty clay loam
			34–48	Rock fragments and silt loam
Chalfont (CfA, CfB2)	0–1	4–8	0–8	Silt loam
			8–14	Silt loam
			14–47	Silt loam
			47–60	Shaly silty clay loam
Chester (CgA2, CgB2)	3+	5–12	0–88	Silt loam
			8–38	Silt loam or silty clay loam
			38–74	Sandy loam to silt loam
Codorus (Ch)	1–2½	3–6	0–13	Silt loam
			13–50	Silt loam or loam
Croton (CrA, CrB2, CsB)	0–½	3–5	0–13	Silt loam
			13–37	Silty clay loam
			37–44	Silt loam
Doylestown (DsA, DsB2)	0–½	4–8	0–8	Silt loam
			8–14	Silt loam
			14–38	Silt loam
			38–43	Shaly silty clay loam
Duffield (DuB2, DuC2, DuC3)	3+	4–12	0–10	Silt loam
			10–40	Silty clay loam
			40–120	Silt loam
Edgemont (EcB2, EcC2, EcD2, EsD)	3+	3–5	0–8	Channery loam
			8–42	Channery loam
			42–54	Very channery sandy loam
Glenelg (GnB2, GnC2, GnD2)	3+	2½–5	0–8	Silt loam
			8–24	Channery silt loam
			24–50	Very channery silt loam
Glenville (GsA, GsB2)	1–2½	4–8	0–8	Silt loam
			8–42	Silt loam or silty clay loam
			42–55	Very micaceous loam

See footnotes at end of table.

properties of soils

were not made for the factor indicated]

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
					Inches per hour	*Inches per inch of soil depth*	*pH value*	*Percent*	*Pounds per cubic foot*	
ML-CL	A-4	90-100	80-95	60-85	0. 63-2. 0	0. 21	5. 0-6. 5	16	112	Moderate.
ML-CL or GM	A-4	70-100	55-95	45-85	<0. 2	. 15	4. 5-5. 5	14	116	Moderate.
ML or CL	A-4 or A-6	95-100	85-100	75-90	0. 63-2. 0	. 22	5. 0-6. 0	14	115	Low to moderate
ML or CL	A-4 or A-6	90-100	80-100	60-70	<0. 2	. 17	4. 5-5. 5	14	118	Low.
ML or SM	A-4	90-100	80-100	40-95	0. 20-0. 63	. 10	4. 5-5. 0	14	110	Moderate.
ML or CL	A-4 or A-6	80-100	80-100	70-95	0. 63-2. 0	. 22	6. 0-7. 0	15	110	Low.
ML-CL or SM	A-4	80-100	75-100	45-55	0. 63-2. 0	. 20	5. 5-6. 5	16	110	Low.
					2. 0-6. 3	. 18	5. 0-6. 0	13	119	Low.
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1).
ML or CL	A-6	95-100	90-100	65-75	0. 63-2. 0	. 24	5. 0-6. 5	14	110	Low.
					2. 0-6. 3	. 19	5. 0-6. 5			
ML-CL or GM-GC.	A-4 or A-2	45-60	25-50	25-40	0. 63-2. 0	. 23	5. 0-6. 0	18	108	Low.
GM	A-2	20-50	15-45	15-35	2. 0-6. 3	. 15	4. 5-5. 5	17	110	Low.
ML	A-4 or A-6	95-100	95-100	85-100	0. 63-2. 0	. 10	4. 5-5. 0			
ML	A-4	80-100	75-95	70-95	0. 2-0. 63	. 22	5. 5-6. 5	18	108	Low.
ML or GM	A-4	50-90	45-85	45-85	<0. 2	. 18	5. 5-6. 5	15	113	Low.
					0. 2-0. 63	. 15	5. 0-6. 0	14	116	Low.
ML, CL, or SM	A-6 or A-7	90-100	80-100	45-75	2. 0-6. 3	. 10	6. 0-6. 5			
ML-CL or SM	A-4 or A-5	80-100	60-90	40-60	0. 63-2. 0	. 22	5. 5-6. 0	18	108	Low.
					2. 0-6. 3	. 18	4. 5-5. 5	16	112	Low.
ML or CL	A-6	95-100	85-100	65-90	2. 0-6. 3	. 12	6. 0-6. 5			
					0. 63-2. 0	. 20	5. 5-6. 0	15	110	Low to moderate.
CL	A-6 or A-7	95-100	90-100	65-95	0. 63-2. 0	. 22	5. 0-6. 5			
CL or SM-SC	A-4	75-100	75-100	40-90	<0. 2	. 17	4. 0-6. 0	17	109	Moderate.
					<0. 2	. 07	4. 0-6. 0	15	112	Moderate.
ML-CL	A-4 or A-6	95-100	95-100	80-100	0. 63-2. 0	. 22	5. 5-6. 5			
ML or CL	A-4 or A-6	80-100	80-100	75-95	0. 2-0. 63	. 20	5. 0-6. 5	18	108	Low.
ML or GM	A-4 or A-6	60-95	55-90	40-80	<0. 2	. 16	5. 5-6. 5	16	111	Low.
					<0. 2	. 08	5. 5-6. 5	15	113	Low.
ML or CL	A-4, A-6	95-100	95-100	70-90	2. 0-6. 3	. 20	6. 0-7. 0			
ML-CL	A-4, A-6	90-100	85-100	65-90	0. 63-2. 0	. 20	5. 0-6. 0	18	108	Moderate.
					0. 63-2. 0	. 20	5. 5-6. 0	19	106	Moderate.
GM or SM	A-2, A-4	60-90	55-75	25-40	2. 0-6. 3	. 16	5. 0-6. 0			
GM or SM	A-1, A-2	55-80	50-75	15-30	2. 0-6. 3	. 13	4. 5-5. 5	11	122	Low.
					2. 0-6. 3	. 10	4. 5-5. 0	12	117	Low.
ML, GC, or SM	A-2, A-4	65-100	60-95	30-55	2. 0-6. 3	. 20	5. 0-6. 5			
SM	A-4	50-100	45-95	40-50	0. 63-2. 0	. 17	4. 5-6. 5	14	116	Low.
					2. 0-6. 3	. 10	4. 5-6. 0	13	116	Low.
ML or CL	A-4	90-100	85-100	70-90	2. 0-6. 3	. 24	4. 5-6. 0			
ML, CL or SM	A-4	75-95	75-90	45-75	0. 20-0. 63	. 20	4. 5-5. 5	17	107	Low.
					0. 63-2. 0	. 15	4. 5-5. 5	16	110	Low.

TABLE 6.—*Estimated*

Soil series or types and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Classification: Dominant USDA texture
	Feet	*Feet*	*Inches*	
Hatboro (Ha)	0–1	4–8	0–10	Silt loam
			10–40	Silt loam or silty clay loam over sandy clay loam or sandy loam.
Howell (HwB2)	2½+	6–30	0–8	Silt loam
			8–16	Silty clay loam
			16–50	Silty clay loam to gravelly clay loam
			50–125	Stratified silt loam, gravelly clay loam, and gravelly sandy loam.
Klinesville (KlB2, KsB3, KsC3, KsE3)	2+	½–1½	0–5	Very shaly silt loam
			5–15	Very shaly silt loam
Lansdale loam, thin (LaB3, LaC3, LaE3)	3+	3–12	0–9	Loam
			9–24	Loam to gravelly sandy loam
			24–32	Channery sandy loam
Lansdale silt loam (LdA2, LdB2, LdC2)	5+	4–12	0–7	Silt loam
			7–32	Loam
			32–57	Sandy loam or loamy sand
Lawrenceville (LeA, LeB2)	1–2	4–12	0–10	Silt loam
			10–27	Silt loam
			27–52	Silt loam
			52–57	Silt loam
Legore (LgC3, LgD3)	3+	2–5	0–4	Clay loam
			4–17	Clay loam to sandy clay loam
			17–30	Sandy loam
Lehigh (LhA2, LhB2, LhB3, LhC2, LhC3, LsB, LsD)	1–2	2–4	0–6	Channery silt loam
			6–21	Channery silt loam or silty clay loam
			21–30	Very channery silt loam
Made land (Ma, Mb, Mc, MdB, MdD, MeB, MeD)	(3)	(3)	(1)	(1)
Manor (MhB2, MhC2, MhE2, MnB, MnD)	4+	2–10	0–8	Channery silt loam
			8–24	Channery silt loam
			24–50	Very channery sandy loam
Mount Lucas (MoA, MoB2, MoC2, MuB, MuD)	1–2½	5–10	0–9	Silt loam
			9–38	Clay loam
			38–106	Sandy loam
Murrill (MvB2)	5+	8–15	0–9	Gravelly silt loam
			9–37	Channery loam
			37–72	Gravelly sandy clay loam
Neshaminy (NeB, NhB2, NhC2, NhD2, NsB, NsD)	3+	3–6	0–8	Silt loam
			8–33	Clay loam
			33–49	Sandy clay loam to sandy loam
Penn shaly silt loams, neutral substratum (PaB2, PaB3, PaC3).	3+	½–3	0–6	Shaly silt loam
			6–18	Shaly silt loam
			18–31	Very shaly silt loam
Penn silt loams, Penn very stony silt loam, Penn-Klinesville complex, and Penn-Lansdale complexes (PeA2, PeB2, PeB3, PeC2, PeC3, PfD, PkD3, PlB2, PlB3, PlC2, PlC3, PlD3).	3+	1½–3	0–8	Silt loam
			8–20	Shaly silt loam
			20–31	Very shaly silt loam or shale

See footnotes at end of table.

properties of soils—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)	*Inches per hour*	*Inches per inch of soil depth*	*pH value*	*Percent*	*Pounds per cubic foot*	
ML	A-4, A-5	95-100	95-100	80-90	2.0-6.3 0.2-0.63	0.19 .17	5.0-6.0 4.5-5.5	20	100	Low.
ML-CL	A-4 to A-6	95-100	95-100	90-100	2.0-6.3 0.63-2.0	.24 .22	6.0-6.5 6.0-6.5	18	109	Low.
ML-CL or SM	A-4 to A-7	70-100	60-100	40-70	0.63-2.0	.18	5.5-6.0	16	112	Low.
SM or GM	A-1 or A-2	50-85	45-80	15-35	2.0-6.3	.10	5.0-5.5	13	117	Low.
GM, SM, GP-GM, or SP-SM.	A-1, A-2	45-75	40-55	10-35	2.0-6.3 2.0-6.3	.18 .10	4.5-5.5 4.5-5.0	14	118	Low.
ML-CL, SM	A-2, A-4	90-100	85-100	25-80	2.0-6.3 0.63-2.0	.17 .16	5.5-6.5 4.5-6.0	14	114	Low.
SM, GM	A-2, A-4	50-100	40-100	15-45	2.0-6.3	.15	4.5-5.5	14	110	Low.
SC or CL	A-4, A-6	80-100	75-95	40-65	2.0-6.3 0.63-2.0	.20 .18	5.0-6.5 4.5-6.0	12	121	Low.
SM	A-4, A-2	65-90	60-85	25-45	2.0-6.3	.16	4.5-5.5	11	123	Low.
ML-CL	A-4 or A-6	95-100	95-100	80-100	2.0-6.3 0.63-2.0	.22 .21	5.5-6.5 5.0-6.5	18	108	Low.
ML-CL	A-4	95-100	95-100	95-100	0.20-0.63	.25	4.5-6.0	17	106	Low.
SM or ML	A-4	95-100	90-100	45-90	0.20-0.63	.22	4.5-6.5	20	102	Low.
SM, MH, or CL	A-6 or A-7	90-100	90-100	45-75	0.63-2.0 0.63-2.0	.18 .18	6.0-6.5 6.0-6.5	21	102	Moderate.
SM or ML	A-4	95-100	85-100	40-65	0.63-2.0	.12	6.0-6.5	13	125	Low.
ML, SM, or GM	A-4	50-85	45-85	40-70	0.63-2.0 <0.2	.20 .15	5.0-6.5 4.5-5.0	16	109	Low.
GM or GC	A-2, A-4	40-65	35-65	30-50	<0.2	.08	4.5-6.0	15	114	Low.
[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]
GM, SM, SP	A-1, A-4, A-6	35-85	30-80	15-45	2.0-6.3 0.63-2.0	.16 .14	4.5-5.5 4.5-5.5	16	110	Low.
GM or SM	A-2, A-4, A-5	55-85	45-85	30-40	0.63-6.3	.10	4.5-5.5	17	110	Low.
ML-CL	A-4, A-6, A-7	95-100	95-100	70-95	0.63-2.0 0.2-0.63	.20 .16	6.0-7.0 6.0-7.0	18	107	Moderate.
SM, SC	A-2, A-4	90-100	85-100	30-50	0.63-2.0	.11	6.0-6.5	16	117	Moderate.
GM-GC or ML-CL.	A-4 or A-7	65-100	60-100	40-80	2.0-6.3 0.2-0.63	.19 .16	6.0-6.5 5.5-6.5	19	108	Low.
SM-SC, ML, CL	A-6 or A-7	70-90	65-80	40-60	0.63-2.0	.18	5.5-6.5	16	105	Moderate.
GM, SM, MH-CH.	A-2 or A-7	55-90	55-85	30-65	2.0-6.3 0.2-0.63	.20 .18	5.0-6.5 6.0-7.0	21	106	Moderate.
MH, SM, GM	A-4, A-7	60-95	60-95	40-55	0.2-0.63	.14	6.0-7.0	20	114	Moderate.
GM or SM	A-4	55-75	50-70	40-50	2.0-6.3 2.0-6.3	.18 .15	5.5-6.5 5.5-6.0	16	111	Low.
GM	A-4	55-70	50-60	40-50	2.0-6.3	.10	5.0-6.0	14	114	Low.
SC, ML, CL	A-4	75-100	65-95	45-75	2.0-6.3 2.0-6.3	.21 .16	6.0-7.0 5.0-6.5	15	113	Moderate.
ML, SM, GC	A-2, A-4	45-100	35-95	20-75	2.0-6.3	.12	4.5-5.5	13	116	Low.

TABLE 6.—*Estimated*

Soil series or types and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Classification: Dominant USDA texture
	Feet	*Feet*	*Inches*	
Raritan (RaA, RaB2)	1–2½	4–15	0–10	Silt loam
			10–38	Clay loam
			38–46	Silty clay loam
Readington (ReA, ReB2, ReC2)	1½–2½	3–5	0–11	Silt loam
			11–33	Silt loam to silty clay loam
			33–44	Shaly silt loam
Reaville (RsA2, RsB2, RsB3, RsC3)	0–1	1–3	0–8	Shaly silt loam
			8–19	Shaly silt loam
			19–32	Very shaly silt loam
Rowland silt loam (Rt)	0–2	4–6	0–12	Silt loam
			12–40	Silt loam
Rowland silt loam, coal overwash (Ru)	0–3	4–12	0–12	Silt loam
			12–42	Silt loam
Rowland silt loam, local alluvium (RwA, RwB)	0–3	3–6	0–10	Silt loam
			10–38	Silt loam
Stony land, steep (StE)	0–3	0–4	(1)	(1)
Watchung (WaA, WaB, Wc)	0–1	3–5	0–10	Silt loam
			10–42	Silty clay loam
			40–50	Loam

[1] Variable.
[2] For the local alluvium phases of Bowmansville silt loam (BrA, BrB), depth to the seasonally high water table is 0 to 1 foot and depth to bedrock is 3 to 6 feet.

TABLE 7.—*Interpretations of*

Soil series and map symbol	Suitability of material for—				Soil features that affect engineering practices	
	Winter grading	Sand and gravel	Road fill	Topsoil	Highway location	Construction and maintenance of pipelines
Abbottstown (AbA, AbB2)	Poor	Poor	Fair	Fair	Seasonal high water table; susceptible to frost action; seeps.	Seasonal high water table
Beltsville (BlB2)	Poor	Poor	Fair	Fair	Seasonal high water table; susceptible to frost action.	Seasonal high water table
Bermudian (Bm)	Fair	Fair	Good	Good	Subject to occasional flooding; seasonal high water table.	Flooding
Birdsboro (BnA, BnB2)	Good	Fair	Fair to good.	Fair	No limiting factors	No limiting factors

properties of soils—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
					Inches per hour	*Inches per inch of soil depth*	*pH value*	*Percent*	*Pounds per cubic foot*	
					2. 0–6. 3	0. 19	5. 5–6. 5			
ML–CL	A–4	85–100	85–100	60–95	0. 20–0. 63	. 18	5. 0–6. 0	16	111	Low.
ML–CL, SM	A–4	85–100	80–100	45–55	<0. 2	. 12	4. 5–5. 5	13	119	Low.
					2. 0–6. 3	. 21	6. 0–7. 0			
ML, CL, SC	A–2, A–4, A–6	85–100	75–100	35–95	0. 2–0. 63	. 17	4. 5–6. 5	16	109	Moderate.
SM, ML–CL, GM	A–2, A–4, A–6	60–100	55–95	20–85	0. 2–0. 63	. 10	4. 5–5. 5	16	113	Moderate.
					0. 63–2. 0	. 19	5. 0–6. 5			
CL	A–6	80–100	80–100	75–100	<0. 2	. 15	5. 0–5. 5	17	109	Moderate.
CL, GC	A–6 or A–4	60–70	50–65	40–60	<0. 2	. 11	4. 5–5. 5	14	114	Low.
					2. 0–6. 3	. 24	5. 5–6. 5			
ML, SM	A–4 or A–5	95–100	95–100	45–85	0. 63–2. 0	. 20	5. 5–6. 5	16	108	Low.
					2. 0–6. 3	. 20	5. 5–6. 0			
ML, SM	A–4 or A–5	95–100	95–100	55–85	0. 63–2. 0	. 18	4. 5–6. 0	18	110	Low.
					2. 0–6. 3	. 24	5. 5–6. 5			
ML, SM	A–4 or A–5	95–100	95–100	45–85	0. 63–2. 0	. 18	4. 5–6. 0	18	110	Low.
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
					0. 63–2. 0	. 22	5. 5–6. 5			
CH or CL	A–6, A–7	80–100	75–100	70–100	<0. 2	. 18	6. 0–6. 5	19	105	Moderate.
ML–CL	A–4, A–6	75–100	70–100	65–90	<0. 2	. 15	6. 0–6. 5	14	118	Moderate.

[3] For different mapping units of Made land, depth to a seasonally high water table and depth to bedrock differ. For the Ma, MeB and MeD mapping units, depth to a seasonally high water table is 0 to 4 feet; for Mb it is 0 to 10+ feet; and for Mc, MdB, and MdD, it is 1 to 5 feet. For the Ma mapping unit, depth to bedrock is 0 to 12 feet; for Mc, MdB, and MdD, it is 0 to 15 feet; for MeB and MeD, it is 0 to 6 feet; and for Mb it is variable.

engineering properties of soils [1]

Soil features that affect engineering practices—Continued				
Ponds	Ponds, dikes, and levees	Terraces, diversions, and waterways	Agricultural drainage	Irrigation
Reservoir area	Embankments [2]			
Slow permeability	Impermeable but lacks stability; use for core.	Seeps	Slow permeability; seeps; fragipan; seasonal high water table.	Moderate available moisture capacity; slow permeability; shallow to fragipan.
Slow permeability; variable rate of seepage.	Slowly permeable but lacks stability; use for core.	Shallow to fragipan	Slow permeability; seasonal high water table.	Moderate available water capacity; slow permeability; shallow to fragipan.
Rapid permeability; excessive seepage; contains lenses of gravel.	Permeable; fair stability; use for outside shell.	No limiting factors; generally not needed, because of nearly level topography.	Rapid permeability; drainage not needed.	High available water capacity; rapid permeability.
Moderate permeability; excessive seepage.	Impermeable; variable stability; use for core; permeable substratum in places.	No limiting factors	Drainage not needed	Moderate to high available water capacity; moderate permeability.

See footnotes at end of table.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbol	Suitability of material for—				Soil features that affect engineering practices	
	Winter grading	Sand and gravel	Road fill	Topsoil	Highway location	Construction and maintenance of pipelines
Bouldery alluvial land (Bo)	Poor	Poor	Poor	Poor	Contains many large stones; subject to flooding; seasonal high water table.	Contains many large stones; subject to flooding; fluctuating water table.
Bowmansville silt loam (Bp)	Poor	Poor	Poor	Fair	Subject to frequent flooding; high water table.	Fluctuating high water table; flooding.
Bowmansville silt loam, local alluvium (BrA, BrB).	Poor	Poor	Poor	Good	High water table; local flooding.	Fluctuating high water table.
Brecknock (BsB2, BsC2, BsD2, BtC, BtD, BvD).	Good	Good (shale material).	Good	Poor	Bedrock at a depth of 2 to 5 feet; steep slopes and some stony areas.	Bedrock at a depth of 2 to 5 feet.
Chalfont (CfA, CfB2)	Poor	Poor	Poor	Fair	Seasonal high water table; susceptible to frost heaving; soils erode easily.	Seasonal high water table; shale is within trenching depth in some places.
Chester (CgA2, CgB2)	Good	Poor	Fair	Good	Slopes require stabilization; soils contain micaceous material.	No limiting factors
Codorus (Ch)	Poor	Poor	Fair	Good	Subject to flooding; seasonal high water table.	Fluctuating water table; flooding.
Croton (CrA, CrB2, CsB)	Poor	Poor	Fair	Fair	Seasonal high water table; seeps; soil material is plastic and unstable; susceptible to frost action.	Fluctuating water table
Doylestown (DsA, DsB2)	Poor	Fair to poor.	Fair	Fair	Seasonal high water table; unstable slopes; susceptible to frost action; seeps.	Fluctuating water table
Duffield (DuB2, DuC2, DuC3).	Fair to good.	Poor	Fair	Good	Bedrock at a depth of 4 to 12 feet; sinkholes may develop as a result of the solution channels in the bedrock.	Hard rock ledges in places
Edgemont (EcB2, EcC2, EcD2, EsD).	Good	Fair	Good	Poor	Bedrock at a depth of 2½ to 5 feet; steep slopes.	Hard bedrock at a depth of 2½ to 5 feet.

properties of soils [1]—Continued

Soil features that affect engineering practices—Continued				
Ponds	Ponds, dikes, and levees	Terraces, diversions, and waterways	Agricultural drainage	Irrigation
Reservoir area	Embankments [2]			
Variable permeability; subject to flooding; contains large stones.	Unsuitable	Not needed	Unsuitable	Unsuitable for crops.
Moderate permeability; high water table; variable rate of seepage.	Impermeable but lacks stability; use for core.	Generally not needed, because of nearly level topography; high water table; flooding.	Seasonal high water table at or above the surface; moderate permeability; lack of suitable outlets.	Moderate available water capacity; moderate permeability; seasonal high water table at or above the surface; slow surface drainage.
Moderate permeability	Upper layers permeable; lacks stability.	Seeps; high water table; local flooding and ponding.	Moderate permeability; seeps; high water table.	Moderate to high available water capacity; moderate permeability; high water table.
Moderate permeability; excessive seepage; shallow over bedrock.	Permeable but has fair to good stability; channery and contains some stones; use for shell.	Some shallow areas and a moderate acreage of stony areas included.	Drainage not needed	Moderate available water capacity; moderate permeability.
Slow permeability; shale bedrock may be encountered in places.	Lacks stability where used for dikes or levees.	Shallow to the fragipan; wet where used for a seedbed.	Slow permeability; subsurface drainage difficult because of the fragipan at a depth of 12 to 18 inches.	Low to moderate available water capacity; slow permeability below a depth of 12 to 18 inches.
Moderate permeability; excessive seepage.	Permeable; fair to poor stability, and not well suited to use for a core or shell.	No limiting factors	Drainage not needed	High available water capacity; moderate permeability.
Moderate permeability; excessive seepage during summer.	Permeable; poor stability; not suitable for a shell or core.	No limiting factors; generally not needed, because of nearly level topography.	Soil properties favorable; seasonal high water table; suitable outlets may be difficult to find.	High available water capacity; moderate permeability.
Slow permeability; slow rate of seepage.	Impermeable; poor stability; use for core.	Shallow to fragipan; seeps; difficult to establish vegetation.	Slow permeability; seasonal high water table; in places suitable outlets may be difficult to find.	Moderate available water capacity; slow permeability; shallow to fragipan; wet late in spring.
Slow permeability; slow rate of seepage.	Impermeable; poor stability.	Shallow to fragipan; seeps.	Slow permeability; seasonal high water table; fragipan.	Moderate available water capacity; slow permeability; shallow to fragipan.
Permeable substratum and excessive seepage likely; sinkholes common; pond probably will not hold water.	Permeable; lacks stability; easily eroded on the steep slopes.	Limestone ledges	Natural drainage adequate.	High to very high available water capacity; moderate permeability.
Moderately rapid permeability; excessive seepage; bedrock exposed in places.	Permeable; stable; use for shell; contains stones.	Moderately rapid permeability; low available water capacity; contains stones; vegetation difficult to establish.	Natural drainage adequate.	Low to moderate available water capacity; moderately rapid permeability.

See footnotes at end of table.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbol	Suitability of material for—				Soil features that affect engineering practices	
	Winter grading	Sand and gravel	Road fill	Topsoil	Highway location	Construction and maintenance of pipelines
Glenelg (GnB2, GnC2, GnD2).	Good	Poor	Good	Good	Bedrock at a depth of 2½ to 5 feet.	Bedrock at a depth of 2½ to 5 feet.
Glenville (GsA, GsB2)	Poor	Poor	Fair	Good	Seasonal high water table; seeps; susceptible to frost action; slopes easily eroded.	Seasonal high water table.
Hatboro (Ha)	Poor	Poor	Poor	Poor	High water table; subject to flooding.	Fluctuating high water table; subject to flooding.
Howell (HwB2)	Fair	Poor	Fair to good.	Fair	No limiting factors	No limiting factors
Klinesville (KlB2, KsB3, KsC3, KsE3).	Good	Good (shale material).	Good	Poor	Bedrock at a depth of ½ to 1½ feet; steep slopes.	Bedrock at a depth of ½ to 1½ feet.
Lansdale loam, thin (LaB3, LaC3, LaE3).	Good	Fair to good.	Good	Poor	Soft to hard bedrock at a depth of 3 to 12 feet.	Some hard rock to be expected in places.
Lansdale silt loam (LdA2, LdB2, LdC2).	Good	Fair	Good	Good	No limiting factors	No limiting factors
Lawrenceville (LeA, LeB2)	Poor	Poor	Fair	Good	Seasonal water table within 1 to 2 feet of the surface; susceptible to frost action; slopes easily eroded; seeps.	Seasonal high water table.
Legore (LgC3, LgD3)	Fair	Poor	Fair	Poor	Hard diabase bedrock at a depth of 2 to 5 feet; steep slopes.	Hard diabase bedrock at a depth of 2 to 5 feet.
Lehigh (LhA2, LhB2, LhB3, LhC2, LhC3, LsB, LsD).	Poor	Poor	Good	Poor	Bedrock at a depth of 2 to 4 feet; seeps; seasonal high water table.	Bedrock at a depth of 2 to 4 feet; seasonal high water table.
Made land; diabase, gabbro materials (Ma).	Fair	Poor	Fair	Unsuitable.	Depth to bedrock variable; contains large diabase stones; possible seasonal high water table; contains plastic soil material.	Depth to bedrock variable; possible fluctuating water table; contains large stones.

properties of soils [1]—Continued

Soil features that affect engineering practices—Continued				
Ponds	Ponds, dikes, and levees	Terraces, diversions, and waterways	Agricultural drainage	Irrigation
Reservoir area	Embankments [2]			
Permeable substratum; excessive seepage.	Permeable; fair to poor stability; not well suited to use for a shell or core.	No limiting factors	Natural drainage adequate.	Moderate available water capacity; moderate permeability; soil erodes easily on the steep slopes.
Moderately slow permeability.	Impermeable; lacks stability; use for core.	No limiting factors	Moderately slow permeability; seasonal high water table; seeps.	High available water capacity; moderately slow permeability.
Moderately slow permeability; moderate rate of seepage during summer; subject to flooding.	Lacks stability; use for core.	Not needed, because of position on flood plains.	High water table; ponding; lack of suitable outlets.	Moderate available water capacity; moderately slow permeability; slow surface drainage.
Moderate permeability; excessive seepage.	Semipermeable; variable stability; not well suited to use for a shell or core.	No limiting factors	Natural drainage adequate.	Moderate to high available water capacity; moderate permeability.
Moderately rapid permeability; very shallow to bedrock; poor sites.	Permeable; stable and can be used for shell; steep slopes.	Bedrock at a depth of ½ to 1½ feet; low available water capacity; very shaly; moderately rapid permeability; difficult to establish vegetation.	Natural drainage adequate.	Very low available water capacity; moderately rapid permeability; shallow to bedrock; steep slopes.
Moderately rapid permeability; excessive seepage; poor sites.	Moderate permeability; stable; use for shell.	Low available water capacity; difficult to establish vegetation.	Natural drainage adequate.	Low available water capacity; moderate to rapid permeability; shallow to underlying material; steep slopes.
Moderately rapid permeability; excessive seepage; poor sites.	Permeable; stable	No limiting factors	Natural drainage adequate.	Moderate to high available water capacity; moderately rapid permeability.
Moderately slow permeability; slow rate of seepage.	Unstable; erodes easily	Seeps; easily eroded	Moderately slow permeability in lower part of subsoil because of fragipan; seasonal high water table.	High available water capacity; moderately slow permeability below a depth of 18 to 30 inches; eroded easily on the slopes.
Moderate permeability; excessive seepage.	Impermeable; lacks stability; use for core; contains stones.	Shallow to substratum or bedrock; easily eroded.	Natural drainage adequate.	Low available water capacity; moderate permeability; steep slopes.
Slow permeability; shallow to bedrock; variable rate of seepage.	Permeable; stable; use for shell; contains stones; has steep slopes.	Shallow to bedrock; difficult to establish vegetation; seeps.	Bedrock at a depth of 2 to 4 feet; seeps; seasonal high water table; slow permeability.	Low available water capacity; slow permeability.
Moderate to slow permeability; variable rate of seepage.	Fair to poor stability; use for core; contains stones.	Contains large stones; erodible on the slopes.	Contains large stones; variable conditions.	Moderate available water capacity; moderately slow permeability; depth of soil material variable.

See footnotes at end of table.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbol	Suitability of material for—				Soil features that affect engineering practices	
	Winter grading	Sand and gravel	Road fill	Topsoil	Highway location	Construction and maintenance of pipelines
Made land, land fill and sediment basins (Mb)	Poor	Unsuitable.	Poor	Unsuitable.	Seasonal high water table; variable material.	Acidity; seasonal high water table.
Made land, limestone materials (Mc)	Fair	Poor	Fair	Unsuitable.	Depth to bedrock variable; possibility of solution channels in the bedrock; possible seasonal high water table.	Depth to bedrock variable.
Made land, schist and gneiss materials (MdB, MdD).	Fair to poor.	Poor	Fair	Unsuitable.	Depth to bedrock variable; slopes easily eroded; possible seasonal high water table.	Depth to bedrock variable; possible fluctuating water table.
Made land, shale and sandstone materials (MeB, MeD).	Fair	Poor	Good	Unsuitable.	Shallow to bedrock; seasonal high water table and seeps probable.	Seasonal high water table; shallow to bedrock.
Manor (MhB2, MhC2, MhE2, MnB, MnD).	Fair	Poor	Fair	Fair	Bedrock at a depth of 2 to 10 feet; steep slopes; rock outcrops.	Bedrock at a depth of 2 to 10 feet.
Mount Lucas (MoA, MoB2, MoC2, MuB, MuD).	Poor	Poor	Poor	Fair	Seasonal high water table; seeps; contains hard diabase stones.	Seasonal high water table; contains stones.
Murrill (MvB2)	Fair to good.	Poor	Fair	Fair	In places sinkholes occur on the lower slopes.	No limiting factors
Neshaminy (NeB, NhB2, NhC2, NhD2, NsB, NsD).	Fair	Poor	Poor	Fair	Bedrock at a depth of 3 to 6 feet; contains hard diabase stones; steep slopes.	Bedrock at a depth of 3 to 6 feet; contains hard diabase stones.
Penn shaly silt loam, neutral substratum, (PaB2, PaB3, PaC3).	Good	Poor	Good	Poor	Bedrock at a depth of ½ to 3 feet.	Shale bedrock at a depth of ½ to 3 feet.
Penn (PeA2, PeB2, PeB3, PeC2, PeC3, PfD).	Good	Fair	Good	Fair	Bedrock at a depth of 1½ to 3 feet; some steep slopes.	Bedrock at a depth of 1½ to 3 feet.
Raritan (RaA, RaB2)	Poor	Fair	Good	Fair	Seasonal high water table; seeps.	Fluctuating water table
Readington (ReA, ReB2, ReC2).	Poor	Poor	Fair	Fair	Bedrock at a depth of 3 to 5 feet; seasonal high water table within 2 to 3 feet of the surface; seeps.	Seasonal high water table

properties of soils [1]—Continued

Soil features that affect engineering practices—Continued				
Ponds	Ponds, dikes, and levees	Terraces, diversions, and waterways	Agricultural drainage	Irrigation
Reservoir area	Embankments [2]			
Variable	Poor stability	Unsuitable	Unsuitable	Unsuitable.
Permeable substratum; excessive seepage.	Poor stability; not well suited to use for a core or shell.	Limestone ledges	Limestone ledges	Moderate available water capacity; moderate to slow permeability; poor physical properties.
Rapid permeability; excessive seepage.	Permeable; poor stability; not well suited to use for a shell or core.	Depth to substratum and bedrock variable; poor physical properties likely.	Depth to bedrock variable.	Moderate to low available water capacity; variable permeability; rapid runoff; easily eroded.
Variable permeability; variable rates of seepage; shallow to bedrock.	Variable permeability; variable stability.	Shallow to bedrock; low available water capacity; difficult to establish vegetation.	Shallow to bedrock; seeps.	Low available water capacity; variable permeability; rapid runoff.
Moderate to rapid permeability; excessive seepage; poor site because of slopes.	Permeable; poor stability; not suitable for a shell or core.	Steep slopes; bedrock outcrops; contains stones; some of the micaceous areas may erode easily.	Natural drainage adequate.	Low to moderate available water capacity; moderate to rapid permeability; rapid surface drainage.
Slow to moderate permeability in substratum; slow to moderate rate of seepage.	Slow permeability; fair to poor stability; use for core; contains stones.	Contains stones and boulders.	Slow permeability; seasonal high water table; seeps.	Moderate available water capacity; slow permeability; slope in steeper soils.
Permeable substratum; excessive seepage.	Permeable; variable stability; not well suited to use for a core or shell.	No limiting factors	Natural drainage adequate.	High available water capacity; moderate permeability.
Moderate to slow permeability; variable rate of seepage; poor sites.	Slow permeability; fair to poor stability; use for core; contains stones.	Contains stones and boulders.	Natural drainage adequate.	Moderate to high available water capacity; moderate to slow permeability; slope in steeper soils.
Rapid permeability; shallow to bedrock; excessive seepage.	Permeable; stable; use for shell.	Bedrock at a depth of ½ to 3 feet; low available water capacity; rapid permeability; difficult to establish vegetation.	Natural drainage adequate.	Low available water capacity; rapid permeability; rapid surface drainage; slope in steeper soils.
Moderate permeability; excessive seepage; poor sites; shallow to shale.	Permeable; variable stability; not well suited to use for core or shell; contains stones.	No limiting factors	Natural drainage adequate.	Low to moderate available water capacity; moderate permeability; slope in steeper soils.
Slow permeability; variable rate of seepage.	Impermeable; variable stability; use for core.	No limiting factors	Slow permeability; seasonal high water table.	Moderate available water capacity; slow permeability.
Moderately slow permeability; bedrock at a depth of 3 to 5 feet; variable rate of seepage.	Variable stability; use for core.	No limiting factors	Moderately slow permeability; seasonal moderately high water table.	Moderate available water capacity; moderately slow permeability.

See footnotes at end of table.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbol	Suitability of material for—				Soil features that affect engineering practices	
	Winter grading	Sand and gravel	Road fill	Topsoil	Highway location	Construction and maintenance of pipelines
Reaville (RsA2, RsB2, RsB3, RsC3).	Poor	Poor	Fair	Poor	Bedrock at a depth of 1 to 3 feet; seasonal high water table; seeps.	Bedrock at a depth of 1 to 3 feet; fluctuating water table.
Rowland silt loam and Rowland silt loam, coal overwash (Rt, Ru).	Poor	Fair	Fair	Good	Flooding; seasonal high water table.	Fluctuating water table; flooding.
Rowland silt loam, local alluvium (RwA, RwB).	Fair to poor.	Fair to poor.	Fair	Good	Seasonal high water table; seeps.	Fluctuating water table
Stony land, steep (StE)	Good	Fair	Good	Poor	Very stony and bouldery; steep slopes.	Steep slopes; stony, and soil material is shallower than typical for this county.
Watchung (WaA, WaB, Wc).	Unsuitable.	Poor	Poor	Poor	High water table; plastic soil material; contains large, hard diabase stones.	Fluctuating water table; contains large, hard diabase stones and boulders.

[1] Soil complexes are not listed separately. For information about the suitability and characteristics of the soils in complexes, see the individual soils. Map symbols of soil complexes in this county are PkD3, PlB2, PlB3, PlC2, PlC3, and PlD3.

None of the soils are considered to be an especially good source of sand or gravel. Several quarries in the county, however, are sources of sand and of coarse aggregates that are crushed from the bedrock (fig. 13).

The ratings given the soils as a source of material for road fill refer to that part of the material below road subgrade. By road subgrade is meant the material immediately below base course.

In determining the ratings given for suitability of the soil material as a source of topsoil, more emphasis was placed on the quality of the material than on the quantity. The content of organic matter and the coarseness of the material were major considerations.

Features that adversely affect a site for the location of a highway are a high water table, susceptibility to flooding, seepage, boulders or rocks, unstable slopes, and susceptibility of the soils to frost action. The windblown silts of the Doylestown, Chalfont, and Lawrenceville soils are poor for the construction of highways and for housing developments. Instability because of low shear strength should be considered when designing structures on these soils.

Features that affect the construction and maintenance of pipelines are acidity, a high content of organic matter, and sulfate and chloride salts contained in the ground water.

Soil features that affect suitability of the soils for ponds are given in the column titled "Reservoir area." They are also given in the column titled "Embankments" under the heading "Ponds, dikes, and levees." A soil may be suitable for the reservoir area of a pond, but it may not be suitable for the embankment around the pond. The features named in the column titled "Reservoir area" are for a soil that has not been disturbed. Those in the column titled "Embankments" are for a soil that has been disturbed. The interpretations given in these columns can be used not only for farm ponds but also for a lagoon or sedimentation pool.

In the column titled "Terraces, diversions, and waterways," the main items considered are depth to bedrock or a pan layer, the presence of boulders and cobbles, seepage, erodibility of the soil, and difficulty in obtaining a good cover of plants.

In the column titled "Agricultural drainage," reference is made to both surface and subsurface drainage. The main adverse features considered in determining drainage needs are slow permeability, a high water table, and seepage. Where lack of an outlet is indicated, reference is mainly to an outlet for subsurface drainage.

The features named in the column headed "Irrigation" refer to application of the water by the sprinkler

properties of soils [1]—Continued

Soil features that affect engineering practices—Continued				
Ponds	Ponds, dikes, and levees	Terraces, diversions, and waterways	Agricultural drainage	Irrigation
Reservoir area	Embankments [2]			
Slow permeability; bedrock at a depth of 1 to 3 feet.	Contains many coarse fragments, some larger than 6 inches in diameter.	Bedrock at a depth of 1 to 3 feet; slow permeability; low available water capacity; difficult to establish vegetation.	Bedrock at a depth of 1 to 3 feet; very slow permeability; seasonal high water table.	Slow permeability; low available water capacity; shallow to underlying material.
Moderate permeability; excessive seepage in summer; subject to flooding.	Permeable; variable stability; possible use for shell.	Flooding; generally not needed, because of nearly level topography and position on flood plains.	High water table; ponding; moderate permeability.	Moderate available water capacity; moderate permeability.
Moderate permeability; excessive seepage.	Permeable; generally lacks stability; not well suited to use for a shell or core.	Seeps; intermittent streamflow.	Moderate permeability; seeps; seasonal high water table.	Moderate to high available water capacity; moderate permeability.
Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable.
Slow permeability; very slow rate of seepage.	Impermeable; lacks stability; use for core; contains stones.	High water table; plastic soil material.	Slow permeability; slow surface drainage; high water table.	Moderate to high available water capacity; slow permeability; slow surface drainage.

[2] In this column, the term "permeability" refers to the permeability of disturbed soil material.

type of irrigation. Some of the features named are depth of the soil, available water capacity, permeability, and the presence of a fragipan or claypan.

In table 7 features are not named that affect the suitability of the soils as a disposal field for the effluent from septic tanks. Features and limitations that affect suitability for this use are given in the section "Soils and Community Developments," which follows.

Soils and Community Developments

Residential, commercial, industrial, and institutional developments are growing rapidly in Montgomery County as the suburbs of Philadelphia and Norristown expand into rural areas. The rapidity with which developments have expanded in the past has led to many problems. These problems clearly show the need for careful planning and for a broad understanding of the physical and economic aspects involved when the use of the land is changed.

This soil survey will help in planning these developments and in solving problems that arise as use of the land changes. Planning officials and developers, as well as homeowners and others, can find useful information in the soil maps, in the text, and in the tables in this survey. The detailed soil maps in the back of the survey are useful because they show the location of each of the soils in the county. The colored general soil map that precedes the detailed soil maps shows the pattern of the major soils within the county. All of the soils are discussed in detail in the section "Descriptions of the Soils." Engineering characteristics of the soils are discussed in the section "Engineering Properties of the Soils."

In table 8 the limitations of the soils in the county for specified uses in community developments are rated as *slight*, *moderate*, or *severe*. Where the limitations for a specified use are rated moderate or severe, the chief limitation for the use specified is shown. A rating of severe does not imply that the soil cannot be used for the purpose indicated, but it does indicate that the soil is poorly suited to the purpose named.

In the column showing major limitations to use of the soils for residential developments, only homes three stories or less in height are considered. Buildings taller than three stories are not considered, because complicated problems could arise if these soils are used for foundations for larger buildings. In determining the degree of limitations for residential developments, disposal of effluent from septic tanks was not considered.

***Figure 13.*—An area where argillite has been quarried for use on county roads. The quarry and the surrounding areas that have been disturbed are mapped as Made land, shale and sandstone materials.**

TABLE 8.—*Major soil properties and estimated degree of limi-*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
AbA	Abbottstown silt loam, 0 to 3 percent slopes.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Slight	Severe; slow permeability; seasonal high water table.
AbB2	Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Moderate; slope; depth to bedrock.	Severe; slow permeability; seasonal high water table.
BlB2	Beltsville silt loam, 2 to 6 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Moderate; slope	Severe; slow permeability; seasonal high water table.
Bm	Bermudian silt loam	12	Severe; flooding	Severe; flooding	Severe; moderately rapid permeability; flooding.	Severe; flooding
BnA	Birdsboro silt loam, 0 to 3 percent slopes.	1	Slight	Slight	Moderate; moderate permeability.	Slight

See footnotes at end of table.

In the column showing properties that influence the suitability of the soils for light industrial, commercial, and institutional developments, stores, shopping centers, community schools, churches, and light industrial buildings three stories or less in height are considered. In this column uses for heavy industrial establishments are not considered.

In the following pages, the soils of the county are placed in 13 community development groups on the basis of soil features that affect their use for building sites and for other community developments. These features include depth of the soil, degree of slope, permeability, estimated percolation rate, content of stones, and susceptibility to erosion and flooding. The use of the soils for community developments is discussed, especially the use of the soils as a disposal field for septic tanks and as a foundation for a building three stories or less in height. Limitations for other specified uses are given in table 8. The names of soil series represented are mentioned in the description of each community development group, but generally not all the soils of a given series appear in the unit. The development group to which each soil belongs can be found in table 8. Also, to find the names of the soils in any given community development group, the reader can refer to the "Guide to Mapping Units, Capability Units, and Community Development Groups" at the back of this soil survey.

COMMUNITY DEVELOPMENT GROUP 1

In this group are areas of Made land and of deep, well-drained soils of the Birdsboro, Chester, Duffield, Edgemont, Howell, Lansdale, Murrill, and Neshaminy series. Most of these soils are moderately eroded. Their slopes are mainly between 0 to 8 percent.

These soils are generally moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Edgemont soil, however, has moderately rapid permeability, and the Neshaminy soils have moderately slow permeability. Depth to bedrock is generally more than 4 feet and exceeds 15 feet in many places. Bedrock is exposed at the surface however, in some areas of Made land. The seasonal high water table is below a depth of 3 feet. A large amount of moisture is held available for plants.

The soils of this group have few limitations for use as sites for residential, light industrial, commercial, and institutional developments. The slope gradient, depth to bedrock, depth to a seasonal high water table, and permeability are all favorable. Grading can be done without difficulty, but large stones and boulders are a problem on the very stony Neshaminy soil.

In some places the limestone bedrock underlying Made land, limestone materials, and the Duffield and Murrill soils contains solution channels. These are openings or underground caverns created where the limestone bedrock dissolved and left a channel or tunnel. An investigation of the underlying rock should be made before construction is begun on roads and large or heavy structures in areas of Duffield and Murrill soils and in areas of Made land, limestone materials.

The Chester and Duffield soils and Made land are unstable, easily eroded, and subject to frost action and gullying if they are disturbed. Excavated areas should be protected with grass or a mulch to prevent serious erosion.

tation that influence use of the soils for community developments

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; wetness	Moderate; wetness	Severe; wetness	Moderate; wetness	Severe; wetness	Severe; wetness.
Moderate; wetness	Moderate; wetness; slope.	Severe; wetness	Moderate; wetness	Severe; wetness	Severe; wetness.
Moderate; wetness	Moderate; wetness; slope.	Severe; wetness; slope.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Moderate; occasional flooding.	Severe; flooding	Moderate; flooding	Moderate; flooding	Severe; flooding	Severe; flooding.
Slight	Slight	Slight	Slight	Slight	Slight.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
BnB2	Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Moderate; moderate permeability; slope.	Slight
Bo	Bouldery alluvial land	12	Severe; flooding; boulders.	Severe; flooding	Severe; flooding	Severe; flooding; high water table.
Bp	Bowmansville silt loam	12	Severe; flooding and high water table.	Severe; flooding; high water table.	Severe; flooding	Severe; flooding; high water table.
BrA	Bowmansville silt loam, local alluvium, 0 to 3 percent slopes.	12	Severe; high water table and ponding.	Severe; high water table and ponding.	Severe; local flooding	Severe; high water table and ponding.
BrB	Bowmansville silt loam, local alluvium, 3 to 8 percent slopes.	12	Severe; high water table.	Severe; high water table.	Moderate; slope	Severe; high water table.
BsB2	Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to to bedrock.	Severe; variable depth to bedrock.
BsC2	Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; shallow to bedrock.	Moderate; slope	Severe; slope	Severe; variable depth to bedrock.
BsD2	Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; steep; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock.
BtC	Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes.	4	Moderate; slope; shallow to bedrock.	Moderate; slope	Severe; slope	Severe; shallow to bedrock.
BtD	Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes.	5	Moderate; shallow to bedrock; slope.	Severe; slope	Severe; slope	Severe; steep; shallow to bedrock.
BvD	Brecknock very stony silt loam, 8 to 25 percent slopes.	5	Moderate; shallow to bedrock; stony.	Moderate to severe; slope.	Severe; slope	Severe; shallow to bedrock; stony; slope.
CfA	Chalfont silt loam, 0 to 3 percent slopes.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Slight	Severe; slow permeability; seasonal high water table.
CfB2	Chalfont silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Moderate; slope	Severe; slow permeability; seasonal high water table.
CgA2	Chester silt loam, 0 to 3 percent slopes, moderately eroded.	1	Slight	Moderate; fair to poor stability.	Severe; permeable	Slight
CgB2	Chester silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Moderate; fair to poor stability.	Severe; permeable	Slight

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Severe; stones and boulders; wetness.	Severe; wetness; boulders.	Severe; boulders; flooding.	Severe; boulders; flooding.	Severe; flooding	Severe; flooding.
Severe; high water table.	Severe; wetness; flooding.	Severe; wetness; flooding.	Severe; wetness; flooding.	Severe; wetness; flooding.	Severe; wetness; flooding.
Severe; wetness	Severe; wetness	Severe; wetness	Severe; wetness	Severe; high water table.	Severe; high water table.
Severe; wetness	Severe; wetness	Severe; wetness	Severe; wetness	Severe; high water table.	Severe; high water table.
Slight to moderate; variable depth to bedrock.	Moderate; shallow to bedrock.	Severe; channery; shallow to bedrock; slope.	Slight	Moderate; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Moderate; slope	Moderate; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope; channery.	Severe; slope; shallow to bedrock.	Severe; slope	Severe; steep	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope; erosion.	Moderate for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope	Severe; slope; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock.	Severe; slope; shallow to bedrock.
Moderate to severe; stony; slope.	Severe; slope; shallow to bedrock; stony.	Severe; slope	Moderate to severe; steep and stony.	Severe; steep; shallow to bedrock and stony.	Severe; steep; shallow to bedrock.
Moderate; wetness	Moderate; seasonal high water table.	Severe; seasonal high water table.	Moderate; seasonal high water table.	Severe; seasonal high water table.	Severe; seasonal high water table.
Moderate; wetness	Moderate; wetness	Severe; wetness	Moderate; wetness.	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Slight	Slight	Slight	Slight	Slight.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
Ch	Codorus silt loam	12	Severe; flooding	Severe; flooding	Severe; flooding; moderate permeability.	Severe; flooding; high water table.
CrA	Croton silt loam, 0 to 3 percent slopes.	11	Severe; high water table.	Severe; high water table.	Slight	Severe; slow permeability and high water table.
CrB2	Croton silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; high water table.	Severe; high water table.	Moderate; slope	Severe; slow permeability and high water table.
CsB	Croton very stony silt loam, 0 to 8 percent slopes.	11	Severe; high water table; stones.	Severe; high water table and poor stability.	Moderate; slope	Severe; slow permeability; stones.
DsA	Doylestown silt loam, 0 to 3 percent slopes.	11	Severe; high water table.	Severe; high water table; poor stability.	Slight	Severe; slow permeability; high water table.
DsB2	Doylestown silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; high water table.	Severe; high water table; poor stability.	Moderate; slope	Severe; slow permeability; high water table.
DuB2	Duffield silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight; solution channels.	Moderate; permeable; possible pollution through solution channels.	Slight; possible pollution through solution channels.
DuC2	Duffield silt loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope; erodible.	Moderate; slope	Severe; permeable; slope.	Moderate; solution channels; slope; possible pollution of ground water.
DuC3	Duffield silt loam, 8 to 15 percent slopes, severely eroded.	2	Moderate; slope; erodible.	Moderate; slope	Severe; slope	Moderate; slope; possible pollution of ground water.
EcB2	Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.	1	Moderate; limited depth to bedrock.	Moderate; limited depth to bedrock.	Severe; moderately rapid permeability.	Moderate; limited depth to bedrock.
EcC2	Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope	Moderate; slope	Severe; slope	Moderate; slope; limited depth to bedrock.
EcD2	Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; slope	Severe; slope	Severe; slope	Severe; slope
EsD	Edgemont very stony loam, 8 to 25 percent slopes.	5	Moderate to severe; stones; slope.	Severe; slope	Severe; slope	Severe; slope
GnB2	Glenelg silt loam, 3 to 8 percent slopes, moderately eroded.	3	Slight	Slight	Severe; moderately rapid permeability.	Moderate to severe; variable depth to bedrock.
GnC2	Glenelg silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; slope	Moderate; slope	Severe; slope	Moderate to severe; variable depth to bedrock.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight; seasonal wetness and flooding.	Severe; flooding	Moderate; wetness	Moderate; flooding.	Severe; flooding	Severe; flooding.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Severe; wetness; stones.	Severe; high water table.	Severe; stones; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe: high water table.	Severe; high water table.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.
Severe; severe erosion.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Severe; erosion.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; variable depth to bedrock.	Moderate; limited depth to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; variable depth to bedrock.	Moderate; limited depth to bedrock.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Severe; slope; stones	Severe; slope	Severe; slope	Severe; slope	Severe; slope; stones	Severe; slope.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight to moderate; variable depth to bedrock.	Slight to moderate; variable depth to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
GnD2	Glenelg silt loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; slope	Severe; slope	Severe; slope	Severe; slope
GsA	Glenville silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table.
GsB2	Glenville silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.
Ha	Hatboro silt loam	12	Severe; flooding and high water table.	Severe; flooding and high water table.	Severe; flooding and inflow.	Severe; high water table; flooding.
HwB2	Howell silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Moderate; moderate permeability to a depth of 4 feet.	Moderate; moderate permeability.
KlB2	Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded.	6	Moderate; shallow to bedrock (rippable).	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.	Severe; shallow to bedrock.
KsB3	Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded.	6	Moderate; shallow to bedrock (rippable).	Moderate; slope; shallow to bedrock (rippable).	Severe; shallow to bedrock.	Severe; shallow to bedrock.
KsC3	Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded.	7	Moderate; shallow to bedrock (rippable).	Moderate; slope	Severe; shallow to bedrock; slope.	Severe; shallow to bedrock.
KsE3	Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded.	8	Moderate; shallow to bedrock (rippable).	Severe; slope	Severe; slope	Severe; slope
LaB3	Lansdale loam, thin, 3 to 8 percent slopes, severely eroded.	3	Slight	Slight	Severe; moderately rapid permeability in substratum.	Moderate; variable depth to bedrock.
LaC3	Lansdale loam, thin, 8 to 15 percent slopes, severely eroded.	7	Moderate; slope; shallow to bedrock.	Moderate; slope	Severe; slope	Severe; shallow to bedrock.
LaE3	Lansdale loam, thin, 15 to 35 percent slopes, severely eroded.	5	Moderate to severe; slope; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope
LdA2	Lansdale silt loam, 0 to 3 percent slopes, moderately eroded.	1	Slight	Slight	Severe; moderate permeability.	Slight
LdB2	Lansdale silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Severe; moderately rapid permeability.	Slight
LdC2	Lansdale silt loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope	Moderate; slope	Severe; slope	Moderate; slope

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Moderate; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; seasonal high water table.	Moderate; slope; seasonal high water table.	Slight	Moderate; seasonal high water table.	Severe; seasonal high water table.
Severe; wetness; flooding.	Severe; flooding; high water table.	Severe; flooding; high water table.	Severe; flooding; high water table.	Severe; wetness; flooding.	Severe; wetness; flooding.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Moderate; shallow to bedrock.	Moderate; slope; shallow to bedrock.	Severe; slope; wetness; shallow to bedrock.	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.
Moderate; slope; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock; erosion.
Severe; shallow to bedrock.	Moderate for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Severe; shallow to bedrock; slope.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; shallow to bedrock; slope.	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; erosion	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; variable depth to bedrock.	Moderate; variable depth to bedrock; eroded.
Severe; erosion	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope; droughty.	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Slight	Slight	Slight	Slight	Slight	Slight.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Moderate; slope	Moderate for roads; slope; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree of			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
LeA	Lawrenceville silt loam, 0 to 3 percent slopes.	9	Moderate; erodible; unstable; seasonal high water table.	Moderate; unstable; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table; fragipan.
LeB2	Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; erodible; unstable; seasonal high water table.	Moderate; slope; unstable; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.
LgC3	Legore clay loam, 8 to 15 percent slopes, severely eroded.	7	Severe; shallow to bedrock.	Severe; slope	Severe; slope	Severe; variable depth to bedrock.
LgD3	Legore clay loam, 15 to 30 percent slopes, severely eroded.	8	Severe; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope
LhA2	Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded.	9	Moderate; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhB2	Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhB3	Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded.	9	Severe; shallow to bedrock; channery; seasonal high water table.	Severe; shallow to bedrock; wetness; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhC2	Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded.	10	Moderate; slope; seasonal high water table.	Moderate; slope; seasonal high water table.	Severe; slope; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhC3	Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded.	10	Severe; slope; shallow to bedrock; seasonal high water table.	Severe; slope; shallow to bedrock; seasonal high water table.	Severe; slope; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LsB	Lehigh very stony silt loam, 0 to 8 percent slopes.	9	Moderate; shallow to bedrock; seasonal high water table; stony.	Moderate; stony; shallow to bedrock.	Severe; shallow to bedrock; stony.	Severe; slow permeability; seasonal high water table.
LsD	Lehigh very stony silt loam, 8 to 25 percent slopes.	10	Moderate; slope; shallow to bedrock; stony.	Moderate to severe; slope.	Severe; slope; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
Ma	Made land, diabase, gabbro materials.	3	Moderate	Moderate; stones; high content of clay.	Severe; shallow to bedrock; stones.	Severe; slow permeability.
Mb	Made land, land fill and sediment basins.	3	Severe; unstable	Severe; unstable	Severe; variable; permeable material.	Severe; variable; unstable material.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight; highly erodible.	Moderate; seasonal high water table.	Moderate; wetness; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight; erodible	Moderate; slope; seasonal high water table.	Moderate; slope; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Severe; severe erosion.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; shallow to bedrock.	Moderate; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; shallow to bedrock.	Moderate; shallow to bedrock; slope; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; channery; shallow to bedrock.	Moderate; shallow to bedrock; slope; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; channery; shallow to bedrock.	Moderate for roads; severe for parking lots; shallow to bedrock; slope; seasonal high water table.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; channery; shallow to bedrock.	Severe; slope; wetness; shallow to bedrock.	Severe; slope; shallow to bedrock.	Moderate; wetness; slope.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; wetness; stony.	Moderate; slope; shallow to bedrock; wetness.	Severe; shallow to bedrock; wetness.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; slope	Moderate to severe for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Moderate to severe; slope; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; stones and channers; high content of clay.	Slight; hard stones and bedrock near the surface.	Moderate; wetness; high content of clay.	Slight; high content of clay.	Severe; shallow to bedrock; wetness.	Severe; shallow to bedrock; wetness.
Moderate; variable	Severe; variable; unstable material.	Severe; variable; unstable material.	Moderate; variable material and conditions.	Severe; variable conditions.	Severe; variable conditions.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
Mc	Made land, limestone materials.	1	Moderate; variable depth to bedrock.	Moderate; solution channels in bedrock.	Severe; variable depth to bedrock.	Severe; possible pollution of ground water.
MdB	Made land, schist and gneiss materials, sloping.	1	Slight; variable depth to bedrock.	Slight; variable depth to bedrock.	Severe; rapid permeability.	Moderate; variable depth to bedrock.
MdD	Made land, schist and gneiss materials, strongly sloping.	2	Moderate; slope; erodible material; variable depth to bedrock.	Severe; slope	Severe; slope	Severe; slope; variable depth to bedrock.
MeB	Made land, shale and sandstone materials, sloping.	9	Moderate; variable conditions; possible seasonal high water table.	Moderate; variable conditions; possible seasonal high water table.	Severe; variable conditions; possible seasonal high water table.	Severe; shallow to bedrock; slow permeability; possible seasonal high water table.
MeD	Made land, shale and sandstone materials, strongly sloping.	10	Severe; slope; variable soil conditions; possible seasonal high water table.	Severe; slope	Severe; slope	Severe; shallow to bedrock; variable permeability.
MhB2	Manor channery silt loam, 3 to 8 percent slopes, moderately eroded.	3	Slight; shallow to bedrock in places.	Moderate; unstable; slope.	Severe; moderately rapid permeability.	Slight to moderate; variable depth to bedrock; possible pollution hazard.
MhC2	Manor channery silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; slope	Moderate to severe; poor stability; slope.	Severe; slope	Moderate to severe; slope; possible pollution hazard.
MhE2	Manor channery silt loam, 15 to 35 percent slopes, moderately eroded.	5	Moderate to severe; slope.	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock.
MnB	Manor very stony silt loam, 0 to 8 percent slopes.	3	Moderate; shallow to bedrock in places.	Moderate; unstable; stones.	Severe; rapid permeability.	Severe; shallow to bedrock in places.
MnD	Manor very stony silt loam, 8 to 25 percent slopes.	5	Severe; stones; slope.	Moderate to severe; slope.	Severe; slope	Severe; slope; shallow to bedrock.
MoA	Mount Lucas silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table.
MoB2	Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; slope; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.
MoC2	Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded.	10	Moderate; slope; fair to poor stability.	Moderate; slope	Severe; slope	Severe; moderately slow permeability; seasonal high water table.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight	Moderate; caverns in bedrock.	Moderate; variable depth to bedrock.	Slight	Severe; variable conditions.	Severe; variable conditions.
Slight	Moderate; variable depth to bedrock.	Slight; variable depth to bedrock.	Slight	Moderate; variable depth to bedrock.	Moderate; variable depth to bedrock.
Moderate; channery; slope.	Moderate to severe; slope; variable depth to bedrock.	Severe; slope; variable conditions.	Moderate; slope; erodible materials.	Severe; slope; variable conditions.	Severe; slope; variable conditions.
Moderate; variable soil conditions.	Moderate; variable depth to bedrock.	Severe; variable conditions.	Moderate; variable conditions.	Severe; variable conditions; possible seasonal water table.	Severe; variable conditions; possible seasonal high water table.
Moderate; shaly; channery.	Moderate to severe; slope; variable depth to bedrock.	Severe; slope	Moderate; variable soil conditions.	Severe; variable	Severe; slope.
Moderate; shallow to bedrock; droughty.	Slight for roads; moderate for parking lots; slope.	Moderate; channery; slope.	Slight	Slight	Slight.
Moderate; shallow to bedrock; droughty.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; shallow to bedrock in places.	Moderate; shallow to bedrock in places.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; stones	Slight for roads; moderate for parking lots; slope; shallow to bedrock in places.	Severe; stones; shallow to bedrock.	Moderate; stones	Severe; stones; shallow to bedrock.	Severe; stones; shallow to bedrock.
Severe; slope; stones	Moderate to severe for roads; severe for parking lots; slope.	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock in places.	Severe; slope; shallow to bedrock in places.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; slope; seasonal high water table.	Moderage; wetness; slope.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Moderate; slope	Moderate for roads; severe for parking lots; slope; seasonal high water table.	Severe; slope	Moderate; slope	Severe; seasonal high water table.	Severe; seasonal high water table.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
MuB	Mount Lucas very stony silt loam, 0 to 8 percent slopes.	9	Moderate; stones; fair to poor stability; seasonal high water table.	Moderate; seasonal high water table.	Slight to moderate; slope.	Severe; moderately slow permeability; seasonal high water table.
MuD	Mount Lucas very stony silt loam, 8 to 25 percent slopes.	10	Moderate; slope; stones; seasonal high water table.	Moderate to severe; slope.	Severe; slope	Severe; moderately slow permeability; slope; seasonal high water table.
MvB2	Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded.	1	Slight	Moderate; solution channels in bedrock; slope.	Moderate; permeable; possible pollution of ground water through solution channels.	Slight; possible pollution of ground water through solution channels.
NeB	Neshaminy extremely stony silt loam, 0 to 8 percent slopes.	8	Severe; stones	Severe; stones	Moderate to severe; slope; stones.	Severe; stones
NhB2	Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Moderate; slope	Moderate; moderate to moderately slow permeability.
NhC2	Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope	Moderate; slope	Severe; slope	Moderate; moderate to moderately slow permeability.
NhD2	Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; slope	Severe; slope	Severe; slope	Severe; slope
NsB	Neshaminy very stony silt loam, 0 to 8 percent slopes.	1	Moderate; stones	Moderate; stones; fair to poor stability.	Moderate; stones	Slight to moderate; slope.
NsD	Neshaminy very stony silt loam, 8 to 25 percent slopes.	5	Moderate; slope; stones.	Moderate to severe; slope.	Moderate; slope	Moderate to severe; slope.
PaB2	Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
PaB3	Penn shaly silt loam, neutral substratum; 3 to 8 percent slopes, severely eroded.	6	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
PaC3	Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded.	7	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; slope; shallow to bedrock.	Severe; shallow to bedrock.
PeA2	Penn silt loam, 0 to 3 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Moderate to severe; variable depth to bedrock.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; stones; wetness.	Moderate; seasonal high water table.	Moderate; stones; seasonal high water table.	Slight; stones	Severe; seasonal high water table; stones.	Severe; seasonal high water table.
Moderate to severe; stones; slope.	Moderate to severe for roads; severe for parking lots; steepness; stones; seasonal high water table.	Severe; slope	Moderate to severe; slopes; stones.	Severe; steep; seasonal high water table.	Severe; steep; seasonal high water table.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Severe; stones	Moderate for roads; moderate to severe for parking lots; slope; stones.	Severe; stones	Moderate; stones	Severe; stones	Severe; stones.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; moderately slow permeability.	Moderate; variable depth to hard bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; stones	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; slope; stones.	Severe; stones.
Moderate to severe; slope.	Moderate to severe for roads; severe for parking lots; slope; stones.	Severe; slope	Moderate to severe; slope.	Moderate to severe; slope; stones.	Severe; slope; stones.
Moderate; shaly; shallow to bedrock.	Slight for roads; moderate for parking lots; shallow to bedrock.	Severe; shallow to shale.	Slight	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; shallow to bedrock; shaly; severe erosion.	Moderate; shallow to bedrock.	Severe; shallow to shale.	Slight	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; shallow to bedrock; shaly; severe erosion.	Severe; slope; shallow to bedrock.	Severe; slope; shallow to bedrock.	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; droughty	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Slight	Moderate; shallow to bedrock.	Severe; shallow to bedrock.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
PeB2	Penn silt loam, 3 to 8 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
PeB3	Penn silt loam, 3 to 8 percent slopes, severely eroded.	6	Moderate; shallow to bedrock (rippable).	Moderate; shallow to bedrock.	Severe; shallow to bedrock; slope.	Severe; shallow to bedrock.
PeC2	Penn silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; slope; shallow to shale (rippable).	Moderate; slope	Severe; slope	Severe; shallow to bedrock.
PeC3	Penn silt loam, 8 to 15 percent slopes, severely eroded.	7	Moderate; slope; shallow to shale (rippable).	Severe; shallow to bedrock.	Severe; slope	Severe; shallow to bedrock.
PfD	Penn very stony silt loam, 8 to 25 percent slopes.	5	Moderate; slope; shallow to bedrock.	Moderate to severe; slope.	Severe; slope	Severe; shallow to bedrock; stones.
PkD3	Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded. (both soils have the same rating.)	5	Moderate; slope; shallow to bedrock (rippable).	Severe; slope	Severe; slope	Severe; shallow to bedrock; slope.
PlB2	Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded. [3]	3				
PlB3	Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded. [3]	6				
PlC2	Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded. [3]	4				
PlC3	Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded. [3]	7				
PlD3	Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded. [3]	5				
RaA	Raritan silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; slow permeability; seasonal high water table.
RaB2	Raritan silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table	Moderate; seasonal high water table.	Moderate; slope	Severe; slow permeability; seasonal high water table.
ReA	Readington silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high table water.	Moderate; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table.
ReB2	Readington silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; shallow to bedrock.	Moderate; slope; shallow to bedrock.	Severe; shallow to bedrock.	Slight	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.
Severe; shallow to bedrock; severe erosion.	Moderate; shallow to bedrock; slope.	Severe; shallow to bedrock; slope.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope; shallow to bedrock.	Moderate; slope	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.
Severe; shallow to shale.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.
Severe; slope; stones.	Moderate to severe for roads; severe for parking lots; slope.	Severe; slope	Moderate to severe; stony slopes.	Moderate to severe; slope; shallow to bedrock.	Severe; steep; slope; shallow to bedrock.
Severe; shallow to bedrock; slope.	Severe; slope	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock.	Severe; slope; shallow to bedrock.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; slope; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
ReC2	Readington silt loam, 8 to 15 percent slopes, moderately eroded.	10	Moderate; slope; seasonal high water table.	Moderate; slope; seasonal high water table.	Severe; slope	Severe; moderately slow permeability; seasonal high water table.
RsA2	Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded.	9	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; shallow to bedrock.
RsB2	Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded.	9	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; slope.	Severe; slow permeability; shallow to bedrock; seasonal high water table.
RsB3	Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded.	9	Severe; seasonal high water table; shallow to bedrock.	Severe; seasonal high water table; shallow to bedrock.	Severe; shallow to shale.	Severe; shallow; slow permeability; seasonal high water table.
RsC3	Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded.	10	Severe; slope; shallow to bedrock; seasonal high water table.	Severe; slope; seasonal high water table.	Severe; slope; shallow to bedrock.	Severe; shallow to bedrock; slow permeability; seasonal high water table.
Rt	Rowland silt loam	12	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; high water table; flooding.
Ru	Rowland silt loam, coal overwash.	12	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; high water table.
RwA	Rowland silt loam, local alluvium, 0 to 3 percent slopes.	12	Moderate; occasional overflow; seasonal high water table.	Moderate; occasional overflow; seasonal high water table.	Moderate; occasional overflow; moderate permeability.	Severe; high water table.
RwB	Rowland silt loam, local alluvium, 3 to 8 percent slopes.	12	Moderate; occasional overflow; seasonal high water table.	Moderate; wetness; overflow.	Moderate; occasional overflow; moderate permeability.	Severe; high water table.
StE	Stony land, steep	13	Severe; slope; stony	Severe; slope; stony	Severe; slope; stony	Severe; slope; stony
WaA	Watchung silt loam, 0 to 3 percent slopes.	11	Severe; high water table.	Severe; high water table.	Slight	Severe; very slow permeability; high water table.
WaB	Watchung silt loam, 3 to 8 percent slopes.	11	Severe; high water table.	Severe; high water table.	Moderate	Severe; very slow permeability; high water table.
Wc	Watchung very stony silt loam.	11	Severe; high water table; stones.	Severe; high water table; stones.	Moderate; inflow	Severe; very slow permeability; high water table.

[1] For residential developments, a rating of *moderate* is given for slopes of 8 to 25 percent.
[2] For roads in subdivisions, a rating of *severe* is given for slopes greater than 8 percent.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; slope	Moderate for roads; severe for parking lots; slope; seasonal high water table.	Severe; slope	Moderate; slope; wetness.	Severe; seasonal high water table.	Severe; seasonal high water table.
Severe; shallow to bedrock; seasonal high water table.	Moderate seasonal; high water table.	Severe; shallow to bedrock; seasonal high water table.	Moderate; shallow to bedrock.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Moderate; shallow to bedrock.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Moderate; wetness; shallow to bedrock.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; shallow to bedrock; shaly.	Moderate for roads; severe for parking lots; slope; seasonal high water table.	Severe; slope	Moderate; slope; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; flooding; seasonal high water table.	Severe; flooding	Moderate; flooding; seasonal high water table.	Moderate; flooding.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.
Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.
Moderate; wetness	Moderate; seasonal high water table; overflow.	Moderate; wetness; overflow.	Moderate; wetness.	Severe; seasonal high water table; overflow.	Severe; seasonal high water table; overflow.
Moderate; wetness	Moderate; seasonal high water table; overflow.	Moderate; seasonal high water table; slope.	Moderate; wetness.	Severe; seasonal high water table; overflow.	Severe; seasonal high water table; overflow.
Severe; slope; stony	Severe; slope; stony	Severe; slope; stony	Severe; slope; stony.	Severe; slope; stony	Severe; slope; stony.
Severe; wetness; high content of clay.	Severe; high water table.	Severe; high water table.	Severe; wetness	Severe; high water table.	Severe; high water table.
Severe; wetness; high content of clay.	Severe; wetness	Severe; high water table.	Severe; wetness	Severe; high water table.	Severe; high water table.
Severe; wetness; stony.	Severe; high water table; stony.	Severe; high water table; stony.	Severe; wetness; stony.	Severe; high water table; stony.	Severe; high water table; stony.

[3] For properties and limitations, see the Penn and Lansdale soils that have similar slopes and a similar degree of erosion. Where ratings of the two components of these complexes differ, the more restrictive limitation ordinarily will show the hazards of the area.

All of these soils, except the Duffield and Murrill soils and Made land, limestone materials, have only slight limitations as foundations for residences and similar buildings. Deep excavations, however, in the Neshaminy, Duffield, and Murrill soils, and in areas of Made land, may require that hard diabase or limestone bedrock be removed (fig. 14).

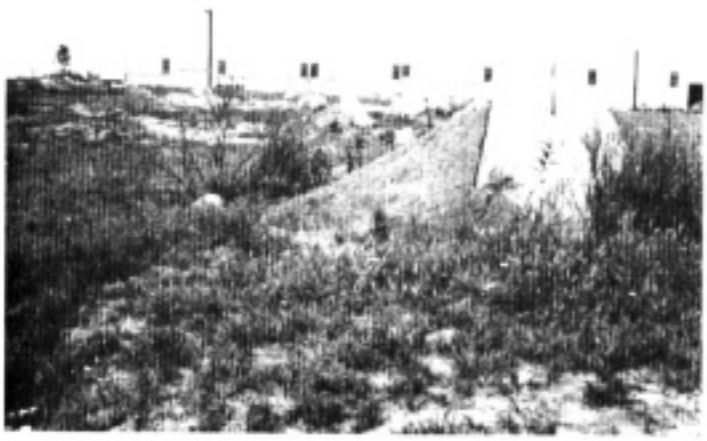

Figure 14.—**Exposed limestone ledges in an area of Made land, limestone materials, where the soil material has been removed when the area was graded for an industrial development.**

Most of these soils have slight limitations as disposal fields for the effluent from septic tanks. Moderate or moderately slow permeability in the Neshaminy and Howell soils, and in Made land, generally restricts use as a disposal field unless the results of percolation tests at the specific site are favorable. Solution channels in the bedrock underlying Made land, limestone materials, and the Duffield soil may cause contamination of the ground water because of poor filtration of the effluent. Most of these soils have slight limitations for use for sanitary land fill.

The soils of this group have few limitations if used for farming, home gardens, nurseries, lawns, or landscape plantings. Made land is fair for lawns and landscaping but needs close investigation where other uses are planned. Most of these soils are a source of fair to good topsoil, but the quantity is limited. After these soils have been disturbed, plants will grow on them, but every effort should be made to replace the original topsoil. Doing this encourages rapid regrowth of vegetation and thus reduces loss of soil material through sheet erosion and gullying. The Edgemont and Lansdale soils are likely to contain many fragments of sandstone and to be droughty if much of the soil material is removed by grading or other construction work.

COMMUNITY DEVELOPMENT GROUP 2

This group consists of Made land and of well-drained, moderately or severely eroded soils of the Duffield, Edgemont, Lansdale, and Neshaminy series. The slopes range from 8 to 15 percent.

The permeability of these soils ranges from moderately slow to moderately rapid, and the percolation rate ranges from 0.63 inch to 2 inches per hour. Depth to hard bedrock is generally more than 3 feet, and it exceeds 10 feet in some places. The seasonal high water table is below a depth of 3 feet. The supply of moisture held available for plants is moderate to large.

The strong slopes are a limitation to use of these soils for residential developments. They are a moderate limitation to use of the soils for light industrial, commercial, or institutional developments. Depth to bedrock, depth to a seasonal high water table, and permeability are favorable for residential developments, and grading can be done without serious difficulty. The Duffield and Neshaminy soils are unstable, however, and are subject to slippage and to sheet and gully erosion if they are disturbed. They are especially likely to slip or erode where the slopes are the strongest.

These soils are generally good for foundations. Also, little or no quarrying of the bedrock is required in most places where an excavation is made for a residence. On the steeper slopes, however, soil creep may be a problem, and bedrock or hard stones are likely to be encountered where a deep cut is made. Because of the possibility that the Duffield soils are underlain by cavernous limestone, those soils should not be used for a heavy structure unless a geologic investigation has been made of the bedrock at the site.

Most of these soils absorb a normal load of effluent from a septic tank used for a residence. The Neshaminy soil and Made land may have limitations if used for that purpose, however, unless the results of percolation tests at the specific site are favorable. Intensive use of the Duffield soils as a disposal field for the effluent from septic tanks may cause contamination of the ground water because of the solution channels in the bedrock and inadequate soil filtration.

The soils of this group are generally well suited to farming, home gardens, nurseries, lawns, and landscape plantings. Runoff needs to be controlled, however, or serious erosion will result. Lawns, trees, and shrubs grow well in areas where the soils have been disturbed, but every effort should be made to replace the original topsoil. Where the topsoil has been restored, vegetation becomes reestablished more quickly and losses from erosion are reduced. The Edgemont and Lansdale soils are likely to be channery and droughty if much of the soil material is removed by grading or construction work. The soils of this group are a source of topsoil of good quality, but the quantity is limited.

COMMUNITY DEVELOPMENT GROUP 3

In this group are mostly moderately deep, well-drained soils of the Brecknock, Glenelg, Lansdale, Manor, and Penn series, and areas of Made land, land fill and sediment basins. These soils are moderately or severely eroded, and their slopes range from 0 to 8 percent.

Most of these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Penn soils, however, have moderately rapid permeability. In most of the soils, depth to hard bedrock is between 2 feet and 12 feet, but in some areas of the Penn soils, bedrock is at a depth shallower than 2 feet. The very stony Manor soil contains stones and outcroppings of rock. The seasonal high water table is below a depth of 3 feet. The amount of moisture held available for plants is generally small. The

supply of moisture is estimated to be 3 to 7 inches in a root zone of 1½ to 3 feet.

These soils have slight or moderate limitations as sites for light industrial, commercial, institutional, and residential developments. The slopes, depth to a seasonal high water table, and permeability are favorable for developments. Grading can be done without difficulty, except in areas of the Manor very stony silt loam, which contains stones and ledges. The Manor, Glenelg, and Penn soils are unstable if they are disturbed, and they are subject to slumping and severe erosion, especially on the steeper slopes. The areas of Made land have severe limitations for residential developments, unless they are fill areas constructed for that purpose.

Most soils of this group have few limitations for use for foundations, but the Manor and Glenelg soils are underlain by deeply weathered, highly micaceous material that is somewhat elastic and unstable. Engineering tests should be made at the specific site to establish the suitability of those soils for heavy installations. Where an excavation is made in the soils of this group, some bedrock must be removed, but this is not difficult, except in the very stony Manor soil.

These soils have limitations ranging from slight to severe for use as a disposal field for the effluent from septic tanks. They are satisfactory for that purpose where the substratum is permeable and bedrock is at a depth of more than 4 feet deep below the tile floor. However, on-site percolation tests should be made.

These soils are only fair for farming, home gardens, and nurseries. They are fair to poor as a source of topsoil and are limited mostly by stones, shale, and stone fragments. Vegetation will grow in areas that have been disturbed, but the available moisture capacity is low and the hazard of erosion is serious. Mulching, adding topsoil, and applying lime and fertilizer help in establishing vegetation.

COMMUNITY DEVELOPMENT GROUP 4

This group consists of moderately deep to shallow, well-drained soils of the Brecknock, Glenelg, Lansdale, Manor, and Penn series. These soils have slopes of 8 to 15 percent. Most of them are moderately eroded.

Most of these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Penn soils, however, have moderately rapid permeability. In most places bedrock is at a depth of 2 to 3 feet, but the depth ranges from 1½ feet in the Penn and Brecknock soils to 12 feet or more in the Glenelg and Manor soils. The seasonal high water table is at a depth below 3 feet. The amount of moisture held available for plants is moderate to small. The supply of moisture is estimated to be 3 to 5 inches in a root zone of 1 to 5 feet.

Because of their strong slopes, these soils have moderate limitations for commercial, light industrial, institutional and residential developments. Nevertheless, the slopes, depth to a seasonal high water table, and permeability are generally favorable, and grading can be done with only minor interference from coarse fragments and bedrock. The Glenelg, Manor, and Penn soils, however, are unstable when disturbed. Soil creep, slippage, sheet erosion, and gullying may be severe unless adequate protection is provided.

These soils are generally good for foundations for small structures, but deep excavations require removal of the bedrock. Also, in some places the Manor and Glenelg soils are underlain by deeply weathered, highly micaceous material that is somewhat elastic and unstable, especially if it is removed and used as fill material. In some places removing the bedrock may create a problem if a road is built on these soils.

These soils vary in their limitations for use as a tile field for the disposal of effluent from septic tanks. They are well suited to that use in places where the subsoil is thick enough, where the substratum is permeable, and where bedrock is at a depth of at least 4 feet. Percolation tests should be made at the site, however, to determine suitability for this use. A large amount of effluent discharged in the more sloping areas causes surface seepage and saturation of the soils downslope.

These soils are only fair for farming, home gardens, nurseries, and lawns. They are good for grass and for landscape plantings. The soil limitations are moderate slopes, rapid runoff, susceptibility to erosion, and low available moisture capacity. The surface layer is thin, and it contains a number of coarse fragments in many places. Where these soils are disturbed, they are likely to be very channery or shaly, highly erodible, and droughty. In disturbed areas establishing vegetation satisfactorily requires protection from erosion, adding topsoil, mulching, and applying lime and fertilizer. In some places it also requires supplemental irrigation.

COMMUNITY DEVELOPMENT GROUP 5

This group consists of shallow to deep, well-drained soils that have slopes of 15 to 35 percent. Also included are very stony soils that have slopes of 8 to 25 percent. These soils are in the Brecknock, Edgemont, Glenelg, Klinesville, Lansdale, Manor, Neshaminy, and Penn series. Many of them are moderately or severely eroded.

In general, these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Edgemont, Penn, and Klinesville soils, however, have moderately rapid permeability. Surface drainage is rapid. Depth to hard bedrock is commonly 2 to 4 feet, but it ranges from 1½ feet in the Penn and Brecknock soils to 12 feet or more in the Manor and Glenelg soils. The seasonal high water table is below a depth of 3 feet. The amount of moisture held available for plants is small to moderate. The supply of moisture is estimated to be 3 to 7 inches in a root zone of 1 to 4 feet.

These soils have severe limitations of slope for commercial, light industrial, institutional, or densely populated residential developments. They are suitable for limited use for individual residences. The major limitations to development are the strong slopes, numerous stones, bedrock near the surface, susceptibility to soil creep, rapid surface drainage, susceptibility to erosion, and poor stability.

These soils are generally fair for foundations, but in some places the Manor and Glenelg soils are underlain by deeply weathered, highly micaceous material that is

somewhat elastic and unstable. The Neshaminy and Penn soils are unstable if they are disturbed, and they are subject to severe erosion. Deep excavations may make it necessary to remove the stones and bedrock.

The strong slopes and bedrock near the surface are moderate or severe limitations to use of these soils for tile fields for the disposal of effluent from septic tanks. The suitability of an individual site should be determined by making percolation tests and examining the local relief. If a large amount of water or effluent from septic tanks is added, these soils are likely to become saturated and seepage to the surface occurs farther downslope.

These soils are fair to good for trees, turf, and landscape plantings. They are generally poor for farming, home gardens, and lawns, and they have limited use for nurseries. The major limitations are the strong slopes, stones, rapid surface drainage, and droughtiness. The surface layer is thin, and it contains many coarse fragments or stones in many places. In disturbed areas establishing vegetation satisfactorily requires protection from erosion, adding topsoil, mulching, and applying lime and fertilizer. Also, supplementary irrigation is needed where it is feasible to use it.

COMMUNITY DEVELOPMENT GROUP 6

This group consists of shallow and very shallow, well-drained, moderately eroded or severely eroded soils of the Klinesville, Lansdale, and Penn series. The slopes range from 3 to 8 percent.

These soils have moderate or moderately rapid permeability and an estimated percolation rate of 0.63 inch to 6.3 inches per hour. Depth to bedrock is generally less than 2 feet, but it is as much as 3 feet in some areas of the Lansdale soil. The seasonal high water table is usually below a depth of 3 feet. The amount of moisture held available for plants is very small. The supply of moisture is estimated to be 1 to 4 inches in a root zone of 10 to 24 inches.

Bedrock near the surface is a limitation if these soils are used for residential, light industrial, commercial, or institutional developments. Grading is difficult because of the bedrock near the surface. These soils are generally stable, but they are subject to severe sheet and rill erosion. They are droughty. In many places shale or bedrock crops out on the surface after the areas are graded. As a result, final grading and landscaping are difficult.

These soils are good for foundations. All excavations, however, require removal of bedrock.

Although these soils are permeable, they have severe limitations if used as a disposal field for the effluent from septic tanks. Shale near the surface causes them to become saturated rapidly, and the effluent then seeps out and comes to the surface. Where the effluent sinks into cracks and fissures in the bedrock, it may cause contamination of the ground water because of inadequate filtration.

These soils are poor for farming, nurseries, home gardens, and turf. They are droughty, shaly, low in content of organic matter, and shallow over bedrock. Grass, shrubs, and trees cannot be readily established. Adding suitable topsoil, mulching, providing protection from erosion, and liming and fertilizing will all greatly aid in establishing sod and landscape plantings. Supplemental irrigation, where feasible, helps to establish and maintain the vegetation.

COMMUNITY DEVELOPMENT GROUP 7

This group consists of moderately deep to shallow or very shallow, well-drained soils that have slopes of 8 to 15 percent. These soils are severely eroded. They are in the Klinesville, Lansdale, Legore, and Penn series.

These soils are moderately permeable to rapidly permeable and have an estimated percolation rate of 0.63 inch to 6.3 inches per hour. Depth to bedrock ranges from 6 inches in the Klinesville soil to 3 feet in the Legore soil. Surface runoff is rapid. In most places the seasonal high water table is deep, but hillside seepage sometimes occurs late in winter or early in spring. The amount of moisture held available for plants is very small. The supply of moisture is estimated to be 1 to 4 inches in the variable depth of the root zone.

The strong slopes are a limitation if these soils are used for commercial, light industrial, or institutional developments. The soils also have limitations for homesites, but they can be used for that purpose. The buildings should be connected with a municipal facility for treating and disposing of sewage. Grading is difficult because of the bedrock near the surface. Also the exposed bedrock and large number of rock fragments and stones make vegetation hard to establish. In most places these soils are stable, but some soil creep can be expected in fill areas. Erosion is a hazard.

These soils are generally good for foundations, but excavations require the removal of bedrock. In some places the Legore and Lansdale soils are underlain by 2 or more feet of sandy loam.

These soils have severe limitations if they are used as a filter field for a septic tank. The soil material is permeable to a depth of ½ foot to 2 feet, but bedrock limits the depth of percolation. As a result, the soil becomes saturated and surface seepage occurs downslope. Even where the effluent seeps into cracks in the bedrock and surface seepage does not occur, contamination of the ground water is likely because the effluent has not had adequate filtration.

These soils are poor for farming, nurseries, home gardens, lawns, and landscape plantings. They are very low in content of organic matter, are shallow or very shallow over the underlying material, and are shaly and very droughty. Surface runoff is very rapid. Little or none of the original surface layer of these soils remains. After a development is established, the remaining soil material contains so much raw, broken rock or is so shallow to bedrock that grass, shrubs, and trees cannot be established easily. Adding topsoil, mulching, applying lime and fertilizer, and supplying extra water through supplemental irrigation greatly aid in establishing and maintaining vegetation.

COMMUNITY DEVELOPMENT GROUP 8

This group consists of well-drained soils of the Klinesville, Legore, and Neshaminy series. The Klinesville and Legore soils have slopes greater than 15 percent, and the Neshaminy soil has slopes between 0 and 8

percent. The Neshaminy soil is extremely stony, and the Klinesville soil is very shaly and shallow over bedrock. The Klinesville and Legore soils are severely eroded.

These soils have an estimated percolation rate of 2 to 6.3 inches per hour. Permeability is rapid in the Klinesville soil and moderate in the Legore and Neshaminy soils. Surface drainage is rapid or very rapid. In places in the Klinesville soil, bedrock is only 6 inches beneath the surface. The seasonal high water table is below a depth of 2 feet. The amount of moisture held available for plants is small or very small. The supply of moisture is estimated to be 1 to 6 inches in a root zone of 10 to 32 inches.

In most places these soils are too steep for commercial, industrial, institutional, or residential developments. In residential developments, they are more suitable for parks and for undeveloped recreational areas, wildlife preserves, and wooded areas than for other uses.

The bedrock underlying these soils is generally firm enough to provide a good foundation, but the areas where the slopes are steep require special investigation and design. Where the soils have been disturbed, they are subject to erosion, slumping, and severe slipping or soil creep. The large numbers of stones, bedrock near the surface, and steep slopes make grading and excavating difficult.

The steep slopes and bedrock near the surface are severe hazards to use of these soils for disposal fields for the effluent from septic tanks. Continuous moisture, such as that from septic tanks, saturates the soils downslope and causes surface seepage.

These soils are well suited to trees or to landscape plantings. The high content of shale and stone fragments, however, limits their use for turf. Also, the Klinesville soil is droughty, and the growth of roots is limited by the bedrock near the surface.

COMMUNITY DEVELOPMENT GROUP 9

In this group are moderately deep and deep, moderately well drained or somewhat poorly drained silt loams of the Beltsville, Glenville, Lawrenceville, Lehigh, Mount Lucas, Raritan, Readington, and Reaville series. Also included are areas of Made land. Some of these soils are moderately or severely eroded. Their slopes range from 0 to 8 percent.

Most of these soils have slow or moderately slow permeability and an estimated percolation rate of less than 0.2 to 0.63 inch per hour. Permeability of the Beltsville, Reaville, and Lehigh soils, however, ranges to very slow. Bedrock is commonly at a depth of 3 to 5 feet, but the depth ranges from 1 to 2 feet in the Reaville and Lehigh soils to 15 feet or more in the Beltsville soil. The seasonal high water table is generally between a depth of ½ foot and 2½ feet, but at times, it is at the surface in the Reaville soils and Made land. The amount of moisture held available for plants is moderate to large. In most of the soils the supply of moisture is estimated to be between 6 and 9 inches where the root zone is 2 to 5 feet thick. The Lehigh and Reaville soils are more droughty than the other soils and have from 3 to 5 inches of available moisture in the root zone.

Somewhat restricted drainage limits the use of these soils for commercial, light industrial, institutional, and residential developments. Buildings constructed on them should be connected to an adequate municipal sewage treatment system. The slopes and depth to bedrock are favorable for the different kinds of development. The major limiting factors are restricted permeability in the subsoil and a seasonal high water table. The water table remains high throughout the winter and early in spring, and it may remain high until early in summer if rainfall is above normal. Surface drainage is difficult where the soils have slopes of less than 3 percent.

Hard diabase stones and boulders in the very stony Mount Lucas soil, and shale and channers in the areas of Made land and the Reaville and Lehigh soils, interfere with grading. Where these soils are removed from their original location, they are unstable and are subject to frost heaving, slumping, severe surface erosion, and gullying.

Where these soils have not been disturbed, they are generally satisfactory for foundations. Excavating in the Lehigh and Reaville soils requires some quarrying of the bedrock, and excavating in the very stony Mount Lucas soil requires that the stones be removed. The seasonal high water table makes difficult the sealing and draining of basements or any other construction below the surface of the ground.

The soils of this group have severe limitations for use as filter fields for septic tanks. A seasonal high water table prevents normal operation of the system for weeks at a time. Also, restricted permeability limits the amount of effluent that can be disposed of. In summer the Readington and Glenville soils are satisfactory for filter fields for septic tanks if the fields are large and the amount of effluent is not excessive.

These soils are fair to good for farming, home gardens, nurseries, lawns, and landscape plantings, provided species that tolerate wetness are grown. The Reaville and Lehigh soils are usually too droughty in summer for the optimum growth of plants or for adequate yields of crops. Most of the soils of this group are a good source of topsoil, but the Reaville, Lehigh, moderately eroded phase of the Readington soils, and Made land are shaly or channery. Where the soils have been disturbed, they are likely to be severely compacted and have slower permeability than where they have not been disturbed. They contain many pieces of rock and are easily eroded.

COMMUNITY DEVELOPMENT GROUP 10

This group consists of deep or moderately deep to shallow, moderately well drained or somewhat poorly drained, mainly moderately eroded or severely eroded soils of the Lehigh, Mount Lucas, Readington, and Reaville series and areas of Made land. The slopes are mainly between 8 and 15 percent, but the very stony soils have slopes of 8 to 25 percent and are generally not eroded.

These soils have moderately slow permeability and an estimated percolation rate of 0.2 to 0.63 inch per hour. In most places bedrock is at a depth of 1 to 4 feet, but it is nearer the surface in some areas of the Reaville soil and Made land, and deeper in the Mount Lucas soils. Depth to the seasonal high water table is only about 1 foot in the Reaville soil, but the depth ranges to as much

as 30 inches in the Readington soil. The available moisture capacity is small or very small. The supply of moisture is estimated to be 1 to 5 inches in a root zone of 1 to 3 feet.

The slopes, slow permeability, seasonal high water table, and seeps are limitations for commercial, light industrial, institutional, or residential developments on these soils. The stones, shale, or channers make grading difficult. Seepage occurs on the lower part of the hillsides in winter and early in spring when the water table is high. These soils are subject to frost heaving, soil creep, and surface erosion. Where they are used as fill, they are unstable and easily eroded.

These soils are generally satisfactory for foundations for small buildings. In most places excavations require removal of the bedrock, however, and the very stony Mount Lucas soil contains many large diabase stones and boulders. The seasonal high water table, seeps, and moderately slow permeability make basements difficult to seal and drain.

Limitations are severe if these soils are used as a filter field for a septic tank. Any amount of water added continuously to these soils is likely to saturate them and cause surface seepage downslope. Also, the high water table prevents the normal operation of the system for many weeks at a time, and the restricted permeability of the subsoil and substratum limits the amount of effluent that can be disposed of. All buildings should be connected to an established central system for disposing of sewage.

These soils are fair to poor for farming, home gardens, and nurseries, and they are fair for landscape plantings, woodlots, and lawns. Plants that tolerate drought and that also tolerate periodic wetness should be selected. The surface layer is mostly thin and shaly, channery, or stony. These soils, whether in place or disturbed, need protection from erosion, additions of topsoil, mulching, and applications of lime and fertilizer. If the soils are used for lawns, the stones and fragments of rock must be removed. Light, frequent applications of water help to maintain the lawns during the dry summer months.

COMMUNITY DEVELOPMENT GROUP 11

This group consists of poorly drained or somewhat poorly drained soils that have slopes of 0 to 8 percent. These soils are in the Abbottstown, Chalfont, Croton, Doylestown, and Watchung series. Some of them are moderately eroded.

These soils are slowly permeable and have an estimated percolation rate of 0.2 to 0.06 inch per hour. In places the seasonal high water table is at the surface but it is as much as 1 foot deep in other places. Surface drainage is slow or very slow where the soils have slopes of 0 to 3 percent, and ponding occurs in the low-lying sites. The Croton, Doylestown, and Watchung soils have a high water table during the greater part of the year. Bedrock is at a depth of 3 to 8 feet. The amount of moisture held available for plants is moderate to small. The supply of moisture is estimated to be 3 to 7 inches in a root zone of 1 to 3 feet.

These soils have severe limitations of drainage for commercial, light industrial, institutional, or residential developments, but the slopes and depth to bedrock are favorable for those uses. The high water table, slow permeability, and poor stability restrict the use of the soils for developments. The soils of this group offer few limitations to grading during summer when the water table is low. Grading, however, leaves the soils highly compacted and subject to severe gully and surface erosion, frost heaving, and slumping. Also permeability is decreased and the water table may be closer to the surface after an area is graded.

The shrinking and swelling of the soil material, slow permeability, high water table, and poor stability limit the use of these soils as foundations for heavy structures. For lighter structures, a permeable and stable fill can be used to raise the foundation above the level reached by high water. The fill needs tile drainage to prevent water from rising into it.

These soils have severe limitations to use as a disposal field for the effluent from septic tanks. All buildings should be connected to a system that will adequately treat the sewage and dispose of it. Careful planning is needed to remove and dispose of the surface water.

These soils are poor for farming, home gardens, and nurseries. Turf, consisting of grasses and legumes that tolerate periodic wetness, grows well, except in the more poorly drained areas of the Watchung, Croton, and Doylestown soils. Shallow-rooted trees and shrubs are fair for landscape plantings. These soils have considerable value for open space conservation areas in conjunction with stream valley preserves, bird sanctuaries, and wildlife habitats.

COMMUNITY DEVELOPMENT GROUP 12

This group consists of well-drained to poorly drained soils on flood plains that are subject to periodic overflow. It consists of soils of the Bermudian, Bowmansville, Codorus, Hatboro, and Rowland series and of Bouldery alluvial land.

In most places these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches. However, permeability ranges from rapid in the Bermudian soil to slow in Bouldery alluvial land and in the Bowmansville and Hatboro soils. Depth to bedrock ranges from 3 to 8 feet. In places the seasonal high water table is at the surface, but it is at a depth of 2 feet in some of the soils and it is commonly at a depth of 3 feet in the Bermudian soil. At times, water is ponded on the surface of the Bowmansville and Hatboro soils. The amount of moisture held available for plants is moderate to large. The supply of moisture is estimated to be 6 to 12 inches in a root zone of 3 to 5 feet.

These soils are subject to flooding. Flooding may occur several times a year or only once in several years, and increase in the speed and volume of runoff, caused by covering large areas with buildings or pavement, may increase the frequency. As a result, flooding may be more frequent than the normal once in 3 to 5 years. The local alluvium phases of the Bowmansville and Rowland soils are not subject to normal flooding. In summer and fall, however, overflow of high velocity occurs for short periods during storms of high intensity.

Flooding and wetness are severe limitations, especially where these soils are used for commercial, residential, light industrial, or institutional developments. Normal flooding may result in extremely great damage to property if structures, built on these sites, are inundated. Though these soils are permeable and deep to bedrock, they have severe limitations for use as a filter field for the effluent from septic tanks. The seasonal high water table makes the system inoperable for weeks or months at a time, and contamination of the streams is likely to result.

The Bermudian, Rowland, and Codorus soils are fair to good for farming and home gardens. All of these soils, except the more poorly drained areas of Bowmansville and Hatboro soils, are suitable for turf and trees. These soils have considerable value for use as open spaces, such as golf courses, parks, wildlife habitats, recreational areas, and stream valley preserves.

COMMUNITY DEVELOPMENT GROUP 13

In this group is one miscellaneous land type, Stony land, steep, which has slopes of 25 to 80 percent. The steep slopes and the high content of stones severely limit the use of this land type for housing, agriculture, forestry, and most forms of recreation. The land has possibilities, however, for development as green areas for esthetic value in parks. It can also be used as a shelter for wildlife or as a part of a municipal watershed protection area.

Descriptions of the Soils

This section describes the soil series and the mapping units in Montgomery County. The procedure is first to describe each soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs.

The soil series contains a description of the soil profile, the major layers from the surface downward. This profile is considered typical, or representative, for all the soils of the series. If the profile for a given mapping unit differs from this typical profile, the differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. Some technical terms are used in describing soil series and mapping units, simply because there are no nontechnical terms that convey precisely the same meaning. Many of the more commonly used terms are defined in the Glossary.

The acreage and proportionate extent of the mapping units are shown in table 9. Detailed technical descriptions of soil series are given in the section "Formation and Classification of Soils." At the back of the survey is a list of the mapping units in the county and the capability unit and community development group each is in. The page where each of these groups is described is also given.

TABLE 9.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Abbottstown silt loam, 0 to 3 percent slopes	4, 419	1. 4	Codorus silt loam	1, 580	0. 5
Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded	8, 569	2. 8	Croton silt loam, 0 to 3 percent slopes	4, 113	1. 3
Beltsville silt loam, 2 to 6 percent slopes, moderately eroded	312	. 1	Croton silt loam, 3 to 8 percent slopes, moderately eroded	6, 689	2. 1
Bermudian silt loam	492	. 2	Croton very stony silt loam, 0 to 8 percent slopes	278	. 1
Birdsboro silt loam, 0 to 3 percent slopes	387	. 1	Doylestown silt loam, 0 to 3 percent slopes	1, 537	. 5
Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded	330	. 1	Doylestown silt loam, 3 to 8 percent slopes, moderately eroded	552	. 2
Bouldery alluvial land	261	. 1	Duffield silt loam, 3 to 8 percent slopes, moderately eroded	2, 565	. 8
Bowmansville silt loam	11, 295	3. 6	Duffield silt loam, 8 to 15 percent slopes, moderately eroded	453	. 1
Bowmansville silt loam, local alluvium, 0 to 3 percent slopes	2, 214	. 7	Duffield silt loam, 8 to 15 percent slopes, severely eroded	150	(1)
Bowmansville silt loam, local alluvium, 3 to 8 percent slopes	1, 941	. 6	Edgemont channery loam, 3 to 8 percent slopes, moderately eroded	587	. 2
Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded	350	. 1	Edgemont channery loam, 8 to 15 percent slopes, moderately eroded	840	. 3
Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded	266	. 1	Edgemont channery loam, 15 to 25 percent slopes, moderately eroded	427	. 1
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded	429	. 1	Edgemont very stony loam, 8 to 25 percent slopes	356	. 1
Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes	313	. 1	Glenelg silt loam, 3 to 8 percent slopes, moderately eroded	4, 157	1. 3
Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes	339	. 1	Glenelg silt loam, 8 to 15 percent slopes, moderately eroded	2, 115	. 7
Brecknock very stony silt loam, 8 to 25 percent slopes	365	. 1	Glenelg silt loam, 15 to 25 percent slopes, moderately eroded	210	. 1
Chalfont silt loam, 0 to 3 percent slopes	3, 948	1. 3	Glenville silt loam, 0 to 3 percent slopes	356	. 1
Chalfont silt loam, 3 to 8 percent slopes, moderately eroded	2, 592	. 8	Glenville silt loam, 3 to 8 percent slopes, moderately eroded	2, 072	. 7
Chester silt loam, 0 to 3 percent slopes, moderately eroded	252	. 1	Hatboro silt loam	2, 352	. 7
Chester silt loam, 3 to 8 percent slopes, moderately eroded	325	. 1	Howell silt loam, 3 to 8 percent slopes, moderately eroded	524	. 2

See footnote at end of table.

TABLE 9.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent
	Acres	*Percent*
Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded	399	0. 1
Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded	1, 203	. 4
Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded	2, 013	. 6
Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded	3, 682	1. 2
Lansdale loam, thin, 3 to 8 percent slopes, severely eroded	2, 049	. 7
Lansdale loam, thin, 8 to 15 percent slopes, severely eroded	1, 316	. 4
Lansdale loam, thin, 15 to 35 percent slopes, severely eroded	1, 092	. 3
Lansdale silt loam, 0 to 3 percent slopes, moderately eroded	288	. 1
Lansdale silt loam, 3 to 8 percent slopes, moderately eroded	3, 991	1. 3
Lansdale silt loam, 8 to 15 percent slopes, moderately eroded	376	. 1
Lawrenceville silt loam, 0 to 3 percent slopes	7, 462	2. 4
Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded	6, 329	2. 0
Legore clay loam, 8 to 15 percent slopes, severely eroded	81	(1)
Legore clay loam, 15 to 30 percent slopes, severely eroded	152	(1)
Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded	466	. 1
Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded	5, 417	1. 7
Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded	1, 457	. 5
Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded	2, 368	. 8
Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded	1, 359	. 4
Lehigh very stony silt loam, 0 to 8 percent slopes	413	. 1
Lehigh very stony silt loam, 8 to 25 percent slopes	691	. 2
Made land, diabase, gabbro materials	244	. 1
Made land, land fill and sediment basins	885	. 3
Made land, limestone materials	6, 885	2. 2
Made land, schist and gneiss materials, sloping	17, 715	5. 6
Made land, schist and gneiss materials, strongly sloping	6, 124	1. 9
Made land, shale and sandstone materials, sloping	27, 631	8. 8
Made land, shale and sandstone materials, strongly sloping	1, 932	. 6
Manor channery silt loam, 3 to 8 percent slopes, moderately eroded	968	. 3
Manor channery silt loam, 8 to 15 percent slopes, moderately eroded	2, 706	. 9
Manor channery silt loam, 15 to 35 percent slopes, moderately eroded	3, 339	1. 1
Manor very stony silt loam, 0 to 8 percent slopes	103	(1)
Manor very stony silt loam, 8 to 25 percent slopes	1, 288	. 4
Mount Lucas silt loam, 0 to 3 percent slopes	154	(1)
Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded	2, 490	. 8
Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded	423	. 1
Mount Lucas very stony silt loam, 0 to 8 percent slopes	2, 336	. 7
Mount Lucas very stony silt loam, 8 to 25 percent slopes	1, 539	. 5
Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded	245	. 1
Neshaminy extremely stony silt loam, 0 to 8 percent slopes	274	0. 1
Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded	1, 047	. 3
Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded	928	. 3
Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded	188	. 1
Neshaminy very stony silt loam, 0 to 8 percent slopes	1, 028	. 3
Neshaminy very stony silt loam, 8 to 25 percent slopes	2, 790	. 9
Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded	904	. 3
Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, severely eroded	800	. 3
Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded	854	. 3
Penn silt loam, 0 to 3 percent slopes, moderately eroded	288	. 1
Penn silt loam, 3 to 8 percent slopes, moderately eroded	4, 212	1. 3
Penn silt loam, 3 to 8 percent slopes, severely eroded	7, 019	2. 2
Penn silt loam, 8 to 15 percent slopes, moderately eroded	1, 070	. 3
Penn silt loam, 8 to 15 percent slopes, severely eroded	5, 117	1. 6
Penn very stony silt loam, 8 to 25 percent slopes	151	(1)
Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded	1, 563	. 5
Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded	4, 163	1. 3
Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded	884	. 3
Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded	731	. 2
Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded	686	. 2
Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded	457	. 1
Raritan silt loam, 0 to 3 percent slopes	1, 061	. 3
Raritan silt loam, 3 to 8 percent slopes, moderately eroded	652	. 2
Readington silt loam, 0 to 3 percent slopes	6, 894	2. 2
Readington silt loam, 3 to 8 percent slopes, moderately eroded	33, 060	10. 6
Readington silt loam, 8 to 15 percent slopes, moderately eroded	1, 814	. 6
Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded	2, 375	. 8
Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded	12, 712	4. 0
Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded	8, 956	2. 9
Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded	5, 030	1. 6
Rowland silt loam	5, 290	1. 7
Rowland silt loam, coal overwash	1, 509	. 5
Rowland silt loam, local alluvium, 0 to 3 percent slopes	458	. 1
Rowland silt loam, local alluvium, 3 to 8 percent slopes	378	. 1
Stony land, steep	3, 150	1. 0
Watchung silt loam, 0 to 3 percent slopes	605	. 2
Watchung silt loam, 3 to 8 percent slopes	847	. 3
Watchung very stony silt loam	2, 579	. 8
Mines and pits	793	. 3
Total	314, 240	100. 0

[1] Less than 0.05 percent.

Abbottstown Series

In the Abbottstown series are deep and moderately deep, somewhat poorly drained soils formed in material weathered from red and brown shale and sandstone. These soils have a slowly permeable subsoil that impedes the downward movement of water. They are nearly level or gently sloping and occur on upland flats, in depressions, and on concave lower slopes in the northern two-thirds of the county.

The Abbottstown soils occur with the moderately well drained Readington soils and the poorly drained Croton soils. Near the Abbottstown soils, but on higher uplands and steeper slopes, are well-drained, reddish-brown Penn soils and brown Lansdale soils.

In a typical profile of an Abbottstown soil, the surface layer is friable, dark-brown or dark reddish-gray silt loam. It is 10 to 11 inches thick and contains a few pieces of shale. The pieces of shale and sandstone increase in number with increasing depth.

The subsoil is reddish-brown or weak-red silt loam or silty clay loam with many gray or strong-brown streaks and mottles. At a depth of 12 to 20 inches, it is slightly firm. If the soil is disturbed, the subsoil breaks to thin, flat pieces, or plates. A firm, dense layer, at a depth of 20 to 40 inches, impedes the downward movement of water and the growth of roots. About 25 percent, by volume, of the lower part of this dense layer consists of fragments of shale.

At a depth of about 40 inches, the material in the subsoil grades to the substratum of reddish-brown or weak-red shaly silt loam. In many places the substratum is mottled with gray. Dusky-red shale bedrock is at a depth of 4 to 5 feet, but the depth ranges from 3 to 8 feet.

The Abbottstown soils are wet late in fall, in winter, and early in spring. Their ability to hold moisture available for plants is high, but the growth of roots is restricted by the dense subsoil. These soils are medium acid to very strongly acid. They are fairly well suited to hay and pasture consisting of grasses and shallow-rooted legumes that tolerate wetness. The unstable soil material, very slow permeability, and seasonal high water table are limitations to use of these soils for developments.

Abbottstown silt loam, 0 to 3 percent slopes (AbA).—This soil is on low-lying flats and in depressions scattered throughout the northern two-thirds of the county. In most places it has a profile like the one described as typical for the series.

In some areas of this soil in the central part of the county, the upper part of the subsoil is very silty, is yellowish brown and gray, and is almost free of shale. The subsoil in those areas is shaly at a depth of 24 to 30 inches, and it contains more clay than the soil material at a comparable depth in the profile described as typical for the series. In the south-central part of the county, especially south of Norristown and Ambler, this soil contains considerable sand and has pieces of sandstone below a depth of 18 to 30 inches. In some places in depressions and in shallow drainageways, this soil has a dark-colored surface layer as thick as 18 inches.

Included with this soil in mapping are very small areas of Croton silt loam, 0 to 3 percent slopes, and of Abbottstown silt loam, 3 to 8 percent slopes.

Permeability is very slow, and the water table is within a foot of the surface late in fall, in winter, and early in spring. Surface drainage is slow, and ponding is common in low-lying pockets late in winter. This soil dries slowly in spring. After a long period of heavy rainfall, it is wet for several days at a time during the growing season. The hazard of erosion is slight. This soil has high moisture-holding capacity, but plants cannot use all of the moisture, because their roots are restricted by the dense subsoil.

This soil is used for the commonly grown field crops and for hay and pasture (fig. 15). Also, in open residential areas near towns, much of it is idle or is in turf associated with golf courses, industries, institutions, and estates. This soil is only fair for corn, soybeans, and spring-planted small grains. Alfalfa and winter grains are likely to be seriously injured by the high water table and by frost heaving.

A suggested cropping system is 1 year of a row crop, 1 year of a spring-seeded small grain, and at least 3 years of grass-legume hay of adapted varieties. Such a cropping system, where graded-row cultivation is practiced, improves surface drainage, reduces losses from erosion, and maintains good tilth. Constructing a diversion terrace on the slope above areas of this soil may reduce wetness caused by seeps, springs, or excess surface water. Open drains help to remove the excess water from low-lying pockets.

This soil has severe limitations for residential, light industrial, commercial, and institutional developments. It also has severe limitations if it is used as a disposal field for the effluent from septic tanks. (Capability unit IIIw–2, woodland suitability group 7, community development group 11)

Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded (AbB2).—The surface layer in this gently sloping soil is thinner and contains more fragments of shale than the one in the profile described as typical for the series. This soil is on broad undulating and smooth uplands. The areas are large and are scattered throughout the northern two-thirds of the county.

In areas of this soil in the central part of the county, brown or yellowish-brown colors are predominant, but reddish colors are most common in the northern half. South of Norristown and Ambler, the profile of this soil is more sandy than the one described as typical for the series, and it contains some gravel and pieces of sandstone. Near Lansdale and east to the Bucks County line, this soil is very silty and contains only a few fragments of shale above a depth of 2 or 3 feet. At higher elevations, it is shaly. Up to 90 percent of the soil material is shale at a depth of 30 to 36 inches.

Included with this soil in mapping are small areas that are in depressions and that have a dark-colored surface layer as thick as 12 to 15 inches. On some slopes bedrock is at a depth of only 3 feet. In some very small areas, it is at a depth of only 2 feet. In many places the surface layer is only about 6 inches thick and contains gray and yellowish or reddish streaks where material from the subsoil has been mixed into it. Small areas of slightly eroded and of severely eroded soils are also included.

This Abbottstown soil is slowly permeable and has a water table within 12 inches of the surface during winter and early in spring. Surface drainage is medium to rapid.

Figure 15.—A field in which Abbottstown silt loam, 0 to 3 percent slopes, is used for hay and pasture. Readington soils are also in this field. Bowmansville soils are along a small stream below the barn, and Croton soils are in the pasture beside the barn.

The hazard of erosion is mostly moderate, but it ranges to severe on long slopes that have a gradient of 6 to 8 percent. The moisture-holding capacity is high, but not all of the moisture can be used by plants, because the growth of roots is restricted in the subsoil.

This soil is used for the commonly grown field crops and for hay and pasture. In open residential areas near towns, much of it is idle, is in nurseries or in permanent grass on golf courses, or is used for industrial or institutional developments. This soil is fair for cultivated crops and small grains seeded in spring. Alfalfa and winter small grains, however, are likely to be severely damaged by the seasonal high water table and frost heaving.

Graded contour stripcropping and a cropping system made up of 1 year of a row crop followed by a cover crop, 1 year of a spring-seeded small grain, and at least 3 years of grass-legume hay of adapted varieties are suggested for the long slopes. The stripcropping and this cropping system help to reduce losses from erosion, remove excess surface water, and maintain good soil tilth. Diversion terraces safely remove additional surface water; they may also be used to intercept subsurface seepage so that small, wet areas will receive less water.

This soil has severe limitations if it is used for residential, light industrial, commercial, and institutional developments. It also has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIw–3, woodland suitability group 7, community development group 11)

Beltsville Series

In the Beltsville series are deep, moderately well drained or somewhat poorly drained, gently sloping soils formed in deposits of silt, clay, sand, or gravel. These soils have a slowly permeable layer in the subsoil that impedes the downward movement of water. They are on upland benches and in depressions on old coastal plain terraces in the south-central part of the county near Conshohocken.

The Beltsville soils occur with the deep, well-drained Howell soils, and they formed in similar material. They also occur with the silty, moderately well drained Lawrenceville soils and the somewhat poorly drained Chalfont soils. Near them are the well-drained Duffield soils that are underlain by limestone.

In a typical Beltsville soil, the plow layer is friable, dark grayish-brown silt loam that is 8 to 9 inches thick.

The upper part of the subsoil is dark yellowish-brown silt loam or gritty silty clay loam mottled with brown. In most places the lower part of the subsoil is more reddish and more clayey than the upper part, and it contains less silt and more sand and gravel. At a depth

of about 21 inches, the subsoil consists of reddish-brown, very firm silty clay loam or clay loam mottled with gray. If this very firm layer is disturbed, it breaks to large columns, called prisms, that readily break to smaller blocks and plates. This part of the subsoil is dense and compact. The subsoil is about 30 inches thick. As much as 30 percent of it is rounded gravel.

The substratum consists of about 30 inches of sandy clay loam. This layer is transitional to gravel, and about 50 percent of it is gravel. Bedrock is generally about 10 feet below the surface, but the depth ranges from 4 to 30 feet.

These soils are slowly permeable and are wet late in fall, during winter, and early in spring. They have high available moisture holding capacity, but their dense subsoil restricts the growth of roots. Also, they are slow to warm in spring and are wet until April or May. The soils are strongly acid. They are well suited to hay and pasture and are fair for corn, soybeans, and spring-seeded small grains. The seasonal high water table and slow permeability are limitations to use of these soils for residential, commercial, light industrial, or institutional developments.

Beltsville silt loam, 2 to 6 percent slopes, moderately eroded (BlB2).—This is the only Beltsville soil mapped in the county. It is in small, gently sloping areas on upland benches and in depressions, at a slightly lower elevation than the well-drained Howell soils. In general, the profile of this soil is like the one described for the series. In some places, however, where this soil is in depressions and has not been affected by erosion, the surface layer is as much as 18 inches thick.

Included with this soil in mapping are small areas of poorly drained soils formed in material similar to that in which these soils developed. Areas of soils that are more reddish than normal for the Beltsville soils are also included.

Permeability is slow, and the water table is at a depth of only ½ to 2½ feet late in fall, in winter, and early in spring. Surface drainage is slow to medium, and there is a moderate hazard of erosion. The moisture-holding capacity is high, but plants cannot use all of the moisture, because the dense subsoil restricts the growth of their roots.

This soil is mostly idle and is overgrown with weeds and brush. Some areas, however, are planted to corn, soybeans, and small grains. This soil is well suited to hay and pasture, and it is fair for corn, soybeans, and spring-seeded small grains. Winter small grains and alfalfa are damaged by the high water table and by frost heaving in winter.

Moisture can be conserved, losses from erosion reduced, excess surface water removed, and good tilth maintained by farming this soil in field or graded strips. The cropping system should consist of 2 years of row crops and a cover crop, 1 year of a spring-seeded small grain, and 2 or 3 years of grass-legume hay. Random tile drains are effective in reducing wetness in depressions and seeps.

This soil has limitations for residential, light industrial, commercial, and institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Bermudian Series

The Bermudian series consists of deep, well-drained, brown or reddish-brown soils on flood plains. These soils formed in material washed from uplands underlain by red shale and sandstone. They are level or nearly level and occur in small areas along the larger streams in the county.

The Bermudian soils occur on flood plains with the moderately well drained to somewhat poorly drained Rowland soils and the poorly drained Bowmansville soils. Nearby, on uplands, are reddish-brown, well-drained Penn soils, brown, well-drained Lansdale soils, and moderately well drained Readington soils.

In a typical profile of a Bermudian soil, the surface layer is friable, dark-brown loam or silt loam about 10 inches thick. The surface layer is underlain by layers of variable soil material, called the substratum.

Typically, the substratum is friable, dark-brown and reddish-brown silt loam or loam. In many places, however, it is stratified and contains considerable sand. Shale bedrock is at a depth of about 5 feet, but the depth to bedrock ranges from 4 to 8 feet.

These are medium acid or slightly acid, moderately permeable soils. They have high available moisture capacity and moderate to high natural fertility.

These soils are well suited to the crops commonly grown in the area, but the size of an area is likely to determine its use. Many of the small or odd-shaped areas are used for pasture. Because of the occasional floods, limitations to use of these soils are severe for residential developments.

Bermudian silt loam (Bm).—This is the only soil of the Bermudian series mapped in this county. Its profile is the one described as typical for the series. This soil is in small, scattered bands along the channels of Skippack and Perkiomen Creeks and along other large streams in the northern two-thirds of the county. Along the edges of some areas, this soil merges with Rowland or Bowmansville silt loams. In those places flooding is more frequent and this soil cannot be worked so early in spring as in other areas. A few wet spots are mapped with this soil.

This soil has moderate permeability, but the water table is within 3 feet of the surface in winter and early in spring. The frequency of flooding ranges from once in several years to once each winter or once early in spring. The available moisture capacity is high. This soil has benefited from lime and fertilizer washed from nearby fields. The hazard of erosion is slight.

Because the areas are small and access to them is obstructed by areas of poorly drained Bowmansville soils, this soil is used primarily for pasture. It is well suited to corn, soybeans, and late-planted vegetables, however, and to alfalfa, orchardgrass, and other deep-rooted grasses and legumes. Winter small grains are sometimes damaged by flooding.

Susceptibility to occasional flooding is a severe limitation to use of this soil for residential, light industrial, commercial, or institutional developments. (Capability

unit I–1, woodland suitability group 1, community development group 12)

Birdsboro Series

In the Birdsboro series are deep, well-drained, reddish-brown silt loams or silty clay loams. These soils formed in old stream sediments washed from uplands underlain by red shale and sandstone. They are at elevations well above the present level of the streams and are above the flood plains occupied by Bermudian, Rowland, and Bowmansville soils. The Birdsboro soils are nearly level or gently sloping. They occupy small, scattered areas along the major waterways in the northern part of the county.

The Birdsboro soils are deeper, less shaly, and more gravelly than the Penn soils. They are not so brown and lack the gray mottling typical of the moderately well drained to somewhat poorly drained Raritan soils that occur on similar stream terraces. The Birdsboro soils are less shaly and lack the firm, slowly permeable layer in the lower part of the subsoil that is typical of the moderately well drained Readington soils.

In a typical profile of a Birdsboro soil, the surface layer is friable, dark reddish-brown silt loam that is about 8 inches thick. It contains a few river pebbles.

The subsoil is friable, reddish-brown silty clay loam or clay loam. It is 2½ to 3 feet thick.

The substratum is red or reddish-brown sandy loam that is about 2 feet thick and contains considerable gravel. The sandy loam overlies a layer of firm, dusky-red silt loam weathered from the underlying rock. This weathered material grades to soft, weathered, dusky-red shale bedrock at a depth of about 7 feet. Depth to bedrock, however, ranges from 4 to 15 feet.

These are very strongly acid or medium acid soils that are moderately permeable. They have high available moisture capacity and moderate to low natural fertility. Limitations are few if they are used for growing field crops, vegetables, or hay, or if they are used for pasture.

These soils have few limitations to use for residential developments. The areas are small, however, and in many places these soils occur with slowly permeable soils that have a seasonal high water table.

Birdsboro silt loam, 0 to 3 percent slopes (BnA).—This is the soil described as typical for the series. It is on benches scattered along the Schuylkill River and on upland flats along Swamp and Perkiomen Creeks in the northern part of the county. The soil is not extensive, but it is important to the agriculture of this area because it is deep and well drained.

Included with this soil in mapping are small areas in which the plow layer is brown or reddish brown and is only about 6 inches thick. In places as much as 30 percent of the plow layer is gravel. The soil material in some small patches or streaks is only 24 to 36 inches deep over partly weathered, dusky-red shale.

This Birdsboro soil is moderately permeable and has a seasonal high water table that rarely rises to within 4 feet of the surface, even early in spring. The available moisture capacity is high, and the hazard of erosion is slight.

This soil is well suited to corn, wheat, barley, alfalfa, and orchardgrass, and it is used mainly for field crops, including winter small grains. A suitable cropping system for conserving moisture, reducing losses from erosion, and maintaining good tilth and the content of organic matter consists of 2 years of row crops, 1 year of a winter small grain, and at least 1 year of deep-rooted grasses and legumes grown for hay. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil has few limitations to use for residential, light industrial, institutional, or commercial developments. The areas are small, however, and in many places this soil occurs with areas of less permeable soils that have an objectionable high water table. (Capability unit I–2, woodland suitability group 2, community development group 1)

Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded (BnB2).—This soil has a brown or reddish-brown plow layer that is 6 to 8 inches thick. In some places as much as 30 percent of the plow layer is gravel, but much of the gravel is concentrated on the surface. Dusky-red underlying material or shale bedrock is normally at a depth of 4 to 6 feet. This gently sloping soil is on upland benches along the Schuylkill River and Perkiomen Creeks.

Included with this soil in mapping are a few small areas in which the plow layer is darker and thicker than typical. Also included are narrow bands in which shale bedrock is within 24 to 30 inches of the surface.

This Birdsboro soil is moderately permeable and has high available moisture capacity. Erosion is the main hazard in cultivated areas.

This soil is well suited to corn, wheat, barley, vegetables, alfalfa, and orchardgrass. It is used mainly for field crops, including winter small grains, and hay. A suitable cropping system, used with field or contour stripcropping, consists of 2 years of row crops, 1 year of a small grain, and 2 years of grass-legume hay. Crops grown on this soil respond well to moderate, frequent applications of lime and fertilizer. Diversion terraces may be needed on the long slopes to safely carry away excess surface water.

This soil has few limitations for residential, light industrial, commercial, or institutional developments. The areas are generally small and scattered, and they are surrounded in places by soils that are undesirable for developments. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Bouldery Alluvial Land

Bouldery alluvial land (Bo) consists of nearly level and gently sloping areas covered mostly by boulders and stones. It is on flood plains along creeks and waterways in the northern and southwestern parts of the county. The areas in the northern part of the county are covered by large diabase boulders and stones that in some places exceed 12 feet in diameter. These areas occur along Unami Creek and similar waterways with the poorly drained Bowmansville soils and moderately well drained or somewhat poorly drained Rowland soils. The areas in the southern part of the county are small. They are scattered along the narrow bottom lands of streams in steep-walled ravines.

Bouldery alluvial land occurs with the poorly drained Hatboro and moderately well drained or somewhat poorly drained Codorus soils. It varies mainly in the size, number, and kinds of stones and boulders. Included with it in mapping are areas of stone-free soils that are also on flood plains and that are too small to be mapped separately.

This land type is subject to periodic flooding; flooding usually occurs several times each year. Permeability is moderate, but the water table is near or at the surface late in fall and during winter and spring. The supply of moisture held available for plants is low.

This land type is in sparsely wooded areas in parks, camps, farms, and estates. It is too bouldery and stony for farming or for the production of timber. Limitations to its use for residential developments are the hazard of flooding and the large number of boulders and stones. (Capability unit VIIIs–1, woodland suitability group 12, community development group 12)

Bowmansville Series

Deep, poorly drained, gray or grayish-brown silt loams or silty clay loams make up the Bowmansville series. These soils formed in material washed from uplands underlain by shale, sandstone, and diabase. They are nearly level or gently sloping and occur along streams and waterways in the northern two-thirds of the county.

Typically, these soils occur on flood plains with moderately well drained or somewhat poorly drained Rowland soils. They are downslope from the poorly drained Croton soils and the somewhat poorly drained Abbottstown soils. The Bowmansville soils are somewhat deeper over bedrock and have a more friable subsoil than the Croton and Abbottstown soils.

In a typical profile of a Bowmansville soil, the surface layer is friable, dark reddish-brown silt loam mottled with weak red and grayish brown. The surface layer is about 10 inches thick.

The upper part of the subsoil is weak-red silt loam that is mottled with reddish brown and gray and is about 6 inches thick. The lower part of the subsoil is also weak-red silt loam, but it is mottled with yellowish red and gray. It extends to a depth of about 3 feet.

Bedrock is dusky-red shale or brown sandstone. Depth to bedrock ranges from 3 to 8 feet, but it is generally about 4 feet.

These soils are strongly acid and have moderate permeability. The water table is at the surface late in fall, in winter, and in spring. Available moisture capacity is moderate, and natural fertility is moderate to low.

These soils are better suited to pasture than to field crops. They have limitations to use for residential developments but are valuable if they are retained as open land or used for bird sanctuaries or wildlife habitats.

Bowmansville silt loam (Bp).—This is the soil described as typical for the series. It is in small areas on flood plains at the base of slopes and is widely scattered throughout the northern two-thirds of the county.

This soil is on the same flood plains as those on which the Rowland soils occur. Where this soil lies along the edges of the flood plains, it merges with the Croton and Abbottstown soils that have similar slopes. It is adjacent to uplands occupied by the steeper Penn and Klinesville soils.

Included with this soil in mapping are small areas in which bedrock is within 2 to 3 feet of the surface. Some small areas are more sandy throughout than the typical soil.

Permeability is moderate, and this soil has slow surface drainage and is frequently flooded. The available moisture capacity is high. The water table is near the surface or water is ponded on the surface late in fall, in winter, and in spring. The water table is also high for several days following floods or extended wet periods during the growing season. The hazard of erosion is slight.

This soil is used primarily for pasture. It is poorly suited to small grains and alfalfa and is also poorly suited to corn, unless the surface water can be removed readily by installing open drains. Even after surface drains are installed, flooding is still a hazard during the growing season. This soil is well suited to permanent pasture of birdsfoot trefoil, reed canarygrass, and other shallow-rooted grasses and legumes.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit VIw–1, woodland suitability group 8, community development group 12)

Bowmansville silt loam, local alluvium, 0 to 3 percent slopes (BrA).—In places this soil has a thicker, darker surface layer than the one in the profile described as typical for the series. It occupies small, scattered areas at the heads of streams and in drainageways above the normal level of the flood plain (fig. 16). This soil is seldom flooded for any significant length of time. Flooding generally occurs for only a short period after a storm of high intensity. This soil formed in material eroded from the adjacent uplands and deposited on low-lying flats and in depressions and drainageways.

This soil has moderate permeability. Surface drainage is slow or ponded, and a seasonal high water table is at the surface or above the surface late in fall, in winter, and early in spring.

This soil generally occurs in small areas; therefore the cropping system is normally the same as that used for surrounding soils. The soil is well suited to perennial hay or pasture consisting of birdsfoot trefoil, reed canarygrass, and other shallow-rooted grasses and legumes. It is fair to poor for corn and poor for alfalfa and small grains. Drainage can be improved by installing open drains and tile drains if outlets are available. If planting is delayed until the period of excessive moisture has passed in spring, this soil is suited to an occasional row crop that requires only a short period to mature.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–1, woodland suitability group 8, community development group 12)

Bowmansville silt loam, local alluvium, 3 to 8 percent slopes (BrB).—This soil is reddish brown and is mottled with gray. It contains more shale than the soil for which a profile is described as typical for the series. This soil occurs in narrow bands at the heads of streams and in drainageways above the normal level of the flood plain. It formed in material that was eroded from the nearby uplands and deposited in depressions and on the lower slopes. Included with this soil in mapping are small areas in which bedrock is at a depth of only 2 to 3 feet.

Figure 16.—**Area of Bowmansville silt loam, local alluvium, 0 to 3 percent slopes, in a narrow drainageway at the head of a stream. The gentle slopes to the right are occupied by Abbottstown and Readington soils.**

Permeability is moderate, and surface drainage is medium. A seasonal high water table is at the surface late in fall, in winter, and early in spring. This soil is seldom flooded for long periods. It is flooded for short periods after storms of high intensity that occur mainly during the growing season.

Because this soil occurs in narrow areas, the cropping system is usually the same as that used for the surrounding soils. This soil is well suited to perennial hay and pasture consisting of birdsfoot trefoil, reed canarygrass, and other shallow-rooted grasses and legumes. It is fair for corn and for small grains planted in spring, but it is poorly suited to alfalfa and winter small grains. Occasionally, a row crop or a small grain planted in spring may be included in a cropping system in which hay is grown most of the time. Tile help to remove the excess water that accumulates in the soil in spring. It also reduces the amount of water that flows from seeps and springs that persist during the growing season.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–1, woodland suitability group 8, community development group 12)

Brecknock Series

The Brecknock series consists of deep to moderately deep, well-drained, dark grayish-brown channery silt loams. These soils developed on hard, gray or black metamorphosed shale, called hornfels. They are gently sloping to steep and are on broad-topped hills and low ridges in the northern part of the county.

Adjacent to these soils are the moderately well drained or somewhat poorly drained Lehigh and poorly drained Croton soils. On nearby uplands are the Neshaminy and Mount Lucas soils, formed on diabase, and the Penn and Reaville soils, formed on red shale.

In a typical profile of a Brecknock soil, the surface layer is friable, very dark grayish-brown channery silt loam about 8 inches thick. Channers, or fragments of flat rock, make up about 30 percent of this layer.

The subsoil is friable, dark grayish-brown or olive-brown channery silt loam or silty clay loam about 26 inches thick. The content of channers ranges from 35 percent in the upper part of the subsoil to nearly 90 percent in the lower part.

The substratum consists mainly of broken pieces of rock with dark grayish-brown and olive-brown silt loam between the pieces. Depth to bedrock is generally about 4 feet, but it ranges from 2 to 5 feet.

Permeability is moderate, and the available moisture capacity is low to high, depending upon the depth to bedrock. The soils are very strongly acid or strongly acid and have low natural fertility. They vary considerably in their suitability for certain crops and for specific uses in residential areas.

Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded (BsB2).—This soil is less steep than the one described as typical for the series. Also, it has a slightly thicker surface layer and subsoil, and typically, it contains fewer rock channers. It is in scattered, small areas on undulating broad hilltops and gently sloping ridges throughout the northern third of the county.

In some places this soil occurs near Reaville, Penn, and Neshaminy soils. Where it occurs near the Reaville and Penn soils, it is redder than typical for this series and its color approaches a dark reddish gray. Where this soil is near the Neshaminy soils, its color is olive brown or olive gray.

Included with this soil in mapping are small wooded areas in which there is a mulch of partly rotted leaves on the surface. Below the leaves, 1 to 2 inches of very dark gray silt loam and 4 to 6 inches of dark grayish-brown channery silt loam overlie the subsoil. In a few places, the subsoil is brown silt loam that is nearly free of coarse fragments to a depth of 3 to 4 feet.

This Brecknock soil has moderate permeability and moderate available moisture capacity. Surface drainage is medium, and the hazard of erosion is moderate. Natural fertility is low.

This soil is used for the commonly grown field crops, small grains, and hay. To a lesser extent, it is used for pasture and for a few orchards and woodlots. The soil is fairly well suited to small grains, hay, and pasture. It is less well suited to corn, alfalfa, and fruit because of the small supply of moisture during August and September. If water is available, supplemental irrigation helps to maintain good yields and improves the quality of the crops. Where lime and fertilizer are applied, moderate, frequent applications are generally preferred to larger, less frequent ones.

To reduce runoff and to provide protection from erosion, field or contour stripcropping is needed on most fields made up of this soil. A suitable cropping system is one in which row crops and small grains are grown for 1 year each and then grasses and legumes are grown for at least 2 years. It is important to maintain the content of organic matter by growing a cover crop, adding manure, and returning crop residue to the soil.

Bedrock fairly near the surface is a limitation to most uses of this soil for residential developments. Suitability for use as a disposal field for the effluent from septic tanks needs to be determined. This can be done by properly conducting percolation tests where the depth of the soil is adequate. (Capability unit IIe–3, woodland suitability group 4, community development group 3)

Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded (BsC2).—This soil is on hills and ridges in the northern third of the county. It is less steep than the soil for which a profile is described as typical for the series. In some places this soil occurs near Penn, Reaville, and Neshaminy soils. Where it is near the Penn and Reaville soils, it is redder than typical for this series and its color approaches a dark reddish gray. Where it is near the Neshaminy soils, its color is olive brown or olive gray.

Included with this soil in mapping are small wooded areas in which a mulch of partly rotted leaves overlies 2 to 3 inches of very dark gray channery silt loam. Beneath the channery silt loam is 5 to 7 inches of very dark grayish-brown channery silt loam. Also included, on some of the lower slopes, are areas in which the surface layer is 8 to 12 inches thick.

Permeability is moderate, and this soil has moderate available moisture capacity. Surface drainage is medium to rapid, and the hazard of erosion is moderate. Natural fertility is low.

This soil is used for the commonly grown field crops, hay, pasture, fruit, and woodlots. About a third of it is idle and is overgrown with weeds, brush, and cedar trees. The soil is suitable for hay or pasture of drought-resistant grasses and legumes, but is is only fair for corn and winter small grains. Contour stripcropping and a cropping system consisting of 1 year of a row crop, 1 year of a small grain, and 3 or 4 years of hay help to reduce erosion and conserve moisture. The soil can be kept in good tilth by growing a cover crop, adding manure, and incorporating crop residue into it. Where lime and fertilizer are applied, moderate, frequent applications are generally better than larger, less frequent ones.

Bedrock fairly near the surface is a limitation if this soil is used for residential developments or as a disposal field for the effluent from septic tanks. Depth to bedrock should be determined and percolation tests ought to be made at the specific site if a residential development is planned. (Capability unit IIIe–3, woodland suitability group 4, community development group 4)

Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded (BsD2).—The profiile of this soil is the one described as typical for the series. This soil is on hills and ridges in the northern third of the county. In some places it occurs near Penn, Klinesville, and Neshaminy soils. Where it is near the Penn and Klinesville soils, its color ranges to dark reddish gray. Where it is near the Neshaminy soils, its color is olive gray.

Included with this soil in mapping are small wooded areas in which there is a thin layer of partly rotted leaves over 5 to 7 inches of very dark gray channery silt loam. Also included are small areas of Lehigh soils that have similar slopes. Outcrops of bedrock and areas that have many channers on the surface occur near gullies.

This soil has moderate permeability and low to moderate available moisture capacity. Surface drainage is rapid, and the hazard of erosion is severe. Natural fertility is low.

Most of this soil is in young trees that are overcrowded and even aged, or it is overgrown with weeds, brush, and cedar trees. A small acreage is used for the commonly grown field crops and for hay and pasture. The soil is fairly well suited to perennial hay, pasture, and trees and to birdsfoot trefoil, reed canarygrass, tall fescue, smooth bromegrass, and other legumes and grasses that resist drought. It is poorly suited to corn, small grains, and alfalfa.

The hayfields and pastures should be reseeded in alternate field strips or contour strips. Half the strips ought to be planted the first year and the rest the following year. Where lime and fertilizer are applied, moderate, frequent applications are better than larger, less frequent ones. The pastures ought to be rotated frequently so that overgrazing will be prevented. The woodland needs thinning and replanting with white or Virginia pine. (Capability unit IVe–3, woodland suitability group 4, community development group 5)

Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes (BtC).—These soils have a surface layer of friable, dark grayish-brown channery silt loam about 6 inches thick. Their subsoil is dark grayish-brown or olive-brown channery silt loam or channery silty clay loam 15 to 20 inches thick. The substratum is similar to the one in the profile described as typical for the series. About 50 percent of the surface layer is fragments of rock, and the content of these fragments increases with increasing depth. About 90 percent of the lower part of the subsoil is fragments of rock.

These soils are on hills and ridges in the northern third of the county. In places they occur near Penn, Reaville, and Neshaminy soils. Where they occur near the Penn and Reaville soils, their color ranges to dark reddish gray. Near the place where they adjoin the Neshaminy soils, their color is olive gray.

Included with these soils in mapping are small pockets of Lehigh soils. Bedrock crops out on some slopes, and there are occasional springs and seeps.

These Brecknock soils are moderately permeable and have low available moisture capacity. Surface drainage is rapid, and the hazard of erosion is moderate to severe. Natural fertility is low.

These soils are used for the commonly grown field crops and for hay and pasture. A large acreage is idle and is overgrown with weeds, brush, young trees, and cedars. These soils are poorly suited to corn, small grains, and alfalfa, but they are suited to perennial hay or pasture consisting of reed canarygrass, birdsfoot trefoil, tall fescue, and other grasses and legumes that resist drought. The areas in hay and pasture should be reseeded, as required, in alternate field strips or contour strips. Rotation grazing encourages good yields of the better quality forage plants. Moderate, frequent applications of fertilizer and lime are required.

The limited depth and strong slopes are limitations to use of these soils for residential developments. They also restrict use as fields for disposing of the effluent from septic tanks. Suitability for these uses must be decided by determining the depth to bedrock and by properly conducting percolation tests at the specific site. (Capability unit IVe–3, woodland suitability group 4, community development group 4)

Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes (BtD).—These soils have a surface layer of dark grayish-brown or dark olive-gray channery or very channery silt loam that is 6 inches or less thick. Their subsoil is dark grayish-brown or olive-brown very channery silt loam 10 to 18 inches thick. The substratum consists of fractured pieces of bedrock coated with silt

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loam. Bedrock is generally at a depth of 2 to 3 feet, but it crops out on the surface in a few places. These soils are in the northern part of the county.

Included with these soils in mapping are small streaks of Klinesville soils that are redder than these soils. Near the base of the slopes, occasional springs or seeps have developed. In those areas small patches of moderately steep Lehigh soils are mapped with these soils. In some places soils are included that are so shallow that tillage is in the shattered rock of the substratum. A few scattered areas of Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded, are also included.

Permeability is moderate, and the available moisture capacity is low. Surface drainage is very rapid, and there is a severe hazard of erosion. Natural fertility is low.

These soils are used, to some extent, for corn, small grains, hay, and pasture. Most of the acreage is idle and is overgrown with sumac, poison-ivy, cedar trees, and weeds. The soils are suitable for pasture and trees, but they are very poorly suited to field crops and hay. Birdsfoot trefoil and reed canarygrass are fairly suitable for pasture, and white pine and Virginia pine are suitable for replanting areas of woodland. New pasture plantings should be made or the areas should be renovated in alternate contour strips. Half of the strips ought to be planted the first year, and the rest the following year. The pastures need to be rotated frequently to prevent overgrazing and loss of the protective cover of plants. Moderate, frequent applications of fertilizer and lime, applied as a topdressing, are required. (Capability unit VIe–1, woodland suitability group 4, community development group 5)

Brecknock very stony silt loam, 8 to 25 percent slopes (BvD).—This soil is on hills and ridges in the northern part of the county. It has a thin layer of partly rotted leaves, twigs, moss, and roots on the surface. Beneath this thin layer is a layer of very dark gray channery silt loam, about 3 inches thick, over about 7 inches of very dark grayish-brown very stony silt loam. The subsoil and substratum are the same as those in the profile described for the series. The stones on the surface and throughout the profile are thick, flat pieces of metamorphosed shale or hornfels 12 to 30 inches across. Included with this soil in mapping are small areas of Lehigh soils.

Permeability is moderate, and this soil has moderate available moisture capacity. Surface drainage is medium to rapid, and there is a slight to moderate hazard of erosion.

This soil is mostly in woodland consisting of mixed oaks, hickory, sweet birch, beech, and red maple. A few areas have been cleared and cultivated, and a few small areas are in pasture. Some of the areas that were formerly cleared and farmed are now overgrown with young trees, weeds, honeysuckle, and poison-ivy. This soil is suitable for trees. Brush and undesirable species of trees should be removed, and open areas or areas that have only a thin stand of trees ought to be planted to white or Virginia pine.

If this soil is cleared and enough stones are removed to permit the use of machinery, it can be used for pasture. Suitable legumes and grasses are ladino clover, birdsfoot trefoil, reed canarygrass, and smooth bromegrass. The pastures need protection from overgrazing. (Capability unit VIs–2, woodland suitability group 4, community development group 5)

Chalfont Series

In the Chalfont series are deep, somewhat poorly drained, nearly level and gently sloping soils that are very silty throughout. These soils are dark yellowish brown mottled with gray. A thick, very slowly permeable layer in the subsoil impedes the downward movement of water and restricts the growth of roots.

These soils are on flats, in depressions, and on the gentle lower slopes in the central part of the county. They are adjacent to the moderately well drained Lawrenceville (fig. 17) and poorly drained Doylestown soils.

In a typical profile of a Chalfont soil, the surface layer is very friable, dark grayish-brown silt loam about 10 inches thick.

The subsoil is dark yellowish-brown silt loam with many, prominent, gray mottles. It is friable just beneath the surface layer, but it is very firm at a depth of about 14 inches. If the part of the subsoil between a depth of 14 and 48 inches is disturbed, the soil material breaks to large blocks that have a gray surface color and are 8 to 10 inches in diameter. The blocks readily break to thin, firm and brittle plates. In places, below a depth of 48 inches, there are many pieces of shale. Depth to bedrock is about 6 feet, but it ranges from 4 to 8 feet.

These soils are slowly permeable and have high available moisture capacity. Plants cannot use all of the moisture, however, because the growth of roots is restricted in the subsoil. The soils are strongly acid to slightly acid.

These soils are suited to hay and pasture. They have severe limitations for use as developments.

Chalfont silt loam, 0 to 3 percent slopes (CfA).—This soil is in depressions, on the lower flats, and on broad uplands in the central part of the county. The areas extend from Norristown to Hatfield and Hatboro along the line between Bucks and Montgomery Counties. The profile of this soil is the one described as typical for the series.

In some places in drainageways, the surface layer of this soil is dark grayish-brown silt loam as much as 18 inches thick. In places where the soil is eroded and part of the subsoil has been mixed with the surface layer by tillage, yellowish-brown and gray colors appear in the surface layer. Narrow, gently sloping areas occur adjacent to the drainageways. In a few areas, the reddish-brown shaly substratum is only 24 to 36 inches beneath the surface.

This soil is slowly permeable, and the water table is at the surface or near the surface late in fall, in winter, and early in spring. Surface drainage is slow to medium, and there is a slight to moderate hazard of erosion. This soil has high moisture-holding capacity, but the restricted growth of roots prevents the plants from using all of the moisture available.

This soil is used for general farm crops and for hay and pasture. It is better suited to perennial hay crops and to pastures of grasses and legumes that tolerate wetness than to other uses. Birdsfoot trefoil and reed canarygrass are suitable for both hay and pasture. The

Figure 17.—Area of dark-colored, somewhat poorly drained Chalfont silt loam in depressions near Jeffersonville. The light-colored areas are moderately well drained Lawrenceville soils.

soil is poorly suited to alfalfa and small grains grown in winter. It is fair for cultivated crops that can be planted in spring after the level of the water table falls. If cultivated crops are grown, a suggested cropping system consists of 1 year of a row crop, 1 year of a small grain planted in spring, and at least 3 years of grass-legume hay of adapted varieties. Planting should be done in graded rows, or graded stripcropping used on the longer slopes.

Limitations are severe to use of this soil for residential, light industrial, commercial, or institutional developments. The main limitations are a seasonal high water table, slow permeability, susceptibility to erosion, and lack of stability in the soil material. (Capability unit IIIw–2, woodland suitability group 7, community development group 11)

Chalfont silt loam, 3 to 8 percent slopes, moderately eroded (CfB2).—This soil has a thinner surface layer than the one in the profile described as typical for the series. Gray mottling begins at a depth of 12 to 15 inches, and the firm, slowly permeable part of the subsoil is at a depth of 16 to 24 inches. This soil is on broad, gently undulating uplands adjacent to drainageways in the central part of the county. The areas extend from Norristown to Hatfield and Hatboro along the line between Bucks and Montgomery Counties. In some places the shaly substratum is only about 24 inches beneath the surface.

Included with this soil in mapping are nearly level areas and areas in depressions or drainageways where the surface layer is thicker than normal for this soil. Also included are small, severely eroded areas in which the plow layer is brown and is streaked with yellowish brown and gray.

This Chalfont soil is moderately to slowly permeable to a depth of 18 to 24 inches, and it is slowly permeable below that depth. The water table is within a foot of the surface late in fall, in winter, and early in spring. Surface drainage is medium. The hazard of erosion is moderate in many places, but it is severe on the long slopes. The available moisture capacity is high, but plants cannot use all of the available moisture, because of the restricted growth of their roots in the subsoil.

This soil is used for the commonly grown row crops, small grains, hay, and pasture. Wetness makes it unsuitable for alfalfa and for small grains grown in winter. The soil is fair for cultivated crops, such as corn and soybeans, and fair to poor for small grains sown in spring. It is suited to hay and pasture consisting of birdsfoot trefoil, reed canarygrass, ladino clover, timothy, and bluegrass. Graded stripcropping is needed where cultivated crops are to be grown. Where graded stripcropping is practiced, a suitable cropping system consists of 1 year of a row crop followed by a cover crop, 1 year of a small grain planted in spring, and at least 3 years of grass-legume hay of adapted varieties.

This soil has severe limitations to use for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–3, woodland suitability group 7, community development group 11)

Chester Series

The Chester series consists of deep, well-drained, dark yellowish-brown silt loams formed in material weathered from schist and gneiss. These soils are nearly level or gently sloping and are on broad, gently undulating uplands in the southern part of the county.

The Chester soils are adjacent to the moderately well drained Glenville soils and moderately deep to deep, well drained Glenelg soils. Near them on the steeper slopes of hills and ridges are the Manor soils, which are well drained and moderately deep or deep over bedrock.

In a typical profile of a Chester soil, the surface layer is very friable, dark-brown silt loam about 8 inches thick.

The subsoil is dark yellowish-brown silt loam or silty clay loam about 30 inches thick. It is slightly firm in place, but it readily breaks to small, rounded blocks if the soil is disturbed.

The substratum is generally thick and consists of dark-brown or dark grayish-brown sandy loam or silt loam. In places it has a slippery feel when rubbed between the fingers, and it contains many small pieces of schist or gneiss. Typically, bedrock is at a depth of about 6 feet. In some areas, however, the substratum is only about 1 foot thick and bedrock is within 5 feet of the surface. In other areas the substratum consists of deeply weathered bedrock 9 feet or more thick.

These soils are strongly acid or medium acid. They are moderately permeable and have high available moisture capacity and moderate natural fertility.

The soils are well suited to all the crops commonly grown in the county. They have few limitations to use for residential developments.

Chester silt loam, 0 to 3 percent slopes, moderately eroded (CgA2).—This soil is less sloping than the soil for which a profile is described as typical for the series, and its surface layer is about 10 inches thick. It is on broad, flat uplands in the southern part of the county. The areas are not large, nor are they extensive.

Included with this soil in mapping are small areas that are in slight depressions and that have a dark-brown surface layer as much as 15 inches thick. The thick surface layer is the result of deposition of material that was eroded from surrounding soils. In those areas the soil is free of coarse fragments and bedrock is below a

depth of 5 feet. Also included are a few broad areas in which the soil is as shallow as 30 inches over the underlying material.

This Chester soil is moderately permeable and has high available moisture capacity. The hazard of erosion is moderate to slight.

This soil is well suited to a number of different field crops, vegetables, small fruits, hay, and pasture. Crops grown extensively are corn, wheat, barley, and alfalfa (fig. 18). The crops respond well to moderate applications of lime and fertilizer. Contour cultivation ought to be practiced where the slopes are stronger than 2 percent. With contour cultivation, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 2 years of grass-legume hay. If 2 years of row crops are desired, field stripcropping is desirable and a cover crop is needed to protect the soil throughout the winter.

This soil has few limitations to use for residential, light industrial, commercial, or institutional developments. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Chester silt loam, 3 to 8 percent slopes, moderately eroded (CgB2).—This soil is on undulating uplands and on gently sloping ridgetops in the southern part of the county. Its profile is the one described as typical for the series. In some places, however, the surface layer is lighter colored than the one in the profile described, or it contains yellowish-brown patches where part of the subsoil has been mixed with the surface soil. Some areas have a thicker surface layer than that in the profile described.

Included with this soil in mapping are small areas in which the soil is only about 30 inches deep over the underlying material. In those areas the soil is free of coarse fragments and bedrock is below a depth of 5 feet.

This soil is moderately permeable and has high available moisture capacity. The hazard of erosion is moderate to severe.

This soil is well suited to small grains and a number of other field crops, and to vegetables, fruit, hay, and pasture.

Figure 18.—**A field of Chester silt loam, 0 to 3 percent slopes, moderately eroded, that has recently been planted to corn. A housing development is encroaching in the background.**

Crops grown extensively are corn, wheat, barley, and alfalfa. The crops respond well to moderate or large applications of lime and fertilizer. Field or contour stripcropping is needed to reduce losses from erosion and to conserve moisture. A cropping system consisting of 2 years of row crops, 1 year of a small grain, and 2 years of hay helps to maintain good tilth, conserve moisture, and reduce erosion. A cover crop is needed to provide protection in winter, and crop residue ought to be returned to the soil.

This soil has few limitations to use for residential, light industrial, commercial, or institutional developments. Precautions are needed, however, because of the hazard of erosion. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Codorus Series

In the Codorus series are deep, moderately well drained or somewhat poorly drained, nearly level silt loams on flood plains in the southern part of the county. These soils formed in soil material washed from uplands underlain by schist, gneiss, limestone, and quartzite.

These soils occur on flood plains with the poorly drained Hatboro soils. On adjacent uplands are the well-drained Glenelg and Manor soils.

In a typical profile of a Codorus soil, the surface layer is friable, dark-brown silt loam about 8 inches thick. The surface layer rests directly on the substratum.

The substratum is brown or yellowish-brown silt loam. It contains flakes of mica that glisten in the sunlight and impart a greasy feel to the soil. Light brownish-gray and strong-brown mottles are common between a depth of 15 and 20 inches. Between a depth of 30 and 54 inches, the substratum is light yellowish-brown loam and contains a few pebbles and many mica flakes. The soil material below a depth of 54 inches consists of stratified sand, silt, and gravel. In many places the substratum contains layers of gray soil material. Depth to bedrock ranges from 3 to 6 feet.

Codorus soils that formed in material eroded from uplands underlain by granite gneiss and quartzite are more sandy than those formed in material eroded from uplands underlain by schist or limestone.

These soils are medium acid. They are moderately permeable and have a high water table late in fall, in winter, and early in spring. These soils are subject to flooding during winter and early in spring. They are also flooded occasionally during the growing season.

These soils are suited to hay and pasture, and they are also suited to corn and small grains sown in spring. The size, shape, and location of the field is likely to determine the use of the soils. Susceptibility to flooding is a limitation to use of these soils for residential, light industrial, commercial, or institutional developments. The soils have value for recreational areas or for open spaces.

Codorus silt loam (Ch).—This is the only Codorus soil mapped in the county, and its profile is the one described as typical for the series. This soil is in narrow strips along most of the streams in the southern part of the county. In a few small areas, it is free of gray mottling to a depth of more than 36 inches.

Included with this soil in mapping are areas of Hatboro soils. These areas are too small to be mapped separately.

This Codorus soil is subject to flooding in winter, early in spring, and sometimes in summer after a storm of high intensity. The water table is at or near the surface late in fall, in winter, and early in spring, but it rarely rises to within 30 inches of the surface during the growing season. The available moisture capacity is high. The hazard of erosion is slight because of the gentle slopes.

This soil is suited to grass and is used mainly for pasture and for sod in golf courses, parks, and estates. It is also suitable for corn, soybeans, and small grains grown in spring, where the size, shape, and location of the fields do not limit use. Occasional flooding is a hazard during the growing season, but tile drains and open drains help to remove the excess water.

The seasonal high water table and the hazard of flooding are severe limitations to use of this soil for residential, light industrial, commercial, or institutional developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Croton Series

Deep, poorly drained, nearly level or gently sloping soils formed on shale and sandstone make up the Croton series. These soils are on broad uplands, on low-lying flats, in depressions, and on the concave lower slopes. Their subsoil is thick and slowly permeable, and it impedes the downward movement of water and the growth of roots.

These soils are redder than the soils of the Doylestown series. They occur throughout the northern two-thirds of the county, adjacent to the somewhat poorly drained Abbottstown, moderately well drained Readington, and shallow, moderately well drained or somewhat poorly drained Reaville soils. On the nearby uplands are the well-drained, reddish-brown Penn and the brown or yellowish-brown Lansdale soils.

In a typical profile of a Croton soil, the surface layer is friable, weak-red silt loam about 9 inches thick. Beneath the surface layer, the soil material to a depth of 12 to 14 inches is friable silt loam mottled with reddish yellow and reddish gray.

The subsoil is dark reddish-gray to weak-red silty clay loam, 2 to 3 feet thick, that is mottled with yellowish red and light gray. It is firm in place. If the soil is disturbed, however, the material in the subsoil breaks to large columns that have thick gray coatings. These large columns, called prisms, readily break, in turn, to many smaller blocks. The subsoil becomes redder and more shaly with increasing depth. It is reddest just above the dusky-red, highly weathered shale bedrock. Depth to bedrock is about 4 feet, but it ranges from 3 to 5 feet.

These soils are slowly permeable and have high available moisture capacity. They are very strongly acid to moderately acid and have moderate natural fertility.

The Croton soils are suited to perennial hay and pasture. They have severe limitations if used for developments.

Croton silt loam, 0 to 3 percent slopes (CrA).—The profile of this soil is the one described as typical for the series. This soil is in low-lying areas and on broad upland flats, in depressions, and in drainageways. It is widely scattered in small and large areas throughout the northern two-thirds of the county. On some flats at the higher elevations, this soil is more shaly throughout and has a thinner surface layer than the one described as typical for the series. In those areas the surface layer is generally 8 to 10 inches thick. In the central part of the county, the soil material in the upper 24 to 30 inches is very silty and is predominantly gray. In depressions and drainageways, the surface layer is as much as 18 inches thick.

This soil is slowly permeable and has a high water table. The water table is at the surface late in fall, in winter, and early in spring. Surface runoff is slow, and water sometimes accumulates in low pockets. The soil is slow to dry out in spring and during the growing season, and it is wet for several days after a period of heavy rainfall. The hazard of erosion is slight, except on long upland slopes of 2 to 3 percent. The available moisture capacity is high. As a rule, however, plants cannot use all of the available moisture, because of the restricted growth of their roots in the subsoil.

This soil is suited to perennial hay and to pasture consisting of shallow-rooted grasses and legumes that tolerate wetness. It is used mainly for pasture, but some areas are used for general field crops. In areas adjacent to cities, much of this soil is in grass on golf courses and in areas surrounding industries and institutions. Large tracts near communities are overgrown with weeds and brush.

Open drains help to remove the surface water. Diversion terraces on the slopes above areas of this soil may reduce wetness caused by seeps and springs. Cultivated crops that require only a short season to mature should be planted in graded rows. On uplands, graded contour strips help to reduce the danger of erosion on the long slopes.

This soil has severe limitations to use for residential, light industrial, commercial, or institutional developments. (Capability unit IVw–1, woodland suitability group 9, community development group 11)

Croton silt loam, 3 to 8 percent slopes, moderately eroded (CrB2).—This soil has a thinner surface layer than the one in the profile described as typical for the series. The surface layer is generally between 6 and 10 inches thick and is underlain by a subsoil of reddish silty clay loam mottled with gray. In some places, however, there are small uneroded or only slightly eroded areas where the surface layer is thicker. This soil is on undulating uplands and on gentle side slopes.

Near Lansdale and Norristown, this soil is very silty and contains only a few pieces of stone above a depth of 24 to 36 inches. South of Norristown and near Hatboro and Ambler, the profile contains more sand than is in the profile described as typical for the series and gray and yellowish-brown colors are predominant. At a higher elevation in the northern part of the county, this soil contains many pieces of shale, and bedrock is at a depth of only about 3 feet. In that vicinity some areas of this soil are dark gray or olive gray mottled with light gray.

This soil is slowly permeable and has a high water table (fig. 19). The water table is at a depth of only 6 inches, or water is ponded on the surface during winter and early in spring. The soil is slow to dry out in spring.

Figure 19.—**Area of poorly drained Croton silt loam in a drainageway through areas of Penn, Klinesville, and Reaville soils. The vegetation is cattails.**

During the growing season, some spots are wet for several days after a period of heavy rainfall. Some springs and seeps persist throughout the growing season. Surface drainage is generally medium, but it is slow in some pockets. The hazard of erosion is moderate in most places. It is severe in some parts of the uplands where the slopes are long and are between 6 and 8 percent. The available moisture capacity is high. As a rule, however, plants cannot use all of the available moisture, because of the restricted growth of their roots in the subsoil.

On most farms the same cropping system is used for this soil as is used for the other soils in a field. Some areas are kept in hay or pasture.

In suburban areas many fields where this soil occurs are idle. Other areas are in permanent grass in golf courses and in areas adjacent to residential, industrial, or institutional developments. This soil is suited to pasture and perennial hay, and it is well suited to birdsfoot trefoil and reed canarygrass grown for pasture or hay. This soil is fair to poor for corn, soybeans, small grains sown in spring, and vegetables. Wetness makes it poorly suited to alfalfa and winter small grains. If cultivated crops are grown, they should be planted in graded strips, mainly to help in reseeding areas of hay or pasture. Diversion terraces that lead to a grassed waterway help to remove excess surface water and may be helpful in intercepting the water from seeps or springs.

This soil has severe limitations if used for residential, light industrial, commercial, or institutional developments. It also has severe limitations if it is used as a disposal field for the effluent from septic tanks. (Capability unit IVw–2, woodland suitability group 9, community development group 11)

Croton very stony silt loam, 0 to 8 percent slopes (CsB).—This soil is more grayish than the one for which a profile is described as typical for the series. Also, it has many rounded stones and boulders, as much as 4 feet in diameter, on the surface and throughout the profile. This soil is on flats and in depressions in small areas of irregular shape in the northern third of the county. The total acreage is small.

Permeability is slow, and this soil has a high water table late in fall, in winter, and early in spring. Surface drainage is also slow, and water often accumulates on the surface. The hazard of erosion is slight. The supply of moisture held available for plants is moderate to low.

This soil is mainly in pasture or trees. It is suitable for woodland or wildlife habitats, but the larger, less stony areas can be used for pasture of native grasses. Limitations are severe for residential developments. (Capability unit VIIs–3, woodland suitability group 9, community development group 11)

Doylestown Series

The Doylestown series consists of deep, poorly drained, gray soils that are nearly level or gently sloping and are silty. These soils formed in windblown silt on low-lying flats, in depressions, and on smooth, broad uplands in the central part of the county. They have a thick, slowly permeable subsoil that impedes the downward movement of water and the growth of roots.

The Doylestown soils are adjacent to silty Chalfont soils (fig. 20). On the surrounding uplands are the Lawrenceville soils.

In a typical Doylestown soil, the surface layer is friable, very dark grayish-brown silt loam 8 to 10 inches thick.

The subsoil is mainly gray silt loam about 36 inches thick, but it contains patches and streaks of yellowish brown and strong brown. If the soil is disturbed, the subsoil breaks to large columns 6 to 8 inches in diameter, and these columns, in turn, back readily to smaller blocks and flat plates. The upper part of the subsoil is friable, but the soil material is very firm below a depth of about 18 inches. Depth to bedrock ranges from 4 to 8 feet.

Permeability is slow, and the soils have high available moisture capacity. They are moderately acid to slightly acid and have moderate to low natural fertility.

These soils are suited to perennial hay and pasture. They have severe limitations for residential developments.

Doylestown silt loam, 0 to 3 percent slopes (DsA).—This soil is in depressions and on low-lying flats. It occurs in the central part of the county, especially near Lansdale. The profile is the one described as typical for the series. In some places, however, the surface layer contains streaks or patches of gray and yellowish brown.

This soil is slowly permeable and has a high water table near the surface late in fall, in winter, and in spring. Surface drainage is slow, and at times, water accumulates on the surface. The hazard of erosion is slight. The available moisture capacity is high. As a rule, however, plants cannot use all the moisture available, because of the restricted growth of their roots in the subsoil.

This soil is used for general field crops, hay, and pasture. Much of the acreage is idle and is overgrown with grass, brush, and trees. The soil is suited to pasture and perennial hay, and reed canarygrass and birdsfoot trefoil are well suited to those purposes. The soil has severe limitations if it is used for cultivated crops that require

Figure 20.—**A typical landscape showing a Doylestown soil near areas of Chalfont and Lawrenceville soils. The Doylestown soil is in the foreground, the Chalfont soil is in the shallow depressions in the center, and the Lawrenceville soil is on the uplands in the background.**

a long time to mature and if it is used for small grains grown in winter. Corn for silage, and other row crops that require only a short growing season, can be grown if surface drainage is improved by planting the crop in graded rows and providing open drains. Yields, however, are likely to be low.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IVw–1, woodland suitability group 9, community development group 11)

Doylestown silt loam, 3 to 8 percent slopes, moderately eroded (DsB2).—This soil has a grayish-brown or dark-gray surface layer that is 6 to 8 inches thick. The surface layer has patches and streaks of yellowish brown and gray in many places. The soil is in small areas scattered throughout undulating uplands and in bands near the foot of long, gentle slopes.

In small areas in depressions and drainageways, this soil has a surface layer like the one in the profile described as typical for the series. Where this soil adjoins areas of Chalfont soils, the upper part of the subsoil is brown and is prominently mottled with gray.

This soil is slowly permeable and has a high water table at or near the surface late in fall, in winter, and early in spring. Surface drainage is medium to slow, and the hazard of erosion is moderate to slight. The available moisture capacity is high. As a rule, however, plants cannot reach all the moisture available, because of the restricted growth of their roots in the subsoil.

This soil is used for general field crops, hay, and pasture, but part of the acreage is idle. The soil is suited to hay and pasture, and it is poor to fair for cultivated crops that require only a short season to mature. It is well suited to reed canarygrass and birdsfoot trefoil, fair to poor for corn grown for silage, and poor for alfalfa and winter small grains. Perennial hay or pasture should be seeded in graded contour strips.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IVw–2, woodland suitability group 9, community development group 11)

Duffield Series

In the Duffield series are deep, well-drained, gently sloping to moderately steep soils formed on limestone. These soils are on undulating uplands in the south-central part of the county. They form a narrow belt that extends from Valley Forge State Park through the town of Plymouth Meeting to just west of Willow Grove.

The Duffield soils are adjacent to the low-lying, very silty Lawrenceville soils. They occur with well-drained Lansdale, Penn, Edgemont, Manor, and Glenelg soils, which are on nearby hills and ridges.

In a typical profile of a Duffield soil, the surface layer is very friable, dark grayish-brown silt loam. It is about 6 inches thick.

The subsoil is mainly friable, strong-brown to yellowish-red silty clay loam, but the extreme upper and lower parts have a texture of silt loam. The subsoil is about 5 feet thick. When soil material from the subsoil is removed, it readily breaks to many small blocks that have smooth, flat surfaces. These blocks can be handled without breaking, but they can be crushed between the thumb and forefinger.

The substratum is strong-brown silt loam about 5 feet thick. Dark-gray limestone bedrock is generally at a depth of about 10 feet, but the depth ranges from 4 to 12 feet.

The Duffield soils are moderately permeable and have high available moisture capacity. They are strongly acid to slightly acid and have high natural fertility.

These soils are well suited to all the crops commonly grown in the county. They have few limitations if used for developments.

Duffield silt loam, 3 to 8 percent slopes, moderately eroded (DuB2).—This soil is on broad, undulating uplands in the limestone valley in the south-central part of the

county. It occupies moderately large areas in a belt about 2 miles wide that extends from Valley Forge State Park to Willow Grove. Its profile is the one described as typical for the series.

Included with this soil in mapping are small areas in which the slopes are less than 3 percent. In slight depressions and on the lower slopes, the surface layer is thicker than typical because a small amount of soil material has been deposited on it. In some places there are lighter colored patches where plowing has mixed part of the subsoil into the surface layer. Near Conshohocken and along the southern edge of the limestone valley, this soil is shallower over bedrock and contains more mica than typical. As much as 35 percent of it consists of fragments of rock. In a few small areas, the subsoil is red silty clay or silty clay loam. On the lower part of gentle slopes, the soil material in the uppermost 1 to 2 feet of the subsoil is yellowish-brown silt loam in which there is a high proportion of silt.

Permeability is moderate, and this soil has high available moisture capacity. Surface runoff is medium, and there is a moderate hazard of erosion. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil is used for general field crops, nursery stock, hay, and pasture. Also, a large acreage is in sod and is used for golf courses. This soil is well suited to corn, vegetables, nursery stock, small grains, and alfalfa. Growing crops in field or contour strips and using a cropping system consisting of 2 years of row crops, 1 year of a small grain, and 2 years of grass-legume hay will conserve moisture, reduce losses from erosion, and help to maintain good tilth. A cover crop ought to be planted with the row crop to provide protection in winter, and crop residue ought to be returned to the soil.

This soil has few limitations for residential, light industrial, commercial, or institutional developments. Possible solution channels and sinkholes or caves in the limestone bedrock, however, make careful investigation of the site necessary before roads are constructed or large or heavy structures are built. This soil is unstable and is subject to severe erosion if it is disturbed. If it is used as a disposal field for the effluent from septic tanks, solution channels in the bedrock may allow contamination of the ground water. (Capability unit IIe–1, woodland suitability group 2, community development group 1)

Duffield silt loam, 8 to 15 percent slopes, moderately eroded (DuC2).—This soil is steeper than the one for which a profile is described as typical for the series, and it has a subsoil that is only 2 to 4 feet thick in most places. It is in the undulating uplands of the limestone valley. This valley extends in a band about 2 miles wide from Valley Forge State Park to a point near Willow Grove. Along the southern edge of the valley, this soil is shallower over bedrock than in other areas and it contains more mica and more channers. In some places on toe slopes, the surface layer is 10 to 15 inches thick.

Permeability is moderate, and this soil has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

Most of the acreage is in grass sod in parks or golf courses, or in areas surrounding institutions, estates, and industries. Part of the acreage is idle, and the rest of it that is farmed is used for commonly grown field crops, nursery stock, fruit, hay, and pasture. This soil is well suited to corn, vegetables, small grains, and alfalfa. Moisture can be conserved and losses from erosion reduced by farming in contour strips and using a suitable cropping system. Such a cropping system may consist of 1 year of a row crop, 1 year of a small grain, and 2 or more years of hay. The crop residue should be returned to the soil.

This soil has few limitations for residential developments. If it is used intensively as a disposal field for the effluent from septic tanks, however, the ground water may become contaminated. Contamination may take place because the effluent is not filtered properly and moves rapidly through the solution channels in the bedrock. Where this soil is disturbed, it is unstable and is subject to severe erosion. (Capability unit IIIe–1, woodland suitability group 2, community development group 2)

Duffield silt loam, 8 to 15 percent slopes, severely eroded (DuC3).—This soil has a surface layer of brown silt loam or silty clay loam 5 to 6 inches thick. The subsoil is like the one in the profile described as typical for the series, except that it is only 1½ to 3 feet thick. In most places the substratum is between 2 and 4 feet thick and bedrock is at a depth of 4 to 6 feet. This soil is on undulating uplands of the narrow limestone valley that extends from Valley Forge State Park to a point near Willow Grove. The slopes are short.

In some places where erosion has been active or this soil is near gullies, there are patches where the surface layer is strong brown. In a few places, bedrock crops out on the surface.

Included with this soil in mapping are areas of soils that are more channery throughout than this soil. Also included are areas of soils that have a micaceous substratum.

Permeability is moderate, and this soil has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

Most of the acreage is idle or is in industrial and residential developments. Part of it is in sod in parks and golf courses. A small acreage is used for general farm crops and pasture. This soil is fair for corn, winter small grains, and fruit. It is better suited, however, to perennial hay and pasture. If this soil is cultivated, the crops ought to be planted in contour strips and a cropping system used that consists of 1 year of a row crop, 1 year of a winter small grain, and at least 3 years of deep-rooted grasses and legumes grown for hay. The crop residue ought to be returned to the soil, and diversion terraces may be needed on the long slopes.

Where this soil is used for residential developments, it needs a protective cover of grass, shrubs, or trees. The strong slope is a limitation if the soil is used for residential developments. This soil erodes easily if it is disturbed. Solution channels in the bedrock may allow contamination of the ground water if this soil is used intensively as a disposal field for the effluent from septic tanks. (Capability unit IVe–1, woodland suitability group 2, community development group 2)

Edgemont Series

In the Edgemont series are moderately deep to deep, well-drained channery loams that are gently sloping to steep. These soils formed in material weathered from

quartzite and quartz schist. They are on hills and ridges in the south-central part of the county and are widely scattered along a line that extends from Valley Forge State Park to just west of Bryn Athyn.

These soils occur on uplands, mainly with the Glenelg and Manor soils, and they are adjacent to the Lawrenceville, Chalfont, and Doylestown soils of association 10. The Edgemont soils are coarser textured than the Glenelg soils. They are less red than the Penn soils, finer textured than the Lansdale soils, and deeper and less micaceous than the Manor soils. The Edgemont soils are at a higher elevation than the Duffield soils, which are adjacent, and they are coarser textured and more channery than those soils.

In a typical profile of an Edgemont soil, the surface layer is very friable, dark grayish-brown channery loam about 8 inches thick. Between 20 and 35 percent of the surface layer consists of flat pieces of rock.

The subsoil is yellowish-brown to brown channery loam about 3 feet thick. From 10 to 30 percent of the subsoil consists of flat pieces of rock.

The substratum is brown very channery sandy loam that is about 1 foot thick. From 40 to 80 percent of it is flat pieces of rock. Gray to brown quartz schist and quartzite bedrock are generally at a depth of about 5 feet, but the depth ranges from 3 to 5 feet.

Permeability is moderately rapid, and the amount of moisture held available for plants is moderate to high, depending on the depth to bedrock. These soils are very strongly acid or strongly acid and have low to moderate natural fertility. A moderate to large amount of lime and fertilizer, in frequent applications, is needed.

These soils are well suited to a number of different field crops and to fruit, hay, and pasture. The high content of stones and the steep slopes are the principal limitations to use for developments.

Edgemont channery loam, 3 to 8 percent slopes, moderately eroded (EcB2).—The profile of this soil is the one described as typical for the series. This soil is on undulating hilltops and ridges in the south-central part of the county. Included with it in mapping are a few narrow flats where the gradient of the slopes is less than 3 percent.

Where this soil is in slight depressions and on the lower toe slopes, its surface layer is 10 to 15 inches thick. In some wooded areas, the surface foot of soil material consists of a layer of leaves and of leaf mold, about 2 inches thick, over about 4 inches of very dark gray channery sandy loam. Beneath the channery sandy loam is about 6 inches of grayish-brown channery loam.

Near Fort Washington State Park, the profile of this soil is more silty than the one described as typical for the series and the color of the subsoil is reddish brown in some places. Also, bedrock is at a depth of only 2 feet on some of the narrow ridgetops.

Included with this soil in mapping are areas in which the soil material above the substratum consists of about 2 feet of silt loam that contains a few fragments of rock. The substratum in those areas is like the one in the profile described as typical for the series.

This soil has moderately rapid permeability and moderate to high available moisture capacity. Surface runoff is medium, and there is a moderate hazard of erosion. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil is mainly in parks and golf courses, or in areas that surround estates, institutions, or residential developments. Only a small acreage is farmed. This soil is fairly well suited to most field crops and to hay and pasture. If cultivated crops are grown, however, they should be planted in field or contour strips. A suitable cropping system, where the crops are planted in strips, consists of 2 years of row crops followed by a cover crop the first year, 1 year of a winter small grain, and 2 years of grass-legume hay.

Bedrock near the surface is a moderate limitation to use of this soil for residential, light industrial, commercial, or institutional developments. It is also a limitation to use of this soil as a disposal field for the effluent from septic tanks. (Capability unit IIe–2, woodland suitability group 3, community development group 1)

Edgemont channery loam, 8 to 15 percent slopes, moderately eroded (EcC2).—This soil is steeper and shallower over bedrock than the one for which a profile is described as typical for the series. The subsoil is only 2 to 2½ feet thick over about ½ to 1 foot of very channery sandy loam. In most places bedrock is at a depth of 3 to 4 feet. This soil is on hills and ridge slopes in the south-central part of the county. It is near areas of Manor and Glenelg soils on the adjacent hilly uplands.

In a few wooded areas, this soil has a layer of leaves and leaf mold on the surface like that described for wooded areas of Edgemont channery loam, 3 to 8 percent slopes, moderately eroded, and the soil material is about the same to a depth of about 1 foot as that in the less sloping Edgemont soil. Near Fort Washington State Park, the profile of this soil is more silty than the one described as typical for the series, and the color of the subsoil ranges to reddish brown. In a few places bedrock is only 2 feet beneath the surface. Included with this soil in mapping are small areas of Penn, Manor, and Glenelg soils.

This Edgemont soil is moderately permeable and has moderate available moisture capacity. Surface runoff is medium to rapid, and there is a moderate hazard of erosion. Crops grown on this soil respond well to large applications of lime and fertilizer.

Most areas of this soil are in golf courses and parks. Part of the acreage is idle, and part of it surrounds estates, institutions, and housing developments. Only a small acreage is farmed. The soil is fairly well suited to corn, winter small grains, alfalfa, and nursery stock. If cultivated crops are grown, however, planting should be done in field or contour strips. A suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume hay.

Because of its strong slopes, this soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It also has moderate limitations for use as a disposal field for the effluent from septic tanks. If a large amount of effluent is discharged on the steeper slopes, seepage downslope may result. (Capability unit IIIe–2, woodland suitability group 3, community development group 2)

Edgemont channery loam, 15 to 25 percent slopes, moderately eroded (EcD2).—This soil is steeper and shallower than the one for which a profile is described as

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typical for the series. The surface layer consists of about 6 inches of dark grayish-brown channery loam or channery sandy loam. The subsoil is 18 to 30 inches thick and is underlain by 4 to 12 inches of very channery sandy loam. This soil occupies sparsely scattered areas on hills and ridge slopes in the south-central part of the county. The areas are in a belt that extends from the Valley Forge State Park to Bryn Athyn. On adjacent slopes are the Manor, Glenelg, and Lansdale soils.

A part of the acreage is wooded. In those areas the surface layer is dark colored; the soil material, to a depth of about 1 foot, is like that described for wooded areas of Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.

In areas near Fort Washington, this soil is more silty than typical and small areas of Manor and Glenelg soils are included with it in mapping. Also included are areas where the soil is severely eroded. In those areas the surface layer is very channery loam 4 to 6 inches thick, and bedrock is generally 2½ to 4 feet beneath the surface. Other inclusions consist of small areas of moderately eroded Duffield soils that have slopes of 15 to 25 percent. These Duffield soils are normally adjacent to and lower lying than the Edgemont soils and have received some coarse-textured material from the Edgemont soils. Bedrock crops out in a few places.

This Edgemont soil has moderately rapid permeability and moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

A large part of the acreage is in golf courses and parks or has been landscaped and surrounds estates, institutions, and housing developments. If this soil is farmed, it is suited to perennial hay and pasture. Corn and small grains can be grown in field or contour strips, in a cropping system consisting of 1 year of a row crop, 1 year of a winter small grain, and 4 years of grass-legume hay. The long slopes need to be protected by diversion terraces.

This soil has moderate to severe limitations for residential developments. It has severe limitations for light industrial, commercial, and institutional developments. (Capability unit IVe–2, woodland suitability group 3, community development group 5)

Edgemont very stony loam, 8 to 25 percent slopes (EsD).—The surface layer of this soil consists of 2 to 3 inches of fresh leaves and leaf mold over a layer, 3 to 4 inches thick, of very dark gray or black very stony loam. Below this is about 4 inches of grayish-brown very stony loam. The subsoil and substratum are similar to those in the profile described as typical for the series. Flat pieces of quartzite or quartz schist, 2 to 10 inches thick and 10 to 24 inches across, are scattered throughout the profile. Stones cover about 1 to 5 percent of the surface. This soil is on hills and ridges in the south-central part of the county. The largest areas are in Valley Forge State Park.

Included with this soil in mapping are nearly level and gently sloping areas on narrow ridges and hilltops. Small areas of Manor and Glenelg soils are also included.

This Edgemont soil has moderately rapid permeability and moderate to high available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight.

This soil is mainly in woods and is in parks or adjacent to estates and residential developments. It is suitable for pasture, but it is better suited to trees. In wooded areas the stands consist of different kinds of oak, tulip-poplar, ash, red maple, and dogwood. Undesirable species and brush ought to be removed, and open areas or areas where the stand is thin should be planted to white or Virginia pine.

The strong slopes and stones are moderate to severe limitations to use of this soil for residential developments. Limitations are also severe for light industrial, commercial, and institutional developments. (Capability unit VIs–2, woodland suitability group 3, community development group 5)

Glenelg Series

In the Glenelg series are moderately deep to deep, well-drained silt loams that are gently sloping to moderately steep. These soils formed in material weathered from schist and gneiss. They are on undulating and rolling uplands in the southern part of the county. Adjacent to them are the well-drained Chester soils that are deep over bedrock and the well-drained Manor soils that are moderately deep or deep over bedrock. Also adjacent are the moderately well drained to somewhat poorly drained Glenville soils.

In a typical profile of a Glenelg soil, the surface layer is friable, dark-brown silt loam about 8 inches thick. From 10 to 15 percent of it is thin, flat pieces of rock.

The subsoil is friable, strong-brown fine silt loam about 16 inches thick. About 15 percent of the upper part is thin fragments of rock, but the content of rock increases to about 35 percent in the lower part of the subsoil.

The substratum is friable, brown very channery silt loam about 2 feet thick. From 50 to 90 percent of it is thin fragments of rock. Depth to slightly weathered bedrock is generally about 4 feet, but it ranges from 2½ to 5 feet.

These soils have a moderately permeable subsoil, but permeability is moderately rapid in the substratum. The available moisture capacity is moderate. These soils are very strongly acid to medium acid and have moderate natural fertility. Where crops are grown, medium to large applications of fertilizer and lime are required.

These soils are well suited to a number of kinds of field crops and to hay and pasture. The gentle to moderately steep slopes are the main limitations to their use for residential developments (fig. 21).

Glenelg silt loam, 3 to 8 percent slopes, moderately eroded (GnB2).—This soil is on undulating uplands in the southern third of the county. Generally, it has a subsoil that is 18 to 24 inches thick, and it contains fewer fragments of rock than the soil for which a profile is described as typical for the series. In the eastern part of the county near Bryn Athyn, this soil is more sandy below a depth of 2 feet than the profile described as typical for the series. Near Gulph Mills in the western part, it is more channery throughout.

Included with this soil in mapping are nearly level areas in which the slopes are less than 3 percent; a few areas in which the surface layer is 10 to 12 inches thick; and many areas in which the substratum contains a higher

Figure 21.—**Typical low-density development on Glenelg, Manor, and Glenville soils near Barren Hill. Glenelg soils are in the foreground, Manor soils are in the background, and Glenville soils are in the depression in the center.**

proportion of mica flakes than typical. Also included are a few small areas of Manor, Chester, and Glenville soils.

Permeability is moderate, and this soil has moderate available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate.

Much of the acreage surrounds estates or residential, industrial, and institutional developments, and part of it is in golf courses. Where this soil is farmed, it is used for general field crops, nursery stock, hay, and pasture. This soil is well suited to corn, fruit, nursery stock, small grains, and alfalfa. Planting the crops in field or contour strips helps to conserve moisture, reduces losses from erosion, and maintains good tilth. A suitable cropping system is one that is no more intensive than 2 years of row crops, 1 year of a winter small grain, and 2 years of grass-legume hay. Diversion terraces help to reduce erosion and loss of moisture on the long slopes. A cover crop ought to be planted in the row crop the first year, and all crop residue should be returned to the soil.

This soil has slight limitations for residential, light industrial, commercial, or institutional developments. Depth is a limitation to use as a disposal field for the effluent from septic tanks. If a septic tank is planned, it is suggested that percolation tests be made at the specific site to determine the effect of bedrock. (Capability unit IIe–2, woodland suitability group 4, community development group 3)

Glenelg silt loam, 8 to 15 percent slopes, moderately eroded (GnC2).—This soil is on rolling hills and undulating uplands in the southern third of the county. Its profile is the one described as typical for the series. In the eastern part of the county, near Bryn Athyn, however, the profile is more sandy throughout than the one described as typical for the series, and it contains fewer fragments of rock. In the western part of the county, near Gulph Mills, the profile has more fragments of schist throughout than typical. In some places the substratum has a high content of soft, weathered mica.

Included with this soil in mapping are small areas of Chester and Manor soils. Also included are eroded areas in which the surface layer is brown silt loam or channery silt loam about 6 inches thick. After an area is plowed, streaks of strong-brown subsoil material can be seen in the plow layer. A few stony areas are included with this soil. In those areas 1 to 3 percent of the surface layer is covered by stones 1 to 3 feet in diameter.

This Glenelg soil is moderately permeable and has moderate available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Less than a third of the acreage is farmed. The rest is in grass, trees, or shrubs, and in golf courses, parks, estates, and areas surrounding residential developments, industries, or institutions. Part of the acreage has not been maintained and is reverting to native vegetation. This soil is well suited to corn, small grains, fruit, nursery stock, alfalfa, and a number of different grasses and legumes. Losses from erosion can be reduced, moisture conserved, and the tilth maintained or improved by growing the crops in contour strips. A suggested cropping system is 1 year of a row crop, 1 year of a small grain, and at least 2 or 3 years of deep-rooted grasses and legumes grown for hay. A cover crop should be grown where feasible, crop residue ought to be conserved and returned to the soil, and manure should be added along with lime and commercial fertilizer.

This soil has moderate limitations of strong slopes if it is used for commercial, light industrial, institutional, or residential developments. It also varies in depth and thus has limitations for use as a field for disposing of the effluent from septic tanks. Percolation tests are needed and depth to bedrock at the specific site should be determined if this soil is to be used as a disposal field for the effluent from septic tanks. (Capability unit IIIe–2, woodland suitability group 4, community development group 4)

Glenelg silt loam, 15 to 25 percent slopes, moderately eroded (GnD2).—This soil is on low hills and ridges in the southern third of the county. It is shallower over bedrock and is more channery in many places than the soil for which a profile is described as typical for the series. The surface layer is about 6 inches thick, and 10 to 35 percent of it consists of flat pieces of rock. The subsoil is 15 to 24 inches thick. In some places the substratum consists of several inches of broken rock. In other places it is as much as 2 feet thick and consists of channery loam or silt loam.

In a few small areas, the slopes are greater than 25 percent. In a few places, the profile contains a large amount of soft mica flakes and has less than 30 percent coarse fragments throughout. In some places the plow layer is very channery, is 4 to 6 inches thick, and has a brown to yellowish-brown color.

Included with this soil in mapping are small areas of Manor soils. Bedrock crops out on the surface in some places, and stones, 1 to 3 feet in diameter, occupy 1 to 4 percent of the acreage. The stones are mostly in small patches.

This soil is moderately permeable and has moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

Practically all of this soil is covered by grass, trees, shrubs, or weeds. This soil is fair for corn and small grains, but it is better suited to long-term hay or pasture. If cultivated crops are grown, they should be planted in field or contour strips. A cropping system made up of 1

year of a row crop, 1 year of a small grain, and at least 3 or 4 years of grasses and legumes grown for hay is suitable. All the crop residue ought to be conserved and returned to the soil. Diversion terraces and grassed waterways safely dispose of runoff and reduce losses of moisture, and they help to control erosion.

Because of its strong slopes, this soil has severe limitations for residential, light industrial, commercial, or institutional developments. It can be used to a limited extent, however, for individual residences. (Capability unit IVe–2, woodland suitability group 4, community development group 5)

Glenville Series

The Glenville series consists of deep, moderately well drained or somewhat poorly drained silt loams or silty clay loams that are nearly level and gently sloping. These soils formed in material weathered from schist or gneiss. Permeability is moderately slow in the subsoil, and as a result, the downward movement of water is slowed.

The Glenville soils are on upland flats, in depressions, and on the lower slopes in the southern part of the county. They occur on uplands with the deep, well-drained Chester soils and the moderately deep, well-drained Glenelg soils. On flood plains adjacent to them or nearby are the Codorus and Hatboro soils. Also, in nearby areas on the narrow ridgetops and steeper side slopes are the shallow, well-drained Manor soils.

In a typical profile of a Glenville soil, the surface layer is very friable, dark grayish-brown silt loam about 8 inches thick.

The upper part of the subsoil is friable, dark yellowish-brown silt loam with a few brown or yellowish-brown mottles. The lower part of the subsoil is yellowish-brown silt loam or silty clay loam, and it has many grayish mottles at a depth of 15 to 30 inches. The material in the subsoil is fairly firm in place. If it is disturbed, it breaks readily to many small blocks that have smooth surfaces and angular edges. The subsoil is about 36 inches thick. It is underlain by a substratum of friable, dark yellowish-brown or reddish-brown loam. The substratum contains mica that glitters and imparts a slippery feel to the soil material. It is more than 2 feet thick. Depth to bedrock ranges from 4 to 8 feet.

Permeability is moderately rapid in the surface layer, moderately slow in the subsoil, and moderate in the substratum. The available moisture capacity is high. The soils are very strongly acid or strongly acid, and they have moderate natural fertility.

These soils are moderately well suited to most cultivated crops planted late in spring and to small grains planted in spring. They are well suited to hay and pasture.

A seasonal high water table is a limitation to use of the soils for residential developments. It is also a limitation to use for disposal fields for the effluent from septic tanks.

Glenville silt loam, 0 to 3 percent slopes (GsA).—This soil is on low-lying flats, in depressions, and on broad upland summits in the southern third of the county. It occurs in scattered patches adjacent to the lower lying Codorus and Hatboro soils of the flood plains. The surface layer is very dark grayish brown and is 10 to 15 inches thick. In the areas on the broad uplands, it more nearly resembles the surface layer in the profile described as typical for the series than does the surface layer in other areas. The upper part of the subsoil has more gray mottling than indicated in the profile described as typical for the series.

In some areas in depressions and drainageways, where this soil has received overwash from surrounding areas, the surface layer is as thick as 24 inches. In a few small areas, gray mottling is at a depth of 10 to 15 inches. South of Fort Washington and near Bryn Athyn, the lower part of the profile contains more sand than normal for this soil.

Beginning at a depth of 15 to 24 inches, this soil contains a layer in which permeability is moderately slow. Permeability is moderate below a depth of 3 to 4 feet. Surface drainage is slow. Late in fall, in winter, and early in spring the water table is within 1 or 2 feet of the surface. This soil is slow to dry out in spring. Usually, it can be worked early enough so that corn can be planted, but some depressions remain wet well into the growing season. This soil has high available moisture capacity, but the growth of roots is restricted in the firm subsoil. The hazard of erosion is slight.

This soil is used for commonly grown field crops, vegetables, fruit, nursery stock, hay, and pasture. Many other areas are in sod on golf courses or in areas surrounding estates, industries, and institutions. This soil is fair for corn, soybeans, small grains planted in spring, and vegetables planted late in spring. Alfalfa and winter small grains, however, are subject to winterkill. The crops grown in areas that do not have long slopes can be planted in graded rows, using a cropping system consisting of 1 year of a row crop, 1 year of a spring-seeded small grain, and at least 1 year of grass-legume hay. On the long slopes, field or graded stripcropping is needed to reduce erosion. A suitable cropping system, where stripcropping is used, consists of 2 years of row crops, each crop followed by a cover crop in winter, and 1 year of grass-legume hay. Tile drains are effective in reducing wetness caused by springs and seeps.

Limitations to the use of this soil for residential, light industrial, institutional, or commercial developments are the seasonal high water table, slow surface drainage, and slow permeability. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIw–2, woodland suitability group 6, community development group 9)

Glenville silt loam, 3 to 8 percent slopes, moderately eroded (GsB2).—This soil is on smooth, gentle upland slopes and on the lower toe slopes and benches. The areas are scattered throughout the southern third of the county. In general, the profile is like the one described as typical for the series. In many places, however, on toe slopes and in depressions, the surface layer is 12 to 18 inches thick. In a few small areas that are wetter than the surrounding areas, gray mottling begins just below the surface layer. South of Fort Washington and near Bryn Athyn, the profile has more sand throughout than the profile described as typical for the series.

Beginning at a depth of 15 to 24 inches, this soil contains a layer in which permeability is moderately slow. Below a depth of 3 to 4 feet, the substratum is moderately permeable. Surface drainage is slow to medium, and

the hazard of erosion is moderate to slight. The water table is within a foot of the surface during winter and early in spring. This soil is slow to dry and warm up in spring, but it can usually be worked in time for planting all but the earliest crops. Some wet pockets, seeps, and springs, however, persist into the growing season. The available moisture capacity is high, but plants cannot use all of the moisture available. This is because the growth of their roots is restricted by the firm subsoil.

Many areas of this soil are in sod and are on golf courses or in areas surrounding estates, institutions, or industries. This soil is fairly well suited to corn, soybeans, vegetables, fruit, and small grains seeded in spring, and part of the acreage is used for those purposes. Yields of winter small grains are likely to be reduced by frost heaving. Also, alfalfa is not so long lived as it is on the adjacent Chester soils. Where crops are grown, field or contour stripcropping should be practiced. Then, a suitable cropping system would be 2 years of row crops, each crop followed by a cover crop, 1 year of a small grain, preferably seeded in spring, and at least 2 or 3 years of grass-legume hay. Random tile drains are effective in reducing wetness in depressions and in seep areas near the foot of slopes.

Lack of good drainage is a limitation to use of this soil for residential, light industrial, institutional, or commercial developments. The seasonal high water table makes the sealing of basements difficult. This soil has severe limitations to use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Hatboro Series

In the Hatboro series are deep, poorly drained silt loams on flood plains in the southern part of the county. These soils formed in soil material washed from uplands underlain by schist, gneiss, limestone, and quartzite. They occur on the same flood plains as the moderately well drained or somewhat poorly drained Codorus soils. Near them, on the adjacent uplands, are the well-drained Chester, Manor, and Glenelg soils.

In a typical profile of a Hatboro soil, the surface layer is dark-brown to dark grayish-brown silt loam. It is about 10 inches thick.

The subsoil is gray silt loam or silty clay loam that is sticky and plastic when wet. It is about 3 feet thick.

The subsoil is underlain by about 1 foot of grayish-brown to light brownish-gray sandy clay loam to sandy loam, which, in turn, is underlain by bedrock. Depth to bedrock ranges from 4 to 8 feet.

These soils are very strongly acid or strongly acid and have moderately slow permeability. Occasionally, the water table is high during the growing season, and it is high late in fall, in winter, and early in spring. The high water table is a limitation to use of these soils for agriculture or developments. The hazard of flooding is also a severe limitation to use of these soils for developments.

Hatboro silt loam (Ha).—This is the only Hatboro soil mapped in the county. Its profile is the one described as typical for the series. This soil is on many of the narrow flood plains in the southern part of the county. It occupies broad, flat areas and is in depressions along the edges of the flood plains at the base of upland slopes. In some places small areas of Codorus silt loam, which is better drained than this soil, are included with it in mapping.

This Hatboro soil is subject to flooding during winter and early in spring. Occasionally, it is flooded during the growing season. The water table is at or above the surface late in fall, in winter, and early in spring. Some areas remain wet all year because they receive extra moisture as the result of hillside seeps or because they have slow surface drainage. The hazard of erosion is slight, and this soil has high available moisture capacity.

This soil is used mainly for pastures or is in sod in parks and estates. Much of the acreage is idle, however, and has a cover of weeds and brush. The soil is well suited to pasture and to birdsfoot trefoil and orchardgrass. It is fairly well suited to poorly suited to corn and soybeans and is poorly suited to small grains and alfalfa. If suitable outlets are available, surface water and the excess water in the soil can be removed by installing open drains and tile drains.

The high water table and hazard of flooding are severe limitations to use of this soil for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–1, woodland suitability group 8, community development group 12)

Howell Series

The Howell series consists of deep, well-drained, gently sloping soils formed in stratified sand, silt, clay, and gravel. These soils developed on remnants of coastal plain terraces on uplands and benches. They occur in the extreme south-central part of the county.

The Howell soils are adjacent to moderately well drained or somewhat poorly drained Beltsville soils that are in depressions underlain by similar material. Near the Howell soils, on the adjacent uplands, are Duffield soils underlain by limestone, and Manor and Glenelg soils underlain by schist and gneiss.

In a typical profile of a Howell soil, the surface layer is very friable, dark grayish-brown silt loam. The surface layer contains a few pebbles.

The uppermost 8 inches of the subsoil is yellowish-brown silty clay loam that contains some gravel. Below a depth of 16 inches, the subsoil is strong-brown silty clay loam to a depth of about 32 inches. It is yellowish-red gravelly clay loam between a depth of about 32 and 50 inches.

The substratum is at a depth below 50 inches. It consists of stratified dark-brown silt loam and yellowish-red or red gravelly clay loam and gravelly sandy loam. Depth to bedrock is generally about 8 feet but ranges from 6 to 30 feet.

These soils are strongly acid. They are moderately permeable and have high available moisture capacity. Their natural fertility is moderate to low.

The Howell soils are well suited to a number of kinds of field crops, vegetables, fruits, hay, and pasture. They have few limitations as sites for developments.

Howell silt loam, 3 to 8 percent slopes, moderately eroded (HwB2).—This is the only Howell soil mapped in Montgomery County. Its profile is the one described

as typical for the series. This soil is on uplands and benches in the south-central part of the county. It occurs near the towns of Bridgeport, Conshohocken, and Plymouth Meeting where coastal plain terraces overlie the limestone and schist bedrock in small areas. The acreage of this soil is not extensive, and the individual areas are small and scattered.

Included with this soil in mapping are small areas in which as much as 2 feet of the upper part of the subsoil consists of very silty, yellowish-brown soil material. Also included are small, nearly level areas in which gray mottling is at a depth of 30 or more inches. These mottled areas dry more slowly in spring than do the surrounding areas.

Permeability is moderate, and the available moisture capacity is high. The hazard of erosion is moderate.

This soil is used mainly for field crops, but idle areas are common. The soil is well suited to corn, soybeans, small grains, alfalfa, orchardgrass, and ladino clover, but field or contour stripcropping is needed to reduce losses from erosion. A cropping system that consists of 2 years of row crops with a cover crop, 1 year of a small grain, and 2 years of hay helps to maintain good tilth, conserve moisture, and reduce erosion. Most of this soil will likely be used for residential or industrial developments. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Klinesville Series

In the Klinesville series are well-drained, gently sloping to steep, reddish-brown, shallow soils that are shaly and droughty. These soils formed in material weathered from red shale and siltstone. They are widely distributed throughout the northern half of the county and are on undulating uplands and on hills and steep side slopes adjacent to drainageways. These soils are adjacent to the Penn, Reaville, and Readington soils. They are shallower and more shaly than the Penn soils and lack the gray, mottled horizon that is typical in the profile of the Reaville soils. They are much shallower and more shaly than the typical Readington soils.

In a typical Klinesville profile, the surface layer is reddish-brown very shaly silt loam about 5 inches thick. About half of the surface layer consists of pieces of dusky-red and reddish-brown fragments of shale. In some places these soils lack a distinct subsoil, but where the subsoil is present, it is reddish-brown very shaly silt loam about 10 inches thick. Fragments of shale make up 50 to 90 percent of this layer. Partly weathered, fractured shale bedrock is generally at a depth of about 15 inches. In some places it lies directly beneath the surface layer, but it is at a depth of as much as 18 inches in other places.

These soils have moderately rapid permeability and very low available moisture capacity. In most places they are strongly acid or very strongly acid. In many places, however, liming has made the plow layer slightly acid or neutral. These soils have low natural fertility. They are fairly well suited to permanent pasture, trees, and wildlife.

Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded (KlB2).—This soil is on undulating uplands in the northern half of the county. It has a thicker surface layer than the one in the profile described as typical for the series. Bedrock is at a depth of 12 to 18 inches.

Included with this soil in mapping are areas in which the subsoil is 6 to 14 inches thick and bedrock is at a depth of 18 to 24 inches. In a few areas, the substratum is only slightly acid. Narrow patches of Reaville soils and areas of Reaville soils in depressions are also included.

Permeability is moderately rapid, and the available moisture capacity is very low. Surface runoff is medium to rapid, and there is a severe hazard of erosion.

This soil is used for general farm crops, hay, and pasture. Also, part of the acreage is in grass, shrubs, weeds, and trees and is within golf courses or estates, or in areas surrounding institutions, industries, and residential developments. The soil is fairly well suited to perennial hay and pasture consisting of drought-resistant grasses and legumes, but alfalfa and row crops make low yields. Renovation of pastures or new plantings for pasture or hay ought to be done in alternate contour strips; half of the strips should be planted the first year and the rest the following year. If irrigation water is available, frequent applications will help to maintain fair stands of forage of fair quality. The pastures should not be overgrazed.

Shale and bedrock near the surface are limitations to use of this soil for residential, light industrial, commercial, or institutional developments, and they also make grading and excavating somewhat difficult. Limitations are severe for use of this soil as a disposal field for the effluent from septic tanks. (Capability unit IVs–1, woodland suitability group 11, community development group 6)

Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded (KsB3).—This soil is on undulating uplands, narrow ridges, and hilltops in the northern half of the county. Its profile is the one described as typical for the series. In some places the subsoil is thin and shaly and the substratum is very shaly and grades to firm bedrock at a depth of about 2 feet. In many places tillage is within the substratum of raw shale. Bedrock crops out in many areas. In most places 35 to 85 percent of the plow layer is shale, and the rest is organic matter mixed with silt loam. In a few areas, the surface layer is brown or yellowish brown.

Included with this soil in mapping are a few small areas of Reaville and Penn soils. These included Penn soils have a neutral substratum.

Permeability is moderately rapid, and this soil has very low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, hay, and pasture, but a large part of the acreage adjacent to residential developments is idle. A small acreage is in estates or is in areas surrounding institutions. This soil is poorly suited to corn, vegetables, and alfalfa. It is suitable for permanent pasture consisting of drought-resistant grasses and legumes, but little grazing is provided in midsummer. Plantings for pasture should be made in alternate contour strips. Half of the strips ought to be planted the first year, and the rest the following year. New plantings can be seeded in a small grain. Rotating the pastures helps to prevent overgrazing.

This soil is suitable for use as woodland or for wildlife habitats. It is fair for plantings of white and Virginia pines.

Shale and bedrock near the surface are limitations to use of this soil for residential, light industrial, commercial, or institutional developments. They make grading, excavating, and landscaping difficult. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit VIs–4, woodland suitability group 11, community development group 6)

Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded (KsC3).—This soil is more sloping than the soil for which a profile is described as typical for the series, and it is generally shallower over bedrock. It is on hills and undulating uplands in the northern half of the county. In a few places, the surface layer is 6 to 8 inches thick and is underlain by a thin, shaly subsoil. In many places bedrock is at a depth of only 6 to 14 inches. Tillage is generally in the substratum, and shale bedrock crops out in many places. Included with this soil in mapping are small areas of Reaville and Penn soils.

This Klinesville soil has moderately rapid or rapid permeability and very low available moisture capacity. Surface runoff is very rapid, and the hazard of erosion is severe.

This soil is poorly suited to field crops, permanent hay, and improved pasture. Much of the acreage is idle and is overgrown with grass, weeds, and brush. Limited grazing of native grass pastures is available in spring and late in fall, but only a small amount of forage is available in summer. This soil is fair for trees. Drought-resistant species, such as Virginia pine and white pine, should be planted.

Bedrock and shale near the surface are severe limitations for grading, excavating, and landscaping. They are also severe limitations to use of this soil as a disposal field for the effluent from septic tanks. (Capability unit VIIs–2, woodland suitability group 11, community development group 7)

Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded (KsE3).—This soil is steeper and shallower over bedrock than the soil for which a profile is described as typical for the series. It is on hills and undulating uplands adjacent to drainageways and streams in the northern half of the county.

The surface layer is 4 to 6 inches thick. In many places it consists mainly of shale that has been brought to the surface by plowing and contains little or no fine soil material or organic matter. In a few areas where erosion has been less severe than typical for this soil, the surface layer is dark reddish-brown silt loam and is 6 to 8 inches thick. Bedrock crops out in many places, but it is at a depth of 6 to 14 inches in most places.

Included with this soil in mapping are small areas of a Penn soil that has a neutral substratum and similar slopes. This included Penn soil is underlain by calcareous shale.

This Klinesville soil has rapid permeability and very low available moisture capacity. Surface runoff is very rapid, and the hazard of erosion is severe.

This soil is mainly in pasture or is overgrown with weeds, grass, and brush. It is not suitable for field crops, permanent hay, or improved pasture. This soil is suitable for woodland plantings of white pine, Virginia pine, or other drought-resistant trees, and these trees will reduce the danger of further erosion. (Capability unit VIIs–2, woodland suitability group 11, community development group 8)

Lansdale Series

In the Lansdale series are moderately deep and deep, well-drained soils that are nearly level to steep. These soils formed in material weathered from gray or yellowish-brown sandstone, conglomerate, and shale. They are on undulating and rolling uplands in the south-central part of the county, adjacent to well drained, reddish-brown Penn soils and moderately well drained Readington soils. The Lansdale soils occur in the same general areas as the poorly drained Croton and somewhat poorly drained Abbottstown soils, on low-lying flats, and the very silty, gray, mottled Lawrenceville and Chalfont soils, on gentle slopes and flats.

In a typical profile of a Lansdale soil, the surface layer is very friable, dark-brown silt loam about 7 inches thick. It contains a few small pieces of sandstone.

The subsoil is friable, brown loam about 3 feet thick. It contains a few small pieces of sandstone. The texture of the subsoil is more sandy in the lower than in the upper part. The lower part grades to soft, crumbly sandstone.

The substratum is firm, dark-brown to yellowish-brown loamy sand that is 2 to 3 feet thick and is firmer with increasing depth. Depth to fairly hard bedrock is generally 5 to 6 feet, but it ranges from 3 to 12 feet.

These soils have a moderately permeable subsoil, and their substratum is moderately to rapidly permeable. The supply of moisture held available for plants is generally high. These soils are very strongly acid to medium acid and have moderate natural fertility. They are fairly well suited to most types of farming commonly practiced in the county. Limitations are slight to moderate for use in developments.

Lansdale loam, thin, 3 to 8 percent slopes, severely eroded (LaB3).—This soil has a brown, loamy surface layer in which as much as 35 percent of the soil material consists of pebbles and fragments of sandstone. This soil is severely eroded, and its profile is much thinner over weathered sandstone than that of the Lansdale silt loams. Depth to hard bedrock, however, ranges from 3 to 12 feet.

This soil is on gently sloping or undulating uplands and hilltops in the southern part of the county. It is in a belt, 3 to 4 miles wide, that extends from the town of Oaks, in the western part of the county, to Hatboro, near the line between Bucks and Montgomery Counties. Along the northern edge of the belt, this soil is more silty than normal, and 10 to 75 percent of the profile consists of fragments of shale. The content of shale increases with increasing depth. As much as 95 percent of the material in the lower part of the substratum is shale. In small areas the substratum is exposed at the surface. Reddish-brown and dusky-red streaks are common on some slopes. These colors originated from the red colors in the bedrock.

Permeability is moderate in the subsoil and moderately rapid below the subsoil. The available moisture capacity is high. Surface runoff is medium, and the hazard of erosion is moderate to severe.

This soil is used for commonly grown field crops, hay, and pasture. Many areas surrounding residential developments are in grass, trees, and weeds. The soil is well suited to hay and pasture of drought-resistant grasses and legumes, and it is fairly well suited to alfalfa, corn, soybeans, and winter small grains. Field or contour stripcropping is needed to reduce losses from erosion, conserve moisture, and improve the soil tilth. With the stripcropping, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 4 years of grass-legume hay. Manure and crop residue should be incorporated into the soil.

This soil has slight limitations for use in residential, light industrial, commercial, or institutional developments. It varies in its limitations for use as a disposal field for the effluent from septic tanks. Where a septic tank is planned, depth to bedrock should be determined and percolation tests ought to be made at the specific site. Knowledge of the depth to bedrock and of the results of percolation tests will help in planning the design of the tile field for such a system. (Capability unit IIIe–3, woodland suitability group 11, community development group 3)

Lansdale loam, thin, 8 to 15 percent slopes, severely eroded (LaC3).—This soil has a profile similar to that of Lansdale loam, thin, 3 to 8 percent slopes, severely eroded, but it is steeper and contains more pieces of sandstone. Erosion tends to concentrate the pebbles and fragments of sandstone on the surface. The substratum is only 10 to 18 inches beneath the surface. Depth to bedrock ranges from only 2 feet to as much as 12 feet.

This soil is on undulating uplands and hills in the south-central part of the county. It occupies small, scattered areas in a belt 3 to 4 miles wide that extends from Oaks in the western part of the county to Hatboro, near the line between Bucks and Montgomery Counties. Along the northern edge of this belt, this soil is more silty than normal. From 15 to 75 percent of it is shale, but the content of shale increases to 95 percent in the lower part of the substratum. A few scattered stones are on the surface, and bedrock crops out in places. In places tillage is in the sandy substratum. On some slopes there are many streaks and broad bands that are reddish brown or dusky red.

Permeability is moderately rapid, and the available moisture capacity is moderate to high. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops and for hay and pasture. Much of the acreage is idle and is overgrown with weeds and brush. The soil is not well suited to corn and small grains, but it is well suited to shallow-rooted grasses and legumes that resist drought. The crops should be planted in alternate field strips or contour strips. Diversion terraces may be needed on the long slopes.

This soil has moderate limitations for residential developments. It has moderate to severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 11, community development group 7)

Lansdale loam, thin, 15 to 35 percent slopes, severely eroded (LaE3).—This soil has a profile similar to that of Lansdale loam, thin, 3 to 8 percent slopes, severely eroded, but it is steeper and shallower over bedrock, and it generally has more fragments of sandstone on the surface. In most places the substratum is at a depth of 10 to 18 inches and bedrock is at a depth of 2 to 8 feet.

This soil is on hills and on short, abrupt slopes adjacent to drainageways. The areas are small and are widely scattered in the south-central part of the county. This soil occurs in a belt, 3 to 4 miles wide, extending from Oaks in the western part of the county to Hatboro near the line between Bucks and Montgomery Counties. Along the northern edge of the belt, this soil is more silty and shaly than normal. In many places the substratum is at the surface. Bedrock crops out in many places, and a few scattered stones are common. On some slopes there are streaks and bands of reddish brown and dusky red.

In most places this soil has moderately rapid permeability. The available moisture capacity is low to moderate. Surface runoff is very rapid, and the hazard of erosion is severe.

This soil is poorly suited to the commonly grown field crops, but it is better suited to permanent pasture and trees. Much of the acreage is idle and is overgrown with weeds and brush. Birdsfoot trefoil, reed canarygrass, and other shallow-rooted legumes and grasses are well suited to pasture. New plantings or seedings for pasture should be made in alternate field or contour strips; half of the strips ought to be planted the first year, and the rest the following year. The pastures ought to be rotated often to prevent overgrazing.

Many of the slopes are more suitable for planting to white or Virginia pines than to pasture. This soil has moderate to severe limitations for residential developments. (Capability unit VIe–1, woodland suitability group 11, community development group 5)

Lansdale silt loam, 0 to 3 percent slopes, moderately eroded (LdA2).—This soil has a surface layer that is 8 to 10 inches thick and a subsoil that is 24 to 40 inches thick. Sandstone bedrock is at a depth of 5 to 10 feet. This soil is on smooth or undulating uplands near Norristown, Ambler, and Hatboro in the south-central part of the county.

In a few places, this soil has a brown or yellowish-brown subsoil of silty clay loam that grades to a substratum of sandy loam. On a few flats and in depressions, the substratum has small gray mottles and black streaks below a depth of 3 feet. In the same areas, the surface layer is dark brown and is 10 to 12 inches thick. In small patches and bands, the sandy substratum is within 2 feet of the surface.

This soil has moderate permeability throughout the subsoil and moderate to rapid permeability below the subsoil. The available moisture capacity is high. Surface runoff is slow to medium, and there is a slight to moderate hazard of erosion. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil is used for golf courses or is in grass in areas surrounding institutions, industries, and estates. It is used for and is well suited to fruit, vegetables, nursery stock, corn, winter small grains, and alfalfa. Losses from erosion can generally be reduced, moisture conserved, and good soil tilth maintained by practicing field stripcropping and using a suitable cropping system. An example of such a cropping system is 2 years of row crops followed by a cover crop the first year, 1 year of a winter small grain, and at least 1 year of deep-rooted grasses and legumes

grown for hay. If drainage is needed, random tile drains will help to remove the excess moisture from the depressions and lower lying flats.

This soil has few limitations for residential, light industrial, commercial, or institutional developments. Limitations are also few for use as a disposal field for the effluent from septic tanks, but percolation tests at the site are suggested. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Lansdale silt loam, 3 to 8 percent slopes, moderately eroded (LdB2).—This soil has the profile described as typical for the series. It is on undulating uplands and hilltops in the south-central part of the county. The areas are fairly large and are widely scattered. They occur in a band, 3 to 4 miles wide, that extends from Audubon in the western part of the county to a point near Hatboro, close to the line between Bucks and Montgomery Counties.

The subsoil ranges from 24 to 36 inches in thickness, and the upper part is silty clay loam in a few places. In some areas the sandy substratum is within 24 inches of the surface. In wooded areas occasional widely spaced stones and a layer of leaves and organic matter, about 3 inches thick, are on the surface.

This soil has moderate permeability throughout the subsoil and moderately rapid permeability below the subsoil. The available moisture capacity is high. Surface runoff is medium, and there is a moderate hazard of erosion.

A large acreage of this soil is in sod on golf courses, in estates, and surrounding institutional, industrial, and residential sites. This soil is suited, however, to corn, winter small grains, fruit, vegetables, and alfalfa. Losses from erosion can be reduced, moisture conserved, and good soil tilth maintained by practicing field or contour stripcropping, returning crop residue to the soil, and using a suitable cropping system. An example of a suitable cropping system is 2 years of corn, 1 year of a winter small grain, and 2 years of deep-rooted grasses and legumes grown for hay. A cover crop ought to be grown following the first year of corn. Crops grown on this soil respond well to moderate applications of lime and fertilizer. During dry seasons, supplemental irrigation generally increases the yield and improves the quality of the crops. Diversion terraces and grassed waterways may be needed on the long slopes to safely carry off excess surface water.

This soil has slight limitations for residential, light industrial, commercial, or institutional developments. It has only slight limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests should be made at the specific site. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Lansdale silt loam, 8 to 15 percent slopes, moderately eroded (LdC2).—This soil is steeper than the one for which a profile is described as typical for the series. Also, the subsoil is thinner and bedrock is nearer the surface in many places. This soil is on undulating or hilly uplands in the south-central part of the county. The areas are small and widely scattered. They are in a band 3 to 4 miles wide, extending from Audubon in the western part of the county to Hatboro near the line between Bucks and Montgomery Counties.

The surface layer ranges from 4 to 8 inches in thickness. In some patches the surface layer has a texture of sandy loam, and it contains fragments of sandstone in places. In wooded areas a mat of leaves and organic matter is on the surface and there are occasional stony patches. Quartz pebbles are common on the surface in some areas. The subsoil ranges from loam to sandy clay loam in texture and from 18 to 30 inches in thickness. Bedrock is only 3 feet from the surface in some places, but it is as deep as 10 feet in other places.

This soil has moderate permeability throughout the subsoil, and moderately rapid permeability below the subsoil. The available moisture capacity is high. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Crops to which this soil is well suited are corn, winter small grains, fruit, and alfalfa. Field or contour stripcropping is needed to reduce losses from erosion, to conserve moisture, and to maintain or improve the soil tilth. With the field or contour stripcropping, a suitable cropping system is 1 year of a row crop, 1 year of a winter small grain, and at least 2 years of grass-legume hay. The crops respond well to moderate or large applications of lime and fertilizer. Moderate applications of irrigation water, applied frequently, generally increase the yield and improve the quality of the crops. Diversion terraces and grassed waterways may be needed on the long slopes to safely carry away excess water and to keep erosion losses to a minimum.

A large acreage of this soil is used for developments of various kinds. Limitations are moderate for residential, light industrial, commercial, or institutional developments. This soil also has moderate limitations for use as a disposal field for the effluent from septic tanks. Percolation tests, however, should be made at the specific site. (Capability unit IIIe–2, woodland suitability group 2, community development group 2)

Lawrenceville Series

In the Lawrenceville series are deep, moderately well drained silty soils that are nearly level or gently sloping. Permeability is moderately slow in a layer in the subsoil, and this layer impedes the downward movement of water and restricts the growth of roots. These soils are on nearly level and undulating uplands, on the lower slopes, and in depressions in the central part of the county. Except where there are scattered fragments of rock just above the bedrock, these soils contain only a few fragments of rock.

The Lawrenceville soils are adjacent to somewhat poorly drained Chalfont and poorly drained Doylestown soils. Near them, on the adjacent uplands, are Readington and Abbottstown soils.

In a typical profile of a Lawrenceville soil, the surface layer is dark grayish-brown silt loam about 15 inches thick. In cultivated areas the uppermost 10 inches of this layer is the plow layer.

The upper part of the subsoil is 15 to 27 inches of friable, yellowish-brown silt loam that has a few gray mottles below a depth of about 20 inches. Yellowish-brown silt loam, prominently mottled with gray, is below this material. The prominently mottled material is firm in place, but when disturbed, it breaks to large

blocks that have a thick, gray surface coating. These blocks are 6 to 8 inches in diameter. They readily break to very small blocks and to thin, flat plates.

At a depth of about 40 inches, the subsoil grades to a firm, strong-brown substratum that is streaked with reddish gray and yellowish red. Depth to the bedrock of dusky-red shale is generally about 5 feet, but it ranges from 4 to 12 feet.

Lawrenceville silt loam, 0 to 3 percent slopes (LeA).—The profile of this soil is the one described as typical for the series. This soil is on the lower slopes and in depressions where it grades to the lower lying Chalfont and Doylestown soils. It occupies areas that are scattered throughout the central part of the county, especially between Norristown and Hatfield or Hatboro.

Near Ambler, small areas that are free of mottling to a depth of 36 inches or more are included in mapping. Also included are small areas where gray mottling occurs above a depth of 15 inches and a fragipan is within 18 to 24 inches of the surface. In some depressions the surface layer is as thick as 20 inches.

This soil is moderately permeable to a depth of 18 to 20 inches, and it is firm and has moderately slow permeability below that depth. The water table is high late in fall, in winter, and early in spring. Surface drainage is slow, and the hazard of erosion is slight to moderate. The soil is strongly acid to medium acid. The available moisture capacity is high, but the growth of roots is restricted in the subsoil.

This soil is well suited to corn, soybeans, ladino clover, timothy, and bluegrass. It is fair for spring-sown small grains, but alfalfa and winter small grains are subject to serious winterkill. If graded-row cultivation is used, a suitable cropping system consists of 1 year of a row crop, 1 year of a spring-sown small grain, and at least 1 year of grass-legume hay (fig. 22). The graded rows allow water to drain away without causing serious erosion.

Many areas of this soil are idle, and many areas have been developed for residential use. The slow permeability, seasonal high water table, and slow surface drainage are limitations to use for residential, commercial, light industrial, or institutional developments. Also, where this soil is disturbed, it is subject to severe erosion.

Figure 22.—**Typical area of Lawrenceville silt loam, 0 to 3 percent slopes. A late-summer cutting of hay has just been completed.**

(Capability unit IIw–2, woodland suitability group 6, community development group 9)

Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded (LeB2).—The profile of this soil is similar to the one described as typical for the series, but this soil is only on undulating uplands, on benches, and on the long, gentle lower slopes. It grades to Chalfont and Doylestown soils in depressions and on low-lying flats. Areas of this soil are large. They occur throughout the central part of the county, especially in the triangular area from Norristown to Hatfield and Hatboro along the line between Bucks and Montgomery Counties.

In many places this soil is underlain by reddish-brown shaly silt loam at a depth of 30 to 40 inches. In a few small patches, cultivation is in the yellowish-brown subsoil. In swales and depressions, the surface layer is as thick as 12 to 15 inches. Some nearly level areas are included in mapping, especially in the vicinity of Lansdale. In some areas the firm, gray, mottled fragipan is at a depth of 15 to 24 inches. Near Ambler, small areas of this soil are free of gray mottling to a depth of 36 inches or more. In another small acreage, the slopes are stronger than 8 percent.

This soil is moderately permeable to a depth of 15 to 24 inches, and it has moderately slow permeability below that depth. The water table is within a foot of the surface during winter and very early in spring, especially during February and March. This soil is slow to dry out early in spring, but the content of moisture is nearly ideal by corn-planting time. The available moisture capacity is high. Plants may not be able to use all of the available moisture, however, because of the restricted growth of their roots in the subsoil.

Large areas of this soil are in golf courses or surround industrial, residential, and institutional developments. Nurseries are common. This soil is fairly well suited to corn, soybeans, wheat, barley, and other crops commonly grown in the area. Yields of alfalfa and of winter small grains are reduced as the result of frost heaving and winterkill. Graded stripcropping is suggested to conserve moisture, reduce losses from erosion, and maintain good tilth. A suitable cropping system, where graded stripcropping is practiced, consists of 2 years of row crops, 1 year of a small grain, and 2 years of grass-legume hay. On the long slopes, diversion terraces will further reduce losses from erosion.

This soil has moderate limitations for use in residential, light industrial, commercial, or institutional developments. The slow permeability, seasonal high water table, and susceptibility to erosion are definite hazards to use for developments. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Legore Series

In the Legore series are well-drained, moderately deep or deep soils that are yellowish red and brown. These soils formed in material weathered from diabase. They are moderately sloping to steep and are on hills and ridges in the northern part of the county. The areas are small and widely scattered. They are adjacent to

the deep, well drained Neshaminy and moderately well drained or somewhat poorly drained Mount Lucas soils.

In a typical profile of a Legore soil, the surface layer is brown clay loam that is 4 to 6 inches thick. From 10 to 20 percent of this layer consists of small flat and rounded pieces of diabase rock.

The subsoil is yellowish-red or strong-brown clay loam that is 10 to 15 inches thick and is more sandy in the lower than in the upper part. About 10 percent of it is weathered pieces of diabase.

The substratum is brown sandy loam speckled with grains of red, yellow, gray, white, and black. From 25 to 30 percent of it consists of small pieces of diabase rock. Some of the pieces are so soft that they can be crushed in the hand to a coarse sand. They are harder and increase in number, however, with increasing depth. The substratum grades to bedrock at a depth of 2 to 5 feet.

The Legore soils are moderately permeable and have moderate to high available moisture capacity. They are moderately acid to slightly acid and have low natural fertility. These soils are suited to pasture and trees.

Legore clay loam, 8 to 15 percent slopes, severely eroded (LgC3).—This soil has a profile like the one described as typical for the series. It is in widely scattered areas on hills and ridge slopes in the northern third of the county. This soil is on the same slopes as the Neshaminy soils; near it, in slight depressions and on toe slopes, are areas of Mount Lucas soils.

Included with this soil in mapping are areas of severely eroded Neshaminy soils. Occasional large stones are on the surface, and bedrock crops out in a few places. In some places erosion has exposed the substratum.

This soil is moderately permeable and has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used mostly for pasture or is idle and overgrown with weeds and brush. It is well suited to perennial hay or pasture of drought-resistant grasses and legumes, such as alfalfa, birdsfoot trefoil, and reed canarygrass. New plantings and reseedings should be made in field or contour strips. Half the strips ought to be planted the first year and the rest the following year. If this soil is used for crops grown in rotation, a long rotation consisting of 3 or more years of hay, 1 year of a cultivated crop, and 1 year of a small grain is suitable.

This soil has limitations for use in residential developments. It has severe to moderate limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 4, community development group 7)

Legore clay loam, 15 to 30 percent slopes, severely eroded (LgD3).—This soil is steeper and shallower over bedrock than the one for which a profile is described as typical for the series. Also, the subsoil is generally thinner and more sandy. This soil is in widely scattered areas on hills and ridge slopes in the northern part of the county. It is adjacent to the Neshaminy and Brecknock soils. In many places bedrock crops out on the surface, and large, round stones are common.

Included with this soil in mapping are a few areas of severely eroded Neshaminy soils. The subsoil is thicker in the included areas than normal for this Legore soil.

This soil is moderately permeable and has moderate available moisture capacity. Surface runoff is rapid or very rapid, and the hazard of erosion is severe.

Most areas of this soil are idle and have a cover of grass, weeds, and brush. This soil is suitable for pasture or trees. In the areas to be used for pasture, shallow-rooted, drought-resistant grasses and legumes should be planted in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The steeper slopes ought to be planted to white pine or Virginia pine. This soil is also suitable for wildlife habitats if it is planted to grasses and shrubs that offer food and cover for birds and small game animals. (Capability unit VIe–1, woodland suitability group 4, community development group 8)

Lehigh Series

The Lehigh series consists of moderately deep to deep soils that are moderately well drained or somewhat poorly drained. These soils formed on hard, gray or black metamorphosed shale, called hornfels. They have a slowly permeable layer in the subsoil that restricts the downward movement of water.

These soils are on low ridges and on broad-topped hills in the northern part of the county. They are adjacent to well-drained Brecknock and poorly drained Croton soils. In some parts of the county, they are adjacent to Penn and Reaville soils. The Lehigh soils are generally less steep than the Brecknock soils and less reddish than the Penn and Reaville soils.

In a typical profile of a Lehigh soil, the surface layer is dark grayish-brown channery silt loam about 6 inches thick. Flat pieces of very dark gray rock, 2 to 12 inches across, make up 35 percent of this layer.

The subsoil is grayish-brown channery silt loam or silty clay loam about 15 inches thick. It is mottled at a depth of about 15 inches with dark yellowish brown and reddish gray. From 30 to 50 percent of the subsoil consists of flat fragments of rock.

The substratum is between a depth of 21 and 30 inches. It is dark grayish-brown very channery silt loam, and it contains streaks of gray and strong brown. As much as 90 percent of this layer consists of fractured pieces of rock. Depth to very dark gray bedrock is generally about 30 inches, but it ranges from 24 to 48 inches.

These soils have a slowly permeable subsoil and low to moderate available moisture capacity. The water table is at a depth of 1 to 2 feet during winter and early in spring. The soils are very strongly acid to moderately acid and have low natural fertility.

The Lehigh soils are suited to general farming. They have some limitations for use in residential developments.

Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded (LhA2).—This soil has a surface layer of very dark grayish-brown channery silt loam about 8 to 9 inches thick. The subsoil is 18 to 24 inches thick and is mottled at a depth of 12 to 18 inches. Thi soil is on broad upland flats and in depressions in the northern part of the county. Adjacent to it on the lower slopes are the poorly drained Croton soils.

Included with this soil in mapping are areas in which the surface layer is dark-colored silt loam to a depth of

as much as 18 inches. Mottling, in some places, is prominent just below the plow layer.

This soil is slowly permeable and has a high water table that is within a foot of the surface late in fall, in winter, and early in spring. The soil is slow to dry out in spring, and some seepage areas and areas in depressions remain wet during the early part of the growing season. Surface drainage is slow, and the hazard of erosion is slight to moderate. The available moisture capacity is moderate.

This soil is used for the commonly grown field crops, hay, and pasture. Many areas are idle and are overgrown with weeds, brush, and cedar trees (fig. 23). The soil is well suited to hay and pasture consisting of grasses and legumes that tolerate wetness, for example, birdsfoot trefoil, reed canarygrass, timothy, orchardgrass, and ladino clover. This soil is fair for corn, but it is generally unsuitable for alfalfa and for winter small grains. Adequate drainage improves its usefulness for crops. Graded strips or rows are needed to reduce erosion and to safely remove excess surface water. If cultivated crops are grown, a suitable cropping system consists of 1 year of a spring-seeded small grain and at least 3 years of grass-legume hay of adapted varieties. Tile drains help to relieve wetness caused by seeps and springs.

The high water table, slow surface drainage, very slow permeability, and numerous fragments of rock are limitations to use of this soil for residential, light industrial, commercial, or institutional developments. This soil also has severe limitations to use as a disposal field for the effluent from septic tanks. (Capability unit IIIw–2, woodland suitability group 7, community development group 9)

Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded (LhB2).—This soil has a profile like the one described as typical for the series. It is on broad undulating hilltops and narrow ridges in the northern part of the county.

Included with this soil in mapping are small areas in which the surface layer is as much as 1 foot thick. Also included, near Sumneytown and Niantic, are areas in which the lower part of the subsoil and the substratum are nearly neutral. The subsoil in a few areas is thicker and browner than the one in the profile described as typical for the series. Less than 20 percent of it consists of coarse fragments.

Figure 23.—Small, rectangular fields of Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded. These fields, bordered by cedar trees and poison-ivy, are typical of fields made up of this soil.

This soil is slowly permeable during winter and early in spring, and the water table is only 1 to 2 feet beneath the surface. The soil dries out and warms slowly in spring, but it is droughty during summer. The available moisture capacity is moderate. Surface drainage is medium, and there is a moderate hazard of erosion.

This soil is used for the commonly grown field crops and for hay and pasture. Some areas, however, consist of brushy woodland or are overgrown with weeds and cedar trees. This soil is well suited to perennial hay or pasture of shallow-rooted grasses and legumes, such as birdsfoot trefoil and reed canarygrass, that tolerate both wetness and drought.

Adequate drainage improves the usefulness of this soil for field crops, but ladino clover and orchardgrass are fair for hay and pasture. This soil is fair for corn, soybeans, and spring-sown oats and barley, but winter small grains are subject to damage from frost heaving. Wetness makes the soil poorly suited to alfalfa.

If cultivated crops are grown, a suitable cropping system consists of 1 year of a row crop with a cover crop, 1 year of a small grain, preferably seeded in spring, and at least 3 years of grass-legume hay. Graded stripcropping is needed to reduce losses from erosion and to remove excess surface water.

Wetness is a limitation to use of this soil for residential, light industrial, commercial, or institutional developments. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIw–3, woodland suitability group 7, community development group 9)

Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded (LhB3).—This soil has a surface layer of grayish-brown or olive-gray channery silt loam that is 5 to 6 inches thick. As much as 50 percent of the surface layer consists of flat fragments of rock. The subsoil is 6 to 12 inches thick. This soil is on undulating hilltops and narrow ridges in the northern part of the county. The areas near Sumneytown and Tylersport in the northeastern part of the county have a nearly neutral subsoil and substratum.

Included with this soil in mapping are small areas in which the surface layer is thicker and less channery than the one in the profile described as typical for the series. In places mottling is at a depth of only 10 to 12 inches.

This soil is slowly permeable and has a high water table within a foot of the surface in winter and early in spring. The moisture level is right for plowing, fitting, and planting for only a short time before the soil becomes too dry. The available moisture capacity is low. Surface drainage is medium to rapid, and the hazard of erosion is severe in most places.

This soil is used for the commonly grown field crops, but it is better suited to hay and pasture. A large part of the acreage is idle and is overgrown with weeds, brush, and cedars. The soil is well suited to perennial hay or pasture consisting of shallow-rooted, drought-resistant plants that tolerate wetness during winter and spring. It is well suited to birdsfoot trefoil and reed canarygrass for hay and pasture. This soil is poorly suited to corn, small grains, and alfalfa.

Where this soil is cultivated, a cropping system of low intensity should be used. An example of such a cropping system is 1 year of a cultivated crop, 1 year of a small grain, and 3 or 4 years of hay. Where necessary for highest production, the areas in hay or pasture should be reseeded in alternate graded strips. Half of the strips ought to be planted the first year and the rest the following year. Diversion terraces and constructed waterways will help to reduce losses from erosion on the long slopes. Supplemental irrigation, if water is available, increases the yield and improves the quality of the crops.

Shallowness and the high water table, slow permeability, and numerous flat fragments of rock are severe limitations to use of this soil for residential, light industrial, commercial, or institutional developments. Also, this soil has severe limitations for use as a disposal field for the effluent from septic tanks. All developments should be connected to an adequate municipal system for treating and disposing of sewage. (Capability unit IVe–4, woodland suitability group 7, community development group 9)

Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded (LhC2).—This soil is steeper than the one for which a profile is described as typical for the series. Also, it is more channery in some places and has a thinner subsoil. This soil is on hills and ridges in the northern part of the county. The areas near Sumneytown, Tylersport, and Niantic have a nearly neutral subsoil and substratum.

Included with this soil in mapping are wooded areas in which little or no erosion has taken place; areas at the foot of some slopes where the surface layer is 10 to 12 inches thick; and areas where mottling occurs just below the plow layer. In some places the profile of this soil is redder or browner than the one described as typical for the series.

This soil is slowly permeable and has a high water table within 1 to 2 feet of the surface late in winter and early in spring. Many seeps and springs occur near the base of slopes and at points where the bedrock is nearest the surface. Surface drainage is rapid, and the hazard of erosion is severe. The available moisture capacity is low to moderate.

A large acreage of this soil is wooded or is overgrown with weeds, brush, and cedars. Also, part of the acreage is used for the commonly grown field crops, hay, and pasture. This soil is well suited to perennial hay and pasture consisting of shallow-rooted grasses and legumes, such as birdsfoot trefoil and reed canarygrass, that tolerate both wetness and drought. It is fair to poor for corn and spring-seeded small grains. Generally, wetness makes it poor for alfalfa and winter small grains.

If this soil is cultivated, the crops should be planted in graded strips. A suitable cropping system to use with the graded strips is 1 year of a row crop followed by a cover crop, 1 year of a spring-seeded small grain, and 3 years of grass-legume hay. Diversion terraces help to reduce losses from erosion on the long slopes. On the lower slopes, tile drains may help to relieve wetness caused by seepage.

This soil has moderate to severe limitations for large residential developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–7, woodland suitability group 7, community development group 10)

Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded (LhC3).—In most places this soil has a surface layer of grayish-brown or olive-gray channery silt loam 5 to 6 inches thick. As much as 60 percent of the surface layer consists of flat pieces of rock. The subsoil is also very channery and ranges from 6 to 12 inches in thickness. Depth to bedrock ranges from 2 to as much as 4 feet. This soil is on hills and ridges in the northern part of the county.

Though the surface layer is generally grayish brown or olive gray, its color ranges to reddish gray and dark yellowish brown in some places. In areas of this soil near Sumneytown, Niantic, and Tylersport, the reaction is nearly neutral throughout the profile.

Included with this soil in mapping are areas in which mottling is in or just below the surface layer. Also included are small areas in which the slopes are more than 15 percent.

This soil is slowly permeable and has a high water table within a foot of the surface during winter and early in spring. Many seeps and springs persist well into the spring months. Although this soil dries slowly early in spring, it soon becomes droughty. It has low available moisture capacity. Surface drainage is rapid, and the hazard of erosion is severe. To some extent, this soil is used for the commonly grown field crops, hay, and pasture. A large acreage is idle, however, and is overgrown with brush, weeds, and cedars. This soil is well suited to perennial hay and pasture consisting of shallow-rooted grasses and legumes, such as birdsfoot trefoil and reed canarygrass, that tolerate both wetness and drought. It is poorly suited to corn, small grains, and alfalfa.

If this soil is used for crops grown in rotation, a long rotation consisting of 1 year of a cultivated crop, 1 year of a small grain, and 4 years of hay is suitable. Hayfields and pastures that are to be renovated should be reseeded in alternate graded contour strips. Half the strips ought to be planted the first year, and the rest the following year. The pastures should be clipped, topdressed, and rotated for best yields. Most areas of this soil are too shallow for installing tile drainage.

This soil has severe limitations for residential developments. It also has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–4, woodland suitability group 7, community development group 10)

Lehigh very stony silt loam, 0 to 8 percent slopes (LsB).—On the surface this soil has about 1 inch of partly decomposed leaves. Beneath the leaves is about 1 inch of very friable, very dark brown silt loam over about 8 inches of very friable, dark grayish-brown stony silt loam. The subsoil and substratum are similar to the ones in the profile described as typical for the series. This soil not only contains fragments 2 to 3 inches across, but in addition, 2 to 20 percent of it consists of flat stones 15 to 25 inches across. This soil is on the summits and lower benches of hills and ridges in the northern part of the county.

Included with this soil in mapping are small wooded areas that are nearly free of stones. In areas of this

soil near Niantic and along the Unami and Ridge Valley Creeks near Sumneytown, the reaction is nearly neutral in the subsoil and substratum.

This soil is slowly permeable and has a high water table only 1 to 2 feet beneath the surface in winter and early in spring. Areas of this soil in depressions and on the lower slopes are slow to dry out in spring. In some years the soil remains wet into the early part of the growing season. Surface drainage is slow, and there is a slight hazard of erosion. The available moisture capacity is moderate.

This soil is used to a small extent for pasture, but most of it is in wooded areas or is overgrown with brush, weeds, and cedars. The soil is fairly well suited to pasture if enough stones can be economically removed to permit the use of machinery. Reed canarygrass, birdsfoot trefoil, bluegrass, and timothy are suitable for planting in the pastures. Desirable trees for planting in weedy or open areas of woodland are white pine, larch, and Norway spruce. (Capability unit VIs–3, woodland suitability group 7, community development group 9)

Lehigh very stony silt loam, 8 to 25 percent slopes (LsD).—This soil is similar to Lehigh very stony silt loam, 0 to 8 percent slopes, but it is steeper, has a slightly thinner surface layer and subsoil, and has outcrops of bedrock in some places. This soil is on hills and ridges in the northern part of the county. Near Niantic and along Unami Creek near Sumneytown, this soil has a nearly neutral subsoil and substratum.

Included with this soil in mapping are areas in which rounded stones and boulders, as large as 6 feet in diameter, are on the surface. Also included are other small areas of soils that have little or no mottling in the subsoil and small patches of Croton soils near the bottom of some slopes.

This Lehigh soil is slowly permeable and has a high water table that is only 1 to 2 feet beneath the surface in winter and early in spring. Springs and seeps occur on the lower slopes and in areas where the bedrock crops out. Surface drainage is medium, and the hazard of erosion is slight to moderate. This soil has low to moderate available moisture capacity.

About two-thirds of the total acreage is in wooded areas. Also, a small acreage is in pasture, and the rest is overgrown with scrub trees, weeds, and cedars. This soil can be cleared and used for pasture, but it is better suited to trees and to wildlife habitats. Suitable trees for replanting are Norway spruce, larch, and white pine. This soil is well suited to birdsfoot trefoil and reed canarygrass. (Capability unit VIs–3, woodland suitability group 7, community development group 10)

Made Land

Made land is extensive and varied in Montgomery County. It consists of areas where earthmoving during development has removed or altered the characteristics of the original soils. The largest areas of Made land are in the southern part of the county and at population centers, such as Norristown, Pottstown, Lansdale, and Ambler. In addition, many smaller areas of Made land, occupied by industrial, residential, commercial, and institutional developments, are scattered throughout the county, even in the rural areas.

The original soils are converted to Made land in many different ways. Grading and leveling for a large residential development, for example, may remove several feet of soil material from a knoll and deposit this material over a soil in a depression. The solum of the low-lying soil is thereby greatly thickened, and only about 6 inches of soil material is left over bedrock in the formerly deep soil on the knoll.

Deep cut and fill operations involved in making modern highways; construction of earthen structures such as dikes and ponds; construction of landfill and sedimentation basins; quarrying and mining; and the digging of foundations and cellars all create other areas of Made land. If a large parking lot is constructed, for example, on a deep, nearly level, well-drained Chester soil, Made land is created. The surface layer and perhaps the upper part of the subsoil of the Chester soil are removed. Crushed stone is placed over the remaining soil material, and concrete is placed over the stone. As a result, the area that was once occupied by a moderately to rapidly permeable Chester soil is changed to an area that is completely impervious to water, and surface runoff is increased to 100 percent.

Specific physical and chemical properties and interpretations for an area of Made land cannot be listed. On the basis of knowledge of the original soils from which Made land was formed, however, the broad range of properties and the probable limitations can be determined.

In this county areas of Made land have been classified on the basis of the soil material from which they were made or on the basis of the bedrock or other material from which the soil material originated. All the statements concerning a specific mapping unit of Made land are considered typical for the unit, but a number of variations and inclusions occur within a small area.

Made land, diabase, gabbro materials (Ma).—This miscellaneous land type is the result of altering and mixing soils formed in material weathered from dark-colored igneous rocks. The altered soils were mainly of the Neshaminy, Mount Lucas, and Watchung series. This land type is mainly nearly level or gently sloping, but moderately sloping and steep areas are included in a few places. It is on low-lying flats and on undulating uplands in the northern half of the county. The areas are mostly small and are widely scattered. The largest areas are east of Pottstown.

Red to brown or gray silty clay loam that is sticky and plastic when wet makes up this land type. Gray colors are predominant in the low-lying areas. The silty clay loam is mixed with sand and small pieces of rock. In some places it contains large, very hard, round stones and boulders 1 to several feet in diameter. Hard bedrock crops out at the surface in some places, but bedrock is at a depth of as much as 12 feet.

This land type is generally slowly permeable. In some years it has a water table at a depth of 1 to 4 feet late in fall, in winter, and early in spring. In the low-lying areas, the soil material is slowly permeable; the water table is at the surface or water is ponded in depressions until early in spring. The estimated available moisture capacity is moderate. Leveling is difficult because of the stones and smaller fragments of rock. The soil material is slightly acid to neutral.

This land type is used for residences and industries. The stones, plasticity of the soil material, areas that have a high water table, and variable depth to bedrock are limitations for residential development. These limitations make special design necessary and make maintenance difficult. Unless satisfactory results are obtained from percolation tests performed at the site, this land type is likely to have limitations for use as a disposal field for the effluent from septic tanks. Trees, grass, and shrubs grow well, but lawns may be difficult to establish and maintain because of the stones and smaller fragments of rock. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 1)

Made land, land fill and sediment basins (Mb).—This land type resulted when man deposited large quantities of soil material and waste products on the surface of other soils. It occupies small, scattered areas throughout the county but is mainly along the Schuylkill River and other streams within the county. The areas are nearly level or gently sloping.

In some places this land type consists of soil material and fragments of rock deposited on low-lying flats and used for constructing buildings above the level reached by high water. In various places along the Schuylkill River, it consists of stream-carried screenings of silt and coal that have been dredged from the river and deposited in constructed basins. In still other places, it consists of industrial waste that has been deposited in similar basins. It also includes areas of sanitary land fill where waste material, other than sewage, has been dumped in old quarries and in large trenches that have been constructed and covered over with soil material.

All the characteristics of this land type are variable. As a rule, permeability depends upon the amount of compaction and on the quality and quantity of the fill. The fill is commonly placed on low-lying areas, and the water table is likely to rise within it unless artificial drainage has been provided.

This land type has limitations for residential, light industrial, commercial, and institutional developments, unless the areas are expressly designed and built for those uses. If the areas are on narrow flood plains, they restrict the stream channel. As a result, the floodwaters rise to a higher level than they formerly did and the velocity of the stream through the areas and below them is increased. This land type is generally not suitable for use as a disposal field for the effluent from septic tanks. Grass, trees, and shrubs grow well in some of the areas, but little or no vegetation grows in areas where industrial waste and coal sediments have been deposited. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 3)

Made land, limestone materials (Mc).—This land type is the result of altering and mixing of soils formed in material weathered from limestone. The areas are mainly nearly level or gently sloping, but a few moderately sloping and steep areas are included. The land type occupies large tracts on nearly level and undulating uplands in the south-central part of the county, from Valley Forge State Park to Willow Grove. The altered soils were mainly those of the Duffield and Lawrenceville series on uplands and of the Rowland and Codorus series on flood plains.

Yellowish-red to yellowish-brown silty clay loam or silt loam, mixed with small pieces of rock, make up most of this land type. In a few places, hard white or gray limestone crops out at the surface. Bedrock is at a depth between 1 and 15 feet, however, in most places. In some places this land type is very silty and is free of pieces of rock. In a few small areas, it contains sand and many small, rounded pebbles. In low-lying areas where there is a seasonal high water table, a very firm, gray, mottled layer is at a depth of 1 to 5 feet.

Some areas of this land type are moderately permeable. In those areas the water table is at a depth of 3 to 5 feet in winter and early in spring. In the low-lying areas, the soil material is slowly permeable below a depth of 1 to 5 feet and the seasonal high water table is often within a foot of the surface. In still other places, the water table never rises to within less than 15 feet of the surface. The estimated available moisture capacity is moderate. Runoff is medium to rapid, and the hazard of erosion is severe unless adequate ground cover is provided. This land type is medium acid and has high natural fertility.

This land type is used mainly for industrial, commercial, and residential developments, and a large acreage is occupied by limestone quarries (fig. 24). Limitations for developments are slight to moderate. Careful investigation of the site is required if a development is planned, because of the solution channels in the bedrock. Special designs may be needed if heavy structures and highways are planned. Susceptibility to erosion, the possibility of a seasonal high water table, and varying depth to hard bedrock are limitations that may make necessary special design and maintenance.

This land type has severe limitations if it is used as a disposal field for the effluent from septic tanks. Rapid percolation and inadequate filtration through the soil material, as well as the solution channels in the bedrock, may cause contamination of the underground water. Where the soil material is not stony, trees, lawns, and shrubs generally grow well if moderate amounts of lime and fertilizer are applied. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 1)

Figure 24.—**Large, deep limestone quarry in an area of Made land, limestone materials. This quarry is at Bridgeport.**

Made land, schist and gneiss materials, sloping (MdB).—This land type is the result of altering and mixing of soils formed in material weathered from schist and gneiss. It is mostly nearly level and gently sloping, but some steep areas and fill escarpments are included. The areas are mainly large, but some are small. They are on smooth and undulating uplands in the southern third of the county. The largest areas surround Narberth, Jenkintown, and Rockledge. The soils changed were formerly in the Chester, Manor, Edgemont, Glenelg, and Glenville series.

Yellowish-red to yellowish-brown loam or silt loam mixed with many pieces of rock make up this land type. In most places the soil material contains a large amount of mica that glitters in the sunlight and imparts a soft, slippery feel to the material. Some areas are sandy, and some contain flat or large, round stones. In places bedrock crops out at the surface, but it is as deep as 15 feet in other places. Near Wyndmoor and Cedarbrook, this land type is more reddish than in other areas, and it contains much gravel of many different sizes.

In depressions or low-lying flats where this land type occurs, the water table rises to within a foot of the surface during winter and early in spring. The estimated available moisture capacity is medium, and runoff is medium. The hazard of erosion is likely to be severe unless adequate cover is provided. The soil material is strongly acid and is medium to low in natural fertility.

This land type is used for residential, industrial, commercial, and institutional developments. It has slight to moderate limitations for residential developments. The main limitations are susceptibility to erosion, a possible seasonal high water table in the low spots, and occasional stones.

This land type varies in its limitations for use as a disposal field for the effluent from septic tanks. Percolation tests should be made at the site to determine whether a specific location is suitable. Lawns, shrubs, and trees grow well if a moderate to large amount of lime and a suitable fertilizer are applied. In some places stones and fragments of rock are too numerous for a lawn to be established. Supplemental irrigation greatly improves the quality of plants used for landscaping, if a moderate amount of water is applied during dry seasons. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 1)

Made land, schist and gneiss materials, strongly sloping (MdD).—This land type is the result of altering and mixing of soils formed in material weathered from schist and gneiss. It is in many narrow areas on hillsides and ridges in the southern third of the county, mainly along drainageways and streams. The areas are mostly moderately sloping to moderately steep, but a few gently sloping areas are included, generally along streams. Most of the changed soils were formerly in the Manor, Glenelg, and Edgemont series.

Yellowish-red to yellowish-brown channery loam or silt loam makes up this land type. In most places the soil material contains a large amount of mica that glitters in the sunlight and imparts a soft, slippery feel to the material. Many areas are sandy, and occasionally there are flat or round stones. Outcroppings of bedrock occur on the steeper slopes, but bedrock is as much as 15 feet from the surface in some places.

Runoff is rapid, and the estimated available moisture capacity is medium. The hazard of erosion is likely to be severe unless adequate cover is provided. The soil material is strongly acid and has moderate to low natural fertility.

This land type is used mainly for institutions and for residences in or near cities. Where it is used for residential developments, it has limitations, mainly the high content of stones, steep slopes, and variable depth to bedrock.

This land type has severe limitations for use as a disposal field for the effluent from septic tanks. Percolation tests should be made at the specific site to determine suitability. If this land type is used as a field for a septic tank, surface seepage is likely to occur downslope where the gradient of the slope is greater than 12 percent. Trees and shrubs grow well if enough lime is added, if they are properly fertilized, and if supplemental irrigation water is supplied during dry seasons. If a lawn is to be established, the fragments of rock and stones must be removed. Also, a large amount of lime and fertilizer ought to be applied, and water should be added frequently and in large amounts during dry periods. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 2)

Made land, shale and sandstone materials, sloping (MeB).—This land type is the result of altering and mixing of soils formed in material weathered from shale and sandstone. It is in large areas throughout the central part of the county and near urban centers to the north. Many smaller tracts are widely scattered throughout the northern half of the county. This land type is mainly nearly level and gently sloping, but some moderately sloping and steep areas are included. It is on low-lying flats and on undulating uplands. Most of the soils were formerly in the Penn, Readington, Abbottstown, Croton, Reaville, Klinesville, Brecknock, Lehigh, Chalfont, Doylestown, and Lawrenceville series.

Dusky-red to yellowish-brown shaly silt loam to channery sandy loam makes up much of this land type, and many areas consist entirely of pieces of shale. Also, in the south-central part of the county, some areas consist entirely of sand and soft sandstone. In the northern part of the county, along the Schuylkill River, some areas consist of gravelly silty clay loam mixed with shale. In a few places in the northern half of the county, some areas consist of olive-gray very channery silt loam. Bedrock crops out in many places, but depth to bedrock is as much as 6 feet. This land type contains occasional stones. Streaks and patches of gray silty clay loam are prominent in the lower lying areas. In the southeastern part of the county, especially near Willow Grove, the soil material is very silty in places and is poorly suited to engineering purposes.

The estimated permeability ranges from moderate to very slow. The water table is at the surface in some seasons, but depth to the water table is as much as 4 feet at other times. Water is frequently ponded on the surface during winter and spring. Seeps and springs are common. The estimated available moisture capacity

is moderate to very low. Runoff is rapid to very slow, and the hazard of erosion is likely to be severe unless adequate cover is provided. The soil material is medium acid to very strongly acid and has moderate to low natural fertility.

This land type is used for residential, industrial, commercial, and institutional developments. It has some limitations for residential developments, mainly the seasonal high water table, shallowness to bedrock, slow permeability, and content of shale and stones.

This land has limitations for use as a disposal field for the effluent from septic tanks. It is only fair for growing trees, shrubs, and grass for landscaping. If a lawn is to be established, topsoil must be added before the area is seeded, and the shale, stones, and fragments of rock must be removed. During summer, supplemental water is needed. A moderate or small amount of water is required, but it must be applied at frequent intervals. Moderate amounts of lime and fertilizer are needed. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 9)

Made land, shale and sandstone materials, strongly sloping (MeD).—This land type is the result of altering and mixing soils formed in material weathered from shale and sandstone. It is in small to large areas on rolling and hilly uplands, mainly in the northern two-thirds of the county. The areas are mostly moderately sloping to moderately steep, but some gentle upland slopes and nearly level areas along streams are included. The changed soils in the northern part of the county were formerly in the Penn, Lansdale, Klinesville, Brecknock, Reaville, and Lehigh series. Those in the south-central part were in the Chalfont, Doylestown, and Lawrenceville series and developed in silty material.

Dusky-red to yellowish-brown shaly silt loam to channery sandy loam makes up this land type. In many places bedrock crops out at the surface, but the depth to bedrock in other places is as much as 4 or 5 feet. In some areas this land type consists only of broken shale or of sand and soft sandstone. In the northern half of the county, some areas consist of olive-gray very channery silt loam.

Permeability ranges from rapid to slow. At times, water is ponded on the surface, but at other times, the water table is at a depth of as much as 3 feet or more. Seeps and springs are common on the lower slopes in winter and spring. The estimated available moisture capacity is low or very low. Runoff is rapid or very rapid, and the hazard of erosion is severe. The soil material is medium acid to very strongly acid and has low natural fertility.

This land type is used mainly for residential developments, but industries, institutions, and quarries occupy part of it. It has severe limitations for residential developments. The main limitations are the shallowness to the high water table and bedrock, the content of shale and stones, and the steep slopes.

Limitations are severe if this soil is used as a disposal field for the effluent from septic tanks. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 10)

Manor Series

The Manor series consists of moderately deep or deep soils that are well drained. These soils formed in material weathered from schist and gneiss. The areas are widely distributed on hills and ridges in the southern part of the county. These soils occupy a large part of the county south of the limestone valley.

The Manor soils are adjacent to the moderately deep or deep, well drained Glenelg soils and moderately well drained Glenville soils that are in depressions and on the lower slopes. They are also adjacent to the deep, well-drained Chester soils, on broad undulating uplands.

In a typical profile of a Manor soil, the surface layer is friable, dark grayish-brown channery silt loam about 7 inches thick. About 15 to 25 percent of it consists of small, flat pieces of rock.

The subsoil is yellowish-brown channery silt loam about 10 inches thick. In places 20 to 50 percent of the lower part consists of flat fragments of rock and enough mica to give the soil material a slippery feel. The soil material in the subsoil grades to the sandy or loamy substratum.

The upper part of the substratum is friable to firm, strong-brown channery loam or sand, and the lower part is very friable, dark grayish-brown loamy sand. The substratum contains small, flat pieces of rock. It also contains a large amount of mica that glitters in the sunlight and gives the soil material a greasy feel if it is rubbed between the fingers. In some places the substratum contains firm gneiss. Hard bedrock is generally at a depth of 4 to 5 feet, but the depth ranges from 2 to 10 feet or more.

The Manor soils that formed in material weathered from schist have a silty substratum. Those that formed in material weathered from gneiss tend to have a sandy substratum.

These soils are moderately permeable and have moderate to low available moisture capacity. Their reaction ranges from very strongly acid to slightly acid, and they have low natural fertility. Crops grown on these soils respond well to frequent applications of lime and fertilizer if there is enough moisture. These soils are suited to uses in which a cover of grass, trees, or shrubs is required.

Manor channery silt loam, 3 to 8 percent slopes, moderately eroded (MhB2).—This soil is on undulating hilltops and narrow ridges in the southern third of the county. In most places its profile is the one described as typical for the series. In areas adjacent to narrow drainageways, gullies, and abrupt changes in slope, however, the surface layer is dark-brown channery loam that is about 5 inches thick. Occasional stones occupy about 1 percent of the surface. On some of the narrower ridges, bedrock crops out in a few places.

Included with this soil in mapping are a few small areas of Edgemont and Glenelg soils. Also included are a few nearly level areas and wooded areas where slight erosion has taken place.

This soil is moderately permeable and has moderate to low available moisture capacity. Surface runoff is medium, and there is a moderate hazard of erosion.

This soil is used, to a small extent, for fruit, nursery stock, and pasture. Only a small acreage is in general field crops. Most of the acreage has a cover of grass, trees, shrubs, or weeds and is in parks, golf courses, wooded areas, estates, institutions, and areas surrounding residential developments.

This soil is fair for corn and alfalfa. Where it is used for crops, however, either field or contour stripcropping is needed on most slopes to reduce erosion and to conserve moisture. A suitable cropping system consists of 1 year of a row crop, 1 year of a winter small grain, and 2 to 3 years of grass-legume hay. If water is available, supplemental irrigation will increase the yields and improve the quality of the crops.

This soil has slight to moderate limitations for residential, light industrial, commercial, and institutional developments. The thick, micaceous substratum that generally underlies this soil is elastic and unstable. Therefore, special handling may be required if heavy structures are to be installed. Because of variations in depth to bedrock, this soil varies in limitations for use as a disposal field for the effluent from septic tanks. Percolation tests ought to be made and depth to bedrock should be determined at the specific site where a septic tank is planned. (Capability unit IIe–4, woodland suitability group 3, community development group 3)

Manor channery silt loam, 8 to 15 percent slopes, moderately eroded (MhC2).—This soil is on hills and ridges in the southern third of the county. It is steeper than the soil for which a profile is described as typical for the series, and the surface layer and subsoil are generally thinner. The subsoil ranges from 6 to 12 inches in thickness.

Included with this soil in mapping are severely eroded patches and entire slopes that are severely eroded. In those areas, tillage is in the substratum if the areas are cropped. Also included are wooded areas that are covered by about 2 inches of leaves and leaf mold. Beneath the leaves and leaf mold is about 1 inch of very dark grayish-brown silt loam over 7 inches of yellowish-brown channery silt loam. Occasional stones, 1 to 4 feet in diameter, and patches of exposed bedrock occupy as much as 3 percent of the surface in some areas. Other inclusions consist of a few areas of sloping, severely eroded Glenelg soils that have a subsoil of strong-brown channery silt loam 12 to 18 inches thick.

This Manor soil has moderate to moderately rapid permeability and low to moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

Most of the acreage is in grass, shrubs, trees, or weeds in parks, golf courses, estates, wooded areas, and areas surrounding institutions and residential developments. Only a small acreage is used for field crops, fruit, nursery stock, and pasture. This soil is well suited to hay and pasture consisting of drought-resistant grasses and legumes, but it is only fair for corn and winter small grains.

If this soil is cultivated, it should be planted in field or contour strips. A suitable cropping system is 1 year of a row crop, 1 year of a winter small grain, and 3 years of grass-legume hay. Incorporating manure, cover crops, and crop residue into the soil helps to maintain or increase the content of organic matter. All depressions, gullies, and severely eroded areas should be kept in permanent grass.

This soil has moderate limitations for commercial, light industrial, institutional, or residential developments. Because of varying depth to bedrock, it varies in its limitations for use as a disposal field for the effluent from septic tanks. Percolation tests and determination of depth to bedrock are desirable at the specific site to determine suitability for use as a disposal field for a septic tank. (Capability unit IIIe–4, woodland suitability group 3, community development group 4)

Manor channery silt loam, 15 to 35 percent slopes, moderately eroded (MhE2).—This soil is more channery and is shallower over the substratum than the one for which a profile is described as typical for the series. It is on hills and ridges in the southern third of the county.

Although bedrock crops out on the surface in many places, the normal depth to bedrock is between 2 and 10 feet. The subsoil is commonly 6 to 10 inches thick. In many places, however, the subsoil is absent and the dark grayish-brown surface layer directly overlies the substratum. Severely eroded patches occur, and in those areas any tillage that takes place is in the uppermost 5 inches of the substratum. On some slopes 1 to 5 percent of the surface is covered by stones. In wooded areas a layer of leaves and leaf mold, about 2 inches thick, is on the surface. The surface layer consists of 1 to 2 inches of very dark grayish-brown silt loam that is underlain by about 7 inches of yellowish-brown channery silt loam.

This soil has moderately rapid permeability and low to moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

This soil is mainly in grass, shrubs, trees, or weeds. It is in wooded areas or in areas surrounding institutions, estates, and residential developments. If this soil is cultivated, the rotation should be a long one consisting of 1 year of a row crop, 1 year of a small grain, and 3 or 4 years of hay. The crops ought to be grown in contour strips, and diversion terraces should be constructed where needed. Areas where the slopes are steeper than 25 percent are best suited to perennial hay or pasture.

This soil has moderate to severe limitations for residential developments. (Capability unit IVe–3, woodland suitability group 3, community development group 5)

Manor very stony silt loam, 0 to 8 percent slopes (MnB).—This soil is on undulating hilltops and on nearly level to gently sloping ridges. In most places it has never been cultivated, and stones occupy 1 to 5 percent of the profile. The stones are generally flat, are 4 to 12 inches thick, and are 15 to 30 inches in diameter. In some places the pieces of gneiss are round and are 2 to 8 feet in diameter. The number of smaller pieces of rock is about the same, or slightly smaller, than in the profile described as typical for the series.

A layer of leaves and leaf mold, about 3 inches thick, is on the surface. Just beneath the leaves and leaf mold is a layer of very dark grayish-brown silt loam about 2 inches thick. This layer, in turn, overlies about 10 inches of very friable, dark yellowish-brown silt loam. In many places the substratum is less sandy than the one in the profile described as typical for the series.

Included with this soil in mapping are areas of Glenville soils in small, stony depressions and drainageways. In a

few places the subsoil is 1 to 3 feet thick and consists of a yellowish-brown to yellowish-red silty clay loam.

This soil is moderately permeable and has moderate to low available moisture capacity. Surface runoff is slow, and the hazard of erosion is slight.

Almost all of the acreage is in wooded areas consisting of mixed oaks, tulip-poplar, beech, red maple, and dogwood. The soil is well suited to trees and to wildlife habitats. Part of the acreage could be used for pasture if it were cleared and enough stones and channers were removed to permit the use of machinery.

Undesirable species and diseased trees should be removed to favor the oaks and tulip-poplars. White pine or Virginia pine should be planted in open areas and in thin stands.

In some places bedrock near the surface is a limitation to use of this soil for residential, light industrial, and institutional developments. Also, the elastic, unstable substratum may require special treatment where a development is planned. The degree of limitation for use as a tile field for disposing of the effluent from septic tanks must be determined at the site. This can be done by performing percolation tests and by determining the depth to bedrock. (Capability unit VIs–2, woodland suitability group 3, community development group 3)

Manor very stony silt loam, 8 to 25 percent slopes (MnD).—This soil is on hills and ridge slopes in the southern part of the county. It is similar to Manor very stony silt loam, 0 to 8 percent slopes, but it is steeper and contains more stones in most places. Bedrock crops out where there are abrupt changes in slope, and narrow escarpments are common.

Included with this soil in mapping are nonstony wooded areas and areas of Glenville soils in a few depressions and on toe slopes. In places the subsoil is redder and thicker than typical for the series.

This soil has moderately rapid permeability and has moderate to low available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Most of the acreage is in wooded areas consisting of mixed oaks, tulip-poplar, beech, hemlock, red maple, and dogwood. The less stony, less sloping areas can be used to a limited extent for pasture if they are cleared and if enough stones and channers are removed to permit the use of machinery. This soil is better suited to trees or to wildlife habitats, however, than to pasture. If it is used for timber, undesirable species, brush, and diseased trees ought to be removed to favor the oak and tulip-poplar. White or Virginia pine should be planted in open areas and in thin stands.

This soil has moderate to severe limitations for residential developments. (Capability unit VIs–2, woodland suitability group 3, community development group 5)

Mount Lucas Series

In the Mount Lucas series are deep, moderately well drained or somewhat poorly drained, nearly level to moderately sloping silt loams that have moderately slow permeability in the subsoil. These soils formed on dark igneous rocks, called diabase. They are on hilltops and ridges and on the lower toe slopes in the northern part of the county.

The Mount Lucas soils occur with the well-drained Neshaminy and poorly drained Watchung soils. Near them on the adjacent uplands are grayish colored Lehigh, Brecknock, and Croton soils.

In a typical profile of a Mount Lucas soil in wooded areas, the surface is covered with a thin layer of leaves and partly decayed organic matter. Beneath this layer is 2 inches of very friable, very dark brown silt loam that is underlain by about 7 inches of yellowish-brown, friable silt loam. Beneath the yellowish-brown silt loam is a layer of friable, brown silt loam or silty clay loam, about 4 inches thick, that grades to the material in the subsoil. About 15 percent of the surface layer consists of large, round stones that range from 1 foot to more than 12 feet in diameter.

The subsoil is about 2 feet thick. It is friable, brown clay loam that is mottled with grayish brown, red, and yellowish red. If the soil is disturbed, the subsoil readily breaks to many very small, smooth-surfaced blocks that can be crushed between the thumb and forefinger. The subsoil is sticky and plastic when wet.

The substratum is dark-brown to dark yellowish-brown sandy loam that is 2 to 5 feet thick and contains many small pieces of soft rock. Hard bedrock is at a depth of 5 to 10 feet.

These soils are moderately permeable to a depth of 10 to 15 inches. Permeability is moderately slow in the subsoil and variable in the substratum. The soils are slightly acid to nearly neutral. They have high available moisture capacity and high natural fertility. Their suitability for growing specific crops is variable.

Mount Lucas silt loam, 0 to 3 percent slopes (MoA).—This soil is on broad flats and in depressions at the base of slopes, and it is also on hilltops in the northern part of the county. Its profile is similar to the one described as typical for the series, but it contains only a few scattered stones. In most places the soil material to a depth of 8 to 10 inches has been mixed by plowing and consists of very dark grayish-brown silt loam. The subsoil is somewhat thicker than the surface layer. It ranges from 2 to 3 feet in thickness. Gray mottling is commonly at a depth of 15 to 24 inches. In some depressions the dark-colored surface layer is as thick as 18 inches.

Included with this soil in mapping are areas of poorly drained Watchung soils. These areas are too small to be mapped separately.

This Mount Lucas soil is slowly permeable and has a high water table within 1 foot of the surface during winter and early in spring. It is slow to dry out in spring. Where it occurs in depressions, it remains wet until early in summer. The hazard of erosion is slight, and surface runoff is slow. The available moisture capacity is high.

This soil is used for the commonly grown field crops, fruit, hay, pasture, and trees. It is fairly well suited to corn, spring-sown small grains, hay, and pasture, but alfalfa and winter grains are subject to winterkill. A suitable cropping system consists of 2 years of row crops and a cover crop, 1 year of a spring-sown small grain, and at least 1 year of grass-clover hay. Graded cultivation is needed to reduce erosion and to remove the excess

surface water. Tile drains help to remove the excess water in depressions and at the base of slopes.

This soil has moderate limitations for commercial, light industrial, institutional, and residential developments. The high water table, moderately slow permeability in the subsoil, and slow surface drainage are definite hazards if a development is planned. Limitations are severe to use of this soil as a disposal field for the effluent from septic tanks. (Capability unit IIw–2, woodland suitability group 7, community development group 9)

Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded (MoB2).—This soil is on broad, undulating hilltops and ridges and near the foot of slopes in the northern part of the county. In a few areas, the surface layer is like the one in the profile described as typical for the series. In most places, however, the surface layer is dark grayish-brown silt loam that is 6 to 8 inches thick. It is as much as 15 inches thick in some places. The subsoil and substratum are like the ones in the profile described for the series, except that gray mottling occurs in the uppermost 10 inches of the subsoil. Only a few scattered stones are on the surface. Included with this soil in mapping are small areas of Watchung soils.

Permeability is moderately slow, and the water table is within a foot of the surface during winter and early in spring. The soil is slow to dry out in spring, and seeps at the foot of some slopes persist into early summer. Surface runoff is medium, and the hazard of erosion is moderate. The available moisture capacity is high.

This soil is used for the commonly grown field crops, fruit, hay, pasture, and trees. It is fairly well suited to corn, soybeans, spring grain, hay, and pasture, but it is fair to poor for fruit and vegetables. Alfalfa and winter small grains are likely to be injured by the high water table and frost heaving.

Using a suitable cropping system and planting the crops in field or graded strips will help to reduce losses from erosion, conserve moisture, and maintain good tilth. A suitable cropping system consists of 2 years of row crops and a cover crop, 1 year of a spring grain, and 2 years of grass-legume hay. On long slopes diversion terraces may be needed to remove excess surface water and to keep losses from erosion to a minimum. Random tile drains are effective in relieving wetness caused by seeps and springs.

This soil has moderate limitations to use for residential, light industrial, commercial, or institutional developments. It has severe limitations if it is used as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 7, community development group 9)

Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded (MoC2).—This soil is on hills and ridges, especially on benches near the foot of slopes. The surface layer is dark grayish-brown or dark-brown silt loam 6 to 8 inches thick. The subsoil and substratum are slightly thinner than those in the profile described as typical for the series.

In some places this soil is shallower over the substratum and is more sandy throughout than the one for which a profile is described as typical for the series. Grayish-brown mottling commonly occurs at a depth of 24 to 30 inches, but it is at a depth of only 15 inches in some places. Most areas of this soil contain only a few scattered stones, but small areas that are very stony have been included where they could not be mapped separately. This soil contains more small pieces of rock and is grayer than normal where it adjoins areas of Lehigh soils. Small areas of Neshaminy soils are included with it in mapping.

Permeability is moderately slow, and the water table is only 1 to 1½ feet below the surface during winter and early in spring. This soil dries slowly, and seeps at the foot of some slopes persist until early in summer. Surface runoff is medium to rapid, and there is a moderate to severe hazard of erosion. The available moisture capacity is high.

This soil is used for fruit, hay, and pasture, and it is used, to a small extent, for general field crops. It is fair for corn, spring-sown small grains, and fruit, but winter small grains and alfalfa are likely to be damaged by frost heaving and the high water table. The crops ought to be planted in graded strips, and a suitable cropping system should be used. A suitable cropping system is 1 year of a row crop and a cover crop, 1 year of a spring-sown small grain, and 2 years of grass-legume hay. All crop residue ought to be returned to the soil. Tile drains can be used to drain the areas where moisture is excessive because of seeps and springs.

This soil has moderate limitations as a site for residential, light industrial, institutional, or commercial developments. It has severe limitations if used as a disposal field for the effluent from septic tanks. (Capability unit IIIe–6, woodland suitability group 7, community development group 10)

Mount Lucas very stony silt loam, 0 to 8 percent slopes (MuB).—This soil is on undulating hilltops and ridges and on low-lying flats in the northern part of the county. It is less steep than the one for which a profile is described as typical for the series, and its subsoil is somewhat thicker, or 2 to 3 feet thick. In a few areas the uppermost 8 to 10 inches has been mixed by plowing. The stones in the surface layer range from 1 to 12 feet or more in diameter (fig. 25). Included with this soil in mapping are small areas of Watchung soils.

Permeability is moderately slow, and the water table is within 1 foot of the surface during winter and early in spring. Where this soil is in depressions, near springs, and in seepage areas, it remains wet until early in summer.

Figure 25.—Typical field of Mount Lucas very stony silt loam, 0 to 8 percent slopes, that has large stones on the surface.

Surface drainage is slow, and the hazard of erosion is slight. The available moisture capacity is high.

Most of the acreage is in wooded areas, but a small acreage is used for pasture or orchards. The woodland consists of mixed oaks, hickory, tulip-poplar, ash, and dogwood. This soil is well suited to trees and is fair for pasture. Where it is used for pasture, removing the stones is not practical. Light farm machinery can sometimes be used, however, for planting, liming, and fertilizing.

This soil is well suited to reed canarygrass, birdsfoot trefoil, Kentucky bluegrass, and ladino clover. The areas in trees should be protected from fire and grazing, and oak and poplar need to be encouraged by selective cutting. Open areas or areas where the stand is thin can be replanted with white or Austrian pine. (Capability unit VIs–1, woodland suitability group 7, community development group 9)

Mount Lucas very stony silt loam, 8 to 25 percent slopes (MuD).—This soil is on hills and on the lower ridge slopes in the northern part of the county. Its profile is the one described as typical for the series. In a few places, however, the profile is shallower over the substratum and is more sandy throughout than the one described.

In a few areas, the uppermost 8 to 10 inches of soil material has been mixed by plowing. The stones range from 1 foot to more than 12 feet in diameter. They are either rounded or have broad, flat tops, and they are so numerous in places that there is only a little soil material between them.

Included with this soil in mapping are small areas of Neshaminy soils that are free of mottling to a depth of more than 3 feet. Also included are areas of moderately sloping Watchung soils that are grayer or are mottled closer to the surface than this soil.

Permeability is moderately slow, and the water table is within 1 foot of the surface during winter and early in spring. Seeps and springs develop early in winter and sometimes persist until July. Surface runoff is medium or slow, and the hazard of erosion is slight. The available moisture capacity is high.

This soil is mainly in wooded areas consisting primarily of mixed oaks, hickory, tulip-poplar, ash, and dogwood. It is well suited to forest trees, but the moderately sloping, less stony areas are fair for pasture and fruit. This soil is also well suited to bluegrass, ladino clover, birdsfoot trefoil, and reed canarygrass. Removing the stones is generally not practical, but light machinery can at times be used for disking, planting, liming, and fertilizing. The oak and tulip-poplar need to be favored through selective cutting. Open areas and areas where the stand is thin can be planted to white pine or Austrian pine. (Capability unit VIs–1, woodland suitability group 7, community development group 10)

Murrill Series

The Murrill series consists of deep, well-drained gravelly silt loams. These soils formed in material weathered from quartzite. Many years ago this material slid or washed off hills and ridges and accumulated at the base of the slopes, where it covered the limestone material on the valley floor.

These soils are on benches that extend along the edges of the limestone valley in the south-central part of the county. They contain more gravel and are less silty than the Lawrenceville soils, and they are coarser textured than the Duffield soils. The Murrill soils are deeper and finer textured than the Lansdale and Edgemont soils.

In a typical profile of a Murrill soil, the surface layer is very friable, very dark grayish-brown gravelly silt loam or loam about 9 inches thick. Small pieces of quartzite and schist make up 20 to 35 percent of the soil material.

The uppermost 18 to 24 inches of the subsoil is friable, dark-brown channery loam, but 15 to 35 percent of it consists of fragments of rock. The lower part of the subsoil is mainly firm, yellowish-red clay loam, but 15 to 20 percent of it is fragments of rock. The subsoil is more sandy and channery with increasing depth. Limestone bedrock is 8 to 15 feet below the surface.

Permeability is moderate, and the available moisture capacity is high. The soils are medium acid to slightly acid and have high natural fertility. These soils are well suited to most of the crops commonly grown in the county. They have few limitations for developments.

Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded (MvB2).—This is the only soil of the Murrill series mapped in this county. It has the profile described as typical for the series. This soil is on narrow benches and toe slopes on the edges of the limestone valley in the south-central part of the county. The areas are generally small and widely scattered, but two large areas are near Valley Forge State Park and Fort Washington State Park.

In depressions and on low-lying flats, areas of Lawrenceville soils occur with this soil. Adjoining this soil on low uplands are areas of the Duffield soils. On the adjacent higher hills and ridges are areas of the Penn, Lansdale, Edgemont, and Manor soils.

Included with this soil in mapping are a few areas that are more silty and shaly than normal for this soil and that contain no fragments of quartzite. In some places the lower part of the subsoil has a texture of silt loam and a color between yellowish brown and red. In places this soil has a channery surface layer. In a few pockets and bands, gray mottling occurs in the lower part of the subsoil below a depth of 30 inches.

Permeability is moderate, and the available moisture capacity is high. Surface runoff is slow to medium, and there is a slight to moderate hazard of erosion.

This soil is mainly used for lawns, trees, and shrubs. It is mostly in parks, golf courses, and estates and in areas surrounding residential developments. A small acreage is used for the commonly grown field crops, hay, pasture, and nursery stock. The crops grown on this soil respond well to moderate applications of lime and fertilizer. This soil is well suited to a number of kinds of field crops and to vegetables, nursery stock, hay, and pasture. If it is farmed, it should be planted in field or contour strips. A cropping system no more intensive than 2 years of row crops followed by a cover crop the first year, 1 year of a winter small grain, and at least 1 year of grass-legume hay is suitable. Crop residue should be incorporated in the soil.

This soil has few limitations for use in residential, light industrial, commercial, or institutional develop-

ments. The possibility of solution channels in the limestone bedrock should be carefully investigated, however, before a heavy structure is installed. Limitations are slight for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–1, woodland suitability group 2, community development group 1)

Neshaminy Series

The Neshaminy series consists of deep, well-drained soils formed in material weathered from dark igneous rocks, called diabase. These soils are gently sloping to steep and are on hills and ridges in the northern part of the county.

The Neshaminy soils are adjacent to moderately well drained or somewhat poorly drained Mount Lucas soils and poorly drained Watchung soils. Near them are gray Lehigh and Becknock soils and reddish-brown Penn soils.

In a typical profile of a Neshaminy soil, the plow layer is friable, dark reddish-brown silt loam about 6 inches thick. Below the plow layer is a layer, about 2 inches thick, of friable, yellowish-red clay loam that grades to the subsoil.

The subsoil is 2 to 3 feet thick. It is friable, yellowish-red clay loam that is somewhat sticky and plastic when wet. If the soil is disturbed, the subsoil breaks to many small, smooth-surfaced blocks that can be broken between the thumb and forefinger. From 10 to 20 percent of the subsoil consists of small pieces of rock. The lower part contains more sand and fragments of rock than the upper part, and it grades to the substratum.

The substratum is 1 to 3 feet thick. It is yellowish-red sandy clay loam and dark-brown sandy loam. About 30 percent of it consists of small pieces of rock. Depth to bedrock is generally about 4 feet, but the range is from 3 to 6 feet.

These soils are slightly acid to neutral and have high natural fertility. Permeability is moderate, and the available moisture capacity is high. The soils are productive, but they vary in suitability for growing specific crops. They have certain limitations to use for developments.

Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded (NhB2).—This soil is less sloping than the one for which a profile is described as typical for the series. Also, it has a surface layer that is 8 to 10 inches thick and a subsoil that is 2 to 3½ feet thick. In places on the lower slopes, the surface layer is 12 to 14 inches thick. This soil is on broad, undulating hilltops and ridges in the northern part of the county.

Included with this soil in mapping are small areas that are nearly level. Also, a few lighter colored patches occur where erosion has removed nearly all of the original surface layer and plowing is in the upper part of the subsoil. In some areas patches of Legore soils that are shallower and more sandy than this soil are included.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate. This soil has high natural fertility.

This soil is used for the commonly grown field crops, fruit, hay, and pasture. It is well suited to corn, small grains, apples, peaches, alfalfa, orchardgrass, ladino clover, and bluegrass. The crops ought to be planted in field or contour strips and a cropping system used that consists of 2 years of row crops, 1 year of a winter small grain, and at least 1 year of grass-legume hay. A cover crop is needed following the first year of row crops. The crop residue ought to be conserved and incorporated into the soil. The crops respond well to small or moderate applications of lime and fertilizer.

This soil has slight limitations for residential, light industrial, commercial, or institutional developments. It has moderate limitations as a disposal field for the effluent from septic tanks, unless percolation tests made at the specific site are favorable. Where this soil is disturbed, it is unstable, erodible, and subject to damage from frost action. (Capability unit IIe–1, woodland suitability group 2, community development group 1)

Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded (NhC2).—This soil has the profile described as typical for the series. It is on hills and ridges in the northern part of the county.

Included with this soil in mapping are small areas, generally near the foot of slopes, that have a dark-colored surface layer 10 to 12 inches thick. A few gullied areas are included. Also, there are many small, light-colored patches where all or nearly all of the original surface layer has been lost through erosion and cultivation is now in the upper part of the subsoil. In many places occasional large, rounded stones occur, but they generally make up less than 1 percent of the surface layer.

This soil is moderately permeable and has high available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe. Natural fertility is high.

This soil is used for general field crops, fruit, hay, and pasture. Also, part of the acreage is idle and is overgrown with weeds and brush. The soil is well suited to corn, winter small grains, apples, peaches, alfalfa, and orchardgrass. Field or contour stripcropping should be practiced. A suitable cropping system consists of 1 year of a row crop, 1 year of a winter small grain, and at least 3 years of hay or deep-rooted grasses and legumes. The crops respond well to moderate applications of lime and fertilizer. On long slopes diversion terraces with grassed waterways further reduce losses from erosion and safely carry away excess surface water.

This soil has moderate limitations for residential developments. It also has moderate limitations for use as a disposal field for the effluent from septic tanks, unless percolation tests made at the specific site prove it to be favorable for that use. Where this soil is disturbed by earthmoving operations, it is subject to severe erosion, damage from frost action, and soil creep. (Capability unit IIIe–1, woodland suitability group 2, community development group 2)

Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded (NhD2).—This soil is steeper than the one for which a profile is described as typical for the series, and its plow layer consists of material from the subsoil mixed with the original surface soil. The subsoil is 1½ to 2 feet thick. This soil is in scattered, small areas on hillsides and ridge slopes in the northern part of the county.

Areas in which the slopes are short and are steeper than 25 percent are included with this soil in mapping. Occassional large stones occur, and bedrock crops out in places

near the crests of slopes. Patches of yellowish-red clay loam and sandy clay loam are common, especially on mid slopes and near actively eroding gullies. In some places small bands of Mount Lucas soils are included near the bottom of slopes.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe. Natural fertility is high.

This soil is used for fruit and pasture and, to a lesser extent, for corn and small grains. Much of the acreage is idle and is overgrown with young trees, weeds, honeysuckle, and poison-ivy. This soil is fair for corn, winter small grains, apples, and peaches. If it is used for cultivated crops, field or contour stripcropping is needed with a cropping system consisting of 1 year of a row crop, 1 year of a small grain, and at least 4 years of deep-rooted grasses and legumes grown for hay. The crops respond well to moderate or large applications of fertilizer. Requirements for lime are generally light to moderate. Crop residue should be conserved and incorporated into the soil. On the long slopes, diversion terraces will reduce damage caused by excessive runoff.

This soil has moderate to severe limitations for residential developments. (Capability unit IVe–1, woodland suitability group 2, community development group 5)

Neshaminy very stony silt loam, 0 to 8 percent slopes (NsB).—This soil has a 3-inch layer of leaves and black leaf mold on its surface. Beneath this layer is about 2 inches of very dark brown very stony silt loam underlain by a layer of friable, yellowish-brown very stony silt loam 6 to 9 inches thick. The subsoil consists of 24 to 40 inches of strong-brown or yellowish-red very stony clay loam. The subsoil is firm in place, but it readily breaks to small blocks if it is disturbed. The substratum ranges from a sandy rind only an inch or so thick over bedrock to a gravelly mass of stony sandy clay loam or sandy loam 1 to 3 feet thick. The stones are rounded and range from 1 foot to more than 12 feet in diameter. They occupy 1 to 6 percent of the surface. This soil is on hilltops, ridges, and midslope benches in the northern part of the county.

In a few places brown or grayish-brown streaks are at a depth of 30 inches or more. Some fields that are now cultivated or that have been cultivated in the past have a plow layer like the one in the profile described as typical for the series. Small areas, especially on ridgetops, are extremely stony or consist entirely of rounded and flat-topped stones and boulders.

Included with this soil in mapping are areas of Mount Lucas soils. These areas are too small to be mapped separately.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is slow, and the hazard of erosion is slight.

Most of this soil is in wooded areas, and the trees are mainly mixed oaks, tulip-poplar, beech, ash, sweet birch, red maple, and dogwood. A few areas are used for pasture and orchards. The soil is well suited to forest trees and is fair for pastures and fruit. Removing the stones and boulders is not practical, but light farm machinery can be used in some areas for planting, liming, and fertilizing. The soil is well suited to Kentucky bluegrass, tall fescue, reed canarygrass, ladino clover, and birdsfoot trefoil. Oak and tulip-poplar should be encouraged by selective cutting. White or Austrian pine ought to be replanted in open areas and in areas where the stand is thin. (Capability unit VIs–1, woodland suitability group 2, community development group 1)

Neshaminy very stony silt loam, 8 to 25 percent slopes (NsD).—In a few areas, this soil has a surface layer like the one described as typical for the series. In most places, however, this soil is similar to Neshaminy very stony silt loam, 0 to 8 percent slopes, except that it is moderately sloping to moderately steep and has a slightly thinner subsoil that ranges from 20 to 36 inches in thickness. It is on hills and ridge slopes in the northern part of the county. In many places this soil occurs above or below the less sloping Mount Lucas soils.

Some areas of this soil are more sandy and are shallower over bedrock than the soil for which a profile is described as typical for the series. Included in mapping are small areas that are extremely stony. Also included are areas of Mount Lucas soils in depressions and drainageways, and on the lower toe slopes. These included areas are too small to be mapped separately.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Most of the acreage is in wooded areas consisting of mixed oaks, hickory, tulip-poplar, beech, sweet birch, and dogwood. A few areas are used for pasture and orchards. This soil is well suited to use as woodland, but the moderately sloping, less stony areas are fair for pasture or orchards. The soil is well suited to bluegrass, ladino clover, birdsfoot trefoil, and reed canarygrass. Removing the stones and boulders is not practical, but light machinery can be used in some areas for plowing, planting, fertilizing, and liming.

White pine or Austrian pine ought to be used to replant areas that are now open or that have a thin stand. This soil is well suited to parks, natural recreational areas, and wildlife habitats. (Capability unit VIs–1, woodland suitability group 2, community development group 5)

Neshaminy extremely stony silt loam, 0 to 8 percent slopes (NeB).—This soil is on hilltops and ridges. It is so stony that a person can usually step or jump from stone to stone without touching the surface of the soil (fig. 26). The stones and boulders are rounded, but some of them have broad, flat tops, and they range from about 1 foot to more than 12 feet in diameter. Except for the stones, the profile of this soil is like that of Neshaminy very stony silt loam, 0 to 8 percent slopes.

Included with this soil in mapping are small areas where bedrock crops out. Also, scattered throughout the areas are nonstony patches that are too small to be mapped separately. Other inclusions consist of extremely stony Mount Lucas soils in depressions and on flats.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is slow, and the hazard of erosion is slight.

Some small areas of this soil were formerly cleared and used for pasture, but now all of the acreage is in wooded areas consisting of mixed oaks, tulip-poplar, hickory, beech, and dogwood. This soil is better suited to trees than to field crops or pasture. Selective and improvement cutting to remove unwanted species and the stunted

Figure 26.—**Neshaminy extremely stony silt loam, 0 to 8 percent slopes, in a wooded area.**

and diseased trees will encourage oak and poplar. White pine or Austrian pine ought to be planted in open areas or in areas where the stand is thin. (Capability unit VIIs-1, woodland suitability group 2, community development group 8)

Penn Series

In the Penn series are moderately deep to shallow, reddish-brown silt loams formed in material weathered from red shale, siltstone, and fine-grained sandstone. These soils are important for agriculture and are widely distributed throughout the northern two-thirds of the county (fig. 27).

The Penn soils occur on undulating and hilly uplands adjacent to the Lansdale, Reaville, Readington, Abbottstown, and Croton soils. In many places they are also adjacent to gray Lehigh and Brecknock soils and to the Neshaminy soils, which are finer textured than these soils. The Penn soils are redder and less sandy than the Lansdale soils. Their profile resembles that of the Reaville soils, but it does not have a gray, mottled layer just above the substratum. They are not so deep as the moderately well drained Readington soils, and they contain more shale than those soils. The Penn soils are shallower and do not have the gray, mottled subsoil that is typical of the somewhat poorly drained Abbottstown and poorly drained Croton soils.

Figure 27.—**A field of Penn soils in the northern part of the county. The wooded ridge in the background is occupied by Neshaminy soils that are underlain by diabase.**

In a typical profile of a Penn soil, the surface layer is friable, dark reddish-brown silt loam about 8 inches thick. About 10 percent of the surface layer is shale.

The subsoil is reddish-brown shaly silt loam about 12 inches thick. Shale makes up 5 to 20 percent of the upper part. The content of shale increases to about 30 to 60 percent, however, where the subsoil grades to the substratum.

The substratum is a weak-red layer about 10 to 12 inches thick. It consists of broken pieces of shale with a small amount of loam or silt loam between the pieces. The material in the substratum grades to firm shale at a depth of about 30 to 36 inches. Dusky-red to reddish-brown shale, siltstone, or fine-grained sandstone bedrock is 2 to 3 feet below the surface.

These soils have moderately rapid permeability and low to moderate available moisture capacity. They have a slightly acid to strongly acid substratum. Large applications of lime, however, have made the plow layer and the subsoil medium acid to neutral. Natural fertility is moderate to low.

These soils are used for fruit, vegetables, commonly grown field crops, hay, and pasture. The crops usually respond well to moderate, frequent applications of lime and fertilizer. The soils have limitations for residential developments.

Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded (PaB2).—This soil has a surface layer of dark reddish-brown silt loam. The surface layer is 8 to 10 inches thick, and 10 to 25 percent of it is shale. The subsoil is 10 to 15 inches thick and is underlain by a substratum of very shaly silt loam. The substratum is slightly acid or neutral in most places. The unweathered, freshly broken shale effervesces if it is treated with dilute hydrochloric acid. In general, depth to bedrock is between 2 and 3 feet, but in a few places bedrock is at a depth of only 12 inches. This soil is on rolling uplands in the northern third of the county.

Near Niantic, less shaly areas in which the substratum is at a depth of about 30 inches were included with this soil in mapping.

This soil has moderately rapid permeability and low to moderate available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate to severe.

This soil is used for fruit, commonly grown field crops, hay, and pasture. It is well suited to hay and pasture consisting of drought-resistant grasses and legumes, and it is suited to alfalfa grown for a short period. This soil is only fair for corn, fruit, and winter small grains. The areas of this soil near Niantic are more suitable for growing fruit than are other parts of the county. Yields of field crops and fruit are moderate in years of normal rainfall, but they are severely reduced in dry years.

In most places moderate, frequent applications of lime and fertilizer are adequate for crops grown on this soil. Either field or contour stripcropping is needed, and a cropping system no more intensive than 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume

hay is suitable. Crop residue should be incorporated into the soil.

This soil is suitable for residential, industrial, commercial, and institutional developments if adequate facilities for treating and disposing of sewage are available. It varies in suitability for use as a disposal field for the effluent from septic tanks. This soil is well suited to grass, trees, and shrubs in parks and estates and surrounding institutions and residential developments. (Capability unit IIIe–5, woodland suitability group 4, community development group 3)

Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, severely eroded (PaB3).—This soil occurs with the Reaville and Klinesvillle soils on rolling uplands and hilltops in the northern third of the county. The surface layer is reddish-brown shaly silt loam, 7 inches thick, and 20 to 30 percent of it is shale. The subsoil is about 11 inches thick, and 20 to 50 percent of it is shale. The substratum grades to shale bedrock at a depth of 24 to 32 inches. The substratum is neutral or slightly acid, and pieces of the freshly broken bedrock effervesce when dilute hydrochloric acid is added.

Included with this soil in mapping are areas in which the soil is only 6 to 12 inches deep over bedrock. Also included are areas in which the substratum is very shaly. In a few places, the substratum is only slightly acid. Very shaly streaks and ridges occur in this soil, as well as occasional outcroppings of weathered shale bedrock.

This soil is rapidly permeable and has low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, fruit, hay, and pasture. It is well suited to perennial hay and pasture consisting of drought-resistant grasses and legumes, but corn, fruit, and small grains are generally not profitable. Moderate to small, frequent applications of lime and fertilizer are needed. Also, where facilities are available, supplemental irrigation helps to maintain fair yields and forage of fair quality.

If this soil is cultivated, a long rotation consisting of 1 year of a row crop, 1 year of a small grain, and 3 or more years of hay is suitable. When necessary for highest production, hayfields and pastures ought to be reseeded in alternate field and contour strips. Half the strips should be planted the first year and the rest the following year. Pastures should be rotated to prevent overgrazing.

This soil has severe limitations for residential, light industrial, commercial, and institutional developments. Shale and shallow bedrock make grading and excavating difficult. This soil also has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 4, community development group 6)

Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded (PaC3).—This soil is steeper and shallower than the one for which a profile is described as typical for the series. The surface layer is 4 to 6 inches thick, and 20 to 50 percent of it is shale. The subsoil is 6 to 12 inches thick, and it is underlain by bedrock or by the thin, very shaly substratum. This soil is on rolling and hilly uplands in the northern third of the county.

In this mapping unit are areas near Niantic that are deeper and less eroded than typical for this soil. In other places bedrock is only 6 inches beneath the surface, and it crops out on the surface in a few bands near the tops of ridges. Patches where the surface layer is very shaly and where tillage is in the substratum are also included. In some places the reaction is medium acid to neutral. Pieces of the raw, freshly broken bedrock effervesce when dilute hydrochloric acid is added.

This soil has moderately rapid permeability and low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is better suited to pasture or wooded areas than to field crops or fruit. It is used, however, for fruit, commonly grown field crops, hay, and pasture. Nevertheless, this soil generally is poorly suited to corn, fruit, small grains, and hay. It is suited to birdsfoot trefoil and reed canarygrass, which tolerate drought.

Plantings for a new pasture or for renovating a pasture should be made in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The pastures ought to be rotated so that overgrazing will be prevented, especially during summer. White pine or Virginia pine could be planted on the short slopes and in areas not needed for pasture.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. It also has severe limitations for use as a disposal field for the effluent from septic tanks. Shale and bedrock near the surface make grading and excavating difficult. (Capability unit VIe–1, woodland suitability group 4, community development group 7)

Penn silt loam, 0 to 3 percent slopes, moderately eroded (PeA2).—This soil is less sloping than the soil for which a profile is described as typical for the series. In most places it also has a thicker subsoil and contains fewer pieces of shale. The substratum in most areas is at a depth of 18 to 30 inches, but it is as shallow as 12 inches in some places and as deep as 36 inches in others. This soil is on smooth or undulating uplands in the northern two-thirds of the county.

Included with this soil in mapping are areas in which the soil is only slightly eroded or that have accumulated soil material on the surface. Also included are small areas of Readington soils. In some narrow ridges and bands, the soil material is shallower and contains more fragments of shale than normal for this soil. Depth to bedrock ranges from 12 inches to 5 feet.

This soil is moderately permeable and has low to moderate available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for vegetables, commonly grown field crops, hay, and pasture. Part of it is in grass or trees in golf courses and estates and surrounding industries, residences, and institutions. The soil is fair for corn, vegetables, and alfalfa, and it is well suited to winter small grains and to hay and pasture. The crops respond well to moderate applications of lime and fertilizer. Supplemental irrigation will increase the yields and improve the quality of the crops.

If this soil is farmed across the slope, a suitable cropping system consists of 2 years of row crops, 1 year of a small grain, and at least 1 year of grass-legume hay. Usually, a cropping system consisting of a row crop and a small grain grown in rotation is also adequate for protection if the soil is cultivated on the contour. A

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cover crop ought to be grown when the soil would otherwise be unprotected during winter. Also, crop residue should be incorporated into the soil.

This soil has moderate limitations for residential, light industrial, commercial, and institutional developments. It has moderate to severe limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests should be conducted at the specific site. (Capability unit IIs–1, woodland suitability group 4, community development group 3)

Penn silt loam, 3 to 8 percent slopes, moderately eroded (PeB2).—This soil is on undulating uplands and hilltops in the northern two-thirds of the county. In most places its profile is the one described as typical for the series. In a few areas, however, this soil has not been cultivated. In those areas it has a layer of leaves and organic matter and a layer of very dark brown silt loam, about 2 inches thick, overlying the described surface layer.

Included with this soil in mapping are slightly eroded areas in which the surface layer is thicker and less shaly than that in the profile described. Also included are small shaly and channery areas. In a few places the reaction in the substratum is medium acid to neutral.

Permeability is moderately rapid, and this soil has low available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate. This soil is used for fruit, vegetables, commonly grown field crops, hay, and pasture. Also, part of it is in golf courses and estates and surrounding industries, residences, and institutions. This soil is fair for corn, vegetables, apples, peaches, and alfalfa, and it is well suited to winter grains, hay, and pasture. Yields are moderate in years of normal rainfall, but they are severely reduced in dry years. Moderate, frequent applications of lime and fertilizer are usually needed. Supplemental irrigation, where available, helps to maintain good yields and the quality of the crop. A cropping system consisting of 1 year of a row crop, 1 year of a winter small grain, and 2 or 3 years of grass-legume hay is suitable. The crops should be planted in field or contour strips, and the crop residue ought to be conserved and incorporated into the soil. Diversion terraces and grassed waterways may be needed on the long slopes to safely carry off the surface water.

This soil has moderate limitations for residential, light industrial, commercial, and institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests should be conducted at the specific site. (Capability unit IIe–3, woodland suitability group 4, community development group 3)

Penn silt loam, 3 to 8 percent slopes, severely eroded (PeB3).—This soil is less deep than the one for which a profile is described as typical for the series. Also, the surface layer contains more shale, is only 6 to 8 inches thick, and consists largely of material from the subsoil mixed with organic matter. The substratum is 12 to 24 inches below the surface. This gently sloping soil is on undulating uplands and hilltops in the northern two-thirds of the county.

Included with this soil in mapping are areas in which the shaly substratum is at the surface, and there are occasional outcroppings of bedrock. Small areas of Reaville and Readington soils are also included. In some places the substratum is medium acid to neutral.

Permeability is moderately rapid, and the available moisture capacity is low. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops and for hay and pasture. Part of the acreage is in grass, weeds, and brush on estates and in areas surrounding residential developments. This soil is fairly well suited to hay and pasture consisting of drought-resistant plants.

This soil is fair to poor for corn and winter small grains, and it is poor for alfalfa. Light, frequent applications of irrigation water help to maintain fair yields and the quality of the crop. A suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume hay. With this cropping system, the crop should be grown in field or contour strips. Barnyard manure and crop residue ought to be incorporated into the soil. Diversion terraces and grassed waterways may be needed on the long slopes to control runoff.

This soil has moderate limitations for residential, light industrial, commercial, and institutional developments. Shale and bedrock near the surface make grading and excavating difficult. The soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–3, woodland suitability group 4, community development group 6)

Penn silt loam, 8 to 15 percent slopes, moderately eroded (PeC2).—This soil is steeper and shallower over the underlying material than the soil for which a profile in described as typical for the series. The surface layer is 6 to 8 inches thick, and 10 to 20 percent of it is shale. The subsoil is 8 to 20 inches thick, and bedrock is at a depth of 18 to 36 inches. This soil is on hills and on undulating uplands in the northern two-thirds of the county.

In wooded areas this soil has a layer of leaves and organic matter, about 2 inches thick, over about 2 inches of very dark brown silt loam. Beneath the very dark brown silt loam is about 6 inches of dark reddish-brown silt loam.

Included with this soil in mapping are small severely eroded and gullied areas where weathered shale bedrock crops out. Also included are areas of Readington and Reaville soils that have gray and black streaks and coatings just above the substratum. In a few areas, the substratum is slightly acid to neutral. Shaly and channery patches are common.

Permeability is moderately rapid, and this soil has low to moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, orchards, hay, and pasture. Also, part of the acreage is in wooded areas or in grass on golf courses and estates and surrounding institutions, industries, and residential developments. This soil is suited to hay and pasture consisting of birdsfoot trefoil, reed canarygrass, orchardgrass, and other drought-resistant grasses and legumes. It is fair for corn and winter small grains, and it is fair to poor for fruit.

Crops grown on this soil respond well to moderate, frequent applications of lime and commercial fertilizer. Also, light, frequent applications of irrigation water help to maintain fair yields and good quality. The crops ought to be planted on the contour in a cropping system no more intensive than 1 year of a row crop, 1 year of a winter small grain, and at least 3 years of grass-legume

hay. Barnyard manure and crop residue ought to be incorporated into the soil. Diversion terraces and grassed waterways help to control runoff on the long slopes.

This soil has moderate limitations for residential, commercial, light industrial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests ought to be made at the specific site. (Capability unit IIIe–3, woodland suitability group 4, community development group 4)

Penn silt loam, 8 to 15 percent slopes, severely eroded (PeC3).—This soil is on hills and undulating uplands in she northern two-thirds of the county. It is steeper, thallower, and more shaly than the one for which a profile is described as typical for the series. The surface layer is generally reddish-brown or weak-red silt loam that is only 4 to 6 inches thick, and 10 to 30 percent of it is shale. The subsoil is 8 to 24 inches thick. Bedrock is at a depth of 14 to 36 inches. Many gullies and rills are within areas of this soil.

In some places the surface layer is like the one in the profile described as typical for the series. In other places weathered shale bedrock crops out on the surface. The substratum in some areas is slightly acid or neutral. Included with this soil in mapping are small areas of Reaville soils in bands and pockets.

This Penn soil has moderately rapid permeability and low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, orchards, hay, and pasture. Much of the acreage, however, is in areas surrounding industries, estates, residences, and institutions and is overgrown with brush, grass, and weeds. This soil is suited to hay and pasture consisting of birdsfoot trefoil, reed canarygrass, and other drought-resistant legumes and grasses. The growing of field crops and small grains is limited, however, by the droughty nature of this soil. Frequent, light applications of irrigation water help to maintain fair yields and the quality of the forage.

On this soil cultivated crops ought to be grown in a long rotation consisting of 3 or 4 years of hay followed by 1 year of a cultivated crop and 1 year of a winter small grain. When necessary, hayfields and pastures ought to be reseeded in alternate contour strips. Half the strips should be planted the first year and the rest the following year. The pastures need protection from overgrazing. Diversion terraces help to control erosion on the long slopes.

This soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. The high content of shale and bedrock near the surface make grading and excavating difficult. (Capability unit IVe–3, woodland suitability group 4, community development group 7)

Penn very stony silt loam, 8 to 25 percent slopes (PfD).—This soil is on hills and on short, abrupt slopes adjacent to streams and drainageways in the northern two-thirds of the county. It is steeper than the soil for which a profile is described as typical for the series. Also, the surface layer is covered with 1 to 2 inches of leaf litter and partly decomposed organic matter over a layer, about 2 inches thick, of very dusky red very stony silt loam. Beneath the layer of very dusky red soil material is a layer, about 5 inches thick, of reddish-brown very stony silt loam. The stones occupy 1 to 5 percent of the surface and consist of large pieces of shale, siltstone, and sandstone that are 2 to 6 inches thick and 10 to 24 inches in diameter. In the areas near Ambler and south of Hatboro, the stones are sandstone and sandstone conglomerate. Near Niantic, they contain some limestone pebbles. In some places the surface layer is brown or yellowish brown.

Included with this soil in mapping are undulating areas on hilltops where the slope is less than 8 percent. In some areas the bedrock contains enough lime to effervesce when dilute hydrochloric acid is added. In the central part of the county, sandy areas are included with this soil.

Permeability is moderately rapid, and the available moisture capacity is low to moderate. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Practically all of the acreage is in wooded areas consisting of ash, mixed oaks, beech, and dogwood. This soil can be used for pasture. It is necessary that it be cleared, however, and enough stones removed to permit the use of machinery for preparing the seedbed and seeding. Mowing of the pastures is generally not practical, but grazing ought to be rotated to prevent overgrazing. Brush and undesirable species need to be removed from the wooded areas. White or Virginia pine ought to be planted in open areas or in areas where the stand is thin.

This soil can be used for residential developments, but it has moderate limitations for that use. (Capability unit VIs–2, woodland suitability group 4, community development group 5)

Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded (PkD3).—This soil complex consists of moderately steep Penn and Klinesville soils that occur together in such an intricate pattern it was not practical to separate them on the map. These soils are on hills and on short, abrupt slopes near streams and drainageways in the northern half of the county. Their profiles resemble the ones described as typical for the Penn and Klinesville series. They are shallower over bedrock, however, and they are more shaly. Their surface layer, especially, contains more shale.

In most places the surface layer is reddish-brown or dusky-red very shaly silt loam 4 to 6 inches thick. In places, however, the surface layer is dark reddish brown and is 6 to 8 inches thick. Hard shale bedrock crops out in a few places. In many places tillage is in the substratum of soft, broken shale. In a few areas, the shale contains enough lime to effervesce when dilute hydrochloric acid is added.

The soils of this complex have moderately rapid permeability and low available moisture capacity. Surface runoff is very rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops and for pasture. Also, part of the acreage is in grass, weeds, trees, or brush on golf courses and estates and surrounding institutions and other areas near residential developments. On farms these soils are well suited to pasture or trees. Birdsfoot trefoil, reed canarygrass, and other drought-resistant plants grow better than for-

age crops that do not resist drought. New plantings or seedings for renovation ought to be made in alternate contour strips, and half the strips should be planted the first year and the rest the following year. The pastures need protection from overgrazing. White pine and Virginia pine are suitable for woodland plantings.

The soils of this complex have severe limitations for commercial, light industrial, and institutional developments, and they have moderate to severe limitations for residential developments. They have severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit VIe–1, woodland suitability group 11, community development group 5)

Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded (PlB2).—This complex consists of Penn and Lansdale soils that occur together on undulating uplands, hilltops, and ridges in the central part of the county. These soils are gently sloping. They have profiles similar to the ones described as typical for the Penn and the Lansdale series, but the Penn soil has slightly more sand throughout the profile.

Included with these soils in mapping are areas underlain by red and brown shale. In those areas the profile of the Lansdale soil is more silty and shaly than the one described as typical for the series. Also included are nearly level areas on narrow hilltops and ridges.

The soils of this complex have moderate or moderately rapid permeability. The Penn soil has low to moderate available moisture capacity, and the Lansdale soil has high available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate.

These soils are used for fruit, vegetables, nursery stock, commonly grown field crops, hay, and pasture. Part of the acreage is in grass and trees on golf courses and estates and in areas surrounding residential developments. The soils are well suited to winter small grains, nursery stock, and most grasses and legumes. They are fair for apples, peaches, corn, vegetables, and alfalfa. Yields are severely reduced in dry years. Field or contour stripcropping is needed in most fields. With the field or contour stripcropping, a suitable cropping system is 1 year of a row crop, 1 year of a winter small grain, and 2 years or more of grass-legume hay. The crop residue should be conserved and incorporated into the soils. Crops grown on these soils respond well to moderate, frequent applications of lime and fertilizer. Supplemental irrigation increases yields and improves the quality of the crop during dry seasons. Diversion terraces and grassed waterways may be needed on long slopes to safely carry away surplus runoff.

This complex has moderate limitations for residential, light industrial, commercial, and institutional developments. Bedrock near the surface is a limitation to use as a disposal field for the effluent from septic tanks. Depth to bedrock ought to be determined and percolation tests should be made at the specific site. (Capability unit IIe–3, woodland suitability group 4, community development group 3)

Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded (PlB3).—This complex consists of Penn and Lansdale soils that occur together on undulating uplands, hilltops, and ridges in the central part of the county. The profiles of these soils are similar to the ones described as typical for the Penn and Lansdale series. They have a thinner surface layer and subsoil and contain more shale and pieces of sandstone. Also, in most places they are more sandy. The soils are generally underlain by interbedded red shale or fine-grained sandstone and by light-brown or gray sandstone. In some areas, however, the bedrock consists of red and brown shale. In these areas the Lansdale soil is more silty and shaly than typical for the series. In a few places, bedrock crops out on the surface. In many places shallow gullies and rills penetrate the substratum.

Permeability is moderate to moderately rapid, and the available moisture capacity is low to moderate. Surface runoff is rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops, fruit, nursery stock, hay, and pasture. Also, a large acreage is in grass, trees, shrubs, or weeds in estates and in areas surrounding residential, industrial, and other developments. These soils are suited to hay or pasture consisting of drought-resistant grasses and legumes. They are fair for corn, winter small grains, and alfalfa. If these soils are cropped, field or contour stripcropping is needed and a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume hay. Manure and crop residue should be incorporated into the soil. Supplemental irrigation helps to maintain fair yields and the quality of the crop in dry seasons. Moderate, frequent applications are usually needed.

This complex has moderate limitations for residential, light industrial, commercial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–3, woodland suitability group 4, community development group 6)

Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded (PlC2).—This complex consists of Penn and Lansdale soils. These soils occur together in such a complex pattern it is not practical to separate them on the map. The soils are on hills and on short, abrupt slopes adjacent to streams and drainageways in the central part of the county. They have profiles similar to the ones described as typical for the Penn and Lansdale series, but they are steeper and contain more shale or pieces of sandstone. Also, their subsoil is thinner and bedrock is generally at a depth of 2 to 4 feet. The profile of the Penn soil is generally more sandy than the one described for the Penn series.

Included in this complex in mapping are areas of a Lansdale soil that is underlain by brown shale. This included soil has a subsoil of shaly silt loam.

The soils of this complex have moderate to moderately rapid permeability and moderate to low available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is severe.

These soils are used for fruit, commonly grown field crops, hay, and pasture. Also, a large acreage is in golf courses and estates and surrounding institutions, residential, and industrial developments. The soils are fair for corn, apples, peaches, winter small grains, and alfalfa. They are also suitable for hay and pasture consisting of drought-resistant grasses and legumes. Contour stripcropping is needed, and a cropping system should be used that is no more intensive than 1 year of a row crop, 1 year of a winter small grain, and at least

3 years of grass-legume hay. Barnyard manure and crop residue ought to be incorporated into the soil. Diversion terraces and grassed waterways help to control runoff on the long slopes. Crops grown on these soils respond well to moderate, frequent applications of lime and fertilizer. Supplemental water supplied by irrigating will greatly increase the yields and quality of the crops that are grown during dry seasons.

The soils of this complex have moderate limitations for residential, commercial, light industrial, or institutional developments. Because of differences in depth to bedrock, the soils vary in suitability for use as a disposal field for the effluent from septic tanks. Depth to bedrock should be determined, and percolation tests ought to be made at the specific site. (Capability unit IIIe–3, woodland suitability group 4, community development group 4)

Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded (PlC3).—This mapping unit consists of Penn and Lansdale soils that occur together on hills and on short, abrupt slopes. These soils are adjacent to streams and drainageways in the central part of the county. They are steeper and shallower and they contain more shale and fragments of sandstone than the soils for which profiles are described as typical for the Penn and Lansdale series. Also, these soils are generally more sandy than the soils for which profiles are described. Bedrock is mainly between a depth of 1½ and 3 feet, but in a few places it crops out on the surface. In many places tillage is in the substratum and gullies and rills have eroded down to hard rock.

The soils in this unit have moderate or moderately rapid permeability. The available water capacity is low to moderate. Surface runoff is rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops, fruit, hay, and pasture. Also, a large acreage is in grass, weeds, and brush in areas surrounding developments and estates. Where these soils are cultivated, a cropping system no more intensive than 1 year of a row crop, 1 year of a small grain, and 4 years of hay is suitable. The soils are suitable for hay or pasture consisting of drought-resistant grasses and legumes, but they are poorly suited to general field crops, small grains, and fruit. The crops ought to be grown in contour strips, and the areas on long slopes need to be protected by diversion terraces. The hayfields and pastures should be reseeded in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The pastures should be protected from overgrazing by rotating grazing. Light but frequent applications of irrigation water will increase the yield and the quality of the forage.

The soils of this mapping unit have moderate limitations for residential, light industrial, commercial, or institutional developments. Because of their variable depth to bedrock, they have severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 4, community development group 7)

Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded (PlD3).—This complex consists of Penn and Lansdale soils that occur together on hills and on short, abrupt slopes. These soils are adjacent to streams and drainageways in the central part of the county. They are steeper and much shallower than the soils for which profiles are described as typical for the Penn and Lansdale series, and they contain many more fragments of rock. The surface layer is only 4 to 5 inches thick. The substratum is shaly or sandy, and bedrock is at a depth of 12 to 36 inches. Tillage is in the substratum in many places. Outcrops of bedrock are common. In some places rills and gullies have eroded through the substratum down to hard bedrock.

Permeability is moderate to rapid, and the available moisture capacity is low to moderate. Surface runoff is very rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops, hay, and pasture. Also, much of the acreage is in grass, weeds, and brush in areas surrounding residential developments. These soils are suited to pasture or woodland, and drought-resistant grasses and legumes are suitable for forage.

New pasture plantings or seedings for renovation should be made in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The pastures need protection from overgrazing.

The soils of this complex have severe limitations for commercial, light industrial, or institutional developments. They have moderate to severe limitations for residential developments. Because of the steep slopes and variable depth to bedrock, the soils have severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit VIe–1, woodland suitability group 4, community development group 5)

Raritan Series

This series consists of deep soils that are moderately well drained or somewhat poorly drained. These soils formed in old stream sediments washed from uplands underlain largely by red shale and sandstone. They are on upland flats, on benches, and in depressions along the Schuylkill River and the larger creeks in the northern two-thirds of the county.

The Raritan soils are less well drained than the Birdsboro soils that formed in similar material. They are less grayish than the poorly drained Croton soils on the adjacent uplands. The Raritan soils are at a higher elevation than the moderately well drained or somewhat poorly drained Rowland and poorly drained Bowmansville soils of the flood plains.

In a typical profile of a Raritan soil, the surface layer is very friable, dark-brown silt loam about 10 inches thick. It contains a few rounded pebbles. A layer of very friable, brown loam about 3 inches thick underlies the surface layer.

The uppermost 18 inches of the subsoil is friable, brown clay loam. Below this, the subsoil is firm and is mottled with reddish gray and grayish brown. This firm layer restricts the movement of water and the growth of roots. If the soil is disturbed, this layer readily breaks to small, angular blocks that can be crushed between the fingers. From 5 to 10 percent of it is gravel.

Below a depth of about 3 feet, the subsoil is very firm, reddish-brown silty clay loam mottled with gray. It

contains a few fragments of shale. Dusky-red shale bedrock is generally at a depth of about 5 feet, but the depth ranges from 4 to 15 feet.

These are strongly acid or medium acid, slowly permeable soils that have high available moisture capacity and moderate to low natural fertility. They are suited to the commonly grown field crops, spring-sown small grains, hay, and pasture. Limitations to developments are the slow permeability and the seasonal high water table.

Raritan silt loam, 0 to 3 percent slopes (RaA).—The profile of this soil is the one described as typical for the series. This soil is on low flats and in depressions above flood level along the Schuylkill River, West Swamp Creek, and Perkiomen Creek. The areas are small and scattered.

This soil has moderate and moderately slow permeability to a depth of 18 to 30 inches, but below that depth it is slowly permeable. Surface drainage is slow. The water table is only 12 to 24 inches beneath the surface during winter and early in spring. The available moisture capacity is high. The hazard of erosion is slight.

In many places along the Schuylkill River, this soil is overgrown with weeds and brush, but other areas are used largely for field crops, small grains, and hay. This soil is fairly well suited to corn, soybeans, spring-sown small grains, hay, and pasture. Generally, wetness makes it poorly suited to alfalfa and winter small grains.

Graded-row cultivation is suggested for this soil, and a suitable cropping system consists of 1 year of a row crop, 1 year of a spring-sown small grain, and 1 year of grass-legume hay of varieties that tolerate wetness. Tile drains help to remove the excess water in the soil.

This soil has moderate limitations if used for residential, light industrial, or commercial developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIw–2, woodland suitability group 6, community development group 9)

Raritan silt loam, 3 to 8 percent slopes, moderately eroded (RaB2).—This soil has a dark-brown surface layer about 8 inches thick. The subsoil is brown or reddish-brown silty clay loam or clay loam and is 24 to 36 inches thick. It has grayish mottles at a depth of 18 to 30 inches. This soil occurs in small patches that generally do not exceed 20 acres in size. It is on undulating uplands and rounded benches along the Schuylkill River, West Swamp Creek, and Perkiomen Creek.

In some places this soil consists of only 18 inches of terrace material over material weathered from bedrock. In a few places, the present surface layer consists almost entirely of material from the subsoil and of organic matter.

This soil has moderately slow permeability to a depth of 18 to 30 inches, and it is slowly permeable below that depth. Surface drainage is medium, and the hazard of erosion is moderate. The water table is within 18 to 30 inches of the surface during winter and early in spring. The available moisture capacity is high.

This soil is used for the commonly grown field crops, hay, and pasture. It is well suited to corn, soybeans, spring-sown small grains, ladino clover, timothy, and birdsfoot trefoil. Wetness causes alfalfa and winter grains to be subject to winterkill. Graded stripcropping is suggested. A suitable cropping system with graded stripcropping is 2 years of row crops and a cover crop for protection in fall and winter, 1 year of a spring-seeded small grain, and 2 years of grass-legume hay. Tile drains will help to remove the excess water from depressions and seeps.

This soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It is severely limited for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Readington Series

In the Readington series are deep, moderately well drained silt loams that are nearly level to moderately sloping. These soils formed in material weathered from shale, siltstone, and sandstone. They are on smooth to rolling uplands in the northern two-thirds of the county. Their profile contains a firm subsoil that has grayish mottles in the lower part.

The Readington soils occur on uplands with the well drained, reddish-brown Penn soils, the well drained, brown Lansdale soils, and the moderately well drained, very silty Lawrenceville soils. Near them, on the lower slopes and flats, are the Chalfont, Abbottstown, and Croton soils. The Readington soils are less silty, contain more shale, and are not so gray as the Chalfont soils. Their profile resembles that of the Abbottstown soils, but they are less gray than those soils and have mottling lower in the subsoil. They generally contain less clay, have a browner surface layer, and lack the gray subsoil characteristic of the Croton soils.

In a typical profile of a Readington soil, the surface layer is friable, dark-brown silt loam about 8 inches thick. About 5 to 10 percent of the surface layer consists of fragments of shale. Below the surface layer is a layer of friable, brown silt loam about 3 inches thick.

The upper part of the subsoil is friable, brown to reddish-brown silt loam containing 5 to 15 percent shale fragments. At a depth of about 28 inches, the subsoil is very firm, reddish-brown silt loam or silty clay loam that is streaked and mottled with a grayish color in many places. When the subsoil is disturbed, it readily breaks to columns, called prisms, that are 4 to 6 inches in diameter and have a reddish-gray surface. These columns, in turn, break to small blocks and plates. From 15 to 30 percent of the subsoil is shale. The material in the subsoil grades to that in the substratum at a depth of about 3 feet.

The substratum is reddish-brown or weak-red shaly silt loam containing many grayish streaks and mottles. From 15 to 30 percent of it is fragments of shale. The amount of weak-red shale increases with increasing depth, and the shaly material grades to bedrock. Depth to bedrock is generally about 4 feet, but the depth ranges from 3 to 5 feet. Black coatings of iron and manganese are common on the surfaces of the peds and on the fragments of shale.

Permeability in the subsoil and substratum of these soils is moderately slow, and the available moisture capacity is moderate to high. These soils range from very strongly acid to medium acid and have moderate natural fertility. They are fairly well suited to corn, spring-sown small grains, and vegetables, and they are well suited to hay and pasture.

These soils can be used for residential developments, but they have moderate limitations for that use. The moderately slow permeability and the seasonal high water table are the major limitations.

Readington silt loam, 0 to 3 percent slopes (ReA).—This soil is in depressions and on flats on smooth or undulating uplands. The areas are large and scattered and occur throughout the northern two-thirds of the county. The profile of this soil is the one described as typical for the series.

In the area extending from Audubon through Norristown and Ambler to Hatboro, this soil is browner and more sandy than typical. Farther north, in a broad band that extends from Mont Clare in the west to Prospectville in the east, this soil is browner and more shaly than typical.

In areas of this soil in depressions, the surface layer is as much as 2 feet thick. In wooded areas leaf litter on the surface covers a layer of very dark brown silt loam about 2 inches thick. Beneath the very dark brown silt loam is a layer of friable, dark-brown or brown silt loam, about 8 inches thick.

Included with this soil in mapping are areas where erosion has removed as much as three-fourths of the original surface layer. Also included are a few areas where the soil is free of gray mottling but contains black concretions and has black coatings on the surface of the fragments of shale. In some small areas, grayish streaks and mottles are within 15 inches of the surface, although mottling is below a depth of 22 inches in most places.

Permeability is moderately rapid in the surface layer. It is moderately slow below a depth of 12 inches in the subsoil. Surface drainage is slow or very slow, and the water table is within 18 inches of the surface late in fall, in winter, and early in spring. This soil is slow to dry out in spring, but a seedbed can be prepared in most years in time for planting corn. Some areas in depressions and in seepage spots, however, remain wet well into the growing season. The available moisture capacity is high, but roots rarely reach all of the moisture available because of their restricted growth in the very firm subsoil. The hazard of erosion is slight.

This soil is used for the commonly grown field crops, fruit, vegetables, hay, and pasture. Also, a few areas are in golf courses and estates and surrounding institutions and residential and industrial developments. This soil is well suited to corn, soybeans, vegetables planted late in spring, spring-sown small grains, ladino clover, and orchardgrass. The high water table and frost heaving make alfalfa, winter grains, and fruit subject to some winter damage. Graded rows and cross-slope cultivation are needed. A suitable cropping system is no more intensive than 1 year of a row crop and a cover crop, 1 year of a spring-sown small grain, and 1 year of grass-legume hay. Row crops can be grown for 2 or 3 years in succession if they are planted in graded rows and if cross-slope cultivation is practiced.

The soil needs to be protected by a cover crop over winter, and crop residue ought to be incorporated into it. Tile drains help to relieve wetness in the depressions and seepage areas. Open drains also help to remove the excess surface water from the depressions.

This soil has moderate limitations for residential, light industrial, institutional, and commercial developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. The seasonal high water table, moderately slow permeability, and slow surface drainage are hazards to be considered if a development is planned. (Capability unit IIw–2, woodland suitability group 6, community development group 9)

Readington silt loam, 3 to 8 percent slopes, moderately eroded (ReB2).—This soil is shallower, has a thinner, more shaly surface layer, and is more sloping than the one for which a profile is described as typical for the series. In most places grayish mottling is 18 inches or more below the surface. This soil is on undulating uplands in the northern two-thirds of the county. The areas are widely distributed and occupy a large part of the acreage in that part of the county.

In the area extending from Audubon through Norristown and Ambler to Hatboro, this soil is browner and more sandy than typical. Farther north, in a broad belt extending from Mont Clare in the west to Prospectville in the east, this soil is also browner than typical and is more shaly throughout the profile. In a few small areas, mottling is at a depth of only 15 inches. A few areas are free of mottling to a depth of 36 inches or more, but they contain black concretions and have black coatings on the fragments of shale in the substratum.

In the central part of the county, areas are included in which the surface layer and the upper part of the subsoil are less shaly and more silty than typical. Scattered throughout areas of this soil are small patches in which the subsoil is more shaly or sandy than typical and the substratum, at a depth of 24 to 30 inches, is very shaly silt loam or channery sandy loam. In a few areas, bedrock is only 3 feet beneath the surface.

Permeability is moderately rapid to a depth of about 1 foot, but it is moderately slow below that depth. Surface runoff is medium in the less sloping areas, and there is a moderate hazard of erosion. On the long slopes of 6 to 8 percent, however, runoff is rapid and the hazard of erosion is severe. During winter and very early in spring, the water table is only 1½ to 2 feet below the surface.

This soil is slower to dry and warm up in spring than are the adjacent Penn and Lansdale soils. In most years, however, a seedbed can be prepared in time for all but the earliest vegetable crops grown in the area. Wet areas, where there are springs and seeps in depressions and on the lower slopes, persist well into the growing season. At times, they seriously interfere with tillage. The available moisture capacity is high. Roots rarely reach all of the moisture available, however, because of their restricted growth in the subsoil.

This soil is used for fruit, vegetables, nursery stock, commonly grown field crops, hay, and pasture. Also, a large acreage is in grass, trees, shrubs, and weeds on golf courses, in estates, and surrounding institutions and residential developments. This soil is suitable for growing corn, vegetables, spring small grains, hay, and pasture. It is fairly well suited to alfalfa grown in a short rotation. In some years yields of winter small grains are reduced as the result of frost heaving and the high water table.

Field or contour stripcropping is needed on most slopes to reduce runoff and erosion. A suitable cropping system is one no more intensive than 2 years of row crops

and a cover crop, 1 year of a small grain, and 2 years of grass-legume hay. If field strips are used, the period during which hay is grown should be extended to 3 years or more. Barnyard manure and crop residue incorporated into the soil help to maintain good tilth. Diversion terraces and grassed waterways help to further reduce losses from erosion and remove excess surface water. In some places they intercept the water from springs and from subsurface seepage. Random tile drains are effective in reducing wetness caused by seeps and springs.

This soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Readington silt loam, 8 to 15 percent slopes, moderately eroded (ReC2).—This soil has a thinner, more shaly surface layer and subsoil than the one for which a profile is described as typical for the series. It is on rolling uplands in the northern two-thirds of the county and occurs in small, widely scattered areas with the Penn, Lansdale, and Reaville soils.

In most places the substratum of shaly silt loam is 30 to 42 inches below the surface and bedrock is at a depth of 3 to 4 feet. A few areas are included, however, in which a very shaly substratum is within 18 inches of the surface. Also, bedrock is at a depth of only 30 inches in a few places. Throughout the central part of the county, this soil is browner than the one for which a profile is described as typical for the series. Near Norristown and Ambler, it is more sandy throughout than is typical. Included with this soil in mapping are areas of Abbottstown soils that have similar slopes.

Permeability is moderately rapid in the uppermost 12 inches of this soil and moderately slow below that depth. Surface runoff is medium to rapid, and the hazard of erosion is severe. During winter and early in spring, the water table is at a depth of 2 to 2½ feet on the upper part of the slopes and at a depth of only 1½ feet on the lower toe slopes.

This soil is slower to dry out and warm up in spring than are the adjacent Penn and Lansdale soils. In most years, however, a seedbed can be prepared in time to plant most of the crops grown in the area. Springs and seeps persist on the lower slopes well into the growing season. The available moisture capacity is high. Roots seldom reach all of the available moisture, however, because of their restricted growth in the subsoil.

This soil is used for fruit, commonly grown field crops, hay, and pasture. A small acreage is in lawns, trees, shrubs, or weeds within estates, on golf courses, and adjacent to developments. This soil is well suited to hay and pasture and is fair for corn, small grains, apples, and peaches. It is also suitable for alfalfa grown in a short rotation. Field or contour stripcropping is needed, and a suitable cropping system is one no more intensive than 1 year of a row crop, 1 year of a small grain, and 3 years or more of grass-legume hay.

Crop residue and manure should be incorporated into the soil, and diversion terraces and grassed waterways may be used to safely carry away runoff. On the toe slopes, random tile drains are effective in relieving wetness caused by seeps and springs. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–6, woodland suitability group 6, community development group 10)

Reaville Series

Moderately deep, moderately well drained or somewhat poorly drained, reddish shaly silt loams make up the Reaville series. These soils have a thin, slowly permeable subsoil and substratum that restrict the downward movement of water. They formed in material weathered from shale and siltstone on level to rolling uplands in the northern two-thirds of the county.

The Reaville soils occur with the well-drained Penn (fig. 28) and Klinesville soils. They are shallower and more shaly than the moderately well drained Readington soils and the somewhat poorly drained Abbottstown soils. They are shallower and less grayish than the poorly drained Croton soils.

In a typical profile of a Reaville soil, the surface layer is friable, reddish-brown shaly silt loam about 8 inches thick. From 15 to 25 percent of the surface layer is shale.

The uppermost 4 inches of the subsoil is friable, reddish-brown shaly silt loam with a few reddish-gray streaks and mottles. At a depth of 12 to 15 inches, this material grades to firm, weak-red shaly silt loam that is distinctly mottled with reddish gray. The subsoil is about 8 inches thick, and 15 to 35 percent of it is shale.

The substratum is very firm, weak-red or dusky-red very shaly silt loam. About 50 percent or more of the upper part is shale. The substratum grades to shale bedrock. Bedrock is generally at a depth of about 30 inches, but the depth ranges from 20 to 36 inches.

These soils are slowly permeable and have moderate to low available moisture capacity. They are very strongly acid to slightly acid and have low natural fertility.

These soils are suited to hay and pasture of shallow-rooted grasses and legumes that tolerate both wetness and drought. Bedrock near the surface and the high content of shale, high water table, and slow permeability are the major limitations to their use for developments.

Figure 28.—**Typical area of Reaville and Penn soils near Fagleysville. Reaville soils occupy the pasture where the cattle are grazing. Penn soils are on the uplands in the backgrouud.**

Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded (RsA2).—This soil is on flats and in depressions on undulating and rolling uplands in the northern two-thirds of the county. In most places its profile is the one described as typical for the series. In a few places, however, the subsoil is 10 to 15 inches thick and has prominent gray mottles 12 to 18 inches beneath the surface.

In wooded areas a litter of leaves and organic matter covers the surface and is underlain by a layer of very dark reddish-brown silt loam, 1 to 2 inches thick. Beneath the layer of very dark reddish-brown silt loam is a layer of friable, reddish-brown shaly silt loam 6 to 8 inches thick.

Included with this soil in mapping are areas in which the surface layer is dark reddish brown and is as much as 1 foot thick. Also included are areas where a thick, very firm, very shaly substratum is at a depth between 6 and 20 inches and bedrock is at a depth of 3 to 5 feet.

This soil is slowly permeable and has a high water table. The water table is at the surface or within a foot of the surface late in fall, in winter, and early in spring. Surface drainage is slow, and the hazard of erosion is slight. This soil is too wet early in spring to be worked with the adjacent well-drained soils. It dries very rapidly, however, and crop yields are reduced in most years by lack of available moisture. The areas near springs and seeps remain wet until early in summer, and the excess moisture hinders tillage. The available moisture capacity is moderate to low.

This soil is used for the commonly grown field crops and for hay and pasture. Also, part of the acreage is in grass, weeds, and brush and is in estates and in areas surrounding developments. This soil is well suited to hay and pasture consisting of grasses and legumes that are drought resistant and that tolerate wetness. It is fair to poor for corn, soybeans, and spring-sown small grains. Because of excessive winterkill, the soil is generally poorly suited to winter small grains and alfalfa.

If this soil is included in a regular cropping system, the crop needs to be planted in graded rows. A satisfactory cropping system consists of 1 year of a row crop, 1 year of a spring-sown small grain, and at least 3 years of grass-legume hay of adapted varieties. A cover crop ought to be seeded in the row crop to provide protection over winter, and crop residue should be incorporated into the soils. Open drains help to remove the surface water from low-lying flats and depressions. Wetness caused by springs and seeps can sometimes be reduced by installing tile drains if the depth to bedrock is adequate.

The high content of shale, bedrock near the surface, high water table, and slow permeability are severe hazards if this soil is used for residential, light industrial, commercial, or institutional developments. This soil also has severe limitations if used as a disposal field for the effluent from septic tanks. (Capability unit IIIw–4, woodland suitability group 10, community development group 9)

Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded (RsB2).—This soil is more sloping than the soil for which a profile is described as typical for the series. Also, in many places it has a thinner subsoil that is distinctly mottled with gray in the lower 1 to 3 inches, just over the substratum. This soil is on undulating and rolling uplands scattered throughout the northern two-thirds of the county.

A layer of leaves and organic matter covers the surface in wooded areas. It is underlain by a layer of very dark reddish-brown silt loam, 1 to 2 inches thick. Beneath this layer is a layer of friable, reddish-brown shaly silt loam about 6 inches thick. In a few places, bedrock is as deep as 3 to 5 feet. The subsoil in a few areas is 10 to 15 inches thick, contains only a few pieces of shale, and is prominently mottled with gray throughout.

Included with this soil in mapping are areas in which the surface layer is less shaly than typical, has a dark reddish-brown color, and is as much as 1 foot thick. Also included are areas underlain by a thick, very firm, very shaly substratum at a depth of 6 to 20 inches.

Permeability is slow, and the water table is at the surface or within a foot of the surface in winter and early in spring. The soil is too wet early in spring to be worked with the adjacent well-drained soils. It dries rapidly, however, and by May it is often too dry for proper preparation of a seedbed. In most years crop yields are reduced by lack of moisture. Springs and seeps remain wet well into the growing season. The available moisture capacity is moderate to low. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is used for the commonly grown field crops, hay, and pasture. Also, part of the acreage is in grass, trees, weeds, and brush within parks, golf courses, and estates, and in areas surrounding developments. This soil is well suited to hay and pasture consisting of grasses and legumes that resist drought and that also tolerate wetness. It is fairly well suited to birdsfoot trefoil, reed canarygrass, and tall fescue. This soil is fair to poor for corn and spring-sown small grains. Generally, because of excessive winterkill, it is poorly suited to alfalfa and winter small grains.

If this soil is included in a regular cropping system, field or contour stripcropping is needed and the cropping system ought to be no more intensive than 1 year of a row crop, 1 year of a spring-sown small grain, and at least 3 years of grass-legume hay. In winter the soil needs to be protected by a cover crop, and crop residue should be incorporated into it. In most places tile drains are not feasible, because bedrock is too near the surface.

Bedrock near the surface and the high content of shale, high water table, and slow permeability are severe hazards if this soil is used for residential, light industrial, commercial, or institutional developments. Also, problems can be expected if this soil is used as a disposal field for the effluent from septic tanks. (Capability unit IIIw–5, woodland suitability group 10, community development group 9)

Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded (RsB3).—This soil is on undulating and rolling uplands in the northern two-thirds of the county. It has a thinner, more shaly surface layer and subsoil than the soil for which a profile is described as typical for the series.

In many places tillage is in the substratum, and in those areas the plow layer consists of dusky-red patches of very shaly silt loam. Shale bedrock is exposed in

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some spots on narrow ridges and where the changes in slope are abrupt.

The thickness of the gray, mottled subsoil ranges from only 1 inch to about 10 inches. Bedrock is generally at a depth between 2 and 3 feet, but shallower areas are also included with this soil in mapping. Included are a few areas that are not severely eroded and a few areas of Readington and Abbottstown soils that have a thin, shaly surface layer.

Permeability is slow, and the water table is high. The water table is at the surface or within a foot of the surface during winter and early in spring. This soil is too wet early in spring to be plowed with the adjacent well-drained soils. It dries rapidly, however, and is droughty in a short time. Areas near springs and seeps remain wet well into the growing season. The available moisture capacity is low. Surface drainage is medium to rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, hay, and pasture. Also, part of the acreage is in weeds, grass, and brush in areas of idle farmland, in estates, and in areas surrounding developments. This soil is fair for hay and pasture consisting of grasses and legumes that are drought resistant and that tolerate wetness. It is poor for corn and spring-sown small grains, and it is poorly suited to alfalfa or winter small grains. The crops need to be planted in graded strips, and a cropping system no more intensive than 1 year of a row crop followed by a cover crop, 1 year of a spring-sown small grain, and at least 4 years of hay consisting of adapted grasses and legumes is suitable. This soil is well suited to permanent hay or pasture made up of adapted grasses and legumes. It is well suited to birdsfoot trefoil and reed canarygrass. Manure and crop residue ought to be incorporated into the soil.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. Bedrock near the surface and the high content of shale, high water table, and slow permeability are hazards to be considered if a development is planned. Limitations are also severe if this soil is used as a disposal field for the effluent from septic tanks. (Capability unit IIIe–7, woodland suitability group 10, community development group 9)

Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded (RsC3).—This soil is more sloping and has a thinner, more shaly surface layer and subsoil than the one for which a profile is described as typical for the series. It is on rolling uplands in the northern two-thirds of the county. This soil has many patches of dusky-red shale on the surface. In many places the surface layer is very shaly silt loam that contains a few white and gray streaks and mottles. In those areas tillage has been in the lower part of the subsoil and in the substratum. The subsoil ranges from 1 inch to 8 to 10 inches in thickness.

Included with this soil in mapping are areas in the south-central part of the county that are more sandy throughout than typical. Also included are areas of Croton and Abbottstown soils that are deeper and grayer than this soil but that have similar slopes. Other inclusions consist of small areas that are steeper than 15 percent.

This Reaville soil is slowly permeable and has a high water table. The water table is at the surface or within 1 foot of the surface during winter and early in spring. This soil is too wet in spring to be plowed with the adjacent well-drained soils, but it becomes droughty rapidly. During only a week or two is the content of moisture suitable for preparation of a seedbed and for planting. Springs and seeps, however, remain wet during the early part of the growing season. The available moisture capacity is low. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, hay, and pasture. Also, a large acreage is in grass, weeds, and brush in areas of idle farmland, in estates, and in areas surrounding developments. This soil is suited to perennial hay and pasture, but it is poorly suited to corn and small grains. It is suited to reed canarygrass, birdsfoot trefoil, and other grasses that tolerate both wetness and drought. Hay and pasture ought to be reseeded, as needed, in alternate graded contour strips, and half the strips ought to be planted the first year and the rest the following year. The pastures should not be overgrazed.

This soil has severe limitations for use for light industrial, residential, commercial, or institutional developments. Also, it has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–4, woodland suitability group 10, community development group 10)

Rowland Series

The Rowland series consists of deep, moderately well drained or somewhat poorly drained, nearly level silt loams on flood plains in the central and northern parts of the county. These soils formed in material washed from uplands underlain by red shale and sandstone.

The Rowland soils occur on stream bottoms with the poorly drained Bowmansville soils. Also, to a smaller extent, they occur on stream bottoms with the well-drained Bermudian soils.

In a typical profile of a Rowland soil, the surface layer is very friable, dark reddish-brown silt loam. It is about 10 inches thick.

The substratum consists of several layers of dark reddish-gray silt loam. The middle and lower layers are streaked with gray and red. Shale or sandstone bedrock is at a depth of about 4 feet, but the depth to bedrock ranges from 3 to 12 feet.

These soils are moderately permeable, but they have a high water table and are subject to flooding late in fall, in winter, and early in spring. Occasional overflows also occur during storms of high intensity in the growing season.

These soils are better suited to pasture or hay than to cultivated crops, but corn, soybeans, and spring-sown small grains do well. Wetness makes the soils poorly suited to winter small grains and alfalfa. The soils are severely limited for use for developments because of the flooding and seasonal high water table.

Rowland silt loam (Rt).—This soil has the profile described as typical for the series. It occurs in narrow bands along most of the streams in the northern two-thirds of the county.

In some places along the natural levees of the larger creeks, this soil is free of mottling to a depth of about

36 inches. In those areas its profile is similar to that of the Bermudian soil. This soil is more frequently flooded than the Bermudian soil, however, and the water table remains high for longer periods.

Included with this soil in mapping are small areas of Bowmansville silt loam that are too small to be mapped separately. These areas are generally shown on the map by a symbol for wet spots.

This Rowland soil is subject to flooding during winter and early in spring. Occasionally, it is flooded during the growing season. The water table is at or near the surface late in winter and early in spring. The soil is only slightly susceptible to erosion and has high available moisture capacity. Lime and fertilizer, applied to soils of the adjacent uplands, have been washed onto it. They have added to the fertility to some extent and have made this soil less acid.

This soil is used mainly for pasture. Cultivation is difficult because of the hazard of flooding and the size, shape, and location of the fields. Where this soil is not susceptible to flooding and can be reached easily, it is well suited to corn, soybeans, spring-sown small grains, and hay. It is not well suited to alfalfa and winter small grains, because those crops are likely to be damaged by the high water table during winter and early in spring. Surface drainage can be improved by open drains, and excessive water in the soil can be reduced by installing tile drains.

Because of the seasonal high water table and hazard of flooding, this soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Rowland silt loam, coal overwash (Ru).—This soil has a surface layer of black silt loam that is 1 to 3 feet thick. The substratum is slightly less reddish than the one in the profile described as typical for the series, and bedrock is at a depth of 4 to 12 feet. This soil is on the flood plains of the Schuylkill River. The thickness and dark color of the surface layer were caused by the deposition of coal sediment washed from the anthracite region far to the north of this county.

This soil is occasionally flooded in fall or early in spring. Permeability is moderate, and surface drainage is slow. The hazard of erosion is slight. The water table is within 1 to 3 feet of the surface during winter and early in spring.

This soil is well suited to pasture, but most of the areas are overgrown with weeds and brush or young trees. The soil is generally not cultivated, because it occurs between the river and industrial developments, railroads, and roads. Many large basins for impounding sediment dredged from the river have been constructed in the areas. The areas that are covered by thin layers of coal sediment are fairly well suited to corn, soybeans, spring-sown small grains, hay and pasture. This soil is poorly suited to winter small grains and alfalfa. It ought to have a cover crop and crop residue plowed under to help to increase the content of organic matter. Tile drainage and open drains help to remove the excess surface water and the excess water in this soil.

This soil has severe limitations as a site for developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Rowland silt loam, local alluvium, 0 to 3 percent slopes (RwA).—This soil is redder and has less gray mottling than the one for which a profile is described as typical for the series. Also, it generally contains more shale. It is in depressions and drainageways at the heads of streams and is above the normal level of the flood plains. This soil consists of material that has eroded from the Penn, Lansdale, Readington, and similar soils of the nearby uplands. The deposited material is generally deep, but it ranges from 18 inches to 4 or 5 feet in thickness.

This soil has a high water table that is near the surface during winter, early in spring, and following extended periods of heavy rainfall during the growing season. Permeability is moderate, and surface drainage is slow. The available moisture capacity is high. Some local flooding occurs during periods of intense rainfall.

This soil is usually farmed with the adjacent soils. If it is used for cultivated crops, the most intensive cropping system suggested consists of 2 years of row crops with a cover crop to protect the soil in fall and winter, 1 year of a spring-seeded small grain, and 1 year of grass-legume hay. In some places tile drains and open drains would help to remove excess surface water and excess water in the soils.

Because of the seasonal high water table, slow surface drainage, and hazard of overflow during flash storms, this soil has moderate limitations for developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Rowland silt loam, local alluvium, 3 to 8 percent slopes (RwB).—This soil is more reddish and has less gray mottling than the one for which a profile is described as typical for the series. Also, it generally contains more shale or fragments of sandstone. This soil consists of soil material that has eroded from the Penn, Lansdale, Readington, and similar soils of the uplands. This soil material was deposited in swales and drainageways at the heads of streams above the normal level of the flood plains. At a depth between 18 inches and about 4 feet, this soil is underlain by material weathered from bedrock. In places bedrock is at a depth of only 2 feet, but in other places it is as deep as 6 feet.

Ordinarily, this soil is not subject to flooding, but it is flooded for brief periods during heavy rainstorms. The water table is high during winter, early in spring, and following periods of extended heavy rainfall. Springs and seeps at the base of upland slopes make some of the areas wet in spring and early in summer. The available moisture capacity is high.

Part of the acreage is idle or is in wooded areas, but most of it is farmed with the soils in adjacent fields. This soil is better suited to sod than to cultivated crops. It should be kept as a waterway for carrying away excess surface water from the adjacent uplands. If cultivated crops are grown in the larger areas, the most intensive cropping system suggested consists of 2 years of row crops and a cover crop to protect the soil in fall and winter, 1 year of a spring-seeded small grain, and 2 years or more of grass-legume hay. Growing the crops in graded strips and installing tile drains and open drains will help to reduce gullying and remove excess surface water and excess water in the soil.

This soil has moderate limitations for use in developments. It is suitable for use in open spaces to be kept in grass, trees, or shrubs. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Stony Land, Steep

Stony land, steep (StE) occurs in areas of Manor, Penn, Neshaminy, and Edgemont soils. The slopes range from 25 to 80 percent. The areas are so stony or ledgy that use and management is similar for all of them, and it is not practical to map individual soil types or phases. Also, the soils are generally shallower than typical for their series, and they have a thin surface layer. The surface layer consists of 1 to 2 inches of leaf litter over a dark-colored A1 horizon of mixed organic material and mineral soil. Below the A1 horizon is the normal sequence of horizons. Depth to bedrock ranges from several inches to 10 feet.

Surface runoff is rapid, and internal drainage is medium to rapid. The available moisture capacity and natural fertility range from high to low.

This land type is suitable only for recreational or esthetic purposes, for watershed protection, or for use as a wildlife propagation or refuge area. Trees and shrubs planted in suitable locations help to maintain and augment the cover of native vegetation and thus improve the protective cover and esthetic value of the land. (Capability unit VIIIs–1, woodland suitability group 5, community development group 13)

Watchung Series

The Watchung series consists of deep, poorly drained soils that formed in material weathered from dark-gray or black igneous rocks. These soils are nearly level and gently sloping, and they have a slowly permeable, sticky and plastic subsoil that impedes the downward movement of water.

Most areas of these soils are on low-lying flats and benches in the northern half of the county. They are adjacent to the well drained Neshaminy and moderately well drained or somewhat poorly drained Mount Lucas soils. The Watchung soils are more clayey than the poorly drained Croton and Bowmansville soils that are on nearby flats, in depressions, and on flood plains.

In a typical profile of a Watchung soil, the surface layer is friable, dark grayish-brown silt loam about 8 inches thick. This layer has a few light-gray mottles.

The subsoil is firm, grayish-brown to gray silty clay loam that is about 30 inches thick. It has many prominent mottles of strong brown and dark gray, and it is sticky and plastic when wet.

The substratum, beginning at a depth of about 42 inches, is friable, yellowish-brown loam mottled with gray and reddish brown. About 10 percent of it consists of fragments of rock. The substratum is about 18 inches thick. Bedrock is generally at a depth of about 5 feet, but the depth to bedrock ranges from 4 to 5 feet.

These soils are slowly permeable and have high available moisture capacity. They are medium acid to neutral and have moderate to high natural fertility.

The Watchung soils are fairly well suited to permanent pasture, wooded areas, and wildlife habitats. They have severe limitations for use in developments, but they can be used for open space conservation areas.

Watchung silt loam, 0 to 3 percent slopes (WaA).—This soil is on low-lying flats and depressions and on a few broad upland summits in the northern half of the county. It has the profile described as typical for the series. In wooded areas, however, a layer of partly rotted leaves covers the surface. The leaves are underlain by a layer of black silt loam, 2 to 4 inches thick, that, in turn, is underlain by a layer similar to but lighter colored than the surface layer described in the profile given for the series.

Where this soil occurs in depressions, the surface layer is 12 to 18 inches thick. In some areas this soil is more silty or more sandy than the soil for which a profile is described as typical. In a few areas the surface layer is only 4 to 6 inches thick, and 5 to 20 percent of it consists of pieces of rock.

This soil is slowly permeable and has a water table at the surface late in fall, in winter, and early in spring. Surface runoff is very slow, and water is ponded in the depressions and on low-lying flats. This soil is slow to dry out in spring. During the growing season, it remains wet for a week or two following periods of heavy rainfall. The hazard of erosion is slight, except on long slopes that are cultivated. The available moisture capacity is high.

A large part of the acreage is used for pasture, though much of it is idle and is overgrown with weeds, brush, and young trees. A small acreage is in field crops and hay. This soil is suited to pasture, trees, and wildlife habitats. If it is used for pasture, birdsfoot trefoil, reed canarygrass, and other legumes and grasses that tolerate wetness are suitable. Open drains help to remove the excess surface water, but they require constant maintenance if they are to remain effective. The pastures should not be grazed in spring and late in fall while the soil is saturated. Plantings of white pine are likely to be most successful for the wooded areas.

This soil is suitable for open space conservation areas that are kept in native trees, shrubs, and grasses. It has severe limitations for use in developments. (Capability unit Vw–1, woodland suitability group 9, community development group 11)

Watchung silt loam, 3 to 8 percent slopes (WaB).—In most places the surface layer of this soil is 6 to 8 inches thick and is browner and contains fewer mottles than the surface layer in the profile described as typical for the series. This soil is on benches and on the lower slopes in the uplands in the northern half of the county.

In places this soil has a layer of leaves and partly rotted organic matter on the surface. Beneath the leaves is a layer about 2 inches thick of black silt loam that, in turn, is underlain by a layer that is similar to but lighter colored than the surface layer of the profile described as typical for the series. In a few areas, plowing has mixed the upper part of the subsoil with the material in the plow layer. Where this soil is in depressions and on some of the lower toe slopes, its surface layer is 10 to 15 inches thick.

This soil is slowly permeable and has a water table at the surface or near the surface late in fall, in winter,

and early in spring. Surface runoff is slow to medium, and the hazard of erosion is slight. This soil is slow to dry out in spring and during the growing season. Also, it remains wet for several days to a week following periods of heavy rainfall. The available moisture capacity is high.

This soil is used for the commonly grown field crops, hay, and pasture. Also, a large acreage is idle and is overgrown with grass, weeds, brush, and young trees. This soil is suited to pasture, trees, and wildlife habitats. If it is used for pasture, however, grasses and legumes that tolerate wetness are needed, and birdsfoot trefoil and reed canarygrass are well suited. Grazing should be delayed in spring until the water table has lowered. Open drains will help to remove the excess surface water.

Where this soil is in trees, plantings of white pine are likely to be the most successful. Small areas are especially suitable for planting trees, grass, and shrubs that will provide food and cover for wildlife. This soil has severe limitations for use in developments. (Capability unit VIw–2, woodland suitability group 9, community development group 11)

Watchung very stony silt loam (Wc).—On the surface this soil has a layer of leaves and partly rotted organic matter, 1 to 3 inches thick, over a layer, 2 to 5 inches thick, of very dark grayish-brown to black very stony silt loam. Below this is a layer, 3 to 5 inches thick, of dark grayish-brown very stony silt loam mottled with brownish gray and gray. The subsoil and substratum are like those described as typical for the series, except that 1 to 5 percent of the soil material in each of these layers consists of large stones. Stones that are 1 to 12 feet in diameter occupy 1 to 10 percent of the surface of this soil. This soil is nearly level or gently sloping and is on flats or benches and in depressions in the northern half of the county.

Included with this soil in mapping are a few areas that have slopes of more than 8 percent. In some places the surface layer is like that in the profile described as typical, but 1 to 3 percent of the surface is covered with stones.

This soil is slowly permeable and has a high water table. The water table is at the surface or only about 1 foot below the surface late in fall, in winter, and early in spring. Surface drainage is slow to very slow, and water is ponded on low-lying flats and in depressions. The hazard of erosion is slight, and this soil has high available moisture capacity.

This soil is mainly in wooded areas consisting of mixed oaks, hickory, ash, red maple, and dogwood. A few areas are in pasture. The more sloping, less stony areas are suitable for limited use for grazing of native grasses. Mowing of the pastures and renovation are not practical, because of the many stones.

Plantings of white pine are fairly well suited to these soils. The wooded areas ought to remain in trees, but improvement cutting should be done to remove the poorly formed trees and undesirable species. This soil is well suited to native grasses, shrubs, and trees that provide food and cover for wildlife. It has severe limitations for use in developments. (Capability unit VIIs–3, woodland suitability group 9, community development group 11)

Formation and Classification of Soils

In this section the major factors that influence the development of soils are described. The two systems used in the United States for classifying soils are then briefly defined, the soils are placed in these two systems, and the great soil groups are described. Finally, the soil series are discussed in detail and profiles that are representative for each series are described. Laboratory data for a number of the soils are given in the section "Laboratory Data."

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on material deposited or accumulated by geologic forces. The characteristics of the soil at any given point depend on the physical and mineralogical composition of the parent material, the climate under which the soil developed, the plant and animal life in and on the soil, the relief, or lay of the land, and the length of time the forces of soil development have acted on the parent material.

Climate and plant and animal life are the active forces that gradually form a soil from parent material. Their effect on the parent material is modified by relief and by the length of time the parent material has been in place. Occasionally, one factor is dominant and determines most of the properties of the soil. Normally, however, the interaction of all five factors determines what kind of soil develops in any given place.

Parent material

The soils of Montgomery County formed in several different kinds of soil material, namely, residuum, alluvium, colluvium, and windblown material. In table 10 the soils are grouped according to the kind of parent material. Also, the relationship of the parent material to the topographic position, depth, and drainage is shown. The grouping shown is a natural grouping of the soils as they actually occur in a landscape. In this grouping, soils that develop from similar kinds of parent material, but that differ in depth and drainage because of their position, are placed together. The grouping is practical, for it enables one to more easily remember the soils and the way they occur in a landscape.

Most of the soils of the county formed in two main kinds of parent material—residuum and alluvium. A few of the soils, however, formed in colluvium or in silty windblown material. Residuum, formed by the weathering of rocks in place, is the most extensive kind of parent material. Alluvium, consisting of sand, silt, clay, and fragments of rock that were transported by water, is the second most extensive. These kinds of parent material are discussed in the following paragraphs.

TABLE 10.—*Soil series arranged to show the relationship of topographic position, parent material, depth, and drainage*

Topographic position and principal kind of parent material	Well drained				Moderately well drained	Somewhat poorly drained	Poorly drained
	Very shallow	Shallow	Moderately deep	Deep			
Soils on uplands:							
Residuum from limestone or dolomite.				Duffield			
Residuum from schist and gneiss		Manor [1]	Glenelg	Chester	Glenville [2]		
Residuum from quartzite and quartz schist.			Edgemont [3]				
Residuum from diabase		Legore [4]	Neshaminy [3]		Mount Lucas.[2]		Watchung.[2]
Dark, metamorphosed shale			Brecknock [5]		Lehigh [2]		Croton.[2]
Red shale or fine-grained sandstone.	Klinesville		Penn [5]		Readington	Abbottstown. Reaville [2]	Croton.[2]
Red, calcareous shale			Penn, neutral substratum.				
Gray or brown sandstone conglomerate or shale.				Landsdale [6]	Readington	Abbottstown.	Croton.[2]
Deposits of silty windblown material over shale, sandstone, limestone, quartzite, schist, or gneiss.					Lawrenceville.	Chalfont	Doylestown.
Soils on the lower slopes:							
Colluvium from soils derived from quartzite, shale, sandstone, schist, or gneiss over limestone.				Murrill			
Local alluvium from soils derived from shale, sandstone, or diabase.					Rowland [2]		Bowmansville.[2]
Soils on stream or marine terraces:							
Old alluvium along the major streams; washed from soils derived predominantly from shale, sandstone, and conglomerate.				Birdsboro	Raritan [2]		
Coastal plain deposits of sand, some gravel, silt, and clay.				Howell [3]	Beltsville [2]		
Soils on flood plains:							
Medium-textured alluvium washed from soils derived from schist, gneiss, limestone, or quartzite.					Codorus [2]		Hatboro.[2]
Medium-textured alluvium washed from soils derived from red and gray shale, sandstone, or diabase.				Bermudian	Rowland [2]		Bowmansville.[2]

[1] Has a shallow solum over deeply weathered micaceous material.

[2] The series name has been placed in the drainage class it most nearly fits. For soils of some series, however, the range in drainage is wide enough to reach into one of the adjoining classes of drainage. The Glenville, Mount Lucas, Lehigh, Rowland, Raritan, Beltsville, and Codorus soils are moderately well drained, but some areas are in the drier part of the somewhat poorly drained class; the Croton, Bowmansville, Hatboro, and Watchung soils are poorly drained, but some areas are in the wetter part of the somewhat poorly drained class; the Reaville soils are somewhat poorly drained, but some areas are in the wetter part of the moderately well drained class; and the Howell soils are well drained, but some areas are in the drier part of the moderately well drained class.

[3] The Edgemont and Neshaminy soils are generally moderately deep, but some areas are deep.

[4] Has a shallow solum over weathered diabase.

[5] The Brecknock and Penn soils are generally moderately deep, but some areas are shallow.

[6] The Lansdale soils are generally deep, but the thin phases are moderately deep.

Residuum.—This parent material was derived from several different kinds of rocks, which are described in the section "Bedrock Geology" near the back of the survey. In brief, sedimentary rocks underlie about three-fourths of the county, and metamorphosed and igneous rocks each underlie a smaller area.

The shale and sandstone that underlie a large part of the northern two-thirds of the county consist of unaltered sedimentary rocks of Triassic age. Typical of the soils developed in material weathered from those rocks are the soils of the Penn, Lansdale, and Readington series. The red color that is characteristic of the Penn and of

some of the Readington soils is inherited from the parent material that was derived from the underlying sedimentary rocks.

The Duffield soils developed in material weathered from the limestone bedrock that forms a narrow valley across the south-central part of the county. The Edgemont soils developed in material weathered from quartzite, a very hard metamorphic rock that underlies a small part of the county. They are coarser textured than soils formed in finer textured material.

The Lehigh and Brecknock soils formed in material weathered from hornfels, a gray, hard metamorphic rock formed from shale and sandstone by heat from igneous intrusions. The gray color of these soils is largely inherited from the parent material.

The Neshaminy, Mount Lucas, and Watchung soils formed in material weathered from igneous rocks. These rocks, mainly diabase, underlie a small part of the northern half of the county.

Most of the southern third of the county is underlain by very old, highly metamorphosed sedimentary and igneous rocks consisting of various kinds of schist and gneiss. The Chester, Manor, Glenelg, and Glenville soils formed in material weathered from those rocks.

Alluvium.—Parent material transported by water, called alluvium, has been deposited on flood plains, stream terraces, and coastal plain terraces. The Rowland, Bowmansville, Codorus, and Hatboro soils are typical of the soils of flood plains developed in recently deposited alluvium. The Raritan and Birdsboro soils formed in higher lying old alluvium deposited by streams along the larger waterways in the northern part of the county. Coastal plain deposits of sand, gravel, silt, and clay are scattered throughout the southern part of the county and are the parent material of the Beltsville and Howell soils.

Colluvium.—The Murrill soils have formed in colluvium, that is, from material that has moved, largely through gravity, down from the hills. These soils are at the foot of hills underlain by quartz and are underlain by material weathered from limestone.

Silty windblown material.—A mantle of silty material covers parts of the county and is underlain by many different kinds of weathered and partly weathered rocks. This fine-textured material was transported by wind. It is especially evident in the central part of the county, where the silt is 4 to 12 feet thick. The Lawrenceville, Chalfont, and Doylestown soils formed in this silty material. As a result, those soils are high in content of silt.

Climate and soils

It is difficult to analyze the role that climate has played, over a period of hundreds of years, as a factor of soil formation. It is known, however, that a humid-temperate climate is necessary to produce the deep weathering, deep leaching, and acid reaction typical of most of the soils in this county. Locally, the bedrock in the county has been weathered to a depth of 8 to 10 feet or deeper. The Duffield, Chester, Glenelg, and Lansdale are examples of soils that are underlain by deeply weathered bedrock.

Exposure to a humid-temperate climate over a long period normally results in the leaching of soluble bases and an acid reaction in the soils. This same climate also generally fosters movement of clay particles from the surface downward into the subsoil. The Chester, Penn, Reaville, Raritan, and many other soils show evidence of movement of clay. Because of this movement, many of the soils have a subsoil that contains a larger amount of clay than the surface layer. Most of the soils in this county are medium acid to very strongly acid.

The overall climate also affects the kind and amount of clay formed during development of a soil. Analysis of the clay fraction of some of the soils shows the kind and amount of clay that could be expected under the influence of a humid-temperate climate. Table 12, in the section "Laboratory Data," shows the relative amount of clay in the horizons of some of the soils in the county. Table 13 shows the mineral composition of the clay fraction of some of the soils. A more detailed description of the temperature and precipitation in this county can be found in the section "Climate" near the back of the survey.

Plants and animals

The original vegetation in this county was a dense forest of hardwoods. Oaks were dominant, but chestnut, tulip-poplar, hickory, ash, red maple, and dogwood also made up a large part of the stand. In soils formed under hardwoods, the base status of the soil tends to remain in balance. Leaves, twigs, roots, and other organic matter accumulate on the surface and are broken down by living organisms, such as bacteria and fungi. Small animals, insects, worms, and roots make the soil more permeable to water by forming channels in it and mixing the soil particles.

Clearing, cultivation, the introduction of new plants and methods of tillage, and artificial drainage will modify the soils in the future and affect soil development. So far, the only apparent effects on the soils, caused by man's activities, are severely accelerated erosion and the alteration of the surface soil by tillage and the application of lime and fertilizer.

Relief

Relief affects the rate of surface drainage and the movement of water through the soil. The rate of surface drainage has determined, in part, the degree of geologic erosion that has taken place. Drainage also has influenced the rate of weathering and the depth to which rock has weathered.

Differences in relief account, in part, for the development of different soils from the same kind of parent material. This can be illustrated by comparing the Penn, Klinesville, Readington, and Croton soils, which all developed in material weathered from red shale. The Penn soils are moderately deep and well drained, and they have gentle to moderate slopes, not steep enough to encourage severe erosion and yet not so nearly level as to prevent runoff. In contrast, the Klinesville soils are shallow, although they too are well drained. They have slopes strong enough that the soil material is removed almost as fast as it is formed.

The Readington soils are deep, moderately well drained, and nearly level, and they have a fragipan in their subsoil. They developed on flats and near the base of slopes where runoff was slow, or they received additional runoff from the slopes above them. The percolating water carried particles of clay and silt downward and deposited them in the lower part of their profile. As a result, a dense, compact fragipan has formed as the profile developed.

The Croton soils are poorly drained and formed in depressions and on flats where the surface drainage is slow. An accumulation of silt and clay in the profile and development of a pan cause the water table to remain near the surface during much of the year. The silt and clay are concentrated in the upper part of the subsoil.

Time

The length of time the other factors of soil formation have operated is indicated, to some extent, by the degree of development of the soil profile. In this county, however, differences in time do not appear to have been responsible for most of the differences in the kind and distinctness of horizons. Differences have been caused mainly by varying combinations of parent material, relief, and plant and animal life.

The soils formed in alluvium on flood plains show the least horizon development because they are continuously receiving fresh material that is deposited on the surface. From the standpoint of time involved in development, they are the youngest soils in the county.

How Soils Are Formed

Soils are formed as a result of physical weathering of parent rock, chemical weathering of rock fragments and organic matter, the transfer of materials, and gains and losses of organic matter and minerals.

Soil formation begins with physical weathering. Large pieces of rock are broken into smaller pieces by frost action and other forces. The rocks and rock fragments are further reduced to the size of particles of sand and silt. These particles form an unconsolidated layer of material in which plants can grow. Organic matter is added to the mineral material when plants and animals die.

The rock fragments and the organic matter are chemically weathered by solution, carbonation, oxidation, reduction, and the action of weak acids. By chemical processes, iron, aluminum, calcium, and other elements are released in a form that plants can use. In a well-drained soil, colors of yellow, brown, and red gradually develop. These colors indicate that iron has been released or that oxidation of ferrous oxide to ferric oxide has taken place in the presence of an adequate supply of oxygen. The Howell soils are examples of soils that have a distinct reddish-colored B horizon.

The reduction and transfer of iron have occurred, to some extent, in soils that have impeded drainage. Where this process has been intense, it is known as gleying. The effect of gleying has been extensive in many of the wet soils of this county. Gleyed or grayish horizons are especially prominent in the Croton, Chalfont, Doylestown, Watchung, Bowmansville, and Hatboro soils.

The transfer of material from one part of the soil to another is common in most soils. Organic matter is suspended in solution and moved. Calcium and other elements are leached from the surface layer. To some extent, these elements are held by the clay in the subsoil or lower part of the profile, but part is leached out of the soil with the ground water. Bases are absorbed by plant roots and stored in the stems, leaves, and twigs of plants. When the plants die and decay, they return to the soil the elements they took from it.

In most of the soils of the county, the translocation and development in place of clay minerals have had a strong influence on the development of horizons. Part of the clay has been removed from the A1 and A2 horizons and has been deposited in the B horizon. This is true of most soils that have a textural B horizon and probably of some soils that do not have a distinct textural B horizon. It is most evident in such soils as the Neshaminy, Watchung, and Duffield that do have a fine-textured B2 horizon.

Some of the gently sloping and nearly level soils contain a dense, brittle layer, called a fragipan, that is commonly part of the B or C horizon. It is generally believed that such a pan is the result of soil-forming processes, although there is some difference of opinion as to the origin. A pan is one of the causes of impeded drainage. The Lawrenceville, Chalfont, Abbottstown, Doylestown, and Beltsville soils contain a fragipan, and they have an accumulation of clay above the fragipan.

Gains and losses cause differences in the soils. Ordinarily, the soil gains material in the form of organic matter returned by plants and in the form of minerals or plant nutrients gained through the weathering of rock. In all of the soils, some organic matter has accumulated to form an A1 horizon, although the A1 horizon may later have lost its identity, as a result of cultivation. The A1 horizon has been lost from severely eroded soils. The amount of organic matter accumulated ranges from very low to moderately high. The Klinesville soils, for example, have a thin A1 horizon that contains only a small amount of organic matter. In contrast, the Watchung soils have a thick, prominent A1 horizon high in content of organic matter.

The soil loses material when the material is dissolved and leached away in solution, when nutrients are removed by plants, when erosion removes soil particles, and when organic matter decomposes and gases escape. Leaching of carbonates and salts has occurred in all the soils; most of the soils in the county are deeply leached of carbonates and the more soluble salts. This is evidenced by the fact that nearly all of the soils are acid and that in most of them the reaction ranges to very strongly acid. Only in the Neshaminy, Mount Lucas, and Watchung soils does the natural reaction range to neutral, although areas of some soils that have received agricultural lime may also show a slightly acid or neutral reaction.

As the soil develops, layers, called horizons, are formed. These horizons gradually develop characteristics that are recognizable and that distinguish one layer from another.

Under forest vegetation, the first horizon to form is at the surface, and it is generally dark colored and contains a large amount of organic matter. It is called

the 01 or 02 horizon. Forming under this horizon is a dark-colored mineral horizon, called the A1 horizon. As soluble material is removed from the upper part of the profile, a light-colored eluviated horizon usually develops under the A1 horizon. This layer, the A2 horizon, generally contains quartz and other resistant minerals. A2 horizons are shown in the technical descriptions of profiles typical of the Mount Lucas and Neshaminy series, in the section "Detailed Descriptions of the Soil Series."

Beneath the A2 horizon, a stronger colored B horizon generally develops. This horizon may or may not be finer textured than the surface horizon. It is formed through alteration in place or by the washing in, or illuviation, of clay, iron, aluminum, or other compounds that have been released from the upper part of the profile. Examples of soils that show an increase in content of clay in the B horizon are the Chester, Abbottstown, and Howell soils.

Deeper in the profile, the B horizon is lighter colored than in the upper part, and in most places it is coarser textured. The lowest part of the B horizon blends with the unconsolidated material weathered from bedrock or with other underlying material. This unconsolidated material, the C horizon, is generally, but not in all areas, made up of the same kind of material as that from which the soil developed. As a rule, it is not considered a part of the true soil, or solum, which is composed of the A and B horizons. However, it is considered part of the solum where the designation Cx is shown, indicating a fragipan.

Classification of Soils

Soils are placed in narrowly defined classes so that knowledge about their behavior within farms and counties can be organized and applied. They are placed in broadly defined categories so that large areas, such as continents, can be studied and compared.

Two systems of natural classification of soils are now in general use in the United States. One of these systems is described in "Soils and Men," the 1938 Yearbook of Agriculture (*8*), and was later revised by Thorp and Smith (*7*). The Sols Bruns Acides of this system have been described by Baur and Lyford (*2*). The other system was placed in general use by the Soil Conservation Service at the beginning of 1965. The reader who is especially interested in this current system should search the literature (*6*, *10*). Modifications in the system are made as knowledge of soils increases.

The older system consists of six categories. In the highest of these, soils of the whole country have been placed in three classes of the soil order. The next two categories, the suborder and family, have not been fully developed and, therefore, have not been used much. Attention has centered on the categories of great soil group, soil series, and soil type. A great soil group consists of soils that have about the same general kind of profile but that may differ greatly in slope, thickness of profile, and other characteristics. The categories of soil series, soil type, and a subdivision of the soil type called the soil phase, are defined in the section "How This Survey Was Made."

The current system of soil classification was developed by soil scientists of the Soil Conservation Service, assisted by their colleagues in other organizations and in foreign countries. This comprehensive system was needed because of the shortcomings of the older system that were apparent when soils were classified in foreign countries and for interpretations in new fields of use.

Like the older system, the new system consists of six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series (*10*). In this system the criteria used as a basis for classification are soil properties that are observable or measurable. The properties are chosen so that soils of similar genesis, or mode of origin, are grouped together.

In the orders of the current classification, soils are grouped according to common properties that seem to be the result of the same kinds of processes acting to about the same degree on soil material and forming horizons. Each order is subdivided into suborders, primarily on the basis of physical or chemical properties that reflect degree of wetness, differences that are the result of differences in climate and vegetation, and extremes of texture. Each great group is defined within its respective suborder according to the presence or absence of diagnostic horizons and the arrangement of those horizons. Subgroups can be defined only in terms of reference to a great group and may represent the central concept of the great group or reflect properties that intergrade toward other classes. Soils are grouped in families largely on the basis of properties important to plant growth.

Listed in table 11 for each soil series in Montgomery County are the family, subgroup, and order of the current system. Also shown is the great soil group of the older system of classification. Placement of some soil series in the current system of classification, especially in families, may change as more precise information becomes available.

Descriptions of the great soil groups

An important category of the older classification is the great soil group. A great soil group consists of soils that are similar in several fundamental characteristics. These soils have the same kinds and numbers of horizons, but corresponding horizons may not be of the same thickness, and they may not be of the same degree of distinctness. Also, some characteristics of the soils in any given group may vary considerably and may resemble characteristics of other great soil groups. The soils in great soil groups that are similar to the soils in other great soil groups in significant characteristics are called intergrades. Each great soil group represented in Montgomery County is described in the following pages.

GRAY-BROWN PODZOLIC SOILS

In most of the soils in the county, characteristics of the Gray-Brown Podzolic great soil group are dominant. The soils of only two series, however, are considered to be true Gray-Brown Podzolic soils. The rest have some characteristics of the soils in other groups and are called intergrades.

TABLE 11.—*Soil series classified according to the old and the current systems*

Series	Current classification			1938 classification with later revisions
	Family	Subgroup	Order	Great soil group
Abbottstown	Fine loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols	Gray-Brown Podzolic.
Beltsville	Fine loamy, mixed, mesic	Typic Fragiudults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Bermudian	Coarse loamy (fine loamy), mixed, acid, mesic.[1]	Typic Udifluvents	Entisols	Alluvial.
Birdsboro	Fine loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Bowmansville	Fine loamy, mixed, acid, mesic.	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley.
Brecknock	Fine loamy, mixed, mesic	Mollic Hapludalfs	Alfisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Chalfont	Fine silty, mixed, mesic	Aquic Fragiudults	Ultisols	Gray-Brown Podzolic (intergrading toward Planosols).
Chester	Fine loamy, mixed, mesic	Alfic Hapludults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Codorus	Fine loamy, mixed, acid, mesic.	Aquic Udifluvents	Entisols	Alluvial.
Croton	Fine loamy, mixed, mesic	Typic Fragiaqualfs	Alfisols	Planosol.
Doylestown	Fine silty, mixed, mesic	Typic Fragiaquults	Ultisols	Low-Humic Gley.
Duffield	Clayey, mixed, mesic	Alfic Hapludults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Edgemont	Fine loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Glenelg	Fine loamy, micaceous, mesic.	Alfic Hapludults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Glenville	Fine loamy, mixed, mesic	Aquic Fragiudults	Utlisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Hatboro	Fine loamy, mixed, acid, mesic.	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley.
Howell	Clayey, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic.
Klinesville	Loamy skeletal, mixed, mesic.	Lithic Dystrochrepts	Inceptisols	Lithosol (intergrading toward Sols Bruns Acides).
Lansdale	Fine loamy, mixed, mesic[1]	Alfic Hapludults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Lawrenceville	Fine silty, mixed, mesic[1]	Aquic Fragiudults	Ultisols	Gray-Brown Podzolic.
Legore	Fine loamy, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic (intergrading toward Lithosol).
Lehigh	Fine loamy, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic (intergrading toward Planosol).
Manor	Coarse loamy, micaceous, mesic.	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Mount Lucas	Fine loamy, mixed, mesic	Aqualfic Hapludults	Ultisols	Red-Yellow Podzolic (intergrading toward Reddish-Brown Lateritic).
Murrill	Fine loamy, mixed, mesic	Alfic Hapludults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Neshaminy	Fine loamy, mixed, mesic[1]	Alfic Hapludults	Ultisols	Red-Yellow Podzolic (intergrading toward Reddish-Brown Lateritic).
Penn	Fine loamy, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic (intergrading toward Lithosol).
Raritan	Fine loamy, mixed, mesic	Aquic Fragiudults	Ultisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Readington	Fine loamy, mixed, mesic	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic (intergrading toward Red-Yellow Podzolic).
Reaville	Fine loamy, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic (intergrading toward Lithosol).
Rowland	Fine loamy, mixed, acid, mesic.	Aquic Udifluvents	Entisols	Alluvial.
Watchung	Fine, mixed, mesic	Typic Ochraqualfs	Alfisols	Planosol.

[1] Classification subject to change.

The soils of the Gray-Brown Podzolic group formed under a deciduous forest in a humid, temperate climate. In an area that has not been disturbed, a typical soil of this group has a thin litter of leaves on the surface. Below this litter is a layer of dark grayish-brown humus that is 1 to 2 inches thick. The humus is underlain by a grayish leached layer that extends to a depth of 8 to 12 inches. Where the soil has been plowed, the layer of humus and the leached layer are mixed together to form a dark-brown plow layer, or Ap horizon.

The B horizon, or subsoil, is distinctly finer textured and brighter colored than the A horizon, and it contains

more clay than the A horizon. The structure of the B horizon is moderately to strongly developed, and it is blocky or subangular blocky in most places. In most places the subsoil is lighter colored and coarser textured in the lower than in the upper part, as it grades to the partly weathered layers of the C and R horizons.

Gray-Brown Podzolic soils are generally less weathered than Red-Yellow Podzolic soils. As a rule, they contain more weatherable primary minerals than Red-Yellow Podzolic soils because they are less weathered. Also, they are normally less acid than Red-Yellow Podzolic soils. Typically, the base saturation of the Gray-Brown Podzolic soils increases with increasing depth. In many places the underlying material is calcareous.

Gray-Brown Podzolic soils are generally productive, but their productivity varies considerably as a result of differences in texture and other characteristics of the material in which they formed. Crops grown on these soils respond well if lime is added and fertilizer is applied.

In this county only the soils of the Abbottstown and Lawrenceville series are considered to be true Gray-Brown Podzolic soils. In both of these series, the soils have a fragipan, that is, a dense, brittle layer of silt loam in the B horizon or subsoil.

Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.—Some soils in the county have features that are characteristic of both the Gray-Brown Podzolic and the Red-Yellow Podzolic great soil groups. They have a horizon sequence (A1, A2, B, and C) similar to that of the typical Gray-Brown Podzolic soils, and their solum has the same general thickness. These soils normally have a more reddish or brighter color and are more acid than the Gray-Brown Podzolic soils, however, and they generally have a lower base saturation than is typical for those soils. Also, they contain fewer weatherable primary minerals because they are more highly weathered.

Typically, these soils are productive, and crops grown on them respond well to applications of lime and fertilizer. They are intermediate in fertility between the Gray-Brown Podzolic soils and the Red-Yellow Podzolic soils, and generally they have lower fertility than the Gray-Brown Podzolic soils.

In Montgomery County well-drained Gray-Brown Podzolic soils that are intergrading toward the Red-Yellow Podzolic great soil group are the Birdsboro, Brecknock, Chester, Duffield, Edgemont, Glenelg, Lansdale, and Murrill. Moderately well drained or somewhat poorly drained soils that are intergrading from the Gray-Brown Podzolic great soil group to the Red-Yellow Podzolic great soil group are the Beltsville, Glenville, Raritan, and Readington, which all have a fragipan, or a brittle dense layer, in their B horizon.

Gray-Brown Podzolic soils intergrading toward Lithosols.—Some soils of the county have characteristics of both Gray-Brown Podzolic soils and of the Lithosol great soil group. Their horizon sequence is similar to that of typical Gray-Brown Podzolic soils, and they have about the same chemical properties. They are shallower, however, and are moderately deep to shallow over bedrock. Also, in some places they have only minimal development of a profile. In the areas where development of a profile is minimal, these soils are similar to the Lithosols in characteristics.

The B horizon in these soils is generally less well defined, the structure is weaker, and the increase in content of clay is lower than in the typical Gray-Brown Podzolic soils. The soils that are in the Gray-Brown Podzolic great soil group, but that are intergrading toward Lithosols, are the well drained Legore and Penn soils and the moderately well drained or somewhat poorly drained Reaville soils.

Gray-Brown Podzolic soils intergrading toward Planosols.—Some soils in the county have characteristics of both the Gray-Brown Podzolic and Planosol great soil groups. Their horizon sequence is similar to that of typical Gray-Brown Podzolic soils (A1, A2, B, and C), and their chemical and physical properties are similar. One or more horizons in their profile, however, are abruptly separated from or contrast to an adjacent horizon. In this way these soils resemble Planosols by having a contrasting layer that is more compact than that of the associated normal soils. In Montgomery County only the moderately well drained and somewhat poorly drained Chalfont and Lehigh series consist of Gray-Brown Podzolic soils that are intergrading toward Planosols.

RED-YELLOW PODZOLIC SOILS

In Red-Yellow Podzolic soils, the major horizons are A1, A2, B, and C. In general, these soils have a bright-red or yellow color. They are highly weathered, are naturally acid, and have a low content of readily weatherable primary minerals. The clay fraction of these soils is commonly high in kaolinite. Generally, these soils contain less organic matter than the Gray-Brown Podzolic soils. They formed under deciduous, coniferous, or mixed forest in a humid, warm-temperate climate.

In areas that have not been disturbed, Red-Yellow Podzolic soils typically have a thin, dark-colored organic-mineral A1 horizon, but the A1 horizon is thick and is generally lighter colored in areas that have been plowed. These soils have a light-colored, leached A2 horizon in areas that have not been disturbed. Their B horizon is finer textured than the A2, and it has a strong reddish or yellowish color, with a chroma of 6 or 8. The C horizon is generally weathered to a depth of many feet.

These soils have moderate or low natural fertility, but they are easy to till. They are suited to a number of crops, and the crops respond well to applications of lime and fertilizer. In this county only the Howell soils are true Red-Yellow Podzolic soils.

Red-Yellow Podzolic soils intergrading toward Reddish-Brown Lateritic soils.—Some soils in this county have features that are characteristic of both the Red-Yellow Podzolic and the Reddish-Brown Lateritic great soil groups. They are leached and are slightly acid to medium acid. They have a relatively high content of highly weathered minerals. The clay minerals they contain are commonly kaolinite or other 1-to-1 layer lattice types with a small amount of chlorite or other 2-to-1 lattice-type minerals. Generally, these soils are less acid than the typical Red-Yellow Podzolic soils. They are red and contain a large amount of free iron oxides.

In areas that have not been disturbed, these soils have a thin, dark-colored, organic-mineral A1 horizon. Their A2 horizon is grayish brown to brown and is slightly coarser textured than the subsoil, or B horizon. The boundary between the A and B horizons is distinct, and typically the subsoil is conspicuously finer textured than the surface layer. The B horizon is dark reddish-brown to red or yellowish-red silty clay loam, and it has moderate or strong structure. The solum is generally 36 to 48 inches thick. In many places the base saturation increases with increasing depth.

These soils have moderate or high natural fertility. They are well suited to a number of crops, and the crops respond well to applications of lime and fertilizer. In this county the soils of the Mount Lucas and Neshaminy series are Red-Yellow Podzolic soils that are intergrading toward the Reddish-Brown Lateritic great soil group.

SOLS BRUNS ACIDES

In areas that have not been cultivated, the soils of the Sols Bruns Acides great soil group typically have a thin A1 horizon and a weakly expressed A2 horizon. Their B horizon contains but little more clay than the horizons above or below it. That horizon is distinguished chiefly by its uniform color that is stronger than that of the A or C horizons. Structural development is weak or moderate. These soils have a low degree of base saturation, and they are strongly acid in most places.

As a rule, soils of the Sols Bruns Acides great soil group are younger or are less weathered than those of either the Gray-Brown Podzolic or the Red-Yellow Podzolic great soil groups. The Manor soils are in the Sols Bruns Acides great soil group.

LITHOSOLS

Lithosols are generally steep and have been strongly influenced by relief or parent material. They do not have clearly expressed morphology, for their soil material is a freshly and imperfectly weathered mass of rock fragments. These soils are shallow and lack distinct horizons. No typical Lithosols occur in Montgomery County.

Lithosols intergrading toward Sols Bruns Acides.—Some soils are similar to typical Lithosols, but they are also similar to Sols Bruns Acides in some ways. Like the Lithosols, they have been strongly influenced by parent material and relief and are shallow to bedrock. They lack a well-developed profile, but they do have weakly expressed A and B horizons over a thin C or R horizon. The A1 or Ap horizon is darker colored than the horizons below and is relatively thin. The B horizon is also thin and shows little evidence of the movement or accumulation of clay. A large amount of coarse fragments is common throughout the profile. In Montgomery County the only Lithosols are the Klinesville soils, and they are intergrading toward the Sols Bruns Acides great soil group.

PLANOSOLS

Planosols have one or more horizons abruptly separated from and sharply contrasting to an adjacent horizon because of compaction or high content of clay. The B horizon is much higher in content of clay than the A horizon. These soils formed in nearly level upland areas under grass or forest vegetation in a humid or subhumid climate. In this county only the soils of the Croton and Watchung series are in this great soil group. The Croton and Watchung soils are poorly drained.

LOW-HUMIC GLEY SOILS

Soils of the Low-Humic Gley great soil group are somewhat poorly or poorly drained and have a thin, dark-colored A1 horizon that is moderately high in content of organic matter. The subsoil is generally fine textured. It has a grayish color or is intensely mottled because the high water table has kept air from reaching it. These soils reflect the influence of their low position and of the high water table. In this great soil group in Montgomery County are the poorly drained Bowmansville and Hatboro soils of the flood plains and the poorly drained Doylestown soils of upland flats or depressions.

ALLUVIAL SOILS

The soils of the Alluvial great soil group formed in deposits of recent alluvium on flood plains. They have a moderately well expressed A1 horizon, but the other horizons that are typical in a well-developed profile are indistinct or lacking. In most places the soil material consists of a fairly uniform deposit of silt loam that extends to a depth of 3 feet or more, but lenses of finer textured or of coarser textured material are included in some places. Generally, the surface layer of these soils is dark colored and the lower layers are brown.

The Alluvial soils in this county are in the Bermudian, Rowland, and Codorus series. The Bermudian soils are well drained, and the Rowland and Codorus are moderately well drained or somewhat poorly drained. In many places the lower part of the profile in the Rowland and Codorus soils is gleyed in places because the water table in those soils is high for fairly long periods.

Detailed descriptions of the soil series

In the following pages, the soil series in the county are described in alphabetic order. For each series, a detailed description of a representative profile is given. Also given are descriptions of the profiles for which the results of laboratory analyses are shown in the section "Laboratory Data." The colors described are for the soil when moist. Some terms used in this subsection are defined in the Glossary, and others are defined in the "Soil Survey Manual" (*9*).

Abbottstown Series

The Abbottstown series consists of deep and moderately deep, somewhat poorly drained soils formed in material weathered from red and brown shale, argillite, and sandstone. These soils are nearly level or undulating and are on upland flats, in depressions, or on concave lower slopes in the northern two-thirds of the county.

The Abbottstown soils formed in similar material and are adjacent to the well-drained Penn and Lansdale soils, but they are on lower uplands than those soils and are less steep. They are also adjacent to the moderately well drained Readington soils and poorly drained Croton soils. Their profile resembles that of the Chalfont

soils, but it is redder, contains more fragments of shale, and has a thinner, weaker fragipan. The Abbottstown soils are deeper and less shaly than the Reaville soils. They have more gray mottles in the upper part of the subsoil than the Readington soils, but they are less grayish than the Croton soils.

Typical profile of Abbottstown silt loam, 0 to 3 percent slopes. This soil was described and sampled for laboratory characterization in a cultivated field one-quarter of a mile south of the intersection of Heckler and Mount Airy Roads in Skippack Township; profile number S60-Pa-46-5 (1-6).

Ap—0 to 10 inches, dark reddish-gray (5YR 4/2) silt loam; 5 percent fragments of siltstone; weak, fine, subangular blocky structure breaking to weak, medium, granular structure; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.7); abrupt, smooth boundary. 9 to 11 inches thick. (S60-Pa-46-5-1)

B1—10 to 13 inches, reddish-brown (5YR 4/3) silt loam; a few, fine, faint mottles of yellowish red (5YR 5/6) and reddish gray (5YR 5/2); 10 percent coarse fragments; moderate, medium, subangular blocky structure; partial clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.2); clear, wavy boundary. 2 to 5 inches thick. (S60-Pa-46-5-2)

B2t—13 to 20 inches, reddish-brown (5YR 5/3) heavy silt loam; many, medium, prominent mottles of strong brown (7.5YR 5/6), red (2.5YR 4/6), and gray (5YR 6/1); 15 to 20 percent coarse fragments; very coarse prismatic structure breaking to moderate, medium, subangular blocky and some platy structure; prominent clay films on the surfaces of the peds; slightly firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.6); clear, wavy boundary. 5 to 9 inches thick. (S60-Pa-46-5-3)

Bx1g—20 to 27 inches, dark reddish-gray (5YR 4/2) heavy silt loam; many, medium and coarse, prominent mottles of strong brown (7.5YR 5/6), reddish gray (5YR 5/2), and gray (5YR 6/1); 15 to 20 percent coarse fragments; very coarse prismatic structure breaking to moderate, medium and thin, platy structure; prominent clay films and some black films on the surfaces of the peds; firm when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.1); clear, wavy boundary. 5 to 9 inches thick. (S60-Pa-46-5-4)

Bx2g—27 to 39 inches, weak-red (2.5YR 4/2) shaly silt loam; common, medium, distinct mottles of gray (N 5/0 or 5YR 6/1) and yellowish red (5YR 5/6); 20 to 25 percent coarse fragments; coarse prismatic structure breaking to moderate, medium and thin, platy structure; a few clay films and silt films on the surfaces of the peds; very firm when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.3); abrupt, wavy boundary. 10 to 14 inches thick. (S60-Pa-46-5-5).

C—39 to 48 inches, reddish-brown (5YR 4/3) shaly silt loam; 20 to 30 percent coarse fragments; many, medium and coarse, distinct mottles of yellowish red (5YR 5/6) and pinkish gray (5YR 6/2); very coarse prismatic structure breaking to weak, medium, platy structure; slightly firm when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.3). 8 to 12 inches thick. (S60-Pa-46-5-6)

R—48 to 52 inches +, dusky-red (2.5YR 3/2), partly weathered shale and siltstone.

Typical profile of Abbottstown silt loam, 0 to 3 percent slopes; sampled for laboratory characterization in a cultivated field three-fourths of a mile southwest of New Hanover Square in New Hanover Township; profile number S60-Pa-46-9 (1-7).

Ap—0 to 9 inches, dark-brown (7.5YR 4/2) silt loam; weak, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.7); abrupt, smooth boundary. 8 to 10 inches thick. (S60-Pa-46-9-1)

B21t—9 to 12 inches, brown (7.5YR 5/4) silt loam to silty clay loam; common, fine, faint, strong-brown (7.5YR 5/6) and brown (10YR 5/3) mottles; moderate, medium, subangular blocky structure breaking to weak, medium, platy structure; thin, partial clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.1); clear, wavy boundary. 1 to 5 inches thick. (S60-Pa-46-9-2)

B22t—12 to 16 inches, weak-red (2.5YR 4/2) fine silt loam; many, fine, distinct, reddish-brown (5YR 5/4) and reddish-gray (5YR 5/2) mottles; 5 to 10 percent shale; weak, very coarse, prismatic structure breaking to moderate, thin, platy structure; thin, partial clay films and black coatings on the surfaces of the peds; contains concretions; slightly firm when moist, slightly sticky and nonplastic when wet; extremely acid (pH 4.2); clear, wavy boundary. 3 to 7 inches thick. (S60-Pa-46-9-3)

Bx1g—16 to 23 inches, weak-red (2.5YR 4/2) fine silt loam; many, medium, prominent, brown (7.5YR 5/4) and reddish-gray (5YR 5/2) mottles; 10 to 15 percent shale; moderate, very coarse, prismatic structure breaking to moderate, thin and medium, platy structure, with prominent clay films on the surfaces of the peds; firm when moist, slightly sticky and slightly plastic when wet; extremely acid (pH 4/2); clear, wavy boundary. 5 to 9 inches thick. (S60-Pa-46-9-4)

Bx2g—23 to 27 inches, weak-red (2.5YR 4/2) fine silt loam; many, medium, prominent, reddish-brown (5YR 5/4) and pinkish-gray (7.5YR 6/2) mottles; 10 to 15 percent shale; weak, very coarse, prismatic structure breaking to moderate, thin and medium, platy structure, with thin, distinct clay films and black coatings on the surfaces of the peds; very firm when moist, sticky and slightly plastic when wet; strongly acid (pH 5.4); clear, wavy boundary. 3 to 6 inches thick. (S60-Pa-46-9-5)

Bx3g—27 to 38 inches, weak-red (2.5YR 4/2) loam to clay loam; many, medium, prominent, brown (7.5YR 5/4) and white (5YR 8/1) mottles; 10 to 18 percent shale; weak, thin and medium, platy structure; clay bridging; prominent clay films and black coatings on the surfaces of the peds; firm when moist, sticky and slightly plastic when wet; medium acid (pH 5.8); gradual, wavy boundary. 9 to 14 inches thick. (S60-Pa-46-9-6)

C—38 to 44 inches, weak-red (2.5YR 4/2) loam; many fine, distinct, reddish-brown (5YR 5/4) and pale-red (2.5YR 6/2) mottles; 10 to 18 percent shale; weak, medium, platy structure, with thin, partial clay films on the surfaces of the peds and bridging; friable when moist, sticky and slightly plastic when wet; medium acid (pH 6.0). 5 to 10 inches thick. (S60-Pa-46-9-7)

R—44 to 50 inches +, dusky-red (2.5YR 3/2), partly weathered siltstone.

The surface horizon ranges from dark brown (7.5YR 4/2) to dusky red (2.5YR 3/2) or dark reddish gray (5YR 4/2) in color and from loam to silt loam in texture. The B horizons range from reddish brown (5YR 5/4), dark reddish brown (5YR 4/2), or brown (7.5YR 5/4) to weak red (10R 4/4) in color and from silty clay loam or clay loam to silt loam in texture. The modal color is reddish brown (2.5YR 4/4 or 5YR 4/3), and the texture is silt loam or silty clay loam. Depth to prominent reddish-gray (5YR 5/2) to gray (N 5/0)

mottling ranges from 8 to 18 inches. The solum ranges from 24 to 48 inches in thickness, and depth to bedrock ranges from 3 to 8 feet. In most places coarse fragments occupy less than 10 percent of the surface layer and upper B horizon, but the number increases with increasing depth.

Beltsville Series

The Beltsville series consists of deep, moderately well drained or somewhat poorly drained soils developed in coastal plain deposits of silt, clay, sand, and gravel. These soils are nearly level or undulating and are on upland benches and in depressions.

The Beltsville soils are adjacent to the well-drained Howell soils and formed in similar material. Their profile resembles that of the moderately well drained Lawrenceville soils and the somewhat poorly drained Chalfont soils. In most places it is more reddish, however, and the lower B horizons contain more clay and coarse fragments. The fragipan in the Beltsville soils is thicker, firmer, and more brittle than that in the Glenville, Readington, and Abbottstown soils. The Beltsville soils are not extensive. They occupy small areas in the southern part of the county.

Typical profile of Beltsville silt loam, 2 to 6 percent slopes, moderately eroded, in an idle field 1 mile south of Bridgeport near Henderson Station in Upper Merion Township.

Ap—0 to 8 inches, dark grayish-brown (2.5Y 4/2) silt loam that contains a very large proportion of silt; weak, medium and thin, platy structure breaking to weak, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0); abrupt, smooth boundary. 5 to 9 inches thick.

B1—8 to 11 inches, dark yellowish-brown (10YR 4/4) silt loam that contains a very large proportion of silt; common, fine, faint mottles of brown (10YR 5/3 and 10YR 4/3); weak, medium, platy structure breaking to moderate, fine, angular blocky structure; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.6); abrupt, wavy boundary. 2 to 6 inches thick.

IIB2t—11 to 21 inches, dark-brown (10YR 4/3) gritty silty clay loam; the interiors of the peds are yellowish brown (10YR 5/6); 2 percent quartz gravel; weak, thick, platy structure breaking to moderate, fine, angular blocky structure; thin clay films on the surfaces of the peds and in pores; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 6.0); clear, wavy boundary. 8 to 12 inches thick.

IIBx1—21 to 28 inches, reddish-brown (5YR 4/4) gritty clay loam or gritty silty clay loam; gray (10YR 5/1) silty clay loam is on the surfaces of the prisms, and many, medium and fine, prominent mottles of yellowish brown (10YR 5/4), gray (10YR 5/1), and brown (10YR 5/3) are in the interiors; about 5 percent quartz gravel; very coarse prismatic structure breaking to moderate, thick, platy and moderate, fine, angular blocky structure; has common, thin clay films on the surfaces of the peds and in the pores; very firm when moist and in place, slightly sticky and plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 6 to 12 inches thick.

IIBx2—28 to 38 inches, reddish-brown (5YR 4/4) clay loam and gravelly clay loam; common, coarse, prominent mottles of dark brown (7.5YR 4/4), yellowish red (5YR 4/6), and gray 10YR 5/1); surfaces of the prisms coated with gray (10YR 5/1) silty clay loam one-fourth of an inch thick; 10 to 30 percent gravel consisting of pebbles less than 2 inches in diameter; very coarse prismatic structure breaking to weak, thick, platy and weak, medium, angular blocky structure; has thin clay films on the surfaces of the peds and in the pores; very firm when moist and in place, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 9 to 14 inches thick.

IIC1—38 to 72 inches, brown (7.5YR 5/4), red (2.5YR 4/6), reddish-gray (5YR 5/2), and yellowish-brown (10YR 5/4) gravelly clay loam, gravelly sandy clay loam, gravelly loam, and loamy sand in discontinuous layers ranging from 2 to 24 inches in thickness; as much as 50 percent gravel and weakly cemented sand grains; massive but tends toward thick platy structure; very firm when moist and in place, nonsticky to slightly sticky and nonplastic when wet; very strongly acid (pH 4.8) gradual, wavy boundary. 28 to 40 inches thick.

IIC2—72 inches +, pale-brown (10YR 6/3) to white (10YR 8/2) sand and gravel, but somewhat loamy in places; single grain or massive; friable to firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 5.0).

The texture of the surface horizon ranges from loam to silt loam, but silt loam that contains a large proportion of silt is most common. In most places the surface horizon contains only a few coarse fragments, but gravel is common in some areas. The B horizons range from reddish brown (5YR 4/4) to dark yellowish brown (10YR 4/3) in color and from silt loam to light silty clay loam, clay loam, or sandy clay loam in texture. The uppermost B horizons are commonly more yellowish and less reddish than the lower ones, and they are more silty and contain less clay than the lower horizons. In most places the lower part of the B horizon contains more sand and gravel than the upper part. Depth to mottling ranges from 12 to 24 inches, and depth to a fragipan that is 1 to 3 feet thick ranges from 15 to 24 inches. The underlying material is commonly stratified, and the layers vary considerably in texture and color. The thickness of the deposits in the underlying material ranges from 4 to more than 35 feet.

Bermudian Series

In the Bermudian series are deep, well-drained soils that formed in alluvium washed from material weathered from sandstone and shale. These soils are nearly level or gently sloping and are on the flood plains of streams.

The Bermudian soils occur on flood plains with the moderately well drained or somewhat poorly drained Rowland soils and the poorly drained Bowmansville soils. They occupy only small areas along the larger creeks in the county.

Typical profile of Bermudian silt loam in grass along Wissahickon Creek, 1 mile west of Fort Washington in Whitemarsh Township.

Ap—0 to 13 inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; many fine roots; neutral (pH 7.0, limed); abrupt, smooth boundary. 11 to 13 inches thick.

C1—13 to 17 inches, dark-brown (7.5YR 4/2) sandy loam; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; few fine roots; strongly acid (pH 5.4); abrupt, wavy boundary. 3 to 5 inches thick.

C2—17 to 34 inches, dark-brown (7.5YR 4/2) gritty loam; weak, fine, subangular blocky structure; friable

when moist, slightly sticky and nonplastic when wet; few roots; strongly acid (pH 5.4); abrupt, wavy boundary. 15 to 18 inches thick.

IIC3—34 to 48 inches, dark-brown (7.5YR 4/2) silt loam; massive but tends to have weak, medium, platy structure; friable when moist, slightly sticky and slightly plastic when wet; contains some coarse roots; strongly acid (pH 5.2); clear, wavy boundary. 12 to 16 inches thick.

IIIC4—48 to 58 inches +, reddish-brown (5YR 4/3) sandy loam that contains layers or lenses of dark-gray (N 4/0) silt ¼ to ½ inch thick; common, medium, distinct mottles of reddish gray (5YR 5/2) and dark reddish gray (5YR 4/2); massive; friable when moist, nonsticky and nonplastic when wet; few iron concretions; very strongly acid (pH 5.0).

The surface layer ranges from 6 to 15 inches in thickness and from sandy loam to silt loam in texture. The color of the surface layer ranges from dark reddish brown (5YR 3/2) to very dark grayish brown (10YR 3/2). The texture of the C horizons ranges from sandy loam to silt loam, and soil material of the different textures is stratified in many places. Sandy loam, loam, and silt loam are the most common textures in the C horizons. The color of the C horizons ranges from reddish brown (2.5YR 4/4) to brown (7.5YR 5/4) or dark brown (7.5YR 4/2). Depth to bedrock or to firm unconsolidated material weathered from bedrock ranges from 4 to 8 feet.

Birdsboro Series

The Birdsboro series consists of deep, well-drained soils that formed in old alluvium from material weathered from shale, sandstone, and conglomerate. These soils are nearly level or gently sloping and are on uplands and benches. The areas are small and are near the Schuylkill River and along the larger streams in the northern part of the county.

The Birdsboro soils are adjacent to the moderately well drained or somewhat poorly drained Raritan soils, and they formed in similar material. They are deeper and generally are not so red as the Penn soils, and in many places they contain more sand and gravel than the Penn soils. The Birdsboro soils have a more strongly developed profile than the Bermudian soils.

Typical profile of Birdsboro silt loam, 0 to 3 percent slopes, in grass along the Reading Railroad in Linfield, Limerick Township.

Ap—0 to 8 inches, dark reddish-brown (5YR 3/3) silt loam; 2 to 5 percent gravel; weak, fine, subangular blocky structure breaking to moderate, fine, granular structure; very friable when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.2); abrupt, smooth boundary. 7 to 10 inches thick.

B1—8 to 15 inches, reddish-brown (5YR 4/3) gritty silt loam; 2 to 5 percent gravel; weak, fine, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.8); clear, wavy boundary. 7 to 9 inches thick.

B21t—15 to 25 inches, reddish-brown (5YR 4/4) silty clay loam; 2 to 5 percent gravel; moderate, medium, subangular blocky structure; clay films are on the surfaces of the peds and in the pores; friable when moist, sticky and plastic when wet; strongly acid (pH 5.4); clear, wavy boundary. 8 to 12 inches thick.

B22t—25 to 38 inches, reddish-brown (5YR 4/4) clay loam to loam; 5 percent gravel; moderate, medium, angular blocky structure and has thin clay films on the surfaces of some peds and in pores; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 5.0); abrupt, smooth boundary. 10 to 15 inches thick.

C1—38 to 54 inches, sandy loam in which the surfaces of the peds are dark red (2.5YR 3/6) and the interiors are brown (7.5YR 5/4); common, fine, distinct mottles of pale brown (10YR 6/3); weak, thin and very thin, platy structure; slightly firm when moist and in place, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, smooth boundary. 12 to 18 inches thick.

C2—54 to 60 inches, red (2.5YR 4/8) gravelly loamy sand to gravelly sand; 30 percent gravel; massive but tends toward thick platy structure; slightly firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 5.0); abrupt, smooth boundary. 4 to 8 inches thick.

IIC3—60 to 84 inches, dusky-red (10YR 3/4) silt loam to loam that is shaly in the lower part; massive; firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 4.6); gradual, wavy boundary. 18 to 30 inches thick.

R—84 to 96 inches, dusky-red (10R 3/4), highly weathered siltstone.

The color of the surface horizon ranges from reddish brown (5YR 4/3) to dark reddish brown (5YR 3/3), and the texture of that horizon ranges from loam to silt loam. The color of the B horizons ranges from reddish brown (5YR 4/4) to red (2.5YR 4/6), and the texture of those horizons ranges from silt loam to sandy clay loam. The color of the C horizons ranges from strong brown (7.5YR 5/6) to red (2.5YR 4/8), and the texture of those horizons ranges from silt loam to gravelly sandy loam, gravelly loamy sand, or gravelly sand. In many places the soil material in the C horizons is stratified. The content of gravel and cobbles throughout the solum ranges from 1 to 35 percent, and the diameter of the coarse fragments ranges from 1 inch to 10 inches. The solum ranges from 30 inches to 60 inches in thickness. Depth to siltstone, shale, or sandstone bedrock ranges from 4 to 15 feet.

Bowmansville Series

The Bowmansville series consists of poorly drained soils that formed in alluvium from material weathered from sandstone, siltstone, shale, hornfels, or diabase. These soils are nearly level or gently sloping and are on flood plains and in depressions. They are in narrow bands along streams and in drainageways that are scattered throughout the northern two-thirds of the county.

The Bowmansville soils are near or adjacent to the well drained Bermudian soils and the moderately well drained or somewhat poorly drained Rowland soils. They do not have the fragipan that is characteristic of the Doylestown and Croton soils, and they are redder and contain more clay and less mica than the Hatboro soils.

Typical profile of Bowmansville silt loam in a weedy pasture on the grounds of the Eastern State Penitentiary, 1 mile east of Rahns in Skippack Township.

Ap—0 to 9 inches, dark reddish-brown (5YR 3/4) silt loam; few, medium, distinct mottles of red (2.5YR 4/6) and grayish brown (10YR 5/2); weak, fine, granular structure; very friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.2); abrupt, smooth boundary. 8 to 11 inches thick.

B21g—9 to 16 inches, weak-red (2.5YR 5/2) silt loam; common, medium, prominent mottles of reddish brown (5YR 4/4) and gray (5YR 6/1); weak, fine and

medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.2); clear, wavy boundary. 6 to 8 inches thick.

B22g—16 to 36 inches, weak-red (2.5YR 5/2) silt loam; common, medium, distinct mottles of yellowish red (5YR 4/6) and gray (5YR 6/1), and gray (10R 6/1) coatings on the surfaces of the peds; weak, medium, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; strongly acid (pH 5.2); abrupt, wavy boundary. 15 to 22 inches thick.

C—36 to 46 inches +, reddish-brown (2.5YR 4/4) loam to silt loam; common, fine, distinct mottles of gray (10R 6/1) and black; 10 percent fragments of shale; weak, medium, platy structure to massive; firm in place; strongly acid (pH 5.4).

The color and thickness of the surface horizon vary, depending largely on the amount and kind of local overwash. The color of the surface horizon ranges from dark reddish gray (5YR 4/2) or dark reddish brown (5YR 3/4) to dusky red (2.5YR 3/2); the texture is loam instead of silt loam in some places; and the thickness ranges from 6 to 10 inches. The horizons beneath the surface horizon range from predominantly weak red (2.5YR 5/2) to a brown (7.5YR 5/2) that is prominently mottled with reddish brown, strong brown, or grayish brown. The texture of the horizons beneath the surface horizon is predominantly silt loam or silty clay loam. Depth to bedrock ranges from 3 to 8 feet.

Brecknock Series

The Brecknock series consists of deep or moderately deep, well-drained soils developed in material weathered from metamorphosed shale. These soils are gently sloping to steep. The areas are small and are on low ridges and hills that are widely distributed throughout the northern part of the county.

The Brecknock soils are adjacent to the moderately well drained or somewhat poorly drained Lehigh and poorly drained Croton soils, and they formed in similar material. They are not so red as the Penn soils, and they are finer textured and more channery than the Lansdale soils. The Brecknock soils are not so fine textured as the Neshaminy soils, and they are more channery than those soils.

Typical profile of Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded, in an idle field near Green Lane Reservoir in Upper Frederick Township.

Ap—0 to 8 inches, very dark grayish-brown (2.5Y 3/2) channery silt loam; 25 to 35 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.6); abrupt, smooth boundary. 5 to 9 inches thick.

B2t—8 to 22 inches, dark grayish-brown (2.5Y 4/2) channery silt loam or silty clay loam; 35 to 60 percent coarse fragments; coatings of dark yellowish-brown (10YR 4/4) silty clay loam on the surfaces of the coarse fragments; weak, medium, subangular blocky structure; has patches of clay films on the surfaces of the peds and lining the pores; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 8 to 15 inches thick.

B3—22 to 34 inches, dark grayish-brown (2.5Y 4/2) and olive-brown (2.5Y 4/4) very channery silt loam; 75 to 90 percent consists of fragments that have a coating of thick, dark yellowish-brown (10YR 4/4) silty clay loam on their surfaces; weak, medium and fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 11 to 13 inches thick.

C—34 to 48 inches, highly fractured hornfels that has dark grayish-brown (2.5Y 4/2) and olive-brown (2.5Y 4/4) silt loam between the fragments; firm when moist and in place, slightly sticky and nonplastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary. 10 to 24 inches thick.

R—48 to 50 inches +, very dark gray (N 3/0) hornfels.

The color of the surface horizon ranges from very dark grayish brown (10YR 3/2 or 2.5Y 3/2) to grayish brown (10YR 5/2 or 2.5Y 5/2). Channery or stony phases are common. The color of the B horizons ranges from dark grayish brown (2.5Y 4/2 or 10YR 4/2) to olive gray (5Y 5/2), and the texture of those horizons ranges from loam to silty clay loam. The thickness of the solum ranges from 15 to 36 inches, but a thickness of 18 to 30 inches is most common. Depth to bedrock ranges from 2 to 5 feet. The content of coarse fragments or stones of hornfels, shale, or diabase ranges from 10 percent to more than 60 percent in the surface horizon and in the upper B horizon. The number of coarse fragments or stones increases with increasing depth and nearness to bedrock. The gray colors through the profile are inherited from the parent rock.

Chalfont Series

In the Chalfont series are deep, somewhat poorly drained, very silty soils developed in windblown silt over material weathered from bedrock. In most places the bedrock is shale, sandstone, or limestone. These soils are nearly level or undulating. They are widely distributed throughout the central part of the county and occur on upland flats, in depressions, and on the lower slopes.

The Chalfont soils occur with the moderately well drained Lawrenceville and the poorly drained Doylestown soils, and they formed in similar material. They contain a larger amount of silt and fewer fragments of shale than the Abbottstown soils. The Chalfont soils are less grayish than the Croton soils, and they contain less clay and fewer coarse fragments than those soils.

Typical profile of an area of Chalfont silt loam, 0 to 3 percent slopes, that has been cultivated but that is now in an idle strip one-half mile north of Eureka near County Line Road in Montgomery Township.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; very friable when moist, slightly sticky and nonplastic when wet; many fine roots; slightly acid (pH 6.5, limed); abrupt, smooth boundary. 6 to 9 inches thick.

A3—8 to 10 inches, brown (10YR 5/3) silt loam; few, fine, faint mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); weak, thin, platy structure breaking to very fine subangular blocky and medium granular structure; friable when moist, slightly sticky and slightly plastic when wet; few roots; slightly acid (pH 6.4); clear, wavy boundary. 1 to 3 inches thick.

B2t—10 to 14 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/6), light brownish gray (10YR 6/2), and light gray (10YR 6/1); weak, medium, platy structure breaking to moderate, fine, angular blocky structure; has thin patches of clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; few roots; medium

acid (pH 5.8); clear, wavy boundary. 2 to 5 inches thick.

Bx1—14 to 18 inches, dark yellowish-brown (10YR 4/4) silt loam; many, medium, prominent mottles of yellowish brown (10YR 5/8), reddish yellow (7.5YR 7/6), dark grayish brown (10YR 4/2), and gray (10YR 5/1); weak, coarse, prismatic structure (the prisms are 8 to 10 inches in diameter) breaking to moderate, medium platy structure; patches of clay films are on the surfaces of the peds and line the pores; firm when moist and in place, slightly sticky and nonplastic when wet; very few roots along the surfaces of the prisms; medium acid (pH 5.6); clear, wavy boundary. 3 to 5 inches thick.

Bx2—18 to 24 inches, dark yellowish-brown (10YR 4/4) silt loam; many, medium and coarse, prominent mottles of strong brown (7.5YR 5/8), dark brown (7.5YR 4/4), and gray (N 6/0 or 10YR 5/1); gray (10YR 5/1) coatings of silt as much as 1 inch thick are on the surfaces of the prisms; moderate, coarse, prismatic structure (the prisms are 8 to 10 inches in diameter) breaking to weak, medium, platy structure; a few thin clay films on the surfaces of the smaller peds; very firm when moist and in place, sticky and slightly plastic when wet; very few roots along the surfaces of the prisms; strongly acid (pH 5.4); abrupt, wavy boundary. 5 to 8 inches thick.

Bx3—24 to 30 inches, dark yellowish-brown (10YR 4/4) silt loam; common, coarse, prominent mottles of strong brown (7.5YR 5/8), grayish brown (10YR 5/2), and gray (N 5/0); thick, gray (N 5/0) coatings of silt on the surfaces of the prisms; 5 percent coarse fragments; moderate, coarse, prismatic structure breaking to weak, coarse and medium, platy structure; a few coatings of iron and manganese on the surfaces of the peds; very firm when moist and in place, sticky and slightly plastic when wet; strongly acid (pH 5.4); gradual, wavy boundary. 5 to 7 inches thick.

Bx4—30 to 47 inches, dark-brown (7.5YR 4/4) silt loam; common, coarse, prominent mottles of strong brown (7.5YR 5/6), grayish brown (10YR 5/2), and gray (N 5/0); has coatings on the surfaces of the prisms; 2 percent coarse fragments; moderate, coarse, prismatic structure breaking to weak, thick, platy structure; has a few coatings of iron and manganese on the surfaces of the peds; very firm when moist and in place, slightly sticky and slightly plastic when wet; strongly acid (pH 5.4); abrupt, wavy boundary. 15 to 20 inches thick.

IIC—47 to 60 inches +, dark yellowish-brown (10YR 4/4) shaly silty clay loam; common, fine, faint mottles of yellowish brown (10YR 5/6) and gray (10YR 5/1); 50 percent consists of pieces of partly weathered black shale as much as 15 inches in diameter; weak, medium, platy structure readily breaking to fine subangular blocky structure; common thin clay films and a few films of iron and manganese on the surfaces of the peds; firm when moist and in place, sticky and plastic when wet; strongly acid (pH 5.2).

The color of the Ap horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). The modal color of the B horizons is a hue of 10YR, but the hues range from 7.5YR to 2.5Y with a value of 4 or 5 and a chroma of 3 to 6. Mottles of low chroma are common in the B horizons, but a low chroma is not dominant. Thick coatings of gray (N 5/0 or 10YR 5/1) silt surround the prisms in the fragipan. The color in the lower part of the solum and in the IIC horizon may be influenced by colors inherited from the underlying rocks. In most places the texture of the B horizons is silt loam, but the texture ranges to light silty clay loam. Depth to the fragipan ranges from 14 to 24 inches, and the thickness of the fragipan ranges from 1 to 3 feet. The thickness of the solum ranges from 3 to 5 feet, and depth to bedrock ranges from 4 to 8 feet or more. In most places the content of coarse fragments in the upper part of the solum is less than 5 percent, and there is a slight accumulation in the Ap horizon. The number of coarse fragments increases with increasing depth. As much as 50 percent of the IIC horizon, immediately above the bedrock, consists of coarse fragments.

Chester Series

In the Chester series are deep, well-drained soils that developed in material weathered from schist and gneiss. These soils are nearly level or undulating. They occur in small areas on upland summits in the southeastern part of the county.

The Chester soils formed in similar material and are adjacent to the less deep, well-drained Manor soils, the moderately deep Glenelg soils, and the deep, moderately well drained or somewhat poorly drained Glenville soils. They are finer textured than the Edgemont and Lansdale soils. The Chester soils are more acid below a depth of 3 feet and contain more mica than the Duffield soils.

Typical profile of Chester silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field one-half mile west of Huntingdon Valley in Abington Township.

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam containing 2 to 5 percent fragments of quartz and gneiss; weak, thin, platy structure readily breaking to moderate, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.2); abrupt, wavy boundary. 7 to 10 inches thick.

A3—8 to 10 inches, dark yellowish-brown (10YR 4/4) silt loam containing as much as 4 percent coarse fragments; weak, very fine, subangular blocky and fine granular structure; friable when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.4); clear, wavy boundary. 0 to 3 inches thick.

B1—10 to 16 inches, yellowish-brown (10YR 5/4) to brown (7.5YR 5/4) fine silt loam containing up to 10 percent small fragments of quartz and gneiss; weak, fine, angular and subangular blocky structure but tends toward weak, medium, platy structure; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 5 to 8 inches thick.

B21t—16 to 25 inches, dark yellowish-brown (10YR 4/4) fine silt loam or silty clay loam; 2 to 5 percent small fragments of quartz and gneiss; moderate, medium and fine, angular and subangular blocky structure; has common thin clay films on the surfaces of the peds and in the pores; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 8 to 11 inches thick.

B22t—25 to 32 inches, yellowish-brown (10YR 5/6 to 10YR 5/4) silt loam containing 5 to 10 percent small fragments of quartz and gneiss; moderate, fine, subangular blocky structure; common thin clay films on the surfaces of the peds and in the pores; friable to slightly firm when moist and in place, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 5 to 9 inches thick.

B3—32 to 38 inches, brown (10YR 4/3) gritty silt loam or loam containing 10 percent coarse fragments; weak, fine, subangular blocky structure; slightly firm when moist and in place, slightly sticky and nonplastic when wet; medium acid (pH 5.6); clear, wavy boundary. 5 to 9 inches thick.

C1—38 to 46 inches, brown (10YR 4/3) gritty loam containing 10 to 15 percent coarse fragments; weak, thick, platy structure breaking to weak, medium, subangular blocky structure; firm when moist and in place, nonsticky and nonplastic when wet; medium acid (pH 5.6); clear, wavy boundary. 6 to 10 inches thick.

C2—46 to 74 inches, dark grayish-brown (10YR 4/2), yellowish-brown (10YR 5/4), and light yellowish-brown (10YR 6/4) sandy loam and gravelly loam; massive, but tends toward weak, thick, platy structure; firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 5.0); abrupt, broken boundary. 24 to 32 inches thick.

R—74 to 85 inches +, partly weathered gneiss.

The surface layer ranges from dark brown (10YR 3/3 or 7.5YR 4/2) to dark grayish brown (10YR 4/2) in color. The B horizons range from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6) in color and from silt loam or loam to silty clay loam in texture. The texture of the C horizons ranges from sandy loam or gritty loam to silt loam. In many places the B3 horizon and the C horizons contain mica. In most places coarse fragments of schist, gneiss, or quartzite make up less than 10 percent of the solum, but the amount increases to as much as 30 to 40 percent in some places in the C horizons. The thickness of the solum ranges from 34 to 48 inches, and depth to bedrock ranges from 5 to 12 feet.

Codorus Series

The Codorus series consists of deep, moderately well drained or somewhat poorly drained soils developed in alluvium washed from uplands underlain by schist, gneiss, limestone, and quartzite. These soils are level or nearly level. They are on narrow flood plains and in drainage depressions in the southern part of the county.

The Codorus soils formed in similar alluvial deposits and are adjacent to or near the poorly drained Hatboro soils. They are not so fine textured as the Chester and Glenville soils, and they lack the fragipan that is common in the B horizon of the Glenville soils. They are deeper and contain fewer coarse fragments than the Glenelg soils.

Typical profile of Codorus silt loam that has slopes of 0 to 3 percent, in an idle field along Mill Creek 1 mile north of Bryn Mawr in Lower Merion Township.

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; contains a few water-rounded pebbles; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.5); abrupt, smooth boundary. 6 to 10 inches thick.

C1—9 to 18 inches, dark yellowish-brown (10YR 4/4) silt loam; 5 percent coarse fragments; weak, fine, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.4); clear, smooth boundary. 8 to 10 inches thick.

C2—18 to 30 inches, brown (10YR 5/3) loam; common, fine, distinct, light brownish-gray (10YR 6/2) and strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; many mica flakes; strongly acid (pH 5.2); gradual, smooth boundary. 9 to 16 inches thick.

C3—30 to 54 inches, light yellowish-brown (10YR 6/4) loam; common, medium, distinct, light brownish-gray (10YR 6/2) and brown (7.5YR 5/4) mottles; few rounded pebbles and many mica flakes; massive to weak platy structure; friable when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.2); clear, smooth boundary. 20 to 26 inches thick.

IIC4—54 inches +, stratified, strongly acid sand, silt, and gravel.

The color of the surface horizon ranges from dark brown (10YR 4/3 or 7.5YR 4/2) to dark grayish brown (10YR 4/2). In places the surface horizon has a loam texture and contains less than 5 percent coarse fragments. The color of the C horizons ranges from brown (10YR 4/3) or dark yellowish brown (10YR 4/4) to light yellowish brown (10YR 6/4), and the texture of those horizons ranges from loam to clay loam. The number of mica flakes in the profile varies. The coarse fragments consist of a few water-rounded pebbles. Depth to distinct mottling ranges from 15 to 20 inches. Depth to bedrock ranges from 3 to 6 feet or more.

Croton Series

The Croton series consists of poorly drained soils developed in material weathered from shale, sandstone, argillite, or hornfels. These soils are nearly level or undulating. They are on upland flats, in depressions, or on concave lower slopes and are widely distributed throughout the northern two-thirds of the county.

The Croton soils are near or adjacent to the well drained Penn and Lansdale soils, the moderately well drained Readington soils, and the somewhat poorly drained Abbottstown soils, and they formed in similar material. They have somewhat redder hues, contain more clay, less silt, and more coarse fragments, and have a wider range in particle-size distribution than the Doylestown soils. The Croton soils are generally deeper and have mottling nearer the surface than the Lehigh soils. They contain a fragipan that is lacking in the Bowmansville soils. The Croton soils are deeper and grayer than the Reaville soils, and they contain fewer coarse fragments.

Typical profile of Croton silt loam, 0 to 3 percent slopes, in a pastured field near Limerick Center in Limerick Township. This soil was described and sampled for laboratory characterization; profile number S60–Pa–46–7 (1–7).

Ap—0 to 9 inches, weak-red (10R 4/2) silt loam; the reddish color of this horizon is caused by overwash from the adjoining Penn soils; 2 percent, by volume, is coarse fragments; weak, fine, granular structure showing some tendency to platiness; friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.2); abrupt, smooth boundary. 8½ to 9½ inches thick. (S60–Pa–46–7–1)

A2g—9 to 13 inches, light brownish-gray (10YR 6/2) silt loam to silty clay loam; many, medium, distinct, reddish-yellow (7.5YR 6/6) and reddish-gray (5YR 5/2) mottles; 2 percent coarse fragments; weak, medium, platy structure breaking to moderate, medium, granular structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 3 to 5 inches thick. (S60–Pa–46–7–2)

Bx1g—13 to 18 inches, reddish-gray (5YR 5/2) silty clay; many, medium, distinct, light-gray (5YR 6/1) and yellowish-red (5YR 5/6) mottles and mostly continuous gray (N 5/0) coatings on the surfaces of the prisms; 5 to 10 percent coarse fragments; moderate, medium, prismatic structure breaking to moderate, medium, angular blocky structure, with prominent clay films on the surfaces of the peds; firm when moist, sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 4 to 7 inches thick. (S60–Pa–46–7–3)

Bx2g—18 to 24 inches, weak-red (2.5YR 4/2) silty clay loam; many, medium, prominent, light-gray (5YR 6/1) and yellowish-red (5YR 5/6) mottles and gray (N 5/0) coatings on the surfaces of the prisms; 5 to 10 percent coarse fragments; moderate, very coarse, prismatic structure breaking to moderate, medium, angular blocky structure that, in turn, breaks to moderate, thin, platy structure, with continuous clay films on the surfaces of the peds; the clay films on the surfaces of the prisms are 1 millimeter thick; very firm when moist, slightly sticky and plastic when wet; very strongly acid (pH 4.6); gradual, wavy boundary. 4 to 8 inches thick. (S60-Pa-46-7-4)

Bx3—24 to 31 inches, weak-red (10R 4/3) silty clay loam; common, medium, distinct, light-gray (5YR 6/1) and yellowish-red (5YR 5/6) mottles and gray (N 6/0) coatings on the surfaces of the prisms; 15 percent coarse fragments; moderate, very coarse, prismatic structure breaking to moderate, fine, angular blocky structure; has prominent clay films 1 millimeter thick on the surfaces of the prisms; very firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.9); gradual, wavy boundary. 5 to 9 inches thick. (S60-Pa-46-7-5)

Bx4—31 to 37 inches, dusky-red (10R 3/3) clay loam; common, fine, distinct, yellowish-red (5YR 5/6) and light-gray (5YR 6/1) mottles and gray (N 6/0) coatings on the surfaces of the prisms; 15 to 20 percent coarse fragments; moderate, very coarse, prismatic structure breaking to moderate, fine, angular blocky structure; has distinct clay films on the surfaces of the peds; very firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.7); clear, wavy boundary. 4 to 8 inches thick. (S60-Pa-46-7-6)

B3—37 to 44 inches +, dusky-red (10R 3/3) silt loam; common, fine, distinct, yellowish-red (5YR 5/6) and light-gray (5YR 6/1) mottles and gray (N 6/0) coatings on the surfaces of the prisms; 5 percent coarse fragments; weak, very coarse, prismatic structure breaking to weak, thin and medium, platy structure, with few partial clay films on the surfaces of the peds; firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.7). (S60-Pa-46-7-7)

The texture of the surface horizon ranges from sandy loam to silty clay loam, but silt loam is predominant. The color of the surface horizon ranges from weak red (10R 4/2) to dark grayish brown (10YR 4/2 or 2.5Y 4/2), and the thickness of that horizon ranges from 6 to 10 inches. The range in color is caused largely by the influence of local recent deposits on the surface. The texture of the B horizons ranges from silt loam to silty clay, but silty clay loam is predominant. The color of the B horizons ranges from predominantly gray (N 6/0) to weak red (2.5YR 4/2) prominently mottled with gray and yellowish brown, reddish brown, or strong brown. In most places mottling occurs in the surface horizon or just below it. Depth to the fragipan ranges from 6 to 18 inches. The thickness of the solum ranges from 24 to 48 inches, and depth to bedrock ranges from 3 to 5 feet. In most places the content of coarse fragments amounts to less than 10 percent in the A horizon and to less than 30 percent in the B horizons. The fragments generally increase in size and in number in the C horizon.

Doylestown Series

In the Doylestown series are deep, poorly drained, very silty soils developed in deposits of windblown silt over various unconforming materials. In most places the underlying rocks consist of shale, sandstone, and limestone. These soils are nearly level or undulating and are on upland flats, in depressions, and on the lower slopes in the central part of the county.

The Doylestown soils formed in silty deposits near the moderately well drained Lawrenceville soils and the somewhat poorly drained Chalfont soils. They contain more silt, less clay, and fewer coarse fragments than the Croton soils. The Doylestown soils contain a fragipan that is not present in the Bowmansville soils, which formed in alluvium. They are grayer, have yellower hues, and contain fewer coarse fragments than the Abbottstown soils.

Typical profile of Doylestown silt loam, 3 to 8 percent slopes, moderately eroded, in a hayfield along Sumneytown Pike in Lower Gwynedd Township.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; few, medium, distinct, strong-brown (7.5YR 5/6) mottles and a few shale chips; weak, thin, platy structure breaking to moderate, fine, granular structure; friable when moist; slightly acid (pH 6.2, limed); abrupt, smooth boundary. 8 to 10 inches thick.

B2tg—9 to 15 inches, grayish-brown (10YR 5/2) silt loam; many, coarse, distinct, yellowish-brown (10YR 5/8) and white (10YR 8/2) mottles; moderate, thick, platy structure breaking to moderate, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; common clay films on the surfaces of the peds; strongly acid (pH 5.4); clear, wavy boundary. 5 to 9 inches thick.

Bx1g—15 to 26 inches, light-gray (10YR 7/2) silt loam; many, coarse, distinct, strong-brown (7.5YR 5/6) and white (2.5Y 8/2) mottles; moderate, coarse, prismatic structure breaking to moderate, thick, platy structure; firm when moist, brittle when dry, slightly sticky and slightly plastic when wet; common patches of clay films on the surfaces of the peds; strongly acid; clear, wavy boundary. 8 to 14 inches thick.

Bx2g—26 to 40 inches, brown (10YR 5/3) fine silt loam; many, coarse, prominent, yellowish-red (5YR 5/8), light-gray (2.5Y 7/2), and white (10YR 8/2) mottles; strong, very coarse, prismatic structure breaking to moderate, thick, platy structure; very firm when moist, slightly sticky and slightly plastic when wet; thin, continuous clay films on the surfaces of the peds; strongly acid (pH 5.2); gradual, wavy boundary. 12 to 16 inches thick.

IIBx3—40 to 48 inches +, brown (7.5YR 5/4) shaly silty clay loam; many, coarse, prominent mottles of yellowish red (5YR 5/8) and white (10YR 8/2); 40 to 50 percent coarse fragments; very firm when moist, sticky and slightly plastic when wet; strongly acid (pH 5.4).

The surface horizon ranges from very dark grayish brown to yellowish brown in color, and it contains a large amount of silt and less than 5 percent coarse fragments. The B horizons are predominantly gray (N 5/0 or 6/0), but the color ranges to grayish brown (2.5Y 5/2 or 10YR 5/2) or brown (10YR 5/3 or 7.5YR 5/4). The surfaces of the peds are coated with yellowish brown, strong brown, yellowish red, and gray, and the interior of the peds is mottled with yellowish brown, strong brown, yellowish red, and gray. The texture of the B horizons ranges from silt loam to silty clay loam that contains a large amount of silt. In places mottlings of low chroma are in the horizon just below the plow layer, but they are in the plow layer in other places. Depth to the fragipan ranges from 12 to 24 inches, and depth

to the underlying unconforming material (bedrock or unconsolidated material) ranges from 40 to 60 inches. Bedrock is at a depth ranging from 4 to 8 feet. The number of coarse fragments increases with increasing depth, but the amount in the upper B horizons is less than 5 percent, by volume.

Duffield Series

The Duffield series consists of deep, well-drained nearly level to moderately steep soils developed in material weathered from limestone or dolomite. These soils are on nearly level and undulating uplands. They occur in a narrow belt in the south-central part of the county.

The Duffield soils are near or adjacent to the moderately well drained Lawrenceville soils. They are less silty than the Lawrenceville soils, and they do not contain a fragipan. The Duffield soils are finer textured and less micaceous than the Chester soils. They are deeper and contain fewer coarse fragments than the Glenelg soils. The Duffield soils are less sandy than the Edgemont soils, and they contain fewer coarse fragments than the Murrill soils.

Typical profile of Duffield silt loam, 3 to 8 percent slopes, moderately eroded, in a grass field in an industrial development, 2 miles west of Conshohocken in Upper Merion Township.

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam containing 2 to 5 percent fragments of quartz and schist; weak, medium, granular structure; very friable when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.5); abrupt, smooth boundary. 5 to 8 inches thick.

B1—6 to 10 inches, strong-brown (7.5YR 5/6) silt loam containing 2 to 5 percent fragments of quartz and schist; weak, medium, platy structure breaking to weak, fine, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 3 to 6 inches thick.

B21t—10 to 22 inches, strong-brown (7.5YR 5/6) silt loam to silty clay loam containing 2 to 5 percent fragments of quartz; moderate, medium and fine, angular blocky structure; common thin clay films are on the surfaces of the peds and line the pores; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 10 to 14 inches thick.

B22t—22 to 31 inches, yellowish-red (5YR 5/6) silty clay loam containing 2 to 5 percent fragments of quartz; moderate, fine, angular blocky structure; common thin clay films are on the surfaces of the peds and line the pores; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 8 to 12 inches thick.

B23t—31 to 40 inches, yellowish-red (5YR 5/8) silty clay loam containing as much as 5 percent fragments of quartz; moderate, fine and very fine, angular blocky structure; common thin clay films are on the surfaces of the peds and line the pores; friable to slightly firm when moist and in place, slightly sticky and plastic when wet; medium acid (pH 6.0); gradual, wavy boundary. 8 to 15 inches thick.

B3—40 to 63 inches, strong-brown (7.5YR 5/6) silt loam containing 10 to 20 percent fragments of quartz and limestone; weak, very fine, subangular blocky structure; few thin clay films are on the surfaces of the peds; slightly firm when moist and in place, slightly sticky and slightly plastic when wet; medium acid (pH 6.0); gradual, wavy boundary. 18 to 26 inches thick.

C—63 to 120 inches, strong-brown (7.5YR 5/6) gravelly loam or gravelly silt loam streaked with yellowish red (5YR 5/6); 20 to 35 percent small fragments of quartz and limestone; weak, medium and fine, subangular blocky structure; friable to slightly firm when moist and in place, slightly sticky and nonplastic when wet; medium acid (pH 6.0); abrupt, smooth boundary. 40 to 60 inches thick.

R—120 to 168 inches +, dark-gray (N 4/0) limestone, slightly weathered on the surface.

The surface layer ranges from loam to silty clay loam in texture, but silt loam is definitely predominant. The subsoil ranges from yellowish red (5YR 4/6) to yellowish brown (10YR 5/6) or strong brown (7.5YR 5/6) in color and from silt loam to silty clay loam in texture. The solum ranges from 36 to 72 inches in thickness. In most places in the profile, the content of coarse fragments is less than 10 percent, by volume. These coarse fragments consist mainly of small weathered pieces of schist, quartz, and sandstone. Depth to limestone bedrock ranges from 4 to 12 feet.

Edgemont Series

In the Edgemont series are moderately deep or deep, well-drained soils developed in material weathered from quartzite and quartz schist. These soils are gently sloping to steep and are on low hills and ridges that border the limestone area in the south-central part of the county.

The Edgemont soils occur with the Manor and Glenelg soils, but they contain less mica and have a thicker solum than the Manor soils and are not so fine textured as the Glenelg soils. The Edgemont soils are coarser textured and have weaker structure than the Duffield and Chester soils. They are not so fine textured as the Glenville and Lawrenceville soils, and unlike those soils, they lack mottling in the B horizons.

Typical profile of Edgemont channery loam, 3 to 8 percent slopes, moderately eroded, that has been cultivated but is now idle; in a partly wooded area 1 mile north of Oreland in Upper Dublin Township.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) channery loam containing 20 to 35 percent flat fragments of quartzite; weak, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 5 to 10 inches thick.

B1—8 to 13 inches, yellowish-brown (10YR 5/4) loam containing 15 percent flat fragments of quartzite; weak, thin, platy structure breaking to weak, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 4 to 7 inches thick.

B21t—13 to 23 inches, yellowish-brown (10YR 5/6) loam containing 5 to 10 percent flat fragments of quartzite; weak, fine, angular and subangular blocky structure; patches of clay films are on the surfaces of the peds and line the pores; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.6); gradual, wavy boundary. 9 to 12 inches thick.

B22t—23 to 34 inches, strong-brown (7.5YR 5/6) channery loam containing 20 to 25 percent flat fragments of quartzite as much as 6 inches across; weak to medium, fine, angular block structure; common thin clay films are on the surfaces of the peds; firm when moist and in place, slightly sticky and nonplastic when wet; very strongly acid (pH 4.5); clear, wavy boundary. 9 to 13 inches thick.

B3—34 to 42 inches, brown (10YR 4/3 to 7.5YR 4/4) channery loam or channery sandy loam containing 20 to 30 percent weathered fragments of quartzite; weak, medium, platy structure breaking to weak, fine, an-

gular blocky structure; a few thin clay films are on the surfaces of the peds; firm when moist and in place, nonstickv and nonplastic when wet; very strongly acid (pH 4.5); gradual, wavy boundary. 7 to 12 inches thick.

C—42 to 54 inches, brown (10YR 4/3) very channery sandy loam, 50 to 85 percent of which is partly weathered quartzite; weak, fine and medium, subangular blocky structure; firm when moist and in place, nonsticky and nonplastic when wet; extremely acid (pH 4.2); gradual, wavy boundary. 9 to 15 inches thick.

R—54 to 65 inches +, partly weathered quartzite or quartz schist.

The texture of the surface horizon ranges from loam to sandy loam, but the modal texture is loam. These soils are predominantly channery or very stony. The B horizons range from strong brown (7.5YR 5/6) to yellowish brown (10YR 5/6) in color, from loam or channery sandy loam to clay loam in texture, and from 5 to 40 percent in content of weathered fragments of schist and quartzite. The thickness of the solum ranges from 18 to 48 inches, but the solum is between 30 and 42 inches thick in most places. Depth to bedrock ranges from 3 to 5 feet.

Glenelg Series

In the Glenelg series are moderately deep or deep, well-drained soils developed in material weathered from various kinds of schist and gneiss. These soils are on undulating and rolling uplands. The areas are widely distributed throughout the southern third of the county.

The Glenelg soils are near or adjacent to the deep, well drained Chester soils, the well drained Manor soils, and the moderately well drained or somewhat poorly drained Glenville soils, and they formed in similar material. They are redder and somewhat finer textured than the Edgemont soils and are shallower and contain more coarse fragments than the Duffield soils.

Typical profile of Glenelg silt loam, 8 to 15 percent slopes, moderately eroded, that has been cultivated. Profile is on the edge of a new housing development, one-half mile west of Gulph Mills in Upper Merion Township.

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; 10 to 15 percent flat fragments of schist; weak, medium and fine, granular structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.5); abrupt, smooth boundary. 7 to 9 inches thick.

B21t—8 to 11 inches, strong-brown (7.5YR 5/6) fine silt loam; 15 percent flat fragments of schist; weak, fine, angular and subangular blocky structure; patches of clay films are on the surfaces of the peds and line the pores; friable when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.2); clear, wavy boundary. 3 to 5 inches thick.

B22t—11 to 18 inches, brown (7.5YR 5/4) channery fine silt loam; 25 to 35 percent flat fragments of schist; weak, fine, subangular blocky structure; patches of clay films are on the surfaces of the peds and line the pores; friable when moist, sticky and slightly plastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 5 to 8 inches thick.

B3—18 to 24 inches, brown (7.5YR 4/4) very channery silt loam containing as much as 60 percent flat fragments of schist; weak, very fine, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary. 6 to 10 inches thick.

C1—24 to 36 inches, brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) very channery silt loam containing 80 percent fragments of schist; weak, thin, platy and very fine, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; extremely acid (pH 4.5); gradual, wavy boundary. 9 to 15 inches thick.

C2—36 to 50 inches, slightly weathered and fractured schist; coarse fragments make up 90 percent or more of the horizon; brown (7.5YR 4/4), dark-gray (N 4/0), and reddish-brown (2.5YR 4/4) loam is between the fragments; structureless; extremely acid (pH 4.2); gradual, wavy boundary. 10 to 15 inches thick.

R—50 to 64 inches +, slightly weathered and fractured schist bedrock, predominantly dark gray (10YR 4/1) but has streaks of light gray, darker gray, white, black, and red.

The surface horizon ranges from dark brown (10YR 4/3) to dark grayish brown (10YR 4/2) in color and from silt loam to loam in texture. In the surface horizon, the amount of fragments of schist or gneiss or of quartz pebbles ranges from 5 to 35 percent. The color of the B horizons ranges from yellowish brown (10YR 5/4 or 5/8) to strong brown (7.5YR 5/6), and the texture of the B horizons ranges from heavy loam to silty clay loam. The texture of the C horizons ranges from channery silt loam to sandy loam. The solum ranges from 20 to 36 inches in thickness, but a thickness between 24 and 30 inches is most common. The amount of coarse fragments in the B horizons ranges from 5 to 35 percent. The amount increases with increasing depth and is generally greater in the B3 and C horizons than in the B2 horizons. Depth to bedrock ranges from 2½ to 5 feet.

Glenville Series

The Glenville series consists of deep, moderately well drained or somewhat poorly drained soils developed in material weathered from schist and gneiss. These soils are on nearly level or undulating upland flats, in drainage depressions, and on concave lower slopes. They occur in scattered small areas in the southern third of the county.

The Glenville soils formed in similar material and occur near or adjacent to the deep, well-drained Chester, the moderately deep, well-drained Glenelg, and the well-drained Manor soils. They are less silty and contain more coarse fragments than the Lawrenceville and Chalfont soils. Their subsoil is somewhat finer textured and is more distinct than that of the Codorus soils.

Typical profile of Glenville silt loam, 3 to 8 percent slopes, moderately eroded, that has been cultivated; in a new housing development 1 mile southeast of Gladwyne in Lower Merion Township.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; 2 percent coarse fragments; weak, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; slightly acid (pH 6.5); abrupt, smooth boundary. 6 to 10 inches thick.

B1—8 to 12 inches, dark yellowish-brown (10YR 4/4) silt loam; 2 percent coarse fragments; weak, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.5); clear, wavy boundary. 2 to 5 inches thick.

B2t—12 to 22 inches, dark yellowish-brown (10YR 4/4) fine silt loam; common, medium, faint mottles of yellowish brown (10YR 5/6), brown (7.5YR 4/4), and grayish brown (10YR 5/2); 2 to 5 percent small, coarse fragments; moderate, medium and fine, angular and subangular blocky structure; common thin patches of clay films on the surfaces of the peds; friable when moist, sticky and slightly plastic when

wet; slightly acid (pH 6.4); clear, wavy boundary. 8 to 12 inches thick.

Bx1—22 to 30 inches, yellowish-brown (10YR 5/4) fine silt loam; many, medium, prominent mottles of light brownish gray (5YR 6/2) and grayish brown (2.5Y 5/2); weak, coarse, prismatic structure breaking to weak, thick, platy and moderate, medium, angular blocky structure; common thin clay films on the surfaces of the peds; slightly firm when moist and in place, sticky and slightly plastic when wet; slightly acid (pH 6.4); clear, wavy boundary. 6 to 10 inches thick.

Bx2—30 to 36 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct mottles of grayish brown (10YR 5/2), brownish yellow (10YR 6/6), and brown (7.5YR 4/4); contains many mica flakes and 5 to 10 percent coarse fragments; moderate, medium, platy structure breaking to weak, fine, subangular blocky structure; firm when moist and in place, slightly sticky and slightly plastic when wet; few thin clay films on the surfaces of the peds; slightly acid (pH 6.4); clear, wavy boundary. 5 to 9 inches thick.

C1—36 to 42 inches, yellowish-brown (10YR 5/6) micaceous silt loam; 5 to 10 percent coarse fragments; weak, medium, platy structure breaking to weak, very fine, angular and subangular blocky structure; firm when moist, brittle when dry, and slightly sticky and nonplastic when wet; thin clay films and a few black iron or manganese coatings on the surfaces of the peds; slightly acid (pH 6.5); gradual, wavy boundary. 4 to 8 inches thick.

C2—42 to 47 inches, yellowish-brown (10YR 5/6) very micaceous loam; 5 to 10 percent coarse fragments; weak, coarse and medium, platy structure; friable when moist, nonsticky and nonplastic when wet; slightly acid (pH 6.5); clear, wavy boundary. 3 to 6 inches thick.

C3—47 to 55 inches +, dark yellowish-brown (10YR 4/4) very micaceous loam streaked with reddish brown (5YR 4/4) and brown (7.5YR 4/4); 10 percent coarse fragments; weak, coarse, subangular blocky structure to massive; very friable when moist, nonsticky and nonplastic when wet; slightly acid (pH 6.5).

The thickness of the surface horizon ranges from 6 to 15 inches, and the color of that horizon ranges from dark grayish brown (2.5Y 4/2) to dark brown (7.5YR 4/2). The texture of the surface horizon is loam instead of silt loam in some places. The texture of the B horizons ranges from silt loam to silty clay loam, and the color of those horizons ranges from yellowish brown (10YR 5/4 or 5/6) to brown (7.5YR 5/4) mottled with gray, brown, and yellowish brown. Depth to prominent mottling ranges from 15 to 22 inches. In some places the texture of the C horizons is micaceous loam, and in other places it is micaceous silt loam or sandy loam. Throughout the profile, the content of coarse fragments is commonly less than 10 percent, but coarse fragments are more numerous in the lower part of the solum and in the C horizon than in the upper part of the solum. The solum ranges from 30 to 60 inches in thickness. Depth to bedrock ranges from 4 to 8 feet or more.

Hatboro Series

The Hatboro series consists of deep, poorly drained, nearly level soils developed in alluvium washed from material weathered from schist, gneiss, quartzite, and limestone. These soils generally have mottling throughout the profile. They occupy small areas on flood plains along streams and drainageways in the southern part of the county.

The Hatboro soils occur on narrow stream bottoms adjacent to the moderately well drained or somewhat poorly drained Codorus soils. They are grayer and are mottled nearer the surface than the Glenville soils, and they lack the fragipan that is typical of the Glenville soils. The Hatboro soils contain more sand, mica, and clay than the Doylestown soils, and unlike those soils, they lack a fragipan.

Typical profile of Hatboro silt loam in a partly wooded pasture along Pennypack Creek just west of Bryn Athyn in Lower Moreland Township.

Ap1—0 to 5 inches, dark-brown (10YR 4/3) silt loam, common, fine, distinct mottles of grayish brown (10YR 5/2) and reddish brown (5YR 4/4); weak, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.5); abrupt, smooth boundary. 2 to 6 inches thick.

Ap2—5 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium and fine, distinct mottles of gray (10YR 5/1) and dark yellowish brown (10YR 4/4); weak, fine, subangular blocky structure breaking to weak, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.5); abrupt, smooth boundary. 4 to 6 inches thick.

B21g—10 to 24 inches, gray (5YR 5/1) silt loam; common, medium and fine, distinct mottles of light gray (10YR 6/1) and brown (10YR 4/3); weak, medium and fine, subangular blocky structure; friable when moist, sticky and slightly plastic when wet; strongly acid (pH 5.4); clear, smooth boundary. 10 to 14 inches thick.

B22g—24 to 36 inches, gray (10YR 5/1) silt loam to silty clay loam; has gray (N 6/0 or 10YR 6/1) coatings on the surfaces of the peds and common, medium and coarse, distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); weak, medium and fine, subangular blocky structure; firm when moist and in place, sticky and slightly plastic when wet; strongly acid (pH 5.4); clear, smooth boundary. 10 to 14 inches thick.

IIC1g—36 to 40 inches, grayish-brown (10YR 5/2) sandy clay loam; common, medium and fine, distinct mottles of yellowish brown (10YR 5/8) and gray (10YR 5/1); weak, medium, subangular blocky structure or massive; slightly firm when moist and in place, slightly sticky and slightly plastic when wet; strongly acid (pH 5.4); gradual, smooth boundary. 4 to 10 inches thick.

IIC2g—40 to 48 inches +, light brownish-gray (10YR 6/2) sandy loam; common, medium, distinct mottles of yellowish brown (10YR 5/8) and gray (10YR 5/1); massive; friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.4).

The surface horizon ranges from dark grayish brown (10YR 4/2) to dark brown (10YR 4/3) in color and from 6 to 12 inches in thickness. In places the texture of the surface horizon is loam instead of silt loam. The B horizons are gleyed. Their modal color is gray in hues of 10YR to 2.5Y, distinctly mottled with brownish colors. The B horizons range from sandy loam to silty clay loam in texture, but the modal texture is silt loam. In the lower part of the profile, sandy or silty micaceous layers are predominant, and soil material of these different textures is stratified in some places. Depth to bedrock ranges from 4 to 8 feet or more.

Howell Series

The Howell series consists of deep, well-drained soils developed in coastal plain deposits of silt, clay, sand, and gravel. These soils are in small areas on gently

sloping upland summits and benches in the southern part of the county.

The Howell soils are near or adjacent to the moderately well drained or somewhat poorly drained Beltsville soils, and they formed in similar material. They resemble the Duffield and Chester soils, but they contain more sand and gravel than the Duffield soils and more clay than the Chester soils. The Howell soils contain more clay and sand and are somewhat redder than the Lawrenceville and Chalfont soils, and they do not have the fragipan that is characteristic of those soils.

Typical profile of Howell silt loam, 3 to 8 percent slopes, moderately eroded, in an idle field at the Harmonville Impounding Basin near Conshohocken in Plymouth Township.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam containing up to 5 percent coarse fragments that are predominantly pebbles; weak, medium, granular structure; very friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.8, limed); clear, smooth boundary. 6 to 9 inches thick.

B21t—8 to 16 inches, yellowish-brown (10YR 5/6) silty clay loam containing up to 5 percent gravel; weak, thin, platy and subangular blocky structure breaking to weak, very fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; common patches of clay films on the surfaces of the peds; slightly acid (pH 6.5); clear, wavy boundary. 6 to 10 inches thick.

B22t—16 to 25 inches, strong-brown (7.5YR 5/6) silty clay loam containing considerably more sand and fine gravel and less silt than the B21t horizon; weak, fine, subangular blocky structure; common thin clay films on the surfaces of the peds and in the pores; friable when moist, sticky and plastic when wet; medium acid (pH 5.8); clear, wavy boundary. 8 to 12 inches thick.

B23t—25 to 32 inches, strong-brown (7.5YR 5/6) silty clay loam containing less than 10 percent gravel; moderate, medium and fine, angular blocky structure; common thin clay films on the surfaces of the peds and in the pores; friable when moist, sticky and plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 7 to 12 inches thick.

IIB24t—32 to 50 inches, yellowish-red (5YR 4/8) gravelly clay loam containing less than 30 percent coarse fragments; weak, coarse and medium, subangular and angular blocky structure; common thin clay films on the surfaces of the peds and in the pores; friable when moist, slightly sticky and plastic when wet; very strongly acid (pH 5.0); gradual, wavy boundary. 10 to 20 inches thick.

IIIC1—50 to 90 inches, red (2.5YR 4/6) and yellowish-red (5YR 4/8) gravelly sandy loam and gravelly sandy clay loam in discontinuous layers, 2 to 12 inches thick; 30 to 50 percent coarse fragments; weak, medium, granular structure to single grain; friable to slightly firm when moist and in place, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0); abrupt, smooth boundary. 36 to 42 inches thick.

IVC2—90 to 101 inches, dark-brown (7.5YR 4/4) silt loam to loam containing 2 percent gravel; weak, thin, platy and very fine, angular blocky structure; friable to slightly firm when moist and in place, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0). 6 to 12 inches thick.

VC3—101 to 125 inches +, red (2.5YR 4/6) gravelly loamy sand; 50 to 75 percent coarse fragments up to 12 inches in diameter; structureless; friable when moist, nonsticky and nonplastic when wet; very strongly acid (pH 5.0).

In some small areas, the texture of the surface layer is gravelly silt loam or loam, but silt loam is the most common texture. The hues in the surface horizon are 10YR grading toward 7.5YR. In general the color of the B horizons ranges from yellowish red (5YR 5/6 or 5/8) to yellowish brown (10YR 5/6 or 5/8), but the color in some places is red (2.5YR 5/6). The texture of the B horizons is dominantly silty clay loam and clay loam. The C horizons vary in texture and color. The solum ranges from 30 to 40 inches in thickness. Pebbles of various sizes and a few cobbles make up as much as 30 percent of the solum. Depth to bedrock ranges from 6 to 30 feet or more.

Klinesville Series

In the Klinesville series are shallow or very shallow, well-drained or somewhat excessively drained, shaly soils developed in material weathered from red shale and siltstone. These soils occur on undulating to steep uplands throughout the northern half of the county.

The Klinesville soils are near or adjacent to the moderately deep, moderately well drained or somewhat poorly drained Reaville and the shallow to moderately deep, well drained Penn soils, and they formed in similar material.

Typical profile of Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded, in a cultivated field 1¼ miles east of Royersford in Upper Providence Township.

Ap—0 to 5 inches, dark reddish-brown (2.5YR 3/4) very shaly silt loam; up to 50 percent shale fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; contains a few roots; very strongly acid (pH 4.8); abrupt, wavy boundary. 4 to 6 inches thick.

B2—5 to 15 inches, reddish-brown (2.5YR 4/4) very shaly silt loam; 60 percent shale fragments; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; very few roots; very strongly acid (pH 4.6); clear, wavy boundary. 5 to 15 inches thick.

R—15 inches +, partly weathered, highly fractured, reddish-brown shale bedrock.

The surface horizon ranges from 4 to 8 inches in thickness. Its color is dark reddish brown (5YR 3/3 or 2.5YR 3/4), and it is predominantly shaly or very shaly silt loam. The B2 horizon is reddish-brown (2.5YR 4/4 or 5YR 4/4) very shaly silt loam, and more than 50 percent of it, by volume, consists of fragments of shale. The solum ranges from 10 to 20 inches in thickness. In places a thin C horizon, composed largely of fragments of shale, underlies the solum. Depth to partly weathered shale bedrock ranges from 10 to 20 inches.

Lansdale Series

In the Lansdale series are well-drained soils that have a moderately thick to thick solum. These soils developed on undulating and rolling uplands in material weathered from gray or brown sandstone, arkose, conglomerate, or shale. The areas are widely distributed throughout the south-central part of the county.

The Lansdale soils occur near or adjacent to the moderately well drained Readington soils, the somewhat poorly drained Abbottstown soils, and the poorly drained Croton soils, and they formed in similar material. They are coarser textured, are less reddish, and have a thicker solum than the Penn soils. The Lansdale soils resemble

the Edgemont soils that formed in material weathered from quartzite, but they have a better developed profile and have more clay and stronger structure in the B horizon than those soils.

Typical profile of Lansdale silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field 4 miles northwest of Hatboro in Horsham Township.

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; 2 to 5 percent sandstone fragments; weak, medium to fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; medium acid (pH 6.0, limed); abrupt, wavy boundary. 5 to 8 inches thick.

B1—7 to 10 inches, brown (7.5YR 4/4) loam; 1 to 2 percent sandstone fragments; weak, thin, platy structure breaking to weak, very fine, subangular blocky structure; very friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 3 to 5 inches thick.

B21t—10 to 17 inches, brown (7.5YR 4/4) loam; 10 to 25 percent sandstone fragments; weak, fine, angular and subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; common clay films are on the surfaces of the peds and line the pores; very strongly acid (pH 4.8); clear, wavy boundary. 5 to 9 inches thick.

B22t—17 to 23 inches, brown (7.5YR 4/4) loam coatings on the peds and strong-brown (7.5YR 5/6) loam in the interior of the peds; less than 5 percent sandstone fragments; moderate, medium and fine, angular and subangular blocky structure; common thin clay films and a few black coatings on the surfaces of the peds; friable when moist, slightly sticky and plastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary. 5 to 8 inches thick.

B23t—23 to 32 inches, brown (7.5YR 4/4) sandy loam; less than 5 percent sandstone fragments; medium, subangular blocky structure; thin clay films on the surfaces of the peds and in the pores; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.6); clear, wavy boundary. 7 to 11 inches thick.

B3—32 to 40 inches, dark-brown (7.5YR 4/4) to strong-brown (7.5YR 5/6) sandy loam; less than 5 percent small sandstone fragments; medium, very thick, platy structure breaking to weak, coarse and medium, subangular blocky structure; firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 4.6); clear, wavy boundary. 6 to 10 inches thick.

C1—40 to 57 inches, dark-brown (7.5YR 4/4) loamy sand; less than 5 percent fine sandstone fragments; massive to weak, medium, platy structure; firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 4.6); abrupt, wavy boundary. 12 to 18 inches thick.

C2—57 to 70 inches, dark reddish-gray (5YR 4/2) gravelly or channery loamy sand to very stony loamy sand; 35 to 75 percent sandstone fragments; massive to weak, medium, platy structure; firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 4.6). 10 to 15 inches thick.

R—70 inches +, dark grayish-brown (10YR 4/2) and reddish-gray (5YR 4/2) sandstone bedrock.

Typical profile of Lansdale loam, thin, 8 to 15 percent slopes, severely eroded, in a cultivated field 1¾ miles south of Prospectville in Horsham Township. This soil was sampled for laboratory characterization, profile number S60–Pa–46–1 (1–6).

Ap—0 to 10 inches, brown (10YR 4/3) loam to silt loam; 5 to 10 percent coarse fragments; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.4); clear, smooth boundary. 9 to 11 inches thick. (S60–Pa–46–1–1)

B21t—10 to 16 inches, brown (7.5YR 4/4) loam; 10 percent soft, coarse fragments; moderate, medium, subangular blocky structure; prominent clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.8); clear, wavy boundary. 4 to 8 inches thick. (S60–Pa–46–1–2)

B22t—16 to 20 inches, brown (7.5YR 4/4) channery loam; 20 percent very highly weathered, soft, coarse fragments; moderate, fine, subangular blocky structure; distinct, partial clay films on the surfaces of the peds; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.7); gradual, wavy boundary. 3 to 7 inches thick. (S60–Pa–46–1–3)

B3—20 to 26 inches, strong-brown (7.5YR 5/6) very channery sandy loam; 80 percent very highly weathered, soft, coarse fragments; weak, very fine to fine, subangular blocky structure; a few partial clay films on the surfaces of the peds; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.8); gradual, wavy boundary. 4 to 9 inches thick. (S60–Pa–46–1–4)

C1—26 to 36 inches, brown (7.5YR 4/4) very channery sandy loam; about 95 percent very highly weathered, soft, coarse fragments; very weak, medium, platy and medium, subangular blocky structure; a very few clay films on the surfaces of the peds; friable when moist, nonsticky and nonplastic when wet; very strongly acid (pH 5.0); gradual, wavy boundary. 8 to 13 inches thick. (S60–Pa–46–1–5)

C2—36 to 42 inches, brown (10YR 4/3), very porous loamy sand; very weak, medium, platy structure; friable when moist, nonsticky and nonplastic when wet; very strongly acid (pH 4.8). (S60–Pa–46–1–6)

The following profile is typical of Lansdale loam, thin, 8 to 15 percent slopes, severely eroded, used for crops at the Norristown State Hospital, East Norriton Township. This soil was sampled for laboratory characterization; profile number S60–Pa–46–4 (1–6).

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam; 15 percent sandstone fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 6.0, limed); abrupt, smooth boundary. 8 to 10 inches thick. (S60–Pa–46–4–1)

B1—9 to 14 inches, dark-brown (10YR 4/3) loam; 10 percent sandstone fragments; weak, medium, subangular blocky structure; thin, partial clay films on the surfaces of the peds; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.8); gradual, wavy boundary. 3 to 7 inches thick. (S60–Pa–46–4–2)

B21t—14 to 21 inches, brown (7.5YR 4/4) fine sandy loam to gravelly sandy loam; 10 to 35 percent coarse fragments; weak, medium, subangular blocky structure; thin, partial clay films on the surfaces of the peds and in the pores; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.6); gradual, wavy boundary. 5 to 9 inches thick. (S60–Pa–46–4–3)

B22t—21 to 24 inches, strong-brown (7.5YR 5/6) to brown (7.5YR 4/4) channery sandy clay loam; 25 percent weathered, soft sandstone fragments; weak, medium, subangular blocky structure; thin, partial clay films on the surfaces of the peds and in the pores; friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.4); clear, wavy boundary. 2 to 4 inches thick. (S60–Pa–46–4–4)

C—24 to 32 inches, brown (7.5YR 5/4) and light yellowish-brown (10YR 6/4) channery sandy loam; 50 percent weathered, very soft sandstone fragments; very weak, medium, subangular blocky structure; a few clay films on the surfaces of the peds; friable to firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 4.6); gradual, wavy boundary; 5 to 12 inches thick (S60–Pa–46–4–5)

R—32 to 34 inches +, highly weathered, very soft, micaceous graywacke.

The texture of the surface horizon of the Lansdale soils ranges from sandy loam to silt loam, but silt loam or loam is the most common texture. The hues in the color of the B horizon range from 7.5YR to 10YR, with values of 4 to 5 and chromas of 4 to 6. The texture of the B horizon ranges from sandy loam to clay loam. The thickness of the solum ranges from 24 to 48 inches. A thickness of 32 to 42 inches is most common, but the solum in the thin phases of the Lansdale soils is typically about 24 inches thick. The amount of coarse fragments that make up part of the solum ranges from 1 to 25 percent. The combined C horizons range from ½ foot to 8 feet or more in thickness, and the texture of the C horizons ranges from loamy sand to channery loam. Depth to bedrock ranges from 3 to 12 feet or more.

Lawrenceville Series

In the Lawrenceville series are deep, moderately well drained, very silty soils that developed in deep deposits of silt. The residual bedrock underlying these soils consists primarily of shale, sandstone, and limestone, but it includes schist, gneiss, and quartzite. These soils are on nearly level and undulating upland flats, in depressions, and on the lower slopes. The areas are widely distributed throughout the central part of the county.

The Lawrenceville soils formed in silty deposits near or adjacent to the somewhat poorly drained Chalfont soils and the poorly drained Doylestown soils. They are more silty, contain fewer coarse fragments, and have greater fragipan development than the Readington, Abbottstown, and Glenville soils.

Typical profile of Lawrenceville silt loam, 0 to 3 percent slopes, in a cultivated field, 1½ miles west of Ambler in Whitpain Township. This soil was sampled for laboratory characterization; profile number S60–Pa–46–3 (1–9).

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable when moist, slightly sticky and nonplastic when wet; neutral (pH 6.7, limed); clear, smooth boundary. 9 to 12 inches thick. (S60–Pa–46–3–1)

A3—10 to 15 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure that shows some platiness; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.8); clear, wavy boundary. 3 to 7 inches thick. (S60–Pa–46–3–2)

B1—15 to 19 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; distinct clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 3 to 6 inches thick. (S60–Pa–46–3–3)

B21t—19 to 27 inches, yellowish-brown (10YR 5/4) silt loam; few, fine, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles becoming common toward the boundary; moderate, medium, subangular blocky structure in the upper part of the horizon but coarse, prismatic structure toward the lower part; distinct clay films on the surfaces of the peds; friable when moist, slightly sticky and plastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 7 to 12 inches thick. (S60–Pa–46–3–4)

Bx1—27 to 33 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, prominent, gray (10YR 6/1) and strong-brown (7.5YR 5/8) mottles; moderate, coarse, prismatic structure breaking to moderate, subangular blocky structure, with partial clay films on the surfaces of the peds; firm to very firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 5 to 8 inches thick. (S60–Pa–46–3–5)

Bx2—33 to 41 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, prominent, gray (10YR 6/1) and strong-brown (7.5YR 5/8) mottles; moderate, coarse, prismatic structure breaking to thin, platy structure; partial clay films on the surfaces of the peds; firm to very firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.6); clear, wavy boundary. 5 to 12 inches thick. (S60–Pa–46–3–6)

Bx3—41 to 52 inches, strong-brown (7.5YR 5/6) silt loam; common, medium, distinct streaks of reddish gray (5YR 5/2), and mottles of yellowish red (5YR 4/6); weak, very coarse, prismatic structure breaking to moderate, medium and thin, platy structure, with a few clay films and some black coatings on the surfaces of the peds; slightly firm when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.6); abrupt, irregular boundary. 7 to 14 inches thick. (S60–Pa–46–3–7)

IIC—52 to 57 inches, dusky-red (10R 3/4) silt loam; yellowish-red (5YR 4/6) and pinkish-gray (5YR 6/2) mottled soil material in pockets; moderate, medium, platy structure; slightly firm when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.6); abrupt, wavy boundary. 4 to 6 inches thick. (S60–Pa–46–3–8)

R—57 to 60 inches +, dusky-red (10R 3/4) siltstone; very strongly acid (pH 4.6). (S60–Pa–46–3–9)

Typical profile of Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field 1¾ miles south of Prospectville in Horsham Township. This soil was sampled for laboratory characterization; profile number S60–Pa–46–2 (1–8).

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; slightly acid (pH 6.5, limed); clear, smooth boundary. 8 to 10 inches thick. (S60–Pa–46–2–1)

A3—9 to 13 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; partial clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.5, limed); clear, boundary. 3 to 6 inches thick. (S60–Pa–46–2–2)

B1—13 to 19 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, subangular blocky structure; prominent clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.4); gradual, wavy boundary. 4 to 8 inches thick. (S60–Pa–46–2–3)

B2t—19 to 25 inches, dark yellowish-brown (10YR 4/4) silt loam; few, fine, faint, grayish-brown (10YR 5/2) and brown (10YR 4/3) mottles; moderate, medium to coarse, subangular blocky structure that tends toward coarse prismatic structure; continuous clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 6.0); gradual, wavy boundary. 4 to 9 inches thick. (S60–Pa–46–2–4)

Bx1—25 to 32 inches, dark yellowish-brown (10YR 4/4) silt loam; common, medium, distinct, light-gray (10YR 7/2) and strong-brown (7.5YR 5/6) mottles and grayish-brown (10YR 7/2) coatings on the surfaces of the prisms; moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky structure; prominent clay films on the surfaces of the peds; very firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary; 5 to 10 inches thick. (S60–Pa–46–2–5)

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Bx2—32 to 44 inches, brown (7.5YR 4/4) silt loam; many, medium, prominent, reddish-brown (5YR 5/4) and pinkish-gray (7.5YR 7/2) mottles and grayish-brown (10YR 7/2) coatings on the surfaces of the prisms; weak, coarse, prismatic structure breaking to moderate, medium and thick, platy structure; prominent clay films on the surfaces of the peds; very firm when moist, slightly sticky and slightly plastic when wet; extremely acid (pH 4.4); gradual, wavy boundary. 8 to 16 inches thick. (S60-Pa-46-2-6)

C1—44 to 68 inches, dark grayish-brown (10YR 4/2) silt; common, medium, distinct, grayish-brown (2.5Y 5/2) and yellowish-red (5YR 5/8) mottles; moderate, medium, platy structure; firm when moist, slightly sticky and nonplastic when wet; extremely acid (pH 4.4); gradual, wavy boundary. 18 to 30 inches thick. (S60-Pa-46-2-7)

C2—68 to 74 inches, yellowish-brown (10YR 4/4) silt loam grading to fine sandy loam in the lower part; common, medium, distinct, gray (10YR 6/1) and strong-brown (7.5YR 5/6) mottles; moderate, medium, platy structure; firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.5).

R—74 to 80 inches +, dusky-red (10R 3/4) shale and siltstone.

The color of the surface horizon ranges from dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/4). In most places the texture of the B horizon is silt loam, but it ranges to silty clay loam. The color of the B horizons ranges from hues of 10YR to 7.5YR in values of 4 or 5 and chroma of 4 to 6. Mottling of low chroma begins at a depth of 15 to 30 inches. The fragipan is at a depth of 24 to 30 inches and ranges from 1 to 3 feet in thickness. The solum ranges from 3 to 5 feet in thickness, and depth to bedrock ranges from 4 to 12 feet. In most places in the solum, coarse fragments amount to less than 5 percent, by volume, of the soil material, but the number of coarse fragments is greater in the C horizons than in the A and B horizons. In places the colors in the lower part of the solum and in the C horizon are influenced by colors inherited from the bedrock.

Legore Series

The Legore series consists of well-drained soils that have a thin solum. These soils developed in material weathered from dark-colored basic igneous rocks, primarily diabase. They are moderately sloping to steep and occur in small areas on hilly uplands in the northeastern part of the county.

The Legore soils formed in similar material and occur near or adjacent to the deep, well drained Neshaminy soils, the moderately well drained or somewhat poorly drained Mount Lucas soils, and the poorly drained Watchung soils. They are less grayish and contain more sand and clay than the Lehigh and Brecknock soils. The Legore soils are not so red as the Penn or Klinesville soils. Also, they contain more clay and more sand, and they contain no fragments of shale.

Typical profile of Legore clay loam, 8 to 15 percent slopes, severely eroded, in an idle field one-fourth of a mile south of Fagleysville in New Hanover Township.

Ap—0 to 4 inches, brown (7.5YR 4/4) clay loam; 10 to 15 percent weathered diabase fragments; weak, very fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); abrupt, smooth boundary. 4 to 6 inches thick.

B2t—4 to 12 inches, yellowish-red (5YR 4/6) clay loam; 10 percent weathered diabase fragments; moderate, medium, subangular blocky structure; patches of clay films on the surfaces of the peds and in the pores; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 6 to 10 inches thick.

B3—12 to 17 inches, yellowish-red (5YR 5/6) sandy clay loam; streaks and grains of reddish brown (5YR 4/3) and very dark gray (5YR 3/1); 10 percent coarse fragments; weak, very thick and medium, platy structure breaking to weak, medium, subangular blocky structure; firm when moist and in place, nonsticky and slightly plastic when wet; slightly acid (pH 6.5); gradual, wavy boundary. 5 to 8 inches thick.

C—17 to 30 inches, brown (7.5YR 4/4 or 7.5YR 5/4) sandy loam; streaks and grains of light brownish gray (10YR 6/2), dark reddish gray (5YR 4/2), and very dark gray (5YR 3/1); 25 to 30 percent coarse fragments, and the number of coarse fragments increases with increasing depth; weak, thick, platy structure; firm when moist and in place, nonsticky and nonplastic when wet; slightly acid (pH 6.5); gradual, wavy boundary. 15 to 24 inches thick.

R—30 to 36 inches +, highly weathered, soft, coarse-grained, brown (7.5YR 4/4) to olive (5Y 4/3) diabase bedrock.

The color of the surface horizon ranges from brown (10YR 4/3) to reddish brown (5YR 4/4), and the texture of the surface horizon ranges from silt loam to clay loam. The texture of the B horizons ranges from loam to clay loam or sandy clay loam, but clay loam is the most common texture. The colors in the profile range from hues of 10YR or 7.5YR to 5YR, with values of 4 or 5 and chromas of 4 to 8. The solum ranges from 10 to 20 inches in thickness. The C horizon ranges from loamy sand to sandy clay loam in texture. Bedrock is at a depth ranging from 2 to 5 feet.

Lehigh Series

In the Lehigh series are moderately deep or deep soils that are moderately well drained or somewhat poorly drained. These soils developed in material weathered from hornfels rocks that have been metamorphosed by heat and pressure from the nearby igneous rocks. They are nearly level to moderately steep and are on low ridges and hills that have broad summits. The areas are widely distributed throughout the northern part of the county.

The Lehigh soils occur near or adjacent to the well-drained Brecknock and the poorly drained Croton soils and formed in similar material. They are not so red as the Reaville soils, and they are somewhat shallower, contain more coarse fragments, and are grayer than the Readington and Abbottstown soils. The Lehigh soils contain more coarse fragments than the Croton soils, and they are normally not mottled just below the plow layer.

Typical profile of Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded, in a pasture 1¼ miles north of Limerick on State Game Farm Road, Limerick Township.

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) channery silt loam; 35 percent coarse fragments; weak, fine, granular structure; very friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 5 to 8 inches thick.

B21t—6 to 15 inches, brown (10YR 4/3) channery silt loam; 30 to 40 percent coarse fragments; weak, fine, sub-

angular blocky structure; common thin patches of clay films on the surfaces of the peds and in pores; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.6); clear, wavy boundary. 5 to 9 inches thick.

B22t—15 to 21 inches, grayish-brown (10YR 5/2) channery silt loam containing 30 to 40 percent coarse fragments; common, medium, distinct mottles of dark yellowish brown (10YR 4/4), reddish gray (5YR 5/2), and dark grayish brown (10YR 4/2); weak, thin, platy and very fine, angular blocky structure; common thin patches of clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; extremely acid (pH 4.4); clear, wavy boundary. 6 to 9 inches thick.

C—21 to 30 inches, dark grayish-brown (10YR 4/2) very channery silt loam containing up to 90 percent coarse fragments; few, coarse, distinct mottles of gray (10YR 6/1 or 10YR 5/1) and strong brown (7.5YR 5/6); weak, medium, platy and very fine, blocky structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.6); gradual, wavy boundary; 7 to 10 inches thick.

R—30 to 35 inches +, slightly weathered, much fractured, very dark gray (10YR 3/1) hornfels.

The color of the surface horizon ranges from dark grayish brown (10YR 4/2) to olive gray (5Y 4/2). The texture of the B horizons ranges from channery silt loam to channery silty clay loam, and the amount of coarse fragments in the B horizons ranges from 10 to 50 percent, by volume. The color of the B horizons ranges from reddish gray (5YR 5/2) or olive gray (5Y 5/2) to brown (10YR 4/3) or grayish brown (10YR 5/2). In some places where parts of the B horizons contain common, medium, distinct mottles, the color of the mottles ranges from reddish gray (10R 4/1) to olive (5Y 4/4) or gray (N 5/0). The solum ranges from 18 to 30 inches in thickness. Depth to mottling ranges from 12 to 28 inches, but a depth between 15 and 24 inches is most common. Depth to bedrock ranges from 2 to 4 feet. The reaction ranges from very strongly acid to medium acid.

Manor Series

In the Manor series are well-drained soils that have a thin solum. These soils developed in material from deeply weathered micaceous and granitic schist and gneiss. They are gently sloping to very steep and are on hills and ridges. The areas are widely distributed throughout the southern third of the country.

The Manor soils formed from the same material and occur in the same general areas as the deep, well drained Chester soils, the moderately deep, well drained Glenelg soils, and the deep, moderately well drained or somewhat poorly drained Glenville soils. They are more micaceous and finer textured than the Edgemont soils, and they have a thinner solum than those soils.

Typical profile of Manor channery silt loam, 3 to 8 percent slopes, moderately eroded, in a new housing development that was formerly cropland; 1 mile southeast of Gladwyne in Lower Merion Township.

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) channery silt loam; 15 to 25 percent coarse fragments; weak, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.2, limed); abrupt, smooth boundary; 4 to 8 inches thick.

B2—7 to 14 inches, yellowish-brown (10YR 5/6) channery silt loam; 15 to 25 percent coarse fragments; weak, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary; 6 to 10 inches thick.

B3—14 to 17 inches, yellowish-brown (10YR 5/4) channery loam; 20 to 50 percent weathered coarse fragments and common mica flakes; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.6); clear, wavy boundary; 2 to 5 inches thick.

C1—17 to 45 inches, yellowish-brown (10YR 5/4 to 10YR 5/6), brown (10YR 4/3), and grayish-brown (10YR 5/2) very channery sandy loam; 50 to 75 percent highly weathered fragments of gneiss and common mica flakes; weak, coarse, subangular blocky structure to massive; firm when moist and in place, nonsticky and nonplastic when wet; strongly acid (pH 5.4); abrupt, wavy boundary; 24 to 30 inches thick.

C2—45 to 53 inches +, dark grayish-brown (10YR 4/2) micaceous loamy sand; structureless; very friable when moist, nonsticky and nonplastic when wet; very strongly acid (pH 5.0).

In places the surface horizon is very stony, instead of channery, and its texture ranges from silt loam to loam. The texture of the B horizons ranges from silt loam to sandy loam, but the predominant texture is loam or silt loam, high in content of mica. The amount of coarse fragments in the B horizons ranges from 10 to 50 percent. The color of the B horizons ranges from brown (7.5YR 5/4) to light olive brown (2.5Y 5/4), but the modal color is yellowish brown (10YR 5/4 to 5/6). The solum ranges from 10 to 24 inches in thickness. In places the C horizons consist of less than 1 foot of very channery silt loam, but the thickness ranges to 8 feet or more, and the texture, to micaceous silt loam or loamy sand that contains 2 to 75 percent coarse fragments in the lower part. Depth to bedrock ranges from 2 to 10 feet.

Mount Lucas Series

The Mount Lucas series consists of deep, moderately well drained or somewhat poorly drained soils developed in material weathered from dark-gray basic igneous rocks, primarily diabase. These are nearly level to moderately steep soils on upland flats, in depressions, and on foot slopes. They occur in the northern part of the county.

The Mount Lucas soils formed from the same material and occur near or adjacent to the well-drained Legore soils, the moderately deep or deep, well-drained Neshaminy soils, and the poorly drained Watchung soils. They are finer textured than the Readington or Abbottstown soils, and they contain fewer small coarse fragments, but more stones, than those soils. The Mount Lucas soils are deeper and finer textured than the Lehigh soils, but they are not so gray as those soils.

Typical profile of Mount Lucas very stony silt loam, 8 to 25 percent slopes, in a wooded area on Hildebrand Road, a half mile east of Anise in New Hanover Township.

O—3 inches to 0, thin layer of leaves, twigs, and moss.

A1—0 to 2 inches, very dark brown (10YR 2/2) very stony silt loam; contains 5 percent coarse fragments up to 2 inches in diameter, and 15 percent stones; moderate, very fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.8); abrupt, wavy boundary. 1½ to 2½ inches thick.

A2—2 to 9 inches, yellowish-brown (10YR 5/4) very stony silt loam; contains 10 percent coarse fragments up to 2 inches in diameter, and 15 percent stones; weak, fine, angular and subangular blocky structure breaking to moderate, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.6); clear, wavy boundary. 6 to 9 inches thick.

A3—9 to 13 inches, dark yellowish-brown (10YR 4/4) very stony heavy silt loam; contains 10 percent coarse fragments up to 1 inch in diameter, and 15 percent stones; weak, fine, angular and subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.8); clear, wavy boundary. 3 to 5 inches thick.

B21t—13 to 20 inches, strong-brown (7.5YR 5/6) clay loam; contains 10 percent coarse fragments up to 1 inch in diameter; moderate, medium and fine, angular and subangular blocky structure; common thin patches of clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.8); clear, wavy boundary. 6 to 11 inches thick.

B22t—20 to 34 inches, brown (7.5YR 4/4) clay loam; many, medium and coarse, prominent mottles of yellowish red (5YR 5/8), red (2.5YR 4/6), and grayish brown (10YR 5/2); moderate, medium, blocky structure; common thin clay films on the surfaces of the peds and in the pores; friable when moist, sticky and plastic when wet; medium acid (pH 6.0); abrupt, wavy boundary. 12 to 18 inches thick.

B3—34 to 38 inches, dark-brown (7.5YR 4/4) clay loam; common, medium, distinct mottles of gray (10YR 6/1) and yellowish red (5YR 5/6); weak, medium, platy and subangular blocky structure; few thin clay films on the surfaces of the peds and in the pores; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); abrupt, wavy boundary. 3 to 5 inches thick.

C1—38 to 54 inches, dark-brown (7.5YR 4/4) clay loam and sandy loam; layers or streaks of reddish brown (5YR 4/4) and gray (10YR 5/1); 10 to 50 percent highly weathered soft diabase; weak, coarse, subangular blocky structure; few thin clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); abrupt, wavy boundary. 5 to 8 inches thick.

C2—54 to 106 inches, dark yellowish-brown (10YR 4/4) loamy sand saprolyte that contains up to 25 percent fragments of weathered diabase; single grain; friable when moist, nonsticky and nonplastic when wet; slightly acid (pH 6.4); abrupt, wavy boundary; 48 to 60 inches thick.

R—106 inches +, highly weathered diabase bedrock.

Where the soil has been cultivated, the color of the surface horizon ranges from dark grayish brown (10YR 4/2) to dark brown (7.5YR 4/2). In the very stony Mount Lucas soils, the stones or boulders are rounded and range from 1 foot to 12 feet in diameter. In places the color of the B horizon is brown (7.5YR 4/4), and in other places it is strong brown (7.5YR 5/6), dark brown (7.5YR 4/4), or yellowish brown (10YR 4/4). The texture of the B horizons ranges from fine silt loam to silty clay or clay loam. Common, medium, distinct or prominent mottles of gray (10YR 5/1 or N 5/0) and yellowish red (5YR 4/6) to yellowish brown (10YR 5/8) occur in many places, and depth to those mottles ranges from 18 to 26 inches. The solum ranges from 36 to 48 inches in thickness. The soil material in the C horizons is primarily very highly weathered diabase. The C horizons range from clay loam to loamy sand in texture and from 6 inches to 6 feet in combined thickness. Depth to bedrock ranges from 5 to 10 feet.

Murrill Series

The Murrill series consists of deep, well-drained soils developed in colluvial material weathered from quartzite, quartz schist, and sandstone that has accumulated over limestone residuum. These soils are gently sloping. They occur in small areas at the foot of low hills and ridges along the edge of the limestone valley in the south-central part of the county.

The Murrill soils occur near or adjacent to the well drained Edgemont, Lansdale, and Duffield soils and the moderately well drained Lawrenceville soils. Their profile closely resembles those of the Edgemont and Lansdale soils, but the Murrill soils are deeper and have a finer texture, especially in the lower part of the profile. The Murrill soils are coarser textured and contain more gravel than the Duffield and Lawrenceville soils, and they lack the gray mottling and fragipan that are typical of the Lawrenceville soils.

Typical profile of Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded, in grass within the boundaries of Fort Washington State Park, 2 miles south of Ambler, Whitemarsh Township.

Ap1—0 to 6 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam containing 20 to 35 percent fragments of quartzite; weak, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.8, limed); abrupt, wavy boundary. 6 to 8 inches thick.

Ap2—6 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam or silt loam containing 25 to 35 percent fragments of quartzite; weak, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.6, limed); clear, wavy boundary. 2 to 3 inches thick.

B1—9 to 16 inches, dark yellowish-brown (10YR 4/4) gravelly loam containing 15 to 25 percent coarse fragments; weak, fine, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 8 to 12 inches thick.

B21t—16 to 25 inches, dark-brown (7.5YR 4/4) gravelly loam containing more clay than the B1 horizon and containing 15 to 30 percent small fragments of quartzite; weak, medium, platy and angular blocky structure; common thin patches of clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary. 8 to 12 inches thick.

B22t—25 to 37 inches, strong-brown (7.5YR 5/6) channery loam containing more sand and less clay than the B21t horizon and containing 25 to 35 percent coarse fragments; weak, fine, subangular blocky structure; common thin patches of clay films on the surfaces of the peds; slightly firm when moist and in place, nonsticky and nonplastic when wet; very strongly acid (pH 4.8); abrupt, wavy boundary. 10 to 14 inches thick.

IIB23t—37 to 47 inches, yellowish-red (5YR 4/6) clay loam containing 15 to 20 percent gravel and channers; weak, fine, angular and subangular blocky structure; thick patches of clay films on the surfaces of the peds; firm when moist and in place, sticky and plastic when wet; strongly acid (pH 5.2); gradual, wavy boundary. 8 to 14 inches thick.

IIB24t—47 to 67 inches, yellowish-red (5YR 4/8) gravelly sandy clay loam containing 20 to 25 percent gravel and channers; moderate, fine, angular blocky structure; thin, common clay films on the surfaces of the peds; firm when moist and in place, slightly sticky and slightly plastic when wet; strongly acid (pH 5.2); clear, wavy boundary. 15 to 24 inches thick.

IIC—67 to 72 inches +, yellowish-red (5YR 4/8) sandy loam containing 10 to 15 percent gravel and 15 percent angular fragments of rock; massive; firm when moist and in place, slightly sticky and slightly plastic when wet; strongly acid (pH 5.2).

Limestone bedrock was observed in an old quarry nearby, 12 to 15 feet below the surface.

The color of the surface horizon ranges from brown (7.5YR 4/2) or dark brown (7.5YR 3/2) to dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2), and the texture is loam in some places. The color of the B2 horizons ranges from hues of 10YR to 7.5YR, with values of 4 or 5 and chroma of 4 to 6. The texture of the B2 horizons ranges from silt loam or loam to clay loam or gravelly sandy clay loam, and those horizons contain more than 10 percent coarse fragments. In most places the IIB2 horizons are redder and contain more clay than the B2 horizons, and the modal color is yellowish red (5YR 4/6 or 5/6). The texture of the IIB2 horizons ranges from clay loam or silty clay loam to gravelly sandy clay loam. The solum ranges from 4 to 8 feet in thickness. Depth to limestone bedrock ranges from 8 to 15 feet.

Neshaminy Series

In the Neshaminy series are moderately deep or deep, well-drained soils formed in material weathered from dark-gray basic igneous rocks, primarily diabase. These soils are nearly level to very steep and are on hills and ridges in the northern part of the county.

The Neshaminy soils formed in similar material and are near or adjacent to the well drained Legore soils, the moderately well drained or somewhat poorly drained Mount Lucas soils, and the poorly drained Watchung soils. They are deeper and finer textured than the Penn soils and redder and finer textured than the Brecknock soils. The Neshaminy soils resemble the Mount Lucas soils, but they are redder or yellower than those soils and do not have gray mottling. They have a thicker, finer textured solum than the well-drained Legore soils.

Typical profile of Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded, in a cropped field, 1½ miles northwest of Upper Perkiomen Valley Park in New Hanover Township. This soil was sampled for laboratory characterization, profile number S60-Pa-46-13 (1-9).

Ap—0 to 6 inches, dark reddish-brown (5YR 3/4) silt loam; 15 percent small diabase fragments; moderate, coarse and medium, granular structure; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.7); abrupt, smooth boundary. 4 to 8 inches thick. (S60-Pa-46-13-1)

A3—6 to 8 inches, yellowish-red (5YR 4/6) clay loam; 10 to 15 percent small diabase fragments; moderate, coarse and medium, granular structure; thin, discontinuous clay films on the surfaces of the peds; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.9); clear, wavy boundary. 1 to 2 inches thick. (S60-Pa-46-13-2)

B1—8 to 11 inches, yellowish-red (5YR 5/6) clay loam; 15 to 20 percent small diabase fragments; moderate, fine to medium, subangular blocky structure; mostly thin, continuous clay films and a few black coatings on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 6.0); clear, wavy boundary. 2 to 4 inches thick. (S60-Pa-46-13-3)

B21t—11 to 16 inches, yellowish-red (5YR 4/8) clay loam; 15 to 20 percent small diabase fragments; moderate, medium, subangular blocky structure; thin, continuous clay films and a few black coatings on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.1); clear, wavy boundary. 4 to 6 inches thick. (S60-Pa-46-13-4)

B22t—16 to 20 inches, yellowish-red (5YR 4/8 or 5/8) clay loam; 10 to 15 percent diabase fragments; moderate, medium, subangular blocky structure; thin, continuous clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 3 to 6 inches thick. (S60-Pa-46-13-5)

B23t—20 to 24 inches, yellowish-red (5YR 4/6) sandy clay loam; red (2.5YR 5/6) and strong-brown (7.5YR 4/6) streaks; 15 to 20 percent diabase fragments; weak, medium, platy structure breaking to fine subangular blocky structure; partial clay films and some black coatings on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 3 to 6 inches thick. (S60-Pa-46-13-6)

B3—24 to 33 inches, yellowish-red (5YR 5/6) to red (2.5YR 4/6) sandy loam; 35 percent diabase fragments; weak, medium to thick, platy and subangular blocky structure; thin, discontinuous clay films and a few black coatings on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.1); gradual, wavy boundary. 7 to 10 inches thick. (S60-Pa-46-13-7)

C1—33 to 39 inches, dark-brown (7.5YR 4/4) coarse sandy loam; 25 to 30 percent diabase fragments; weak, thick and medium, platy structure breaking to weak, medium, subangular blocky structure; some thin, partial clay films on the surfaces of the peds; firm when moist and in place, slightly sticky and nonplastic when wet; slightly acid (pH 6.3); clear, wavy boundary. 5 to 8 inches thick. (S60-Pa-46-13-8)

C2—39 to 49 inches, yellowish-red (5YR 4/6) sandy loam; 30 percent diabase fragments; weak, very thick, platy structure breaking to weak, medium and coarse, subangular blocky structure; firm when moist and in place, slightly sticky and nonplastic when wet; slightly acid (pH 6.3). 8 to 12 inches thick. (S60-Pa-46-13-9)

R—49 inches +, diabase boulders with yellowish-red (5YR 4/6) coarse sandy loam between.

Typical profile of Neshaminy very stony silt loam, 8 to 25 percent slopes, in a wooded area 1½ miles north of Sumneytown in Marlborough Township. This soil was sampled for laboratory characterization, profile number S60-Pa-46-17 (1-9).

O1—3 inches to 1 inch, litter of hardwood leaves.

O2—1 inch to 0, black, well-rotted leaf mold; slightly acid (pH 6.2); abrupt, wavy boundary. ¼ inch to 2 inches thick. (S60-Pa-46-17-1)

A1—0 to 2 inches, dark-brown (10YR 4/3) very stony silt loam; weak, fine, granular structure; friable when moist, nonsticky and slightly plastic when wet; strongly acid (pH 5.3); clear, wavy boundary. 1 to 3 inches thick. (S60-Pa-46-17-2)

A2—2 to 8 inches, yellowish-brown (10YR 5/4) very stony silt loam; weak, fine, granular structure; friable when moist, nonsticky and slightly plastic when wet; strongly acid (pH 5.2); gradual, wavy boundary. 5 to 7 inches thick. (S60-Pa-46-17-3)

A3—8 to 11 inches, brown (7.5YR 5/4) very stony silt loam; weak, fine, subangular blocky structure breaking to weak, fine, granular structure; friable when moist, nonsticky and slightly plastic when wet; strongly acid (pH 5.4); gradual, wavy boundary. 2 to 4 inches thick. (S60-Pa-46-17-4)

B1—11 to 14 inches, brown (7.5YR 5/4) very stony silt loam or silty clay loam; moderate, medium, subangular

blocky structure breaking to moderate, coarse, granular structure; partial clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.7); clear, wavy boundary. 2 to 4 inches thick. (S60-Pa-46-17-5)

B21t—14 to 21 inches, strong-brown (7.5YR 5/6) very stony clay loam grading toward yellowish red (5YR 5/6); moderate, medium, subangular blocky structure; distinct clay films and a few black coatings on the surfaces of the peds; firm when moist and in place, sticky and plastic when wet; medium acid (pH 5.9); gradual, wavy boundary. 5 to 9 inches thick. (S60-Pa-46-17-6)

B22t—21 to 29 inches, yellowish-red (5YR 5/6) very stony clay loam; moderate, medium, angular blocky structure breaking to moderate, fine, angular blocky structure; distinct clay films and common black coatings on the surfaces of the peds; firm when moist and in place, sticky and plastic when wet; medium acid (pH 6.0); gradual, irregular boundary. 5 to 12 inches thick. (S60-Pa-46-17-7)

B31—29 to 39 inches, yellowish-red (5YR 5/6) very stony clay loam containing a few olive (5Y 5/6) grains of weathered diabase; moderate, medium, angular blocky structure; thin, partial clay films and a few black coatings on the surfaces of the peds; firm when moist and in place, sticky and plastic when wet; medium acid (pH 6.0); abrupt, irregular boundary. 5 to 15 inches thick. (S60-Pa-46-17-8)

B32—39 to 52 inches, yellowish-red (5YR 5/6) extremely stony sandy clay loam containing common black and olive grains of weathered diabase; moderate, medium, angular blocky structure; thin, partial clay films and a few black coatings on the surfaces of the peds; slightly firm when moist and in place, sticky and slightly plastic when wet; medium acid (pH 6.0); abrupt, irregular boundary. 10 to 15 inches thick. (S60-Pa-46-17-9)

C—52 to 52½ inches, sandy rind on diabase stones and weathered soft diabase fragments; less than 1 inch thick.

R—52½ to 55 inches +, black and white, fine-grained diabase bedrock.

The color of the surface horizon ranges from dark reddish brown (5YR 3/4) to dark yellowish brown (10YR 4/4) or dark brown (10YR 4/3), and the texture of the surface layer ranges from silt loam to silty clay loam. In some places the surface layer is stony or extremely stony. The stones or boulders are rounded and range from 1 foot to more than 12 feet in diameter. The B horizons range from red (2.5YR 4/6) to brown (7.5YR 4/4) or strong brown (7.5YR 5/6) in color, but the most common color is yellowish red (5YR 4/6 or 5/6). The texture of the B horizons is silty clay loam or clay loam in most places, but it ranges from fine silt loam to sandy clay loam or sandy loam. The solum ranges from 30 to 48 inches in thickness. The texture of the C horizon ranges from sandy clay loam to sandy loam, and it ranges from a thin rind of weathered material on diabase bedrock to 3 feet or more in thickness. In many places the full range in thickness occurs within a short distance. Depth to bedrock ranges from 3 to 6 feet or more.

Penn Series

In the Penn series are moderately deep to shallow, well-drained, nearly level to moderately steep soils that developed in material weathered from red shale, siltstone, and fine-grained sandstone. These soils are in widely distributed areas on undulating to hilly uplands throughout the northern two-thirds of the county.

The Penn soils formed in similar material and are near or adjacent to the moderately well drained Readington soils, the somewhat poorly drained Abbottstown soils, and the poorly drained Croton soils. They generally have a thicker solum than the Reaville soils, and they are not mottled with gray. They are deeper and contain fewer coarse fragments than the Klinesville soils. The Penn soils have a more reddish color and in most places are shallower and more silty than the Lansdale soils.

Typical profile of Penn silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field, 1 mile north of Trappe and 2 miles northwest of Collegeville in Perkiomen Township. This site was sampled for laboratory characterization, profile number S61-Pa-46-15 (1-5).

Ap—0 to 8 inches, dark reddish-brown (2.5YR 3/4) silt loam; 10 to 15 percent fragments of shale; weak, fine and medium, granular structure; friable when moist, nonsticky and nonplastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 7 to 10 inches thick. (S61-Pa-46-15-1)

B1—8 to 11 inches, reddish-brown (2.5YR 4/4) fine silt loam; 15 percent fragments of shale; weak, fine, subangular blocky and weak, thin, platy structure; thin, partial clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.1); gradual, wavy boundary. 1 to 5 inches thick. (S61-Pa-46-15-2)

B2t—11 to 17 inches, reddish-brown (2.5YR 4/4) shaly silt loam; 15 to 25 percent fragments of shale; moderate, fine and medium, subangular blocky structure; distinct clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 6.0); clear, wavy boundary. 4 to 8 inches thick. (S61-Pa-46-15-3)

B3—17 to 20 inches, weak-red (10R 4/4) shaly silt loam to shaly loam; 50 percent fragments of shale; common black coatings on the surfaces of the fragments; weak, medium, subangular blocky structure; few partial clay films on the surfaces of the peds; firm when moist and in place, slightly sticky and nonplastic when wet; medium acid (pH 5.7); clear, wavy boundary. 1 to 5 inches thick. (S61-Pa-46-15-4)

C—21 to 31 inches +, weak-red (10R 4/4) shale coated with loam or silt loam; a few black films of iron or manganese and thin partial clay films; strongly acid (pH 5.4). (S61-Pa-46-15-5)

Typical profile of Penn silt loam, 3 to 8 percent slopes, severely eroded, in a cultivated field 2 miles south of Kulpsville in Towamencin Township. This site was sampled for laboratory characterization, profile number S61-Pa-46-14 (1-5).

Ap—0 to 8 inches, dusky-red (2.5YR 3/2) silt loam containing 15 percent shale; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.7, limed); clear, wavy boundary. 7 to 9 inches thick. (S61-Pa-46-14-1)

B21t—8 to 14 inches, weak-red (10R 4/3) silt loam containing 10 to 20 percent shale; weak, fine, subangular blocky structure, with thin, partial clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.5); gradual, wavy boundary. 4 to 8 inches thick. (S61-Pa-46-14-2)

B22t—14 to 20 inches, weak-red (10R 4/3) shaly silt loam containing 30 to 40 percent shale; moderate, fine, angular and subangular blocky structure, with thin, partial clay films on the surfaces of the peds; slightly firm when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); clear, irregular boundary. 4 to 12 inches thick. (S61-Pa-46-14-3)

B3—20 to 24 inches, weak-red (10R 4/3) very shaly silt loam or loam containing 35 to 50 percent shale;

moderate, fine, blocky and platy structure with thin, partial clay films and black coatings on the surfaces of the peds; firm when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.1); clear, irregular boundary. 20 to 24 inches thick. (S61-Pa-46-14-4)

C—24 to 32 inches, weak-red (10R 4/4), thin-bedded shale, with weak-red (10R 4/3) loam coatings on the surfaces of the peds; moderate, medium, platy structure, with a few clay films and black coatings on the surfaces of the peds; very firm when moist and in place; very strongly acid (pH 5.0); gradual, irregular boundary. 6 to 12 inches thick. (S61-Pa-46-14-5)

R—32 to 36 inches, slightly weathered dusky-red (10R 4/4) shale.

The color of the surface horizon ranges from dusky red (2.5YR 3/2) to dark reddish brown (5YR 3/4 or 2.5YR 3/4). The texture of the surface horizon is loam in some places. In some places this surface layer is very stony or shaly. The color of the B horizons ranges from weak red (10R 4/3 or 4/4) to reddish brown (5YR 4/4 or 2.5YR 4/4). The texture of the B horizons ranges from loam to silty clay loam, but the modal texture is silt loam. The content of coarse fragments throughout the solum ranges from 5 to 20 percent in the upper part of the solum to 30 to 60 percent in the lower part. The thickness of the solum ranges from 12 to 32 inches, and the thickness of the C horizon ranges from 6 inches to 2 feet. In most places weathered shale bedrock is 2 to 3 feet below the surface.

Raritan Series

In the Raritan series are deep, moderately well drained or somewhat poorly drained soils developed in old alluvium from material weathered from shale, sandstone, and conglomerate. These soils are on nearly level and gently sloping stream terraces. They occupy small areas along the Schuylkill River and along large creeks in the northwestern part of the county.

The Raritan soils formed in similar material and are near or adjacent to the well-drained Birdsboro soils. They are less grayish than the poorly drained Croton soils and are deeper to bedrock and contain more clay and more gravel than the moderately well drained Readington soils and the somewhat poorly drained Abbottstown soils.

Typical profile of Raritan silt loam, 0 to 3 percent slopes, in a cultivated field, 1 mile northeast of Boyertown in Douglass Township.

Ap—0 to 10 inches, dark-brown (10YR 4/3) silt loam; 10 percent small pebbles; weak, very fine, granular structure; very friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.4); abrupt, wavy boundary. 8 to 11 inches thick.

A3—10 to 13 inches, brown (7.5YR 4/4) fine loam to clay loam; 10 to 15 percent small pebbles; weak, thin, platy structure that readily breaks to very fine, subangular blocky and fine, granular structure; very friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.6); clear, wavy boundary. 2 to 4 inches thick.

B1—13 to 17 inches, brown (7.5YR 5/4) clay loam; 10 percent coarse fragments; weak, fine, subangular blocky structure breaking to very fine, subangular blocky structure; few thin clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 3 to 5 inches thick.

B21t—17 to 20 inches, brown (7.5YR 5/4) clay loam; 5 percent coarse fragments; moderate, medium, subangular blocky structure breaking to fine and very fine subangular blocky structure, with common thin clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); gradual, wavy boundary. 2 to 5 inches thick.

B22t—20 to 30 inches, brown (7.5YR 4/4) clay loam containing less sand than the A and B1 horizons and 5 percent coarse fragments; common, fine, distinct mottles of brown (7.5YR 5/2) and dark reddish gray (5YR 4/2); moderate, medium, angular blocky structure; common thin clay films on the surfaces of the peds and in the pores; firm when moist and in place, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 6 to 10 inches thick.

Bx1—30 to 38 inches, brown (7.5YR 4/4) clay loam; 2 percent coarse fragments; coatings of grayish-brown (10YR 5/2) silty clay loam on the prisms, and common, medium, prominent mottles of reddish gray (5YR 5/2), grayish brown (10YR 5/2), and red (2.5YR 4/6); moderate, very coarse, prismatic structure breaking to moderate, medium, subangular and angular blocky structure; common thin clay films on the surfaces of the smaller peds and lining the pores; firm when moist and in place, slightly sticky and plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 7 to 9 inches thick.

IIBx2—38 to 46 inches +, reddish-brown (5YR 4/3) silty clay loam; 2 percent coarse fragments; coatings of grayish-brown (10YR 5/2) silty clay loam on the surfaces of the prisms and many, medium and coarse, prominent mottles of pinkish gray (5YR 6/2), reddish gray (5YR 5/2), and strong brown (7.5YR 5/8); weak, very coarse, prismatic structure breaking to weak, coarse, subangular blocky structure; very firm when moist and in place, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8).

The surface horizon ranges from dark brown (10YR 4/3) to reddish brown (5YR 4/3) in color. In places the texture of the surface horizon is loam instead of silt loam. The amount of gravel or cobbles of sandstone or quartz in the surface horizon ranges from 5 to 30 percent. The B horizons range from brown (7.5YR 4/4) to red (2.5YR 4/6) in color. Their texture is silty clay loam or clay loam, and the content of coarse fragments is as high as 20 percent. Depth to distinct or prominent, low-chroma mottling ranges from 15 to 24 inches. The solum ranges from 36 to 60 inches in thickness. The underlying material ranges from silty clay loam to sandy loam in texture, from 2 to 50 percent in content of coarse fragments, and from 1 to 10 feet in thickness. Depth to bedrock ranges from 4 to 15 feet. Depth to the fragipan ranges from 24 to 36 inches. The fragipan has coarse prismatic structure and platy to blocky microstructure.

Readington Series

The Readington series consists of deep, moderately well drained soils developed in material weathered from shale, siltstone, argillite, and sandstone. These soils contain a moderately or weakly developed fragipan. They are on nearly level to rolling upland summits, in depressions, and on the lower slopes throughout the northern two-thirds of the county.

The Readington soils formed in similar material and are near or adjacent to the well-drained Penn soils, the somewhat poorly drained Abbottstown soils, and the

poorly drained Croton soils. They are deeper and contain fewer coarse fragments than the Reaville soils. The Readington soils are deeper than the Penn soils and have mottling in the lower part of the solum. Gray mottling is not so near the surface, however, as in the Abbottstown and Croton soils. Where these soils formed in material weathered from brown or black shale or argillite, they resemble the Lawrenceville soils, but the Readington soils contain more shale fragments and have a thinner, weaker fragipan.

Typical profile of Readington silt loam, 0 to 3 percent slopes, used as cropland, 1½ miles south of New Hanover Square in New Hanover Township. This site was sampled for laboratory characterization, profile number S60–Pa–46–12 (1–8).

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; 5 to 10 percent coarse fragments; weak, medium and fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.1); abrupt, wavy boundary. 7 to 10 inches thick. (S60–Pa–46–12–1)

A3—8 to 11 inches, brown (10YR 4/3) silt loam; 5 percent coarse fragments; weak, fine, subangular blocky stucture; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.8); clear, wavy boundary. 0 to 3 inches thick. (S60–Pa–46–12–2)

B1—11 to 15 inches, brown (7.5YR 4/4) silt loam; 10 to 15 percent coarse fragments; moderate, medium, platy and angular blocky structure, with a few thin clay films on the surfaces of the peds, friable when moist, slightly sticky and slightly plastic when wet; medium acid (pH 5.6); clear, wavy boundary. 3 to 5 inches thick. (S60–Pa–46–12–3)

B21t—15 to 20 inches, reddish-brown (5YR 4/3) fine silt loam; 10 to 15 percent coarse fragments; moderate, medium, subangular blocky structure, with common thick patches of clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; strongly acid (pH 5.2); clear, wavy boundary. 3 to 7 inches thick. (S60–Pa–46–12–4)

B22t—20 to 29 inches, reddish-brown (5YR 4/3) fine silt loam to silty clay loam; many, fine, distinct mottles of reddish brown (5YR 5/3) and strong brown (7.5YR 5/6); 15 to 20 percent coarse fragments that have common black coatings on their surfaces; moderate, coarse and medium, platy structure breaking to medium and fine subangular blocky structure, with continuous thick clay films on the surfaces of the peds; firm when moist and in place, sticky and slightly plastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary. 7 to 10 inches thick. (S60–Pa–46–12–5)

Bx1—29 to 33 inches, reddish-brown (5YR 4/4) shaly clay loam; reddish-gray (5YR 5/2) coatings on the surfaces of the prisms and pinkish-gray (5YR 6/2) coatings on the surfaces of the smaller peds; common, fine, distinct interior mottles of yellowish red (5YR 5/6), pinkish gray (5YR 6/2), and dark reddish gray (5YR 4/2); 20 to 30 percent coarse fragments that have common black coatings on their surfaces; weak, very coarse, prismatic structure breaking to weak, very thick, platy and medium angular blocky structure; common thick clay films on the surfaces of the peds; very firm when moist and in place, sticky and slightly plastic when wet; very strongly acid (pH 4.8); abrupt, smooth boundary. 6 to 10 inches thick. (S60–Pa–46–12–6)

Bx2—33 to 40 inches, reddish-brown (5YR 4/3) shaly fine silt loam to silty clay loam; common, fine, faint mottles of reddish gray (5YR 5/2) and dark reddish gray (5YR 4/2); weak, very thick, platy structure breaking to thick platy and medium subangular blocky structure, with common thin clay films on the surfaces of the peds; very firm when moist and in place, sticky and slightly plastic when wet; very strongly acid (pH 4.8); abrupt, smooth boundary. 6 to 10 inches thick. (S60–Pa–46–12–7)

C—40 to 44 inches +, weak-red (2.5YR 4/2) shaly silt loam; common, medium, faint mottles of reddish brown (5YR 5/3) and pinkish gray (5YR 6/2); 20 to 30 percent coarse fragments, with black coatings on their surfaces; weak, very thick, platy structure, with a few, thin clay films on the surfaces of the peds; very firm when moist and in place, slightly sticky and nonplastic when wet; very strongly acid (pH 4.8). (S60–Pa–46–12–8)

Typical profile of Readington silt loam, 0 to 3 percent slopes, in a cultivated field at Limerick Center in Limerick Township. This site was sampled for laboratory characterization, sample number S60–Pa–46–6 (1–7).

Ap—0 to 10 inches, dark-brown (7.5YR 4/2) silt loam; weak, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; strongly acid (pH 5.4); abrupt, smooth boundary. 9 to 11 inches thick. (S60–Pa–46–6–1)

B1—10 to 14 inches, brown (7.5YR 4/4) heavy silt loam to silty clay loam; weak, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 3 to 5 inches thick. (S60–Pa–46–6–2)

B21t—14 to 20 inches, brown (7.5YR 4/4) silty clay loam; few, fine, faint, strong-brown (7.5YR 5/6) mottles; 5 percent shale; moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky structure; thin clay films on the surfaces of the peds and lining the pores; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 4 to 8 inches thick. (S60–Pa–46–6–3)

B22t—20 to 27 inches, reddish-brown (5YR 4/3) silty clay loam; common, medium, prominent, strong-brown (7.5YR 5/6 or 5/8) and gray (5YR 6/1) mottles; 10 percent shale; moderate, very coarse, prismatic structure breaking to moderate, medium, angular blocky structure, with prominent clay films on the surfaces of the peds; slightly firm when moist, slightly sticky and plastic when wet; very strongly acid (pH 4.7); abrupt, wavy boundary. 5 to 9 inches thick. (S60–Pa–46–6–4)

Bx1—27 to 36 inches, reddish-brown (5YR 4/4) silty clay loam; common, medium and fine, distinct, yellowish-red (5YR 5/6) and light pinkish-gray (5YR 6/2) mottles and reddish-brown (5YR 4/3) coatings on the surfaces of the prisms; 10 percent shale; moderate, very coarse, prismatic structure breaking to moderate, fine, angular blocky structure, with prominent clay films on the surfaces of the peds; firm when moist, slightly sticky and plastic when wet; very strongly acid (pH 4.7); clear, wavy boundary. 8 to 12 inches thick. (S60–Pa–46–6–5)

Bx2—36 to 46 inches, weak-red (2.5YR 4/2) silty clay loam; common, fine, distinct, pinkish-gray (5YR 6/2) and strong-brown (7.5YR 5/6) mottles and reddish-brown (5YR 4/3) coatings on the surfaces of the prisms; 10 to 15 percent shale; moderate, very coarse, prismatic structure breaking to moderate, medium, platy structure; partial clay films on the surfaces of the peds; very firm when moist, slightly sticky and plastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary. 8 to 12 inches thick. (S60–Pa–46–6–6)

C—46 to 54 inches +, reddish-brown (2.5YR 4/4) shaly silt loam; few, fine, distinct, yellowish-red (5YR 5/6) and light reddish-brown (5YR 6/3) mottles; 20 to 25 percent shale; weak, coarse, prismatic structure breaking to weak, medium, platy structure; slightly firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.7). (S60–Pa–46–6–7)

The surface horizon ranges from dark reddish gray (5YR 4/2) to dark grayish brown (10YR 4/2) in color, and its texture is loam in some places. The B horizons range from weak red (10R 4/3 or 2.5YR 4/2) to brown (7.5YR 4/4) in color, and from silt loam to silty clay loam in texture. The modal color of the B horizons, however, is reddish brown (5YR 4/4), and the modal texture is silty clay loam. Depth to low-chroma mottling ranges from 18 to 36 inches, but the depth is typically between 22 and 30 inches. Coarse fragments typically make up less than 15 percent of the upper horizons. The content of coarse fragments increases with increasing depth, however, and coarse fragments make up 40 percent or more of the lower B horizon and the C horizon in some places. The solum ranges from 30 to 48 inches in thickness. Depth to the fragipan ranges from 24 to 36 inches, and depth to bedrock ranges from 3 to 5 feet.

Reaville Series

The Reaville series consists of somewhat poorly drained or moderately well drained soils that have a thin solum over a firm, very shaly substratum. These soils developed in material weathered from shale and siltstone. They occur on nearly level to rolling uplands throughout the northern half of the county.

The Reaville soils are near or adjacent to the well-drained Penn and Klinesville soils and formed in similar material. They have a thinner, more shaly solum than the Readington and Abbottstown soils. The Reaville soils have grayish mottling in the B horizons that is lacking in the Penn and Klinesville soils.

Typical profile of Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded, in an idle field near School Road, 2 miles northwest of Trappe in Limerick Township. This site was sampled for laboratory characterization; profile number S61–Pa–46–16 (1–6).

Ap—0 to 8 inches, reddish-brown (2.5YR 4/4) shaly silt loam; 15 to 20 percent coarse fragments; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.2); abrupt, smooth boundary. 7½ to 8½ inches thick. (S61–Pa–46–16–1)

B1—8 to 12 inches, red (2.5YR 4/6) shaly silt loam to silty clay loam; a few, fine, faint, reddish-gray (10R 5/3) mottles; 15 percent coarse fragments; weak, medium, platy structure breaking to moderate, fine, blocky structure, with partial clay films on the surfaces of the peds; friable when moist, nonsticky and slighty plastic when wet; very strongly acid (pH 5.0); clear, wavy boundary. 2 to 5 inches thick. (S61–Pa–46–16–2)

B21t—12 to 15 inches, weak-red (10R 4/3) shaly silty clay loam; a few reddish-gray (10R 5/3) coatings on the surfaces of the peds; 25 to 30 percent coarse fragments; moderate, fine, subangular blocky structure; partial clay films on the surfaces of the peds and lining the pores; slightly firm when moist and in place, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); gradual, wavy boundary. 3 to 5 inches thick. (S61–Pa–46–16–3)

B22t—15 to 19 inches, weak-red (10R 4/4) shaly silty clay loam; common, fine, distinct, red (2.5YR 5/6) and reddish-gray (10R 5/1) mottles and weak-red (10R 5/2) coatings on the surfaces of the peds; 15 to 20 percent coarse fragments; moderate, medium, blocky structure; thin clay films on the surfaces of the peds and lining the pores; firm when moist and in place, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 3 to 6 inches thick. (S61–Pa–46–16–4)

C1—19 to 26 inches, weak-red (10R 4/4) very shaly silt loam; 50 to 60 percent shale fragments; a few red (10R 5/4) coatings on the surfaces of the peds; weak, thick, platy structure breaking to moderate, fine, blocky structure, with partial clay films on the surfaces of the peds; firm when moist and in place, slightly sticky and nonplastic when wet; very strongly acid (pH 4.7); clear, wavy boundary. 5 to 9 inches thick. (S61–Pa–46–16–5)

C2—26 to 32 inches, dusky-red (10R 3/4) very shaly silt loam; 85 percent shale fragments that have a few black coatings on their surfaces; weak, thick, platy structure, with partial clay films on the surfaces of the peds; very firm when moist and in place, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0); gradual, smooth boundary. 4 to 8 inches thick. (S61–Pa–46–16–6)

R—32 to 36 inches +, dusky-red (10R 3/3) shale bedrock.

Typical profile of Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded, in an idle field, 2 miles south of New Hanover Square in Upper Frederick Township. This site was sampled for laboratory characterization; profile number S60–Pa–46–11 (1–5).

Ap—0 to 7 inches, reddish-brown (5YR 4/3) shaly silt loam containing 25 percent coarse shale; moderate, medium, granular structure; friable when moist, slightly sticky and nonplastic when wet; medium acid (pH 5.6); abrupt, smooth boundary. 6 to 8 inches thick. (S60–Pa–46–11–1)

B1—7 to 10 inches, reddish-brown (5YR 4/4) fine silt loam; few, fine, distinct, yellowish-red (5YR 5/8) mottles; 8 to 10 percent coarse shale; moderate, medium, subangular blocky structure with some platiness near the top, and thin, partial clay films on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy boundary. 2 to 5 inches thick. (S60–Pa–46–11–2)

B2t—10 to 14 inches, reddish-brown (5YR 4/4) shaly silty clay loam; common, medium, prominent, yellowish-red (5YR 5/8) and gray (5YR 6/1) mottles; 20 to 25 percent coarse shale; moderate, medium and coarse, blocky structure; thin, partial clay films on the surfaces of the peds and lining pores; friable to firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.6); clear, wavy boundary. 2 to 7 inches thick. (S60–Pa–46–11–3)

C1—14 to 23 inches, weak-red (10R 4/2) very shaly silty clay loam; 30 to 50 percent coarse and fine shale; moderate, coarse, blocky structure breaking to medium blocky structure; thin, partial clay films on the surfaces of the peds; firm when moist, slightly sticky and slightly plastic when wet; very strongly acid (pH 4.5); clear, wavy boundary. 6 to 12 inches thick. (S60–Pa–46–11–4)

C2—23 to 40 inches, weak-red (10R 4/2) very shaly silty clay containing 40 to 60 percent coarse and fine shale; weak, very thick, platy structure, with distinct, nearly continuous clay films on the surfaces of the small peds; very firm when moist, slightly sticky and plastic when wet; very strongly acid (pH 4.5). (S60–Pa–46–11–5)

R—40 to 45 inches +, weak-red (10R 4/3) shale bedrock.

The Ap horizon ranges from weak red (10R 4/3) to reddish brown (2.5YR 4/4 or 5YR 4/3) in color. The color of the B horizons ranges from hues of 10R to 5YR with a value of 4 and chroma of 3 or 4. A texture of shaly silt loam is predominant in the surface layer, and a texture of shaly silt loam or shaly silty clay loam is predominant in the B horizons. Depth to mottles that have a low chroma ranges from 10 to 18 inches. The solum ranges from 10 to 20 inches in thickness. The amount of coarse fragments in the solum ranges from

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10 to 40 percent, but the amount increases to 50 to 90 percent in the C horizon. Depth to bedrock ranges from 1½ to 3 feet.

Rowland Series

In the Rowland series are deep, moderately well drained or somewhat poorly drained soils developed in alluvium from material weathered from shale, sandstone, hornfels, and diabase. These soils are nearly level to gently sloping and are on flood plains and in depressions. The areas are widely scattered and are in narrow bands along streams and drainageways in the northern two-thirds of the county.

The Rowland soils are near or adjacent to the well-drained Bermudian and poorly drained Bowmansville soils. Unlike the Readington and Abbottstown soils, they have little or no development of a B horizon and no fragipan. The Rowland soils have redder hues than the Codorus soils. They are mottled higher in the profile than the well-drained Bermudian soils.

Typical profile of Rowland silt loam in an overgrown pasture along West Swamp Creek, 1½ miles southwest of New Hanover Square in New Hanover Township.

Ap—0 to 12 inches, dark reddish-brown (5YR 3/2) silt loam; moderate, medium, granular structure; very friable when moist, slightly sticky and nonplastic when wet; many fine roots; medium acid (pH 6.0); clear, wavy boundary. 8 to 14 inches thick.

C1—12 to 24 inches, dark reddish-gray (5YR 4/2) silt loam; few, medium, faint, pinkish-gray (5YR 6/2) mottles in the lower part of the horizon; occasional coarse fragments; weak, medium, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; roots are common; medium acid (pH 5.8); clear, wavy boundary. 10 to 14 inches thick.

C2—24 to 31 inches, dark reddish-gray (5YR 4/2) silt loam; common, medium, faint, pinkish-gray (5YR 6/2) mottles; occasional coarse fragments; weak, coarse, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; common roots; medium acid (pH 5.8); abrupt, smooth boundary. 5 to 9 inches thick.

IIC3—31 to 36 inches, dark reddish-gray (5YR 4/2) loam; less than 2 percent coarse fragments; common, medium, distinct mottles of dark red (2.5YR 3/6), weak red (2.5YR 5/2), gray (10YR 5/1), and yellowish red (5YR 4/6); weak, coarse, subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; very few roots; strongly acid (pH 5.5); clear, smooth boundary. 4 to 7 inches thick.

IIIC4g—36 to 40 inches, gray (10YR 5/1) silt loam containing 1 percent coarse fragments; common, coarse, distinct mottles of grayish brown (10YR 5/2), yellowish red (5YR 4/6), and strong brown (7.5YR 5/6); weak, coarse, blocky structure; firm when moist and in place, slightly sticky and plastic when wet; very few roots; strongly acid (pH 5.4); abrupt, smooth boundary. 3 to 5 inches thick.

IVC5—40 to 42 inches +, loose very coarse sand and gravel up to 6 inches in diameter.

The color of the surface horizon ranges from dark brown (10YR 4/3) to dark reddish brown (5YR 3/2), and the texture of the surface horizon is loam in some places. The C horizons range from brown (7.5YR 4/2) to weak red (2.5YR 4/2) or dark reddish gray (5YR 4/2) in color. In many places the color is more grayish with increasing depth. Depth to mottles that have a low chroma ranges from 18 to 36 inches, but the depth is most commonly between 24 and 30 inches. Textures of silt loam and loam are predominant in the C horizons, but the C horizons are stratified in many places, and the texture of the layers is sandy loam to silty clay loam. The amount of coarse fragments is less than 1 percent in some places, but it ranges to as much as 75 percent in some of the lower horizons. Depth to bedrock ranges from 3 to 12 feet.

Watchung Series

In the Watchung series are deep, poorly drained soils developed in material weathered from dark-gray basic igneous rocks, primarily diabase. These soils are nearly level and gently sloping, and they are on upland flats, in depressions, and on the lower slopes. The areas are medium sized and are scattered throughout the northern part of the county.

The Watchung soils formed in similar material and are near or adjacent to the moderately deep, well drained Legore soils, the moderately deep or deep, well drained Neshaminy soils, and the moderately well drained or somewhat poorly drained Mount Lucas soils. They are finer textured than the poorly drained Croton and Bowmansville soils. The Watchung soils are grayer and are mottled nearer the surface than the Mount Lucas soils. They are grayer and finer textured than the Abbottstown soils.

Typical profile of Watchung silt loam, 0 to 3 percent slopes, in an idle field that was formerly cultivated, 1¾ miles northeast of Sumneytown in Marlborough Township.

Ap—0 to 8 inches, dark grayish-brown (2.5Y 4/2) silt loam; few, medium, distinct, light-gray (2.5Y 7/2) mottles; moderate, medium, granular structure tending toward weak, medium, platy and subangular blocky structure; friable when moist, slightly sticky and nonplastic when wet; slightly acid (pH 6.4); abrupt, smooth boundary. 6 to 10 inches thick.

B1g—8 to 12 inches, grayish-brown (10YR 5/2) fine silt loam; many, coarse, prominent mottles of light gray (2.5Y 7/2 or N 7/0), strong brown (7.5YR 5/6), and dark gray (N 4/0); moderate, medium, angular blocky structure, with common, thin films of silt and clay on the surfaces of the peds; friable when moist, slightly sticky and slightly plastic when wet; slightly acid (pH 6.2); clear, wavy boundary. 4 to 6 inches thick.

B21tg—12 to 28 inches, gray (5Y 5/1) silty clay or silty clay loam; many, medium, prominent, strong-brown (7.5YR 5/6) interior mottles; weak, coarse, prismatic structure breaking to moderate, medium and fine, angular blocky structure; films of silt and clay, ⅛ to ¼ inch thick, on the surfaces of the prisms; firm when moist and in place, slightly sticky and plastic when wet; medium acid (pH 6.0); gradual, wavy boundary. 10 to 20 inches thick.

B22tg—28 to 42 inches, gray (5Y 5/1) silty clay loam; many, coarse, prominent interior mottles of dark gray (N 4/0), strong brown (7.5YR 5/6), and brownish yellow (10YR 6/6); weak, coarse, prismatic structure breaking to weak, thick, platy and coarse, angular blocky structure; many thick films of silt and clay on the surfaces of the prisms and on the surfaces of the smaller peds; very firm when moist and in place, sticky and plastic when wet; slightly acid (pH 6.4); abrupt, wavy boundary. 10 to 20 inches thick.

C—42 to 52 inches +, yellowish-brown (10YR 5/4) loam; 10 percent coarse fragments; dark-gray (N 4/0) coatings on the surfaces of the prisms and dark reddish-brown (2.5YR 2/4) coatings on the surfaces

of the plates; weak, coarse, prismatic structure breaking to weak, medium, platy structure; friable when moist, slightly sticky and slightly plastic when wet; neutral (pH 6.6).

In places the surface horizon is very stony. In those areas rounded diabase stones and boulders, as much as 12 feet or more in diameter, are on the surface and throughout the profile. In some places the texture of the surface horizon is silty clay loam and the color of the surface horizon is dark grayish brown (10YR 4/2). The color of the B horizons ranges from predominantly gray (10YR 5/1 or 5Y 5/1) to dark grayish brown (2.5Y 4/2 or 10YR 4/2) mottled with strong brown (7.5YR 5/6) and gray (N 5/0). The texture of the B horizons ranges from silt loam or clay loam to silty clay. The solum ranges from 30 to 48 inches in thickness. In most places bedrock is at a depth of 3 to 5 feet, but it is at a depth of 8 to 12 feet in some places.

Laboratory Data[5]

The physical and chemical properties of selected soils in Montgomery County are shown in tables 12 and 13. The series sampled are the Abbottstown, Croton, Lansdale, Lawrenceville, Neshaminy, Penn, Readington, and Reaville. Profiles of the soils sampled are described in the section "Formation and Classification of Soils."

Two sites for sampling were selected for most of the series. Typical profiles were located in areas where the soils were in the most common land use. Samples were collected from each horizon that could be recognized in a pit dug through the solum and into the parent material. Selected horizons of soils in these series, as well as soils of several other series, were also sampled for engineering tests made by the Soil Testing Laboratory of the Pennsylvania Department of Highways and the U.S. Bureau of Public Roads. These additional tests are reported in table 5 in the section "Engineering Properties of the Soils."

Methods of Analyses

In all the chemical procedures used in testing, air-dry samples were crushed with a rolling pin so that the material would pass through a round-hole sieve. Care was taken to avoid breaking the nonsoil material into fragments so small that they would pass the 2-millimeter sieve. The percentage, by weight, of fragments coarser than 2 millimeters was determined. All laboratory determinations, except those for bulk density and moisture retention at ⅓ atmosphere tension, were made on the part of the sample consisting of soil material less than 2 millimeters in diameter, and results are reported on that basis.

Particle size was determined by the pipette method, with dispersion by sodium hexametaphosphate and by mechanical shaking, using the method of Kilmer and Alexander (*3*).

[5] Laboratory analyses were made at the Soil Characterization Laboratory of the Pennsylvania State University by R. P. Matelski, C. F. Engle, L. J. Johnson, and other members of the staff.

Bulk density, expressed in grams per cubic centimeter, was determined on 1- by 2-inch cylindrical core samples. The samples were taken using the modified Uhland core sampler of the Salinity Laboratory.

In the samples examined, moisture retained at a tension of ⅓ atmosphere was determined by using the pressure plate apparatus on the core samples. The moisture retained at a tension of 15 atmospheres was determined by using the pressure plate and pressure membrane apparatus on the fragmented samples.

Extractable calcium, magnesium, sodium, and potassium were determined by extraction, using ammonium acetate and digesting with nitric acid, according to the methods of Mehlich (*4*). Extractable sodium and potassium were determined by using a Beckman flame spectrophotometer, as described by Peech (*5*). The calcium and magnesium were determined by titration, and the cation-exchange capacity was determined by the summation of the cations and exchangeable acidity. The chemical procedures are essentially those published by Peech, Alexander, and others.

Clay minerals in selected horizons of the soils were determined by first treating the air-dry sieved soil with hydrogen peroxide to remove the organic matter. Then, the coatings of iron oxide were removed by treating the samples with oxalic acid, potassium oxalate, and magnesium ribbon. The clay was separated by using a centrifuge. One part of the clay was saturated with potassium and was placed on glass slides. These slides were heated to 300° C., and X-ray diffraction tracings were made both before and after they were heated. Then, the slides were further heated to 500° C. and another X-ray diffraction tracing was made. Another part of the clay was saturated with magnesium, and tracings were obtaianed before and after glycerol solvation. The X-ray diffraction tracings were interpreted by Dr. L. J. Johnson, Agronomy Department, Pennsylvania State University.

Summary of Data

Some of the results of the analyses of the various soils are discussed in the following pages. All of the profiles that were sampled are described in the section "Formation and Classification of Soils," under the heading "Detailed Descriptions of the Soil Series." The analytical data for each soil horizon in the various profiles sampled are given in tables 12 and 13.

The information obtained by these analyses can be used to check field observations made by less precise methods, such as the determination of texture by feel. The results of the physical tests can be used to determine the engineering properties of the soils, the response of soils to tillage, and the ability of soils to absorb, transmit, and store moisture for use by plants.

The chemical data indicate the degree of leaching of the soils and the ability of the soils to hold and to supply plant nutrients. The tests are also helpful in determining the amount of liming material needed. Extractable cations can be used as a basis for estimating the fertility of the soil.

TABLE 12.—*Physical*

[Laboratory analyses were made at the Soil Characterization Laboratory of the Pennsylvania State University by R. P. Matelski,

Soil name, sample number, and location of sample site	Horizon	Depth	Coarse fragments (larger than 2.0 mm.)
		In.	*Pct. by weight*
Abbottstown silt loam:			
S60–Pa–46–5 (1–6); ¼ of a mile S. of intersection of Heckler and Mount Airy Roads in Skippack Township.	Ap	0–10	4. 1
	B1	10–13	10. 0
	B2t	13–20	21. 1
	Bx1g	20–27	21. 9
	Bx2g	27–39	20. 0
	C	39–48	23. 8
S60–Pa–46–9 (1–7); ¾ of a mile SW. of New Hanover Square in New Hanover Township.	Ap	0–9	3. 0
	B21t	9–12	2. 3
	B22t	12–16	10. 2
	Bx1g	16–23	15. 2
	Bx2g	23–27	15. 2
	Bx3g	27–38	16. 7
	C	38–44+	17. 0
Croton silt loam:			
S60–Pa–46–7 (1–7); near Limerick Center in Limerick Township	Ap	0–9	3. 6
	A2g	9–13	2. 0
	Bx1g	13–18	8. 6
	Bx2g	18–24	6. 5
	Bx3	24–31	13. 1
	Bx4	31–37	17. 4
	B3	37–44+	4. 2
Lansdale loam, thin:			
S60–Pa–46–1 (1–6); 1¾ miles S. of Prospectville in Horsham Township	Ap	0–10	10. 4
	B21t	10–16	. 5
	B22t	16–20	0
	B3	20–26	0
	C1	26–36	0
	C2	36–42	0
S–60–Pa–46–4 (1–6); Norristown State Hospital in East Norriton Township	Ap	0–9	17. 2
	B1	9–14	8. 7
	B21t	14–21	38. 9
	B22t	21–24	13. 6
	C	24–32	28. 5
	R	32–34+	29. 4
Lawrenceville silt loam:			
S60–Pa–46–3 (1–9); 1½ miles W. of Ambler in Whitpain Township	Ap	0–10	1. 9
	A3	10–15	. 4
	B1	15–19	. 7
	B21t	19–27	1. 5
	Bx1	27–33	. 7
	Bx2	33–41	3. 4
	Bx3	41–52	1. 6
	IIC	52–57	3. 0
	R	57–60+	1. 1
S60–Pa–46–2 (1–8); 1¾ miles S. of Prospectville in Horsham Township	Ap	0–9	4. 0
	A3	9–13	4. 5
	B1	13–19	7. 8
	B2t	19–25	3. 9
	Bx1	25–32	2. 2
	Bx2	32–44	2. 2
	C1	44–68	0
	C2	68–74	1. 9

properties of selected soils

C. F. Engle, L. J. Johnson, and other members of the staff. Dashes in columns indicate samples not taken or material not present]

Particle-size distribution							Bulk density	Moisture held at tension of—		Available moisture
Very coarse sand (2.0 to 1.0 mm.)	Coarse sand (1.0 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)		⅓ atmosphere (core)	15 atmospheres	
Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Gm./cc.*	*Pct.*	*Pct.*	*In./in. of soil depth*
2.1	1.7	1.3	2.2	4.8	71.5	16.4	1.44	24.4	7.5	0.24
1.3	1.5	.8	1.2	5.0	69.5	20.7	1.65	20.0	8.8	.18
2.3	2.3	1.3	1.1	4.1	66.1	22.8	1.72	18.1	9.5	.15
.9	1.6	1.3	1.4	4.2	69.3	21.3	1.68	19.8	9.7	.17
1.7	3.2	2.2	2.0	4.3	68.5	18.1	1.72	17.6	8.4	.16
.6	1.6	1.5	2.2	5.0	71.4	17.7			8.2	
2.9	3.5	2.3	1.7	2.0	70.9	16.7	1.36	24.1	8.3	.21
.8	1.0	1.0	.7	1.5	66.3	28.7	1.46	24.2	11.8	.18
1.5	2.8	2.2	1.5	1.9	64.6	25.5	1.62	21.8	11.2	.17
2.5	4.5	3.1	1.7	2.1	64.7	21.4	1.74	19.3	10.5	.15
5.3	8.3	5.5	2.3	1.9	58.1	18.6	1.81	16.8	9.5	.13
10.5	15.6	7.8	3.2	1.9	44.2	16.8	1.73	15.9	9.2	.12
7.2	14.1	8.6	4.3	2.9	45.9	17.0			9.3	
.7	1.4	1.0	2.0	3.4	65.8	25.7	1.40	25.6	8.7	.24
.2	.4	.3	1.0	4.1	64.6	29.4	1.49	21.1	10.4	.16
0	.1	.1	.7	3.5	54.4	41.2	1.46	28.3	15.2	.19
.2	.5	.5	.4	5.1	58.3	35.0	1.44	29.1	14.1	.22
2.1	2.9	2.7	4.7	6.5	51.6	29.5	1.59	23.1	13.0	.16
1.7	2.6	2.8	5.5	7.8	48.3	31.3	1.76	19.2	13.2	.07
.3	.8	1.1	4.1	10.7	56.7	26.3			10.8	
.9	2.4	6.6	10.1	5.3	63.1	11.6	1.41	19.1	7.2	.17
1.2	4.8	9.2	11.9	13.3	42.1	17.5	1.52	20.6	8.0	.19
1.8	9.5	14.1	16.3	7.0	37.4	13.9	1.65	18.6	7.4	.18
3.0	14.9	23.6	22.2	8.0	19.4	8.9	1.62	15.8	6.1	.16
1.8	13.7	18.8	21.9	8.3	28.6	6.9	1.56	17.6	5.3	.19
4.0	17.5	20.2	27.6	9.2	17.6	3.9			3.7	
3.2	7.2	15.3	15.1	7.2	40.7	11.3	1.27	18.5	6.3	.15
3.9	8.3	15.6	15.6	7.4	36.2	13.0	1.49	16.3	5.7	.16
2.4	8.1	16.8	18.1	8.3	26.6	19.7	1.55	16.3	8.6	.11
2.6	9.7	18.7	16.5	7.8	21.9	22.8	1.58	17.5	9.8	.12
2.5	10.1	17.8	18.5	9.4	24.2	17.5	1.59	17.2	8.2	.14
1.5	5.8	12.2	26.6	15.0	24.4	14.5			7.9	
.9	1.5	2.1	2.4	3.7	69.4	20.0	1.29	24.6	8.7	.21
.3	.7	.9	.9	1.6	73.0	22.6	1.42	24.4	9.8	.21
.2	.3	.4	.5	1.5	72.7	24.4	1.40	26.2	10.6	.22
.1	.2	.4	.5	1.9	71.1	25.8	1.31	27.1	11.6	.20
0	.2	.5	.5	2.3	71.3	25.2	1.40	27.9	11.1	.24
.2	1.0	1.1	1.3	3.9	72.8	19.7	1.55	23.9	10.0	.22
.2	1.1	1.5	1.3	3.6	76.4	15.9	1.55	24.9	8.4	.26
1.0	3.3	4.1	3.7	5.7	67.2	15.0	1.69	20.9	7.7	.22
2.2	2.4	2.4	4.8	10.8	66.5	10.9			5.9	
1.4	1.0	1.1	3.1	4.2	73.4	15.8	1.29	26.8	8.5	.24
.3	.7	1.6	2.1	4.0	73.2	18.1	1.50	22.1	7.4	.22
.4	1.0	1.7	2.3	3.9	70.7	20.0	1.51	22.6	8.5	.21
1.3	.9	.3	1.9	3.9	72.8	18.9	1.55	23.3	9.2	.22
.2	.5	.9	1.4	4.0	75.4	17.6	1.56	22.7	8.5	.22
.1	.4	.6	1.1	4.0	79.8	14.0	1.60	22.1	7.1	.24
.2	.5	.5	1.0	4.6	87.5	5.7	1.58	22.0	4.7	.27
1.2	.9	4.2	4.5	6.4	76.2	6.6			4.3	

TABLE 12.—*Physical properties*

Soil name, sample number, and location of sample site	Horizon	Depth	Coarse fragments (larger than 2.0 mm.)
		In.	*Pct. by weight*
Neshaminy silt loam:			
S60-Pa-46-13 (1-9); 1½ miles NW. of Upper Perkiomen Valley Park in New Hanover Township.	Ap	0-6	16.9
	A3	6-8	12.8
	B1	8-11	21.2
	B21t	11-16	18.3
	B22t	16-20	15.2
	B23t	20-24	15.4
	B3	24-33	39.8
	C1	33-39	27.2
	C2	39-49	21.9
Neshaminy very stony silt loam:			
S61-Pa-46-17 (1-9); Delmont Boy Scouts of America (BSA) Camp, 1½ miles N. of Sumneytown in Marlborough Township.	O1	−3- −1	(1)
	O2	−1-0	39.0
	A1	0-2	39.4
	A2	2-8	25.9
	A3	8-11	37.5
	B1	11-14	55.2
	B21t	14-21	67.4
	B22t	21-29	60.4
	B31	29-39	71.1
	B32	39-52	87.0
Penn silt loam:			
S61-Pa-46-14 (1-5); 2 miles S. of Kulpsville	Ap	0-8	32.2
	B21t	8-14	26.9
	B22t	14-20	47.9
	B3	20-24	56.6
	C	24-32	80.4
S61-Pa-46-15 (1-5); 1 mile N. of Trappe	Ap	0-8	22.6
	B1	8-11	25.9
	B2t	11-17	35.7
	B3	17-20	55.6
	C	20-31+	53.3
Readington silt loam:			
S60-Pa-46-12 (1-8); Camp Laughing Water, 1½ miles S. of New Hanover Square in New Hanover Township.	Ap	0-8	11.2
	A3	8-11	5.6
	B1	11-15	13.5
	B21t	15-20	12.2
	B22t	20-29	21.3
	Bx1	29-33	34.5
	Bx2	33-40	31.2
	C	40-44+	21.3
S60-Pa-46-6 (1-7); at Limerick Center in Limerick Township	Ap	0-10	1.9
	B1	10-14	1.8
	B21t	14-20	7.6
	B22t	20-27	10.3
	Bx1	27-36	10.7
	Bx2	36-46	14.9
	C	46-54+	20.8
Reaville silt loam:			
S61-Pa-46-16 (1-6); 2 miles NW. of Trappe in Limerick Township	Ap	0-8	10.4
	B1	8-12	9.4
	B21t	12-15	20.8
	B22t	15-19	8.2
	C1	19-26	65.7
	C2	26-32+	77.2
S60-Pa-46-11 (1-5); Camp Laughing Water, 2 miles S. of New Hanover Square in Upper Frederick Township.	Ap	0-7	24.2
	B1	7-10	11.0
	B2t	10-14	24.3
	C1	14-23	47.1
	C2	23-40+	55.6

[1] Leaves.
[2] No determination made.

of selected soils—Continued

Particle-size distribution							Bulk density	Moisture held at tension of—		Available moisture
Very coarse sand (2.0 to 1.0 mm.)	Coarse sand (1.0 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)		⅓ atmosphere (core)	15 atmospheres	
Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Gm./cc.*	*Pct.*	*Pct.*	*In./in. of soil depth*
1.6	4.8	5.0	7.1	6.9	57.2	17.4	1.15	28.4	15.0	0.15
.8	3.5	4.6	6.3	6.7	46.3	31.8	1.24	32.5	19.8	.16
1.4	3.9	4.8	7.1	7.5	43.5	31.8	1.21	34.5	20.8	.17
1.3	5.6	6.5	7.8	8.7	40.1	30.0	1.23	35.5	21.5	.17
4.4	11.2	6.8	7.5	8.3	34.0	27.8	1.21	36.1	21.1	.18
7.3	19.5	8.9	7.0	8.1	25.3	23.9	1.41	27.7	15.2	.18
12.1	12.6	18.2	6.7	8.1	27.3	15.0	1.40	27.4	13.0	.20
7.7	22.7	10.6	9.5	9.9	25.2	14.4	1.42	24.3	14.4	.14
5.7	16.0	10.4	10.5	9.5	27.8	20.1	----------	----------	18.4	----------
(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	5.28	(2)
2.6	5.3	6.6	7.0	5.5	59.3	13.7	----------	----------	11.7	----------
3.3	5.6	6.2	6.5	5.2	62.7	10.5	----------	----------	8.1	----------
2.9	6.1	4.8	4.8	4.6	58.1	18.7	----------	----------	9.8	----------
3.3	5.7	5.0	5.1	4.7	54.1	22.1	----------	----------	12.1	----------
3.9	7.3	5.4	5.4	6.0	45.4	26.6	----------	----------	16.2	----------
5.3	9.1	7.0	7.5	7.9	35.5	27.7	----------	----------	18.7	----------
4.7	8.5	6.0	6.5	8.2	35.9	30.2	----------	----------	17.3	----------
9.2	15.7	9.2	6.8	7.3	25.1	26.7	----------	----------	16.6	----------
5.9	4.9	2.5	1.7	3.6	69.3	12.1	1.33	25.0	10.5	.19
5.6	5.2	2.9	1.7	3.7	62.5	18.4	1.56	20.3	7.8	.20
8.5	8.7	4.9	2.3	3.3	50.5	21.8	1.55	18.3	9.4	.14
10.4	10.6	6.4	3.6	3.7	44.0	21.3	----------	----------	9.0	----------
8.6	11.5	6.9	3.1	2.7	44.3	22.9	----------	----------	9.4	----------
3.1	2.7	1.8	1.9	4.0	70.7	15.8	1.33	26.0	9.6	.22
3.9	4.1	2.0	1.8	3.7	63.5	21.0	1.55	19.2	9.6	.15
6.5	5.7	3.2	2.5	3.6	62.0	16.5	1.60	19.1	8.7	.17
6.3	21.1	6.1	3.3	3.8	46.9	12.5	1.79	13.3	6.7	.12
9.5	12.6	8.5	5.0	4.2	47.0	13.2	1.84	12.8	6.5	.12
2.3	4.0	4.0	2.4	2.2	70.0	15.1	1.35	25.0	9.0	.22
1.1	3.2	3.9	2.6	2.1	65.3	21.8	1.45	21.9	8.8	.19
1.1	2.8	2.9	1.8	2.0	65.8	23.6	1.42	23.3	9.8	.19
1.2	2.8	3.0	2.1	2.1	62.7	26.1	1.45	25.4	11.3	.20
1.8	3.7	3.8	2.6	2.5	58.8	26.8	1.47	22.4	11.8	.16
3.3	6.0	5.2	3.5	2.6	41.7	37.7	1.67	20.6	13.1	.13
2.2	4.6	4.3	2.8	2.7	57.8	25.6	1.66	20.3	13.4	.11
1.2	2.9	3.4	2.4	2.4	65.7	22.0	----------	----------	14.4	----------
1.5	1.5	1.5	2.0	2.8	70.7	20.0	1.25	26.2	10.8	.19
0	.3	.3	.5	1.7	62.6	34.6	1.43	25.4	11.9	.19
0	.1	.1	.5	1.7	62.6	35.0	1.49	25.8	13.9	.18
.1	.2	.2	.6	2.2	60.3	36.4	1.56	24.6	14.8	.15
.2	.5	.6	.9	2.9	63.1	31.8	1.56	23.4	13.1	.16
.8	1.4	1.9	2.6	4.4	60.8	28.1	1.82	17.5	12.0	.10
6.3	7.7	6.6	6.1	5.6	55.6	12.1	----------	----------	9.5	----------
1.4	1.9	1.3	1.7	6.1	68.5	19.1	1.45	22.4	8.4	.20
1.4	1.9	1.8	2.2	5.7	58.9	28.1	1.62	18.9	11.2	.12
1.4	2.6	2.4	2.3	5.3	57.0	29.0	1.69	17.0	11.6	.09
1.5	2.1	.8	2.6	4.6	58.7	29.7	1.60	19.2	11.6	.12
4.2	5.0	3.4	2.3	4.2	55.5	25.4	1.67	16.7	10.0	.11
6.9	8.7	5.6	2.5	3.0	51.7	21.6	----------	----------	9.2	----------
3.8	3.9	2.5	1.6	2.2	66.6	19.4	1.38	22.1	8.4	.19
.4	.8	.6	.5	1.4	69.2	27.1	1.57	22.4	10.8	18
1.1	1.3	1.2	1.0	1.6	62.0	31.8	1.51	25.1	13.5	.18
3.0	3.0	2.4	1.9	2.2	52.0	35.5	----------	----------	13.9	----------
2.9	3.8	1.1	2.6	3.1	44.6	41.9	----------	----------	15.7	----------

TABLE 13.—*Chemical*

[Laboratory analyses were made at the Soil Characterization Laboratory of the Pennsylvania State University by R. P. Matelski,

Soil name, sample number, and location of sample site	Horizon	Depth from surface	Organic carbon	Nitrogen	Carbon-nitrogen ratio	Calcium-magnesium ratio
		In.	*Pct.*	*Pct.*		
Abbottstown silt loam:						
S60-Pa-46-5 (1-6); ¼ of a mile S. of intersection of Heckler and Mount Airy Roads in Skippack Township.	Ap	0-10	1.11	0.104	11	3.3
	B1	10-13	.68	.052	13	1.7
	B2t	13-20	.21			1.0
	Bx1g	20-27	.21			.8
	Bx2g	27-39	.10			.8
	C	39-48	.08			.9
S60-Pa-46-9 (1-7); ¾ of a mile SW. of New Hanover Square in New Hanover Township.	Ap	0-9	1.28	.128	10	3.4
	B21t	9-12	.60	.054	11	1.9
	B22t	12-16	.27			1.3
	Bx1g	16-23	.17			.8
	Bx2g	23-27	.12			.6
	Bx3g	27-38	.10			.7
	C	38-44+	.10			.8
Croton silt loam:						
S60-Pa-46-7 (1-7); near Limerick Center in Limerick Township.	Ap	0-9	1.19	.128	9	
	A2g	9-13	.66	.050	13	
	Bx1g	13-18	.46	.050	9	
	Bx2g	18-24	.21			
	Bx3	24-31	.12			
	Bx4	31-37	.08			
	B3	37-44+	.04			
Lansdale loam, thin:						
S60-Pa-46-1 (1-6); 1¾ miles S. of Prospectville in Horsham Township.	AP	0-10	.91	.090	10	
	B21t	10-16	.42	.036	12	4.3
	B22t	16-20	.25	.023	11	3.1
	B3	20-26	.10			3.4
	C1	26-36	.10			1.7
	C2	36-42	.08			1.3
S60-Pa-46-4 (1-6); Norristown State Hospital in East Norriton Township.	Ap	0-9	1.94	.164	12	
	B1	9-14	.61	.042	14	
	B21t	14-21	.31	.025	12	
	B22t	21-24	.27			
	C	24-32	.25			
	R	32-34+	.08			
Lawrenceville silt loam:						
S60-Pa-46-3 (1-9); 1½ miles W. of Ambler in Whitpain Township.	Ap	0-10	1.47	.126	12	2.6
	A3	10-15	1.15	.077	15	2.3
	B1	15-19	.66	.056	12	1.9
	B21t	19-27	.62	.048	13	2.5
	Bx1	27-33	.39	.036	11	1.3
	Bx2	33-41	.23			1.0
	Bx3	41-52	.17			.6
	IIC	52-57	.12			1.6
	R	57-60+	.12			
S60-Pa-46-2 (1-8); 1¾ miles S. of Prospectville in Horsham Township.	Ap	0-9	1.73	.131	13	3.8
	A3	9-13	.76	.051	15	3.4
	B1	13-19	.42	.040	10	3.4
	B2t	19-25	.29	.035	8	2.4
	Bx1	25-32	.23			1.3
	Bx2	32-44	.15			.9
	C1	44-68	.10			1.5
	C2	68-74+	.12			

See footnote at end of table.

properties of selected soils

C. F. Engle, L. J. Johnson, and other members of the staff. Dashes in columns indicate sample not taken or material not present]

Extractable cations					Cation-exchange capacity (sum)	Base saturation (sum)	Reaction field (electrometric) 1:1 H_2O	Relative mineral composition of the clay fraction [1]				
Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Hydrogen (H)				Quartz	Kaolinite	Illite (mica)	Interstratified chlorite and vermiculite	Vermiculite
Meq./100 gm.	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Pct.*	pH					
5.9	1.8	0.3	0.1	5.3	13.4	60	5.7	xx	xx	xx	xx	
5.3	3.1	.3	.1	5.2	14.0	63	5.2					x
5.7	5.4	.3	<.1	5.1	16.5	69	4.6	xx	xx	xxxx	x	x
5.3	6.4	.4	<.1	4.6	16.7	72	5.1					
5.0	6.2	.4	<.1	4.1	15.7	74	5.3	x	xx	xxxx		x
4.9	5.4	.4	<.1	3.4	14.1	76	5.3	x	xx	xxxx	x	
5.7	1.7	.2	.1	6.3	14.0	55	4.7	x	xx	xx	xx	xx
5.9	3.1	.2	.1	6.6	15.9	59	5.1					
4.4	3.4	.2	<.1	8.7	16.7	48	4.2	x	xx	xx		xx
4.1	5.2	.3	<.1	7.7	17.3	55	4.4					
4.9	7.5	.4	<.1	3.9	16.7	77	5.4	x	xx	xxxx		xx
5.2	7.5	.4	.1	2.6	15.8	84	5.8					
5.7	7.4	.4	.1	2.3	15.9	86	6.0	x	x	xxxx		xx
5.3	.5	.2	.1	8.9	15.0	41	4.6	xx	xx	xx	xx	xx
1.9	.3	.2	.1	8.0	10.5	24	4.2	xx	xx	xx	xx	x
2.6	.9	.2	.1	17.8	21.6	18	4.0					
1.9	.7	.2	<.1	14.4	17.3	17	4.0	x	xx	xxx		xx
.9	1.0	.2	<.1	13.1	15.2	14	4.0	x	xx	xxx		xx
.8	1.3	.3	<.1	12.8	15.2	16	4.1					
.4	1.5	.3	.1	8.2	10.4	21	4.2	x	xx	xxxx		xx
2.8	.8	.1	.2	7.9	11.8	33	5.4	xx	xxx	x	xx	x
4.3	1.0	.2	.1	5.8	11.4	49	5.8					
4.4	1.4	.1	.1	5.1	11.1	54	5.7	xx	xxx	xx	xx	x
3.7	1.1	.2	.1	4.6	9.7	52	5.8	xx	xxx	x	x	xx
1.7	1.0	.1	<.1	5.8	8.6	32	5.0	xx	xxx	xx	x	xx
1.2	.9	.1	<.1	6.5	8.7	25	4.8					
2.2	.8	.2	.4	6.1	9.7	37	6.0	xx	xx	xxx	x	xx
2.6	.5	.2	.2	2.6	6.1	57	5.8					
3.4	.5	.2	.1	3.6	7.8	54	5.6	xx	xxx	xx	x	x
3.6	.5	.2	.1	4.4	8.8	50	5.4					
3.3	.4	.2	<.1	5.0	8.9	44	4.6	x	xxx	xx		xx
3.3	.4	.2	<.1	7.9	11.8	33	4.3					
6.1	2.3	.5	.3	5.0	14.2	65	6.7	xx	xx	xx	xx	x
4.3	1.9	.2	.1	5.8	12.3	53	5.8					
4.2	2.2	.1	.1	6.3	12.9	51	5.6	xx	xx	xx	x	xx
4.5	1.8	.1	.1	6.5	13.0	50	5.0					
3.7	2.9	.2	.1	7.9	14.8	47	4.8	xx	xx	xx	x	xx
2.3	2.2	.2	<.1	8.8	13.5	35	4.6					
1.3	2.3	.2	<.1	8.1	11.9	32	4.6	xx	xxx	xx	x	xx
1.6	1.0	.2	<.1	8.0	10.8	26	4.6					
1.7	.9	.2	<.1	5.6	8.4	33	4.6	xx	xxx	x	xx	x
7.2	1.9	.2	.1	4.8	14.2	66	6.5	xx	xx	x	xx	xx
3.4	1.0	.1	.1	7.4	12.0	38	6.5					
4.1	1.2	.2	<.1	5.0	10.5	52	6.4	xx	xxx	x	x	xx
4.4	1.8	.2	<.1	5.1	11.5	56	6.0					
2.9	2.3	.1	<.1	7.9	13.3	41	4.8	x	xxx	xx	x	xx
1.7	1.8	.2	<.1	7.7	11.4	32	4.4					
1.9	1.3	.1	<.1	5.5	8.8	38	4.4	x	xxx	xx	x	xx
2.0	.7	.1	<.1	3.6	6.4	44	4.5					

TABLE 13.—*Chemical properties*

Soil name, sample number, and location of sample site	Horizon	Depth from surface	Organic carbon	Nitrogen	Carbon-nitrogen ratio	Calcium-magnesium ratio
		In.	*Pct.*	*Pct.*		
Neshaminy silt loam:						
S60-Pa-46-13 (1-9); 1½ miles NW. of Upper Perkiomen Valley Park in New Hanover Township.	Ap	0-6	1.54	0.180	9	3.8
	A3	6-8	.44	.054	8	2.2
	B1	8-11	.29	.039	7	2.0
	B21t	11-16	.19			1.5
	B22t	16-20	.21			1.5
	B23t	20-24	.14			1.4
	B3	24-33	.05			7.3
	C1	33-39	.05			3.9
	C2	39-49	.05			8.0
Neshaminy very stony silt loam:						
S61-Pa-46-17 (1-9); Delmont Boy Scouts of America (BSA) Camp, 1½ miles N. of Sumneytown in Marlborough Township.	01	−3- −1				
	02	−1-0	12.74	.423	30	4.0
	A1	0-2	2.00	.112	18	
	A2	2-8	.44	.084	5	
	A3	8-11	.31	.037	8	.6
	B1	11-14	.27			.5
	B21t	14-21	.27			.6
	B22t	21-29	.27			.8
	B31	29-39	.24			.9
	B32	39-52	.17			.9
Penn silt loam:						
S61-Pa-46-14 (1-5); 2 miles S. of Kulpsville.	Ap	0-8	1.41	.206	7	2.3
	B21t	8-14	.44	.059	7	1.9
	B22t	14-20	.23			2.1
	B3	20-24	.14			1.6
	C	24-32	.03			1.0
S61-Pa-46-15 (1-5); 1 mile N. of Trappe.	Ap	0-8	2.17	.141	15	2.9
	B1	8-11	.45	.072	6	2.3
	B2t	11-17	.19			2.2
	B3	17-20	.12			1.6
	C	20-31+	.09			.8
Readington silt loam:						
S60-Pa-46-12 (1-8); Camp Laughing Water, 1½ miles S. of New Hanover Square in New Hanover Township.	Ap	0-8	1.02	.131	8	2.6
	A3	8-11	.67	.100	7	2.3
	B1	11-15	.22	.049	4	2.2
	B21t	15-20	.14			1.8
	B22t	20-29	.02			.9
	Bx1	29-33	.02			.6
	Bx2	33-40	.01			.6
	C	40-44+				
S60-Pa-46-6 (1-7); at Limerick Center in Limerick Township.	Ap	0-10	1.36	.159	9	4.4
	B1	10-14	.53	.056	10	4.3
	B21t	14-20	.33	.045	7	2.6
	B22t	20-27	.23			1.0
	Bx1	27-36	.15			.5
	Bx2	36-46	.10			.5
	C	46-54+	.08			.7
Reaville silt loam:						
S61-Pa-46-16 (1-6); 2 miles NW. of Trappe in Limerick Township.	Ap	0-8	.89	.095	9	2.0
	B1	8-12	.10	.057	2	1.4
	B21t	12-15	.10			1.2
	B22t	15-19	.09			1.0
	C1	19-26	.05			.9
	C2	26-32	.05			1.1
S60-Pa-46-11 (1-5); Camp Laughing Water, 2 miles S. of New Hanover Square in Upper Frederick Township.	Ap	0-7	1.14	.138	8	2.6
	B1	7-10	.20	.039	5	1.8
	B2t	10-14	.12			.6
	C1	14-23	.10			.4
	C2	23-40+	.05			.3

[1] x=low; xx=moderate; xxx=abundant; and xxxx=dominant.

of selected soils—Continued

Extractable cations					Cation-exchange capacity (sum)	Base saturation (sum)	Reaction field (electrometric) 1:1 H_2O	Relative mineral composition of the clay fraction [1]				
Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Hydrogen (H)				Quartz	Kaolinite	Illite (mica)	Interstratified chlorite and vermiculite	Vermiculite
Meq./100 gm.	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Pct.*	*pH*					
8.3	2.2	0.1	0.2	10.7	21.5	50	5.7	------	xxxx	xx	x	x
8.6	3.9	.1	.1	7.9	20.6	62	5.9	------	------	------	------	
9.0	4.6	.2	.1	8.2	22.1	63	6.0	x	xxxx	x	x	
10.0	6.6	.2	.1	8.4	25.3	67	6.1	------	------	------	------	
10.7	7.3	.2	.1	7.9	26.2	70	6.2	x	xxxx	------	------	x
9.0	6.4	.2	.1	5.5	21.2	74	6.2	------	------	------	------	
8.0	1.1	.2	.1	4.9	14.3	66	6.1	x	xxxx	x	xx	x
7.5	1.9	.2	.1	3.7	13.4	72	6.3	------	------	------	------	
8.8	1.1	.3	.2	5.5	15.9	65	6.3	------	xxxx	x	------	x
9.1	2.3	.2	.5	15.1	27.2	45	6.2	------	------	------	------	
1.2	.9	.2	.3	12.4	15.0	17	5.3	x	xxx	xx	xxx	
.6	.8	.1	.2	11.3	13.0	13	5.2	------	------	------	------	
2.0	3.1	.1	.2	9.1	14.5	37	5.4	x	xxx	x	xxx	x
2.7	5.0	.1	.2	8.8	16.8	48	5.7	------	------	------	------	
4.0	6.7	.1	.2	9.6	20.6	53	5.9	x	xxx	xx	xx	x
6.3	8.3	.2	.3	11.0	26.1	58	6.0	------	------	------	------	
7.1	8.0	.3	.3	11.3	27.0	58	6.0	------	xxxx	------	xx	xx
5.8	6.4	.3	.3	11.0	23.8	54	6.0	------	xxxx	xx	------	x
7.7	3.4	.1	.3	3.7	15.2	76	7.3	x	xx	xx	xxx	
4.1	2.2	.1	.1	4.0	10.5	62	7.1	------	------	------	------	
5.4	2.6	.1	.2	2.7	11.0	75	6.8	x	xxx	xx	xx	xx
5.2	3.2	.1	.2	3.4	12.1	72	6.8	------	------	------	------	
3.2	3.3	.1	.2	5.5	12.3	55	6.4	------	xx	xxx	xx	xx
5.2	1.8	.1	.5	6.1	13.7	55	6.2	x	xxx	xx	xxx	
4.3	1.9	.1	.2	6.7	13.2	49	6.1	------	------	------	------	
4.3	2.0	.1	.2	5.2	11.8	56	6.0	x	xxx	xx	x	xx
3.0	1.9	.1	.2	5.5	10.7	49	5.7	------	xxx	xxx	x	xx
2.1	2.6	.3	.2	6.7	11.9	44	5.4	------	------	------	------	
4.5	1.7	.1	.1	7.6	14.0	46	6.1	x	xx	xx	xxx	
3.9	1.7	.1	.1	7.9	13.7	42	5.8	------	------	------	------	
3.1	1.4	.1	<.1	7.9	12.5	37	5.6	x	xxx	xx	xx	x
3.5	2.0	.1	<.1	8.2	13.8	41	5.2	------	------	------	------	
2.3	2.5	.1	.1	11.3	16.3	31	4.8	x	xxx	xxx	------	x
2.2	3.4	.1	.1	12.0	17.8	33	4.8	------	------	------	------	
2.4	4.3	.1	.1	11.4	18.3	38	4.8	------	xxxx	xx	------	xx
------	------	------	------	------	------	------	4.8	------	------	------	------	
4.8	1.1	.1	.2	8.9	15.1	41	4.4	xx	xx	xx	xx	
3.0	.7	.1	.1	8.8	12.7	31	4.5	------	------	------	------	
2.9	1.1	.2	.1	11.8	16.1	27	4.1	xx	xx	xx	x	x
2.0	1.9	.2	<.1	13.1	17.2	24	4.0	------	------	------	------	
1.2	2.6	.2	<.1	11.9	15.9	25	4.1	x	xx	xxx	x	xx
1.7	3.3	.2	<.1	10.2	15.4	27	4.1	------	------	------	------	
2.3	3.2	.2	<.1	8.4	14.1	40	4.2	x	xx	xxxx	------	xx
2.0	1.0	.1	.3	12.0	15.4	22	5.2	------	xx	xxx	xx	x
2.7	1.9	.1	.2	11.4	16.3	30	5.0	------	------	------	------	
2.7	2.3	.2	.2	11.7	17.1	32	4.8	------	xx	xxxx	------	xx
2.8	2.7	.2	.2	12.5	18.4	32	4.8	------	------	------	------	
2.6	2.9	.2	.2	10.0	15.9	37	4.7	------	x	xxxx	------	xx
3.2	2.8	.2	.2	8.5	14.9	43	5.0	------	x	xxxx	------	xx
4.6	1.8	.1	<.1	5.2	11.7	56	5.6	x	xx	xx	xxx	x
2.7	1.5	.1	<.1	7.5	11.8	36	4.8	------	------	------	------	
1.6	2.5	.2	<.1	9.5	13.8	31	4.3	x	xx	xxx	------	xx
1.6	4.0	.3	.1	10.1	16.1	37	4.4	------	------	------	------	
2.6	7.9	.5	.1	9.5	20.6	54	4.5	------	x	xxxx	------	

Data showing texture, reaction, percentage of base saturation, and other characteristics of the soils are used as a basis for placing soils in the higher categories of the current soil classification system.

Abbottstown Silt Loam

S60–Pa–46–5 (1–6) and S60–Pa–46–9 (1–7)

The particle-size distribution analysis of the samples of this soil shows that the textural B horizon is fairly well expressed. This is indicated by an increase of 3 to 10 percent in the content of clay in the upper B horizons over the amount in the A horizon. In the lower horizons, the amount of clay decreases with increasing depth from that shown in the upper B horizons. The field identification of the textural class agrees well with the laboratory determination. The amount of coarse fragments ranges from nearly 3 to nearly 24 percent and is not important in the classification of these soils. The fragipan, as described in the field, is associated with the layers that have a high bulk density of 1.7 to 1.8 grams per cubic centimeter. The available moisture capacity is moderate, as determined by testing the core samples.

The chemical properties of these soils indicate that a relatively moderate degree of weathering has taken place. The soils are strongly acid or very strongly acid and have a base saturation that tends to increase with increasing depth. This may indicate that the substratum is a source of bases or that the rate at which bases are removed is reduced by slow permeability. The decrease, with increasing depth, in the calcium-magnesium ratio suggests that the surface layer has had calcium added, probably in the form of agricultural limestone. The average cation-exchange capacity of 16 milliequivalents per hundred grams of soil indicates that the ability to hold plant nutrients available is moderate.

In the clay mineral fraction of the Abbottstown soils of Montgomery County, illite is dominant, and the amount of illite tends to increase with increasing depth. The illite is probably inherited from the parent rock. The amount of kaolinite is moderate, and this amount remains nearly constant with increasing depth. The interstratified clay minerals, chlorite and vermiculite, are formed during the process of weathering; the amount of these minerals reflects the intense weathering that is taking place in the surface layer. The content of vermiculite in profile S60–Pa–46–5 (1–6) is low, but in profile S60–Pa–46–9 (1–7), it is moderate. The underlying material also probably contains vermiculite.

Croton Silt Loam

S60Pa–46–7 (1–7)

Particle-size distribution analysis of profile S60–Pa–46–7 (1–7) shows that this soil has a fairly well expressed textural B horizon. This fact is indicated by the increase of 6 to 16 percent in the content of clay in the B horizons over that in the A horizon. The field identification of texture agrees reasonably well with the laboratory determination, but several horizons were judged in the field to be finer textured than indicated by laboratory analysis. The average amount of coarse fragments is about 20 percent; therefore, the amount of coarse fragments does not influence the classification of the soils at higher categories. The bulk density of the horizons described as a fragipan in some cases is lower than considered normal for a fragipan. In the fragipan horizons, the bulk density ranges from nearly 1.5 to nearly 1.8. The available moisture capacity is moderate, as determined by testing the core samples.

The chemical properties of this soil indicate that a relatively moderate degree of weathering has taken place. In general, the soils are very strongly acid to medium acid, but the B horizons are extremely acid. The base saturation is generally below 35 percent, but it ranges to more than 35 percent in places, according to data not shown here. The decrease in base saturation with increasing depth suggests that agricultural lime has been added to these soils. The soils have an average cation-exchange capacity of about 19 milliequivalents per 100 grams of soil, indicating the ability of the soils to hold a moderate amount of plant nutrients.

The amount of clay minerals in the Croton soils of this county is not very consistent from profile to profile. However, the amounts of illite (mica) and vermiculite, the two major minerals, are abundant or dominant in the profiles sampled. In profile S60–Pa–46–7 (1–7), the amount of kaolinite is consistently moderate throughout the profile. The content of vermiculite is consistently moderate throughout nearly all of the profile. Only the upper 13 inches of soil contain interstratified minerals.

The Croton soils occur in low areas and are subject to a certain degree of deposition. As a result, the soil material is of mixed ages and varies in degree of weathering; clays that have mixed layers of minerals are dominant. The large amount of illite and the increase in content of illite with increasing depth suggest that this mineral is inherited directly from the underlying material.

Lansdale Loam, Thin

S60–Pa–46–1 (1–6) and S60–Pa–46–4 (1–6)

The thin phases of the Lansdale loams sampled in Montgomery County have a moderately to weakly expressed B horizon as indicated by an increase of 5 to 8 percent in the content of clay in the upper B horizons. This soil is finer textured than other Lansdale soils analyzed in the southeastern part of Pennsylvania. In some places the field identification of texture indicates that these soils are finer textured than shown by laboratory determination; in other places it indicates that the soils are coarser textured than shown by laboratory determination. The content of coarse fragments is generally less than 38 percent and is not significant in classifying the soils. Bulk density is generally about 1.5 or 1.6, or lower than the density of 1.7 to 1.8 normally associated with a fragipan. A moderate amount of moisture is held available for plants.

Chemical properties, such as soil reaction, base saturation, and the calcium-magnesium ratio, show a rather divergent trend, indicating differences in the kind of material in which the soils formed and in the management of plant nutrients. The base saturation is generally above 35 percent in both profiles. The reaction ranges from slightly acid to very strongly acid, and the

soils have a tendency to become more acid with increasing depth.

These soils have a rather low to moderate capacity to store plant nutrients. In profile S60–Pa–46–1 (1–6), the average cation-exchange capacity is nearly 12 milliequivalents per 100 grams of soil, but the cation-exchange capacity is only about 9 milliequivalents per hundred grams of soil in profile S60–Pa–46–4 (1–6). Where the cation-exchange capacity is low, small amounts of fertilizer should be added as a sidedressing.

Profile S60–Pa–46–4 (1–6) is shallower and appears to be less weathered than profile S60–Pa–46–1 (1–6). In the clay mineral fraction of the Lansdale soils that were sampled, kaolinite is abundant. The large amount of kaolinite may indicate that weathering has taken place over a long period. Also, it may be the result of the weathering of a large amount of feldspar, which seems to form dominantly kaolinite while it is weathering. The amount of illite is low to moderate in profile S60–Pa–46–1 (1–6), but profile S60–Pa–46–4 (1–6) has abundant illite in the surface horizon and a moderate amount in the horizons below the surface horizon. The supply of interstratified minerals is moderate to low, but in profile S60–Pa–46–1 (1–6), the amount increases with increasing depth. The supply is low in profile S60–Pa–46–4 (1–6), which also indicates that less weathering has taken place in that profile. The amount of vermiculite is low to moderate in both profiles.

Lawrenceville Silt Loam

S60–Pa–46–3 (1–9) and S60–Pa–46–2 (1–8)

The Lawrenceville profiles that were sampled and described as typical for the series have moderately to weakly expressed textural B horizons. This fact is indicated by an increase of about 5 to 10 percent in the content of clay in some of the B horizons when compared to the content in the upper or lower horizons. The field identification of texture agrees well with the laboratory determination, except in two horizons that were shown in the laboratory to be finer textured than judged by field examination. Coarse fragments are conspicuously absent; the content of coarse fragments ranges from 0 to 8 percent, but it is generally less than 4 percent. A fragipan was evident when the soils were described in the field; however, the bulk density is between 1.4 and 1.7, which is not high. The available moisture capacity is high, as determined by testing the core samples.

The chemical properties of these soils indicate that the profiles are well leached. The soil reaction ranges from about pH 4.5 to pH 6.5. The base saturation is generally above 35 percent, but the pH values, base saturation, and calcium-magnesium ratio decrease with increasing depth. This trend suggests that a large amount of bases, primarily calcium, has been added to the surface horizon by commercial fertilization. Also, some bases may have been added to the surface layer through the recycling of bases by plants or through the deposition of fresh windblown material. The average cation-exchange capacity of about 12 milliequivalents per 100 grams of soil is moderate to low.

In the clay fraction of these soils, kaolinite is dominant. The amount of kaolinite generally increases with increasing depth. It is moderate in the upper horizons, but increases to abundant in the lower horizons. The kaolinite is probably inherited from the material in which these soils formed. This material is generally considered to be loess derived from the soils of adjacent uplands, river flood plains, and coastal plains where the soil material is highly weathered. Additional kaolinite may have formed in the present soil profile after the soil material was deposited. Illite and vermiculite are generally abundant in these soils, but the content is low in a few horizons. These profiles contain only a small amount of interstratified minerals.

Neshaminy Silt Loam and Neshaminy Very Stony Silt Loam

S60–Pa–46–13 (1–9) and S61–Pa–46–17 (1–9)

The Neshaminy silt loam and Neshaminy very stony silt loam that were sampled and described as typical for the series have moderately well expressed B horizons, as indicated by the increase in content of clay of about 10 to 20 percent in the B horizons when compared to the content in the A and C horizons. The field determination indicates texture somewhat coarser than that shown by the results of laboratory testing. The content of coarse fragments is higher for more horizons in profile S61–Pa–46–17 (1–9) than in profile S60–Pa–46–13 (1–9). In profile S61–Pa–46–17 (1–9), the proportion of coarse fragments ranges from about 26 to 87 percent and generally increases with increasing depth. In profile S60–Pa–46–13 (1–9), the proportion of coarse fragments ranges from 13 to 40 percent and generally increases only slightly with increasing depth. The available moisture capacity is moderate.

The chemical properties of these soils reflect the high base status of the parent material, which is generally weathered from a dark basic igneous rock, although the soils are strongly acid to neutral. The amounts of exchangeable calcium and magnesium are moderate and increase with increasing depth. The amount of magnesium is higher than in other soils sampled for laboratory analysis in Montgomery County.

The clay fraction of the Neshaminy soils is high in content of kaolinite. In profile S60–Pa–46–13 (1–9) kaolinite is dominant throughout the profile. In profile S61–Pa–46–17 (1–9) kaolinite is abundant in three of the upper horizons and is dominant in the lower two. The amounts of illite and vermiculite are low or moderate in both profiles. The amount of interstratified clay is low to moderate in profile S60–Pa–46–13 (1–9), but it is abundant in the A1 and A3 horizons in profile S60–Pa–46–17 (1–9). It is moderate in the B21t and B31 horizons. Both profiles are highly weathered, as indicated by the large amount of kaolinite in the clay fraction. The larger amount of interstratified minerals in these profiles suggests that these soils contain some less weathered material or that fresh material has been added to the surface layer. The large number of coarse fragments indicates that the fresh material is related to the local bedrock. The feldspar and other minerals in these rocks weather easily and produce a large amount of a kaolinite-type clay.

Penn Silt Loam

S61–Pa–46–14 (1–5) and S61–Pa–46–15 (1–5)

The Penn soils that were sampled as representative of the Penn series in Montgomery County have a weakly defined B horizon. This is indicated by the increase in content of clay of only 7 to 9 percent over that in the upper and lower horizons. The laboratory analysis of texture indicates that these soils are slightly coarser textured than judged by field identification. The content of coarse fragments is fairly high, or from 22 percent in the A horizon to about 56 percent in some of the B horizons, and to about 80 percent in the C horizon. Bulk density is fairly high in the B horizons. It ranges from 1.6 to about 1.8 in the B horizons, but those values are strongly influenced by the large amount of coarse fragments included in the core. The available moisture capacity is low, ranging from 3.6 to 4.9 inches of water without correcting for the content of coarse fragments.

In these soils the calcium-magnesium ratio is fairly low, or from about 3 to 1 or less. The average cation-exchange capacity is about 12 milliequivalents per 100 grams of soil. This indicates a moderate to low storage capacity for plant nutrients, and the capacity is further reduced by the large amount of fragments that are greater than 2 millimeters in diameter. Reaction ranges from neutral to strongly acid, and the base saturation ranges from 44 to 76 percent. The pH value and base status decrease with increasing depth.

The Penn soil profiles that were analyzed contain moderate or abundant amounts of kaolinite, illite, and vermiculite. Kaolinite is generally abundant, which indicates a relatively high degree of weathering. The kaolinic clay minerals may have been inherited from the material in which these soils formed, or they may have been formed through weathering. The increase in content of illite with increasing depth suggests that this material was released from the material in which the soils formed. The amount of interstratified clay minerals is abundant in the surface horizon and moderate or low in the lower horizons. This decrease probably indicates weathering of the vermiculite, which does not show in the surface horizon. The interstratified minerals are generally formed in the soils through weathering. The content of vermiculite is fairly constant throughout the profile, although the surface horizon (results of testing not shown in table 13) apparently contains more than the other horizons.

Readington Silt Loam

S60–Pa–46–12 (1–8) and S60–Pa–46–6 (1–7)

The Readington soils sampled as representative of this series in Montgomery County have a moderately developed textural B horizon. In the B horizon, the content of clay is 15 to 20 percent higher than in the upper or lower horizons. Laboratory analysis of the texture indicates that the texture is somewhat coarser than judged by field examination. The content of coarse fragments increases with increasing depth and ranges from about 2 percent in the upper part of the profile to nearly 35 percent in the lower part. Bulk density in the horizons designated as fragipans ranges from about 1.6 to 1.8. The available moisture capacity is generally moderate.

In the Readington soils sampled, the reaction ranges from extremely acid to slightly acid. The percentage of base saturation is fairly low, but the average base saturation is just more than 35 percent. Also, the calcium-magnesium ratio and pH value decrease with increasing depth. These trends indicate that the soil is highly leached and would normally be strongly acid throughout.

The fact that the base saturation of the surface layer is higher than that of the lower layers indicates that agricultural lime has been applied or that possibly bases have been brought to the surface by plants where the soils are under forest. The soils have generally been cultivated for more than 200 years, and the influence of agriculture has modified the soil reaction that was established under the native vegetation. The average cation-exchange capacity is about 15 milliequivalents per 100 grams of soil, and as a result, a moderate storage capacity for plant nutrients is provided.

The kind and distribution of clay minerals in the Readington soils indicate differences in the kind of minerals that are predominant in the material in which these soils formed. In profile S60–Pa–46–6 (1–7) the content of kaolinite remains moderate throughout the profile but the content of illite increases from moderate in the upper horizons to dominant in the C horizon. In contrast, the content of kaolinite in profile S60–Pa–46–12 (1–8) increases from moderate in the surface horizon to dominant in the Bx2 horizon; the content of illite, or mica, is moderate except in the Bx2 horizon, where it is abundant. In both profiles the content of interstratified minerals is highest in the surface horizons and decreases with increasing depth; the content of vermiculite increases from low to moderate with increasing depth. Weathering has been more intense in the surface horizon than in the lower horizons. The differences in the content of inherited minerals in the two profiles make a great apparent difference in the degree of weathering that takes place.

Reaville Silt Loam

S61–Pa–46–16 (1–6) and S60–Pa–46–11 (1–5)

The Reaville silt loams that were sampled for characterization have a weakly defined textural B horizon that is indicated by an apparent accumulation of clay that is 2 to 5 percent higher in this horizon than in the upper horizon. The amount of clay in the B horizons may have been reduced by the removal of the surface layer, which normally would have been lower in clay than shown. The upper horizon was found to be somewhat coarser textured according to field identification than was determined in the laboratory, and the lower horizons were found to be somewhat finer textured. The content of coarse fragments ranges from 8 to nearly 25 percent in the solum, and coarse fragments make up as much as 77 percent of the substratum. Bulk density is high, approximately 1.5 to 1.7, in these soils because of the many coarse fragments. Bedrock near the surface and the large number of coarse fragments make the available moisture capacity very low.

The chemical properties indicate that the soils are fairly well leached. Base saturation is rather low for both profiles. These soils are extremely acid to medium

acid. In general, the soil reaction, base saturation, and calcium-magnesium ratio decrease with increasing depth.

The average cation-exchange capacity is about 15 milliequivalents per 100 grams of soil. This would indicate a moderate storage capacity for plant nutrients per gram of soil. However, because of bedrock near the surface and the large number of coarse fragments, the total storage capacity for plant nutrients is low.

The clay minerals in the Reaville soils sampled for characterization are predominantly illite. In both profiles the content of illite increases with increasing depth. It is abundant in the Ap horizon of profile S61–Pa–46–16 (1–6) and increases to dominant in the B21t horizon and below. It increases from abundant in horizon B2t of profile S60–Pa–46–11 (1–5) to dominant in the C2 horizon. The dominance of this mineral is probably related to the content of illite in the bedrock. In these soils bedrock is near the surface and contributes many coarse fragments that release illite when they are broken down or crushed. The content of kaolinite is moderate in the upper part of both profiles but decreases to low with increasing depth. Interstratified minerals are abundant in the surface layer of profile S60–Pa–46–11 (1–5), where they were formed from vermiculite or illite. They are moderate in the surface layer of profile S61–Pa–46–16 (1–6). The content of vermiculite is low in the Ap horizons, but the amount increases to moderate and remains moderate in the lower horizons.

General Nature of the County

This section provides general information about Montgomery County. It gives facts about the climate and geology, discusses the agriculture, and describes the industries and markets. The statistics used are mainly from recent records of the U.S. Bureau of the Census.

The territory that is now Montgomery County was first inhabited by the Lenni Lenape or Delaware Indians. The earliest settlers were the Dutch, but they were mainly interested in trade with the Indians and generally did not make permanent settlements. The Swedes and Finns, who arrived next, were more interested in farming than the Dutch, and they established permanent homes in the wilderness. Then, in 1664, the English took control of the area and began to establish their settlements. The first major settlements near the end of the 17th century were made by the English, including the Scotch, Irish, and Welsh, and the Germans. The chief occupation was farming.

The countryside was the scene of several skirmishes and encampments during the American Revolution. The area is noted chiefly as the scene of the encampment at Valley Forge during the winter of 1777–78. It was here that Washington's army reorganized and disciplined for the campaigns that lay ahead.

In 1790, the Census records show that there were 22,924 inhabitants in the county. The number had increased to 70,500 by 1860, and to 516,682 by 1960. As late as 1920, more than half of the population lived on farms or in rural communities of less than 2,500 population. Since 1940, the population of the county has increased greatly. Between 1950 and 1960, it increased by more than 46 percent. Much of this growth can be attributed to the further expansion of industry and to the number of persons who moved to small communities from the city of Philadelphia and other large cities in the east.

Climate [6]

Warm, humid summers, moderately cold winters, and ample rainfall characterize the climate of Montgomery County. The prevailing westerly winds produce a humid-continental type of climate, although the Atlantic Ocean, 75 miles to the southeast, occasionally affects the weather. The range in temperature is relatively wide between winter and summer and between day and night. Variations in temperature from one day to the next are common, because the county is near the paths of weather systems that alternately bring in warm air from a southerly direction and cold air from a northerly direction. Frequent changes in weather are most common in winter and spring. They are less frequent in summer and fall because of the slower movement of the high and low pressure systems that are responsible for the weather.

From June through October, weather systems occasionally stagnate, and as a result, the same weather persists for a week or more. Generally, during such periods in summer, the days are hot and humid and the nights are warm. When such conditions develop in fall, the days are dry and balmy and the nights are cool. One or more such periods can be expected in most years, but there are summers when extreme heat and humidity are noticeably absent. Because the weather systems move rapidly in winter and spring, unusually cold periods seldom last for more than a few days at a time.

Differences in climate from one part of the county to another are caused largely by differences in local topography and in the elevation. Although the range in elevation in this county is generally only 100 to 400 feet, differences in local relief are great enough to produce variations in temperature, especially at night. Minimum readings in the smaller valleys tend to be lower than those in the surrounding higher areas because the colder are, being heavier than warm air, drains into the valleys. Freezing temperatures in the valleys, therefore, occur somewhat later in spring and earlier in fall than they do on the surrounding hillsides. As a result, the growing season in the valleys is shortened to some extent.

Table 14, compiled from records kept at Norristown, gives temperature and precipitation data considered representative for this county. These data are useful for planning purposes, if allowances are made for differences in elevation. Norristown is in the valley of the Schuylkill River, however, in the southwestern part of the county. In that area the average temperature is slightly higher and the amount of precipitation is somewhat lower than in areas at a higher elevation in the northern part of the county.

[6] By NELSON M. KAUFFMAN, U.S. Weather Bureau State climatologist, Harrisburg, Pa.

TABLE 14.—*Temperatures and precipitation at Norristown, Montgomery County, Pa.*

Month	Temperature				Precipitation					
	Average daily maximum	Average daily minimum	Average extreme maximum	Average extreme minimum	Average total	One year in 10 will have—		Average number of days with—		Average snowfall
						Less than—	More than—	Precipitation of 0.5 inch or more	Snowfall of 3 inches or more	
	°F.	°F.	°F.	°F.	In.	In.	In.			In.
January	40	24	58	9	2.8	1.2	5.5	2	3	5.4
February	43	26	62	9	2.8	1.5	4.1	2	4	4.9
March	50	32	72	18	4.2	1.9	5.4	3	2	4.8
April	64	42	85	31	4.2	1.4	6.4	3	0	0
May	74	52	89	38	3.0	.9	7.8	2	0	0
June	82	61	95	49	3.1	1.4	5.4	2	0	0
July	87	66	97	55	4.1	1.3	6.6	3	0	0
August	84	64	95	53	4.6	1.0	7.9	3	0	0
September	78	57	93	41	4.1	2.4	7.6	3	0	0
October	68	46	84	32	2.6	1.2	5.5	3	0	0
November	56	36	73	21	3.6	1.5	5.8	3	(1)	.8
December	43	26	64	11	3.3	1.2	5.4	3	2	4.2
Annual	68	45	[2] 103	[3] −3	42.4	34.0	51.1	32	11	20.1

[1] Less than 0.5 day.
[2] Highest maximum in 1952–64 period.
[3] Lowest minimum in 1952–64 period.

Temperature.—Montgomery County is in the warmest part of Pennsylvania, and it has an average annual temperature of 57° F. The average monthly temperature ranges from 32° in January, however, to 77° in July. From March to June, the average temperature is about 10° higher than the average for the year, and from September through December, it is about 10° lower. Most of the time, departures from the normal average temperature for any month are no greater than +5° to −5°, but departures in any given day may be considerably greater. A temperature of below zero or of above 100° is rare, although extremes of −3° and of 103° have occurred at Norristown.

From May through September, a maximum temperature of 90° or higher may be expected on an average of 25 days. The distribution of the days on which these maximum temperatures occur is 1 day in May, 5 in June, 10 in July, 6 in August, and 3 in September. Occasionally, a temperature of 90° occurs as early as April and as late as October. The number of days when the temperature rises as high as 90° varies from year to year. It ranges from only a few days in cool summers to more than 40 in abnormally warm summers.

A combination of uncomfortably high temperature and humidity can be expected on a number of days during any summer. Very cold weather is unusual in winter. From December through the early part of March, temperatures of zero or below are normally experienced on only 1 or 2 days, although temperatures of 32° or lower occur on an average of 101 days each year.

The interval between the date of the last temperature of 32° in spring and the date of the first temperature of 32° in fall is known as the growing season. At Norristown, this interval normally extends from April 9 to October 29, or a period of 203 days. Freezing temperatures have occurred as late as April 25, however, and as early as October 11. During the period that records have been kept at Norristown, the length of the growing season has ranged from 190 to 223 days.

The probability of freezing temperatures after specified dates in spring and before specified dates in fall are given in table 15. The data in table 15 are from records kept at Norristown, but they apply to other areas in the county where the elevation and the air drainage are similar. Data in table 15 indicate, for example, that there is 1 chance in 10 that a temperature of 32° or lower will occur after April 21 and 1 chance in 10 that a temperature of 32° or lower will occur before October 12. The data showing probabilities for 5 years in 10 correspond to the average, or normal, dates of occurrence. The data apply to Norristown and to most other areas of the county. They do not apply to some areas in the northern part of the county that are at a higher elevation than Norristown. In those higher areas, freezing is likely to occur somewhat later in spring and earlier in fall than indicated by the data in table 15.

Precipitation.—Slightly more than 42 inches of precipitation, including both rainfall and the water equivalent of melted snow, is normally received annually at Norristown. Elsewhere in the county, the total amount of precipitation ranges from 43 inches in the eastern part to 47 inches in the extreme northern part. In most years the amount is between 37 and 46 inches, but annual amounts have ranged from less than 32 inches to more than 58 inches.

In general, precipitation is well distributed throughout the year, but there is a difference in the normal amounts of about 2 inches between the wettest month (August) and the driest month (October). Variations between any given month and the next month, as well as for a given month in different years, may be fairly large. During the period of record, for example, the amount of monthly precipitation has ranged from less than 0.05 inch in October

TABLE 15.—*Probabilities of the last freezing temperatures in spring and the first in fall at Norristown, Montgomery County, Pa.*

Probability	Dates for given probability and temperature of—				
	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 10	March 23	March 30	April 13	April 21
2 years in 10 later than	March 3	March 16	March 26	April 6	April 16
5 years in 10 later than	February 20	March 6	March 16	March 25	April 9
Fall:					
1 year in 10 earlier than	December 4	November 22	November 14	October 30	October 12
2 years in 10 earlier than	December 9	November 27	November 19	November 5	October 19
5 years in 10 earlier than	December 16	December 4	November 29	November 13	October 29

to more than 17 inches in August. The large amount in August was caused by the passage of two hurricanes. Nearly 55 percent of the annual precipitation falls during the period April through September. Throughout the county, the total amount of rainfall for this 6-month period normally ranges from 23 to 26 inches, but less than 15 inches has been received in some dry seasons and more than 31 inches has been received in some wet seasons.

Most of the rainfall in warm seasons is received from showers and thunderstorms. At times, these storms last for only a few minutes, and at other times, they last for as long as several hours in any one area. They affect only part of the county at any one time. About 30 thunderstorms occur each year. These storms are mainly responsible for the intense rainfall that occurs over a short period. About once each year, 1.2 inches of rainfall can be expected in an hour; once every 25 years, 3 inches can be expected in 2 hours; and once every 10 years, 5 inches can be expected in 24 hours. Heavy rainfall, of course, is not necessarily desirable, even during dry periods. Generally, considerable erosion occurs during heavy rains. Also, local flooding may occur, because the soils cannot readily absorb a large amount of water and much of the water runs off.

In this county the amount of water received through precipitation is generally adequate for domestic, industrial, and agricultural needs, but dry spells that affect the entire area develop occasionally. Short periods of deficient precipitation may develop at any time. Because of the greater need for moisture during the growing season, however, the effects are more pronounced during that season than at other times. One of the most severe droughts of record in this county occurred in 1963. In that year precipitation was below normal in every month but two, and the rainfall during the growing season was more than 8 inches below normal. During most dry seasons, however, the amount of rainfall is generally not more than 4 inches below normal.

From December through the early part of March, part of the precipitation falls as snow. This snow is produced from storms that are more extensive than the type of storm that occurs in warm seasons. Consequently, the precipitation is likely to be more widespread, but less intense, than rain that falls in summer, and the period during which it falls is more prolonged.

Periodically, moisture-laden storms that move northward along the Atlantic seaboard produce heavy snow and strong winds. These storms occasionally produce near-blizzard conditions that occasionally last for several days. Nevertheless, an appreciable amount of snow usually covers the ground for only a few days at a time. At Norristown, the snow is normally 3 inches or more in depth on 11 days each winter, but it is 3 inches or more in depth on as many as 20 days in the northern parts of the county.

The average amount of snow received in an entire season in this county ranges from 20 to 30 inches. The larger amounts are usually received in the northern and eastern parts of the county. During the period of record, however, as little as 4 inches and as much as 44 inches have been received. A large amount of snow sometimes produces a heavy load that causes extensive damage to objects that are exposed. Trees and utility lines are especially vulnerable to such damage. Snowstorms of ths type are most likely to occur late in winter.

Storms.—Thunderstorms are the principal cause of damage to crops in this county. They may occur in any month, but they are most frequent in summer. The heavy rains that accompany the more severe thunderstorms cause soil erosion and injure tender plants. Hail that sometimes accompanies the storms causes extensive property damage and damage to crops over a limited area. Lightning is more destructive to buildings by far, however, than hail because of the resulting fires. Winds of 50 to 60 miles per hour that often accompany thunderstorms also damage the roofs of houses and other buildings.

Infrequently, strong winds and heavy rains from hurricanes or remnants of hurricanes occur during the period of July through October. As a rule, however, the benefits from the rain received from hurricanes far outweigh the damage that may result from the wind or from possible local flooding.

According to available records, only a few small tornadoes have ever occurred in this county. The probability that a tornado will occur is small.

Bedrock Geology

Underlying Montgomery County are sedimentary igneous and metamorphic rocks. Among these are rocks that are nearly the oldest in the country. The age of the rocks varies greatly, however, and in places the rocks make up the most recent formations. Figure 29 shows the locations of the major kinds of bedrock in the county.

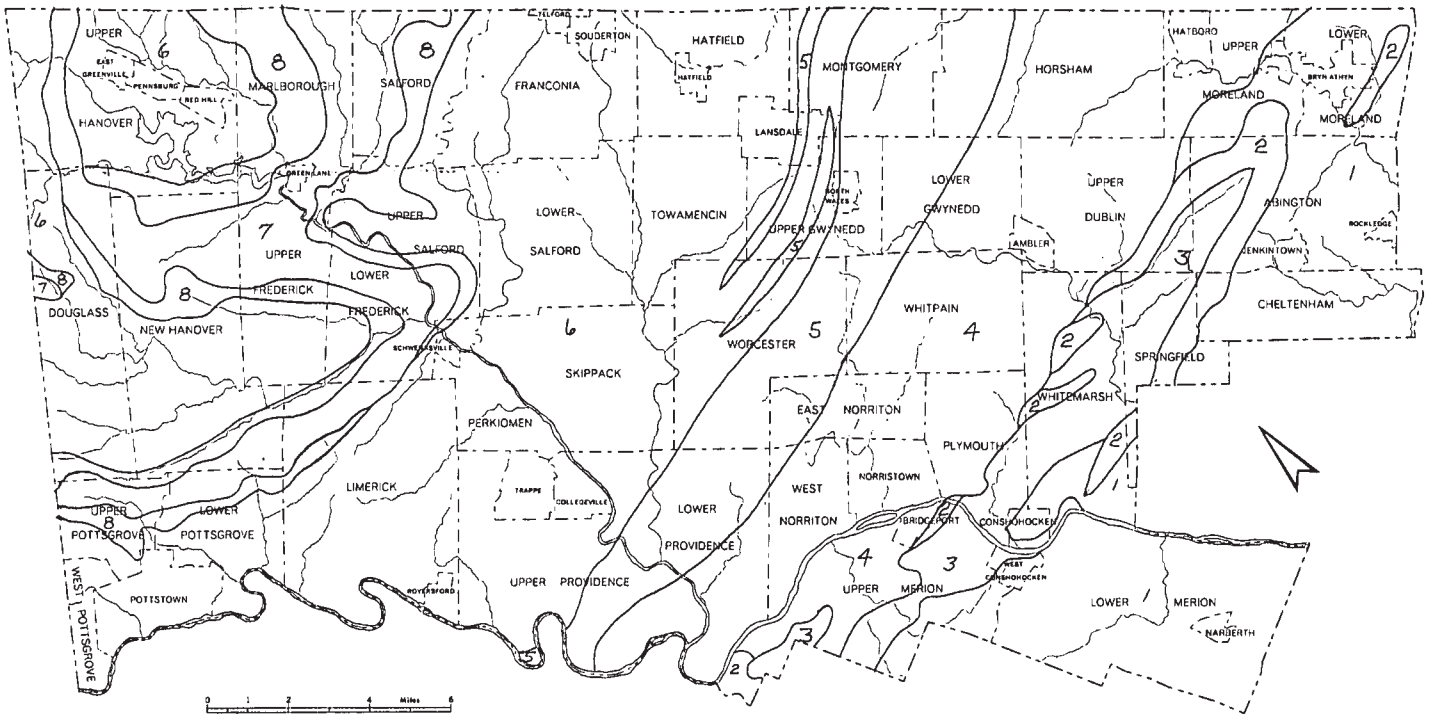

Figure 29.—**Bedrock geology of Montgomery County, according to geologic map of Pennsylvania, Commonwealth of Pennsylvania, Department of Internal Affairs, Topographic and Geologic Survey, 1960.**

1. **Wissahickon schist, granite gneiss, and hornblende gneiss and schist.**
2. **Chickies quartzite and quartz schist.**
3. **Ledger dolomite, Elbrook limestone, and Conestoga limestone.**
4. **Stockton arkosic sandstone, conglomerate, and shale.**
5. **Lockatong argillite and shale.**
6. **Brunswick shale and fine-grained sandstone.**
7. **Diabase.**
8. **Hornfels.**

Throughout the southern third of the county are the oldest formations, which are highly metamorphosed crystalline rocks of Precambrian age. The Wissahickon formation consists of various kinds of schist that contain considerable mica. The schist is soft and is highly weathered in the upper part. Other rocks in this area are granite gneiss and hornblende gneiss and schist, which are harder and more resistant to weathering than the schist. Near Philadelphia these harder rocks formerly were quarried extensively for building and paving stone, but only two quarries are now active. Mica was formerly the mineral mined most extensively in this area.

Just north of the area underlain by schist and gneiss are several narrow hills and ridges underlain by quartzite and quartz schist. The quartzite has been metamorphosed by pressure and heat to form a very hard rock that resists weathering. It is cemented together with silica. The quartzite and quartz schist are members of the Chickies formation of Cambrian age. In the past they were quarried for building stone. Still produced at two quarries are building stone and crushed stone for use in the construction of roads.

Adjacent to the northern part of these two areas, a narrow, poorly defined valley extends from just west of Willow Grove to the Valley Forge State Park at the western boundary of the county. This valley is underlain by sedimentary rocks of Cambrian or Ordovician age. These rocks make up the Ledger formation, consisting of light-gray, pure crystalline dolomite and siliceous dolomite; the Elbrook formation, consisting of light-gray or yellowish-gray siliceous limestone; and the Conestoga formation, consisting of bluish-gray impure limestone that is interbedded with slate or schist in some places. Many old abandoned quarries in this area and several large quarries are presently active. In this area the manufacture of cement, the quarrying of agricultural limestone, the quarrying of limestone for the steel industry, and quarrying of crushed stone for road construction are all important.

The northern two-thirds of the county is underlain by more recent geologic formations of Triassic age. The oldest of these formations is the Stockton. This formation occurs as a band about 4 miles wide across the south-central part of the county, just north of the area underlain by limestone. The Stockton formation consists of light-gray or buff, coarse-grained arkosic sandstone and conglomerate and of red and brown, fine-grained siliceous sandstone and red shale. In the past some sand and gravel were quarried in this area, but only a small amount is produced at present. As a rule, the Stockton formation is soft and highly weathered near the surface. It is not well suited to use as building stone.

The Lockatong formation occurs as a series of bands that run east and west through the Stockton formation and north of that formation. It consists mainly of dark-gray or black, thick-bedded argillite, but it contains an occasional zone of thin-bedded black shale or thin layers of calcareous shale. The rocks of this formation are

hard and resist weathering. In former years building stone was quarried in this area, but now, crushed stone is quarried extensively and is used in constructing roads.

The youngest sedimentary rocks in the county are in the Brunswick formation, which underlies the northern half of the county. These rocks are of Triassic age. The Brunswick formation consists of red shale that is interbedded in some places with red or brown, fine-grained siliceous sandstone or calcareous shale. In most places these rocks are too soft to be used for building purposes, but they are used to some extent for the manufacture of pottery and tile.

In the northern part of the area underlain by the Brunswick formation are igneous intrusives in the form of diabase dikes and sills. This diabase is hard, but the upper part is highly weathered. In the past, stone was cut in this area for building purposes and a small amount of iron was mined.

In areas adjacent to these diabase intrusives, the Brunswick shale has been baked or metamorphosed to a hard, black or gray shale or slate, called hornfels. The hornfels is quarried to a small extent for crushed stone to be used in building roads.

Agriculture

The pressure of expanding cities and communities is rapidly changing the agriculture in Montgomery County. The number of people who live on farms and the number of full-time farmers have declined in the past few years. Parts of the county still have the appearance of an old, well-established farming area, but in 1960 the rural population made up less than one-fourth of the total population in the county. The average-sized farm in 1960 was slightly less than 74 acres.

Much of the county is now characterized by country estates and part-time farms. These are the homes of persons whose main interests lie in the nearby cities to which they commute to work. Farming is complex and technical, and emphasis is placed on obtaining the highest yields possible per acre. Assistance in planning current or future use of the soils can be obtained from representatives of the Montgomery County Soil and Water Conservation District, the Soil Conservation Service, the Agricultural Extension Service, and other organizations that maintain offices in Montgomery County.

The U.S. Census of Agriculture reports a total of 1,510 farms in 1959. Of these, 723 were miscellaneous and unclassified. The rest were classified according to the main source of income as follows:

Type of farm:	*Number*
Cash-grain	55
Vegetable	25
Fruit and nut	5
Poultry	182
Dairy	400
Livestock farms other than poultry and dairy	80
General	40

A large part of the cash farm income in this county is derived from the sale of livestock and livestock products. About two-thirds of the total income derived from all livestock and livestock products sold in 1959 was from sales of dairy products and from poultry and poultry products. Following are the kinds and numbers of livestock raised in this county in 1959 and the numbers of beef cattle, calves, and chickens sold:

	Number
Cattle and calves	20,690
Milk cows	10,836
Hogs	12,268
Sheep and lambs	3,734
Cattle and calves sold alive	7,728
Beef cattle, not counting calves, sold alive	5,404
Chickens sold	573,556

Following is the acreage of the principal crops grown in the county. Also given are the numbers of the principal kinds of fruit trees and vines of all ages in 1959:

Corn:	*Acres*
Grown for all purposes	21,174
Harvested for grain	18,262
Cut for silage	2,654
Wheat harvested	8,845
Oats harvested	4,886
Barley harvested	3,046
Soybeans grown for all purposes	2,004
Hay:	
Alfalfa and alfalfa mixtures	4,115
Clover and timothy and mixtures of clover and grasses	15,538
Vegetables harvested for sale	1,318
Nursery products, including trees, shrubs, vines, and ornamentals	1,502
	Number
Apples	29,091
Peaches	24,364
Pears	2,299
Grapevines	2,026

Industries and Markets

Close proximity to markets and easy accessibility are two factors that have led to continued development of industries in this county. Since World War II, light industry and a research type of industry have grown extensively. The recent trend toward lighter types of industry and toward research have led to the development of large, well-landscaped industrial parks. The major industrial parks are near Valley Forge and King of Prussia and at Fort Washington and Willow Grove.

About one-sixth of the entire population of the United States lives within 100 miles of Montgomery County. The products of this county can reach more than half of the national markets within 12 hours. The three seaports of New York, Philadelphia, and Baltimore can be reached in 3 hours or less.

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Glossary

Aeration, soil. The process by which air and other gases in the soil are renewed. The rate of soil aeration depends largely on the size and number of pores in the soil and on the amount of water clogging the pores.

Aggregate, soil. Many fine soil particles held in a single mass, or cluster, such as a clod, crumb, block, or prism.

Alluvial soil. Soil formed from material, such as gravel, sand, silt, or clay, deposited by a stream and showing little or no modification of the original material by soil-forming processes.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. The amount of moisture held in a soil between field capacity and the permanent wilting point of plants. Commonly expressed as inches of water per inch of soil depth.

Base saturation. The degree to which a material is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Calcareous. Containing calcium carbonate, or lime.

Channery soil. A soil that contains more than 15 percent thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment or channer.

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. See also Texture, soil.

Claypan. A compact layer, or horizon, rich in clay and separated more or less abruptly from the overlying horizon.

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

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; the soil does not hold together in a mass.

Friable.—When moist, the soil crushes easily under gentle pressure between the thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, the soil crushes under moderate pressure between the thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, the soil is readily deformed by moderate pressure but can be pressed into a lump; forms a wire when rolled between the thumb and forefinger.

Sticky.—When wet, the soil adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, the soil is moderately resistant to pressure and is difficult to break between the thumb and forefinger.

Soft.—When dry, the soil breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour stripcropping. Growing crops in a systematic arrangement of strips or bands, on the contour, to reduce water erosion. The crops are arranged so that a strip of grass or a close-growing crop is alternated with a strip of a clean-tilled crop or fallow.

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

Diversion terrace. A channel that has a supporting ridge on the lower side. It is constructed across the slope to intercept runoff and to carry runoff to a planned outlet. These terraces are kept in permanent sod.

Erosion, accelerated. Erosion of the soil over and above normal or natural erosion. It generally results from the activities of man or animals. There are several kinds of accelerated erosion. They are (1) *Sheet erosion,* or removal of a more or less uniform layer of material from the land surface. The effects are less conspicuous than those of other types of erosion that produce large channels. In many places where sheet erosion has taken place, the eroding surface consists of numerous very small rills. (2) *Rill erosion,* or erosion by water, which produces small channels that can be obliterated by tillage. (3) *Gully erosion,* or erosion by water that produces channels larger than rills. Normally, gullies carry water only during and immediately after rains or following the melting of snow. Gullies are deeper than rills and are not obliterated by normal tillage.

Field stripcropping. Growing crops in a systematic arrangement of strips or bands, across the general slope but not on the contour, to reduce water erosion. The crops are arranged so that a strip of grass or a close-growing crop is alternated with a clean-tilled crop or fallow.

Fine-textured soil. Clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, and clay.

Fragipan. A dense and brittle pan, or layer, in soils that owes its hardness mainly to extreme density or compactness rather than to cementation or to a high content of clay. Fragments that are removed are friable, but the material in place is so dense that roots cannot penetrate it, and water moves through it very slowly because of the small size of the pores. A fragipan is indicated by the letter *x* in the description of the profile.

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

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes and that differs in one or more ways from adjacent horizons in the same profile.

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

Infiltration. The downward entry of water into the immediate surface of a soil or other material. Infiltration rate refers to the rate at which water penetrates the surface of the soil at any given instant, generally expressed in inches per hour. It may be limited either by the infiltration capacity of the soil or by the rate at which water is applied to the surface of the soil.

Leached soil. A soil from which most of the soluble material has been removed from the entire profile or removed from one part of the profile and accumulated in another part.

Loam. A soil that consists of a relatively uniform mixture of sand and silt and a somewhat smaller proportion of clay, generally a desirable quality. Loam texture may be subdivided as sandy loam, loam, silt loam, and clay loam. Specifically, loam is soil material containing 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. See also Texture, soil.

Mottled. Irregularly marked with spots of different color that vary in number and size. Descriptive terms are as follows: Abundant—*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 (0.6 inch) in diameter along the greatest dimension.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod, which is a mass of soil brought about by digging or other disturbance.

Percolation. The downward movement of water through the soil, especially the downward flow of water in saturated or nearly saturated soil.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. The terms used to describe permeability are *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in either pH values or in words, as follows:

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

Residual soil. Soil formed in place from mineral material weathered from the underlying rock. Presumably developed from the same kind of rock as that on which it lies.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters in diameter. 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. See also Texture, soil.

Silt. Individual mineral particles in a soil that range from the upper limit of clay (0.002 millimeter) in diameter 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. See also Texture, soil.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons.

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), *angular blocky* (blocks with sharp corners), *subangular blocky* (blocks with mostly rounded corners), *granular* (granules relatively nonporous), *crumb* (similar to granular but very porous). *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering without any regular cleavage, as in many claypans and hardpans).

Subsoil. In many soils, the B horizon; commonly that part of the profile below plow depth.

Subsurface soil. That part of the A horizon below the surface soil.

Substratum. Any layer lying beneath the solum or B horizon; the C or R horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soils, about 5 to 8 inches. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine." See also Clay; Loam; Silt; Sand.

Tilth, soil. The physical properties of the soil that affect the ease of cultivating it or its suitability for crops (implies the presence or absence of favorable soil structure).

Topsoil. Presumably fertile soil or soil material, ordinarily rich in organic matter, that is used to topdress roadbanks, gardens, parks, and lawns.

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