SOIL SURVEY

Fulton 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
THE PENNSYLVANIA DEPARTMENT OF AGRICULTURE
State Soil and Water Conservation Commission
Issued November 1969

Soil names and descriptions in this soil survey were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service, the Pennsylvania State University, College of Agriculture and Agricultural Experiment Station, and the Pennsylvania Department of Agriculture, State Soil and Water Conservation Commission; it is part of the technical assistance furnished to the Fulton County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

All of the soils of Fulton 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 symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information 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 the woodland 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 units and other groupings.

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

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

Land use planners, county commissioners, and others interested in broad land use planning will find information about use of the soils for selected nonagricultural purposes in the section "Selected Nonfarm Uses of the Soils."

Engineers and builders will find, under "Engineering Uses 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."

Newcomers in Fulton 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.

U.S. GOVERNMENT PRINTING OFFICE: 1969

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Contents

Issued November 1969

SOIL SURVEY OF FULTON COUNTY, PENNSYLVANIA

BY NORMAN J. CHURCHILL

FIELD SURVEY BY NORMAN J. CHURCHILL, CLEO WILDASIN, R. W. LONG, L. R. STALEY, D. M. HERSH, AND H. W. HANNIGEN, 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 PENNSYLVANIA DEPARTMENT OF AGRICULTURE, STATE SOIL AND WATER CONSERVATION COMMISSION

FULTON COUNTY lies in the Appalachian Ridge and Valley section of south-central Pennsylvania on the Maryland border (fig. 1). The county is almost rectangular in shape. It is bounded on the north by Huntingdon County, on the east by Franklin County, on the South by the Mason-Dixon Line (Maryland), and on the west by Bedford County. Tuscarora Mountain forms the eastern boundary, and Rays Hill the western boundary. The county consists of 278,400 acres. It is approximately 15 miles wide from east to west and 29 miles long. From east to west, the county is crossed by U.S. Route 30 (Lincoln Highway) and the Pennsylvania Turnpike, and from north to south, by U.S. Route 522. Elevation above sea level ranges from 2,458 feet on Big Mountain to 430 feet where Tonoloway Creek leaves the county. The population in 1960 was 10,597. Of this number, 1,245 are in McConnellsburg, the county seat and the largest town.

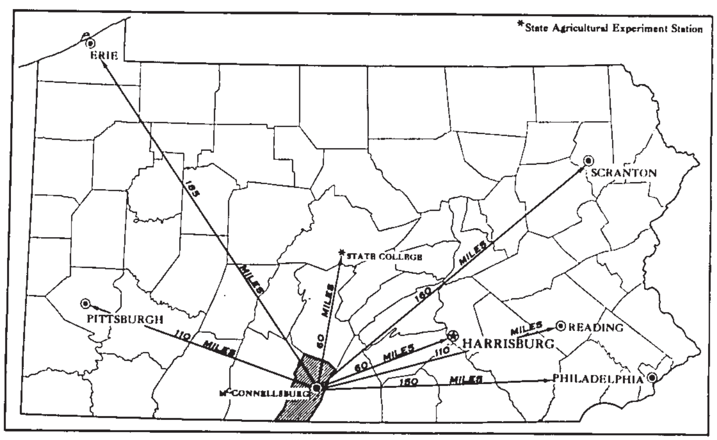

Figure 1.—Location of Fulton County in Pennsylvania.

Fulton County is primarily agricultural. Dairying is the main farm enterprise. About three-fourths of the land area is intermountain valleys in which there are nearly level to rolling, shaly soils of moderate to low productivity and some soils that were formed on limestone and are highly productive. The remaining one-fourth is steep, wooded mountains that have on them stony, shallow soils formed on shale and sandstone. The mountains and adjacent foothills are becoming increasingly popular as sites for summer homes, and for recreation.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Fulton 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. For successful use of this survey, 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. Berks and Hagerstown, 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 landscape. Soils of one series can differ in texture of the surface soil and 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. Hagerstown silt loam and Hagerstown silty clay loam are two soil types in the Hagerstown 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, Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded, is one of several phases of Hagerstown silt loam, a soil type that ranges from gently sloping to 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 woodlands, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map at the back of this survey was prepared from the aerial photographs.

The 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, Calvin-Berks channery silt loams, 3 to 8 percent slopes, moderately eroded. Another kind of mapping unit is the undifferentiated soil group. The undifferentiated soil group consists of two or more soils not shown separately on the map, because differences among them are small, their practical value is limited, or they are too difficult to reach. An example is Laidig and Murrill cobbly loams, 3 to 8 percent slopes. Also, most surveys include areas where the material is so rocky, so shallow, or so frequently worked by wind and water that it cannot be classified by soil series. These areas are shown on a soil map like other mapping units but are given descriptive names, such as Rubble land or Strip mine spoil, and are called land types.

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, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in soil surveys. On the basis of yield and practice tables and other data, the soil scientists set up trial groups, and then test them 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

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

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

Eight soil associations were mapped in the county. Association 1 is on the mountaintops and upper slopes. Associations 2, 4, and 8 are in the intermountain valleys. Associations 5 and 6 are mainly on ridges, hillsides, and some foot slopes. Associations 3 and 7 are on foot slopes at the base of mountains.

1. Dekalb-Lehew-Cookport Association

Moderately deep and deep, well-drained to somewhat poorly drained, stony soils on the upper part of mountain slopes

This association is on high mountaintops and upper slopes, 1,200 to 2,000 feet above sea level. The mountain slopes are steep or very steep, and there are some small ledges and depressions where seep spots are present. The association makes up about 28 percent of the county.

Major soils of this association are the Dekalb, Lehew, and Cookport. Dekalb soils make up about 70 percent of the association. They are very stony soils on the mountaintops and upper mountain slopes. Their entire profile contains a large amount of sandstone fragments. Lehew soils, which make up about 10 percent of the association, are redder than Dekalb soils and are also very stony and steep. Cookport soils make up about 10 percent of the association. They are very stony, moderately well drained, and less steep than the Dekalb soils.

Minor soils, which make up about 10 percent of the association, are mainly the Laidig, Buchanan, and Andover. These soils are gently sloping to steep and are mostly on foot slopes of the mountains. There are also some strip-mined areas.

Most of this association is wooded. Even where the slope permits farming, soil acidity, low soil fertility, and steep slopes make a high level of management necessary. The potential for recreational use of the soils is good where a supply of water can be obtained.

2. Klinesville-Calvin Association

Shallow and moderately deep, well-drained, reddish shaly soils in intermountain valleys

This association is mostly in the western part of the county in the intermountain valleys. Prominent features of the landscape (fig. 2) are the rolling shale hills, the steep, wooded hollows, and the narrow flood plains. Most of the association is about 1,000 feet above sea level, but the elevation ranges from 600 feet on the narrow flood plains to 1,500 feet on the highest points in the rolling shale hills. This association makes up about 33 percent of the county.

The soils are mostly shaly and medium textured. They have low to medium available moisture capacity. The dominant Klinesville soils occupy the steeper, rolling slopes and the steep, wooded hollows. The moderately deep, well-drained Calvin soils are on gently sloping hilltops and strongly sloping hillsides. Klinesville soils make up about 50 percent of this association, and Calvin soils 40 percent. Gently sloping Albrights and Brinkerton soils along drainageways and Barbour, Basher, and Atkins soils on flood plains along the streams make up the other 10 percent.

About 70 percent of the association is used for crops and pasture, and the rest is wooded. Almost all the crops are grown on the gently sloping uplands and the narrow flood plains. Part of the association has been farmed, then abandoned and left to grow up in Virginia pine. About 45 percent of the pulpwood cut in the county comes from previously cropped fields in this association.

The Calvin soils are more productive than the more droughty Klinesville soils, but both must be limed and fertilized heavily if crops are grown. Most of the cultivated areas are in small or low-producing farms. Many of the farmers work off the farm. There are some commercial dairy farms. Some areas of the association are used for campsites and summer homes, especially in areas of Brinkerton or Albrights soils, because these soils generally provide good sites for ponds.

***Figure 2.*—A typical landscape of the Klinesville-Calvin association. Calvin soils are dominant in cleared areas, and Klinesville soils on steeper, wooded slopes.**

If homes that have basements are built on soils of this association, some bedrock generally must be quarried. If a septic system is not properly located, the effluent can seep into cracks in the bedrock and contaminate wells.

3. Laidig-Buchanan-Andover Association

Deep, well-drained to poorly drained, gravelly and stony soils on foot slopes of mountains

This soil association is made up of soils on the foot slopes of mountains. Most of the association is wooded. The soils developed in colluvial material that moved down the slope by gravitational creep. Most of the soils are stony or very stony, and small areas are gravelly. This association makes up about 6 percent of the county.

The well-drained Laidig soils are in the steep to gently sloping, high parts of the association. They occupy 60 percent of the total area. The moderately well drained to somewhat poorly drained Buchanan soils occupy 25 percent of the association, and they lie mostly below areas of Laidig soils. The rest of the association is made up of the poorly drained to somewhat poorly drained Andover soils, which are in depressions, and other areas where seepage from higher areas accumulates.

All the soils in this association are acid, and exceptionally good management is required to keep them productive. At present most of the association is wooded. About 10 percent is cleared and used as pasture. Timber production is probably the best potential use of the soils. The potential for recreational uses is good where a supply of water is available.

4. Weikert-Berks Association

Shallow and moderately deep, well-drained, brownish shaly soils in intermountain valleys

This association is mostly in the central part of the county in the intermountain valleys. Prominent features of the landscape are the rolling shale hills, the steep, wooded hollows, and the narrow flood plains. Most places are around 950 feet above sea level, but the elevation ranges from 600 feet on the narrow flood plains to 1,100 feet on tops of the rolling shale hills. The association makes up about 24 percent of the county.

The soils have a shaly or channery, medium-textured surface layer. They have low to moderate available moisture capacity. The shallow Weikert soils are on the steeper, rolling slopes and in the steep, wooded hollows. They make up about 60 percent of the association. The moderately deep, well-drained Berks soils are on both gently sloping hilltops and strongly sloping hillsides. They make up about 30 percent of the association. Nearly 10 perecnt of the association is Ernest and Brinkerton soils on the gentle slopes beside drainageways. Small areas of Pope, Philo, and Atkins soils are on the flood plains along streams.

About 65 percent of the association is used for crops and pasture. Almost all the crops are on the gently sloping and sloping soils of the uplands and on the narrow flood plains. About 35 percent of the association is wooded. Part of the association has been farmed, then abandoned and left to grow up in Virginia pine. About 55 percent of the pulpwood cut in the county comes from previously cropped fields in this association.

Except for the very strongly sloping to very steep soils, most of the soils are suited to farming. The Berks soils are more productive than the droughty Weikert soils, but both should have heavy additions of lime and fertilizer if crops are grown. Most of the cultivated soils in this association are in low-producing or part-time farms. Many of the farmers work off the farm. There are some commercial dairy farms. Parts of the association are favored for campsites and summer homes, especially in areas of Brinkerton and Ernest soils that provide good sites for ponds.

If homes that have basements are built on soils of the association, some bedrock generally must be quarried. If a septic system is not properly located, the effluent can seep into cracks in the bedrocks and contaminate wells.

5. Frankstown-Elliber Association

Deep, well-drained, cherty soils on ridges and foot slopes

This association is on gently sloping to steep ridges in the intermountain valleys where the bedrock is cherty or very cherty limestone. The tops of these ridges are about 1,000 feet lower than the tops of the mountains and 150 feet higher than the adjacent valleys. The largest area of this association is in the south-central part of the county on Stillwell and Tonoloway Ridges and their foot slopes on the Pigeon Cove side, between Pigeon Cove and the Maryland State line. A smaller area of the association is on the ridge west of Fort Littleton. The ridgetops of this association are wooded, and only their less steeply sloping foot slopes are farmed. This association makes up about 2 percent of Fulton County.

The deep, well-drained Frankstown soils make up about 60 percent of the association. They lie on the cherty, gently sloping to steeply sloping foot slopes. They are some of the best soils in the county for farming. The deep, well-drained, very cherty Elliber soils occupy wooded ridgetops and make up about 35 percent of the association. Minor soils are the moderately well drained soils in depressions and drainageways. The soils have formed in soil material that moved downward from higher slopes by gravitational creep.

All of the soils in this association are acid, unless they have been limed. Good management is needed to control erosion and to keep the soils productive. Most of the Frankstown soils have been cleared and are being farmed. Almost all of the Elliber soils are wooded. Both of these soils contain enough chert to make farm machinery wear out sooner than on other soils in the county. When Frankstown soils are fertilized properly, they are especially desirable for farming.

Gently sloping and sloping soils of this association generally make attractive building sites. The effluent from a septic system, however, is likely to flow through channels in the underlying limestone and reach the ground water to pollute wells.

6. Bedington-Edom Association

Deep to shallow, well-drained, dominantly shaly soils on ridges and hillsides

This association is in two widely separated parts of the county. Two small areas are near Fort Littleton, and a

Figure 3.—**Typical landscape showing the Bedington-Edom association in cleared areas in the foreground and the Frankstown-Elliber association on steeper, wooded ridges in the background.**

larger one is surrounded by the Frankstown-Elliber association (fig. 3) that extends from Pigeon Cove to the Maryland State line. Prominent features of the landscape are the rounded, rolling shale hills and a few wooded areas in the steeper hollows. Elevation in this association is mostly about 650 feet, but it ranges from 580 feet on the flood plains to 700 feet on the hilltops. The association makes up about 2 percent of the county.

The soils are shaly and have a medium-textured surface layer. Except where they have been severely eroded, they have moderate capacity to hold moisture that is available to plants. In 90 percent of this association, the soils are Bedington and Edom shaly silt loams. In the rest there are Hagerstown soils in the uplands, Wiltshire and Lawrence soils on gentle slopes adjacent to drainageways, and Lindside and Melvin soils on flood plains. The Bedington soils and the Edom soils are mostly in alternate strips too narrow to be shown separately on the detailed soil map. Such areas are mapped as Bedington-Edom complexes. The Bedington soils are more shaly than the Edom soils, and they make up about 70 percent of the area of the Bedington-Edom complexes.

About 85 percent of the association is in crops and pasture; 15 percent is wooded. Most of the crops are grown on commercial dairy farms. A number of farmers work off the farm.

The soils of this association are slightly more productive than those of the Klinesville-Calvin or the Weikert-Berks associations.

Water flows along some of the cracks in the shale that underlies the major soils. If a septic system is not properly located, the effluent can seep into cracks in the bedrock and contaminate wells.

7. Murrill-Wiltshire Association

Deep, well drained and moderately well drained, gravelly soils at the base of mountains

This association is in Big Cove. It surrounds and lies slightly higher than the Hagerstown association. Elevation ranges from 800 feet on the flood plains to about 1,100 feet on the hilltops but is mostly around 900 feet. The association makes up about 3 percent of the county.

The soils have a gravelly surface layer and moderate to high capacity to hold moisture that is available to plants.

The well drained Murrill soils lie slightly higher than the moderately well drained Wiltshire soils. Murrill and Wiltshire soils are about equal in area, and together they make up about 80 percent of the association. About 10 percent of the association consists of the somewhat poorly drained to poorly drained Lawrence soils. The rest is Lindside and Melvin soils on the flood plains along streams.

About 70 percent of the association is used for crops and pasture. The rest has never been cleared and is wooded. All the soils are acid unless they have been limed, and good management is needed to control erosion and to maintain productivity. Some drainage of the Wiltshire and Lawrence soils is needed if crops are grown. Most of the farms are commercial dairy farms. Around McConnellsburg many new houses are being built on soils of this association.

The soils of this association have more limitations for homes and other buildings than soils of the Hagerstown association. The gravel fragments are troublesome in tilled fields and in lawns. Wells in the Murrill soils can be contaminated by sewage from septic tanks. The Wiltshire and Lawrence soils have a seasonal high water table.

8. Hagerstown Association

Deep, well-drained, medium-textured soils in intermountain valleys

This soil association is in Big Cove, which extends from McConnellsburg to Webster Mills in the eastern part of the county (fig. 4). Prominent features of the landscape are the rolling topography and the scattered sinkholes that were formed by solution of the underlying limestone. Elevation ranges from 700 to 900 feet. This association makes up about 2 percent of the county.

The Hagerstown soils have a medium-textured surface soil, which in some places is 5 to 10 percent chert. They are in the uplands and make up about 85 percent of the association. About 5 percent of the association is Frankstown soils, also in the uplands; the rest consists of minor soils. Lawrence soils are on gentle slopes adjacent to drainageways, and Pope, Lindside, and Melvin soils are on flood plains along the streams.

About 95 percent of the association has been cleared and is farmed. All of the soils in this association are acid unless they have been limed, and good management is needed to control erosion and to maintain productivity. The high production when fertilizer is applied makes the soils desirable for farming. Most of the farms are commercial dairy farms.

Figure 4.—**Typical landscape of the Hagerstown association in the valley south of McConnellsburg.**

Many houses are being built on soils of this association. If homes are built beyond sewage and water-supply systems, the effluent from septic systems can flow through solution channels in the underlying limestone and reach the water in wells some distance away. Contamination of the ground water no doubt will become more of a problem in this association as more homes are built.

Use and Management of the Soils

This section of the survey deals with the soils of the county in relation to various uses and methods of management.

In the first part the system of capability classification used by the Soil Conservation Service is explained. Then, the capability units, or groups of soils that have similar management, are discussed and suitable crops or other uses and the main needs for management are described. The second part gives estimates of the productivity of the soils for various crops under two levels of management. In the third part the productivity of the soils for forest products is discussed. This is followed by a discussion of wildlife and the suitability of the various soils for the production of game and for wildlife habitats. Another part gives data from engineering tests, estimated engineering properties of the soils, and interpretations of soil properties that influence engineering work. The last part deals with selected nonfarming uses of the soils in community developments and for recreation.

Capability Groups of Soils

Capability classification is the grouping of soils to show, 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 classification does not apply to most horticultural crops, or to rice and other crops that have their own special requirements. 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. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

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

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

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

Class IV. Soils 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 have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (None in Fulton County.)

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

Class VII. Soils 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 have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States, but not in Fulton County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only 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, 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–I or IIIe–2. 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 paragraphs. The Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

Described in the following pages are the capability units in Fulton County. The soils in any one unit are similar in the kind of management they require, and in their response to that management.

Certain practices basic to good soil management can be mentioned before describing the individual capability units. Fundamental is the selection of a suitable crop rotation, and application of conservation practices that will supplement this rotation in maintaining productivity of the soil and in controlling wetness or erosion. The practices to be applied depend on the nature of the soil and the intensity of the rotation used.

Conservation practices that can be applied on sloping soils are contour stripcropping, terraces, and sod waterways. On sloping, wet soils, surface water can be removed and erosion can be controlled by use of graded strips, terraces, and grassed waterways. Subsurface water can generally be removed by random tile lines or open ditches if suitable outlets are available.

Practices to maintain and improve the organic-matter content and soil structure, and to reduce erosion, include the growing of winter cover crops, stubble mulching, minimum tillage, and the growing of green-manure crops. Such practices are needed most if the rotation is intensive or the cultivation is continuous.

Lime and fertilizer should be applied according to soil tests and the needs of the crops.

Additional help in managing the soils can be obtained by consulting the local representatives of the Soil Conservation Service, the County Extension Service, or members of the staff of the State Agricultural Experiment Station.

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 and the capability unit in which each one has been grouped, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–1

In this capability unit are deep, well-drained, nearly level Barbour and Pope soils of the flood plains and upland drainageways. They formed from acid or limy sediments that were deposited by the streams. These soils have moderate to moderately rapid permeability and moderate to high capacity to hold moisture that plants can use. They range from very strongly acid to neutral, and they have high natural fertility. They are subject to occasional floods late in winter or early in spring.

The soils of this unit are suited to many kinds of crops, including truck crops, hay, and pasture. Corn, small grains, and alfalfa grow well. If the entire crop is removed, as when corn is cut for silage, the supply of organic matter is likely to become depleted. The supply can be replenished by growing a green-manure crop or by adding livestock manure. Corn can be grown year after year without damage to the soils if maintenance applications of fertilizer and lime are made, and if the crop residues are shredded and left on the surface during winter. Sod cover in the natural waterways where floodwater flows, and in the depressions formed by scouring, will generally prevent further washing in those places.

CAPABILITY UNIT IIe–1

In this unit are deep, well-drained soils that developed in material weathered from limestone or in mixed material that had a high content of lime. They are gently sloping, have a medium-textured surface layer, and have been moderately eroded. They are Frankstown, Hagerstown, and Murrill soils. Except for the Hagerstown soil, they contain enough fragments of chert or other stones to make tillage difficult. They are moderately permeable, and they have

Figure 5.—Contour stripcropping in an area of capability unit IIe-1 on Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded.

high capacity to hold moisture that plants can use. They are fertile, and they range from strongly acid to neutral.

The soils of this unit are suited to most crops grown in the county, including hay and pasture. If excessive removal of crops tends to deplete the organic matter, a green-manure crop should be grown or other organic matter, such as livestock manure, should be applied. An example of a 4-year rotation that does not cause damage to the soil is one consisting of a row crop followed by a cover crop for 1 year, a row crop, a small grain, and hay or pasture, each for 1 year. Contour stripcropping helps reduce runoff and control erosion (fig. 5). On most slopes longer than 300 feet, diversion terraces are needed to control runoff.

CAPABILITY UNIT IIe-2

This unit consists of deep, well-drained soils that developed in acid materials. They are gently sloping, moderately eroded Allegheny and Laidig soils. They contain enough gravel to make tillage difficult. They have moderate to moderately slow permeability and high capacity to hold moisture that plants can use. Their natural fertility is moderate, and their reaction is extremely acid to slightly acid.

The soils of this unit are suited to many kinds of crops, including hay and pasture. Corn, small grains, and alfalfa grow well. If excessive removal of crops tends to deplete the organic matter, a green-manure crop should be grown or other organic matter, such as livestock manure, should be applied. An example of a 3-year rotation that can be followed without damage to the soil is one consisting of a row crop, a small grain, and hay, each for 1 year. Contour stripcropping reduces runoff and helps to control erosion. If the slope is longer than 300 feet, diversion terraces probably are needed to help control runoff. Natural depressions and waterways should be left in sod.

CAPABILITY UNIT IIe-3

This unit consists of gently sloping, deep, moderately well drained to somewhat poorly drained soils that have a fragipan in the subsoil. They are Albrights, Buchanan, Ernest, Monongahela, and Wiltshire soils. These soils formed in material that was derived from limestone, shale, or sandstone, or in the material of old water-laid deposits. Permeability is moderate in the surface layer and moderately slow or slow in the subsoil. The capacity is moderate to hold moisture that plants can use. Natural fertility is moderate to high. The reaction ranges from extremely acid to neutral. The Buchanan and Wiltshire soils have enough gravel on the surface and in the soil to make tillage difficult.

The soils of this unit are moderately well suited to corn, small grains, adapted varieties of alfalfa, and pasture. Deep-rooted crops do not yield so well on these soils as on well-drained soils. A 3-year rotation consisting of a row crop, a small grain, and hay, each for 1 year, will give satisfactory protection from erosion if runoff is controlled and fertility is maintained. Cover crops are needed to maintain organic matter, and the residue from harvested crops should be mixed with the surface soil. Sodded natural drainageways, graded stripcropping, or diversion terraces will provide surface drainage and help control erosion. Seep areas can be drained by random lines of tile.

CAPABILITY UNIT IIe-4

This unit consists of moderately deep and deep, well-drained, gently sloping, moderately eroded, channery and shaly soils that developed in limy or in acid materials. They are soils of the Bedington, Berks, Calvin, Edom, and Leck Kill series. Most of the soil mapping units are complexes or undifferentiated units that have in them soils of two of these series. All the soils of this capability unit have a medium-textured surface layer and medium-textured to moderately fine textured subsoil. Their permeability is moderate, and their capacity is moderate to hold moisture that plants can use. Natural fertility of these soils is moderate to high, and the reaction ranges from extremely acid to neutral.

These soils are moderately well suited to corn, alfalfa, and pasture. The organic-matter content and structure of the soils can be maintained by following a 3-year rotation of corn, small grain, and hay. Growing cover crops, working crop residues into the soil, and practicing minimum tillage all help to control runoff and erosion. These practices and contour stripcropping are effective for control of erosion on short slopes. Contour strips and diversion terraces are needed if the length of slope is more than 300 feet.

CAPABILITY UNIT IIw-1

In this capability unit are deep, moderately well drained to somewhat poorly drained, medium-textured soils of the flood plains. They are Basher, Lindside, and Philo soils. The soils of this unit formed in sediments deposited by streams. They are nearly level. Permeability is moderate, but the capacity to hold moisture for plants is high. Natural fertility is high, and the reaction ranges from strongly acid to neutral. These soils are subject to occasional floods, and most of these floods occur late in winter or early in spring. The water table is high during part of each year.

These soils are suited to most general farm crops and to pasture. Corn, small grains, adapted varieties of alfalfa, and other farm crops grow well. Deep-rooted crops do not grow so well, however, as they do on the well-drained soils of the flood plains. Corn can be grown year after year if tillage is kept to a minimum, cover crops are grown, and crop residues are shredded and left on the surface during winter. It is necessary to maintain good organic-matter content and good structure in the surface soil.

Drainage is needed for the best growth of corn and other crops. Diversion terraces can be used to protect the soils from runoff that flows from higher areas. Maintaining sod in the natural waterways and depressions helps to prevent scouring by floodwaters.

CAPABILITY UNIT IIIe-1

In this unit are deep, well-drained soils that developed in material weathered from limestone, in mixed material that has a high content of lime, or in acid colluvium. They are Frankstown, Hagerstown, Laidig, and Murrill soils. Most of the soils of this unit are sloping and moderately eroded. All of the soils except the Hagerstown are gravelly or cherty enough to make tillage difficult, although they can be cultivated. Permeability of the soils is moderate to moderately slow, and their capacity for holding moisture for plants is high. Natural fertility is high, and the reaction ranges from extremely acid to neutral.

These soils are suited to many kinds of crops and to pasture. Corn, small grains, and alfalfa grow fairly well. The soils are subject to severe erosion if they are cultivated and not protected, but they are suitable for farming if conservation practices are applied. A suitable 4-year rotation consists of a row crop, a small grain, and hay for 2 years. With such a rotation, contour stripcropping, diversion terraces, and minimum-tillage practices are needed to help control erosion. Shredding cornstalks or other residue from the row crop, or growing a cover crop after the row crop, will further protect the soil. The natural waterways should be maintained in sod.

CAPABILITY UNIT IIIe-2

The soil in this unit is Buchanan gravelly loam, 8 to 15 percent slopes, moderately eroded. It is a moderately well drained to somewhat poorly drained soil that has a fragipan in the subsoil. This soil formed in colluvium that was derived from acid shale and sandstone. Permeability is moderate in the surface soil and slow in the subsoil. The capacity is low to moderate for holding moisture that plants can use. Natural fertility is high, and the reaction is strongly acid to extremely acid. The soil is gravelly enough to make cultivation difficult, but it can be cultivated.

This soil is moderately well suited to corn, small grains, and adapted varieties of alfalfa and of pasture plants. Deep-rooted crops do not grow so well on it as on the well-drained soils. A suitable rotation consists of a row crop for 1 year, a small grain for 1 year, and hay for 2 or more years. In such a rotation the crops should be grown in graded strips and diversion terraces should be installed. A cover crop is needed after the row crop, unless residue from the row crop is mixed with the surface soil. Seepy areas can be drained by random tile lines.

CAPABILITY UNIT IIIe-3

This unit consists of shallow to moderately deep, well-drained, channery or shaly soils that developed in limy or in acid materials. They are soils of the Bedington, Edom, Berks, Calvin, Klinesville, and Weikert series. These soils are gently sloping or sloping, and some of them have been moderately eroded. Some of the mapping units are complexes that have in them soils of two of these series. Permeability of the soils in this capability unit ranges from moderately slow to moderately rapid. Their capacity is moderate to low for holding moisture that plants can use. Natural fertility is low or moderate, and the reaction ranges from extremely acid to neutral.

These soils are suited to many kinds of crops and to pasture. Corn, small grains, and alfalfa grow well on them. The moderate to low available moisture capacity of the soils is the limiting factor for production of most crops, especially corn. The organic-matter content and the structure of the surface soil can be maintained by following a rotation consisting of a row crop for 1 year, a small grain for 1 year, and hay for 2 or more years. Growing cover crops, working crop residues into the surface soil, and practicing minimum tillage help to control erosion and to conserve moisture. Contour strips and diversion terraces are also needed to control erosion and reduce runoff, especially on the sloping soils if the length of slope is more than 300 feet.

CAPABILITY UNIT IIIw-1

This unit consists of deep, nearly level, medium-textured, somewhat poorly drained to poorly drained soils that are not subject to flooding. They developed in acid or in limy materials. They are soils of the Lawrence and Tygart series. Their permeability is slow to moderately slow, and they have high to moderate capacity for holding moisture that plants can use. The natural fertility is high to moderate, and the reaction ranges from very strongly acid to neutral.

These soils are best suited to shallow-rooted crops, such as birdsfoot trefoil, timothy, and bluegrass. They are only fairly well suited to corn and to spring-sown small grain. They are suited to pasture. If they have not been artifically drained, a suitable rotation consists of a row crop for 1 year, a small grain for 1 year, and hay for 2 or more years. After drainage, these soils are suited to a more intensive rotation. The organic-matter content can be maintained by growing cover crops and plowing under crop residues. Diversion terraces help control the runoff from higher areas. Bedding can be used to provide surface drainage, and tile drains can be installed if an outlet is available. Animals should not be allowed in pastures until the soil has dried enough that it will not be damaged by trampling.

CAPABILITY UNIT IIIw-2

This unit consists of somewhat poorly drained to poorly drained, medium-textured, nearly level soils of the flood plains. They are soils of the Atkins and Melvin series. The permeability of these soils is moderately slow. The capacity is high to hold moisture that plants can use. Their natural fertility is moderate, and the reaction ranges from very strongly acid to neutral. These soils are flooded from time to time in winter and early in spring. A few areas are also flooded occasionally during the cropping season, but usually for only a few hours. The water table in these soils is high during much of the year. Scouring is done by the floodwaters, but there is no other erosion. Figure 6 shows a typical area of a soil in this unit.

If artifically drained, these soils are suited to corn, small grains, shallow-rooted legumes, adapted varieties of alfalfa, and pasture. Crops do not grow so well as on the better drained soils of the flood plains. The soil structure and organic-matter content can be maintained by following a 3-year rotation made up of a row crop, a small grain, and hay. Cover crops should be plowed under to help maintain the soil structure and organic-matter content. Artificial drainage can be provided by open drainage and bedding, or by tile drains if outlets are available. Location of suitable outlets for tile is likely to be difficult. Cleaning

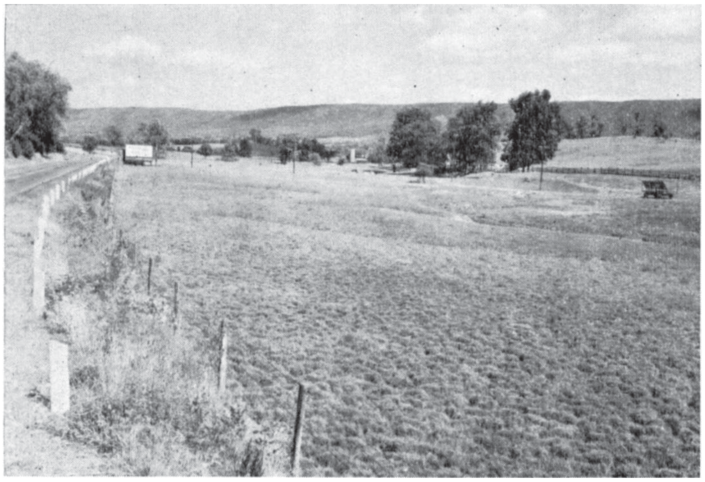

Figure 6.—**Typical area in capability unit IIIw-2. The soil in the foreground is Melvin silt loam.**

streams and straightening channels will reduce flooding. A cover of sod should be maintained in channels that carry floodwaters and in depressions caused by scouring.

CAPABILITY UNIT IIIs-1

The only soil in this unit is Elliber very cherty loam, 3 to 8 percent slopes, moderately eroded. It is deep and well drained. It has enough chert fragments on the surface and throughout its depth to make tillage difficult and to make tillage equipment wear out rapidly. Permeability is moderately rapid, and the capacity is moderate to hold moisture that plants can use. Natural fertility is moderate, and the reaction ranges from strongly acid to neutral.

This soil is suited to many kinds of crops and to pasture. Corn, small grains, and alfalfa grow well. If a rotation no more intense than 1 year of corn, 1 year of small grain, and 1 year of hay is followed, the risk of erosion is fairly low. The expense of the excess wear on tillage equipment makes this soil best suited to a rotation of low intensity. If annual crops are grown, contour stripcropping is needed to help reduce runoff and control erosion.

CAPABILITY UNIT IVe-1

This unit consists of deep, well-drained soils that developed in weathered limestone or in acid materials. They are moderately steep, moderately eroded soils of the Frankstown, Hagerstown, and Laidig series. Except for the Hagerstown soil, they have enough stone or chert fragments on the surface and in the soil to make tillage difficult. They are moderately to moderately slowly permeable and have moderate to high capacity to hold moisture that plants can use. Their fertility is high to moderate, and their reaction ranges from very strongly acid to neutral.

These soils are best suited to long-term hay and pasture. An alfalfa-grass mixture grows well. When reseeding is needed, a suitable rotation consists of a row crop for 1 year, a small grain for 1 year, and hay or pasture for several years. Long slopes should be reseeded in strips on the contour, so that only part of the slope is cultivated each year. Diversion terraces are needed to control runoff on long slopes, and sod should be maintained in the natural waterways and the terrace outlets.

CAPABILITY UNIT IVe-2

This unit consists of moderately deep to shallow, well-drained, medium-textured, channery and shaly soils that are sloping to moderately steep and have been moderately to severely eroded. They are members of the Bedington, Berks, Calvin, Edom, Klinesville, and Weikert series. Some of the mapping units are complexes that have in them soils of two of these series. Permeability of all these soils is moderate to moderately slow, and their capacity is moderate to low for holding moisture that plants can use. Natural fertility is low to moderate, and the reaction ranges from extremely acid to neutral.

These soils are not suited to intensive use for cultivated crops. They are best suited to long-term hay, but an occasional row crop can be grown when hay is reseeded. Long slopes should be reseeded in contour strips so that only part of the field is cultivated in any one year. Diversion terraces and grassed waterways are needed to control runoff on long slopes. In well-managed pastures, deep-rooted grasses and legumes grow well.

CAPABILITY UNIT IVw-1

This unit consists of deep, somewhat poorly drained to poorly drained, nearly level and gently sloping, slightly to moderately eroded soils formed in medium-textured, colluvial material that was derived from acid shale, siltstone, and sandstone. They are Andover and Brinkerton soils and the poorly drained variant of the Tygart series. The permeability of these soils is moderately slow, and they have a high water table much of the year. The chief limitation of the soils is their poor or somewhat poor drainage. The available moisture capacity is moderate to high. Fertility is moderate to low, and the reaction ranges from extremely acid to neutral.

If drained, these soils are suited to row crops and to moisture-tolerant small grains, legumes, and grasses. If not drained, they are suited only to grasses and to legumes that tolerate wetness. The drained soils of this unit are suited to a rotation consisting of 1 year of a row crop, 1 year of a small grain, and 1 year of hay. The organic-matter content can be maintained by growing cover crops and plowing under crop residues. Diversion terraces can be built to protect these soils from runoff and seepage that come from higher areas. Graded strips are needed on long, gentle slopes to control runoff. Tile drains, bedding, or open drains can be used to provide drainage. Because the soils are wet in winter, their use for pasture needs to be delayed in spring until they have dried enough that livestock will not damage them by trampling.

CAPABILITY UNIT IVs-1

The soils in this unit are deep, well drained, and cobbly or very cherty. They are gently sloping to sloping, and they have been only slightly or moderately eroded. They are soils of the Elliber, Laidig, and Murrill series. Chert and cobblestones make tillage very difficult. The permeability of these soils is moderately slow to moderately rapid, and their capacity is moderate to high for holding moisture that plants can use. Natural fertility is moderate, and the reaction ranges from strongly acid to neutral.

These soils will produce corn, small grains, and deep-rooted grasses and legumes. Alfalfa grows well. The slopes and the chert or cobblestones make tillage expensive, because equipment wears out rapidly. These soils are better suited, therefore, to long-term hay or pasture than to intertilled crops or small grain. Long slopes should be protected by diversion terraces that control runoff. Cultivation on the contour also helps control runoff when row crops are grown. Sod should be maintained in the waterways.

CAPABILITY UNIT VIe-1

The soil in this unit is Frankstown cherty silt loam, 25 to 35 percent slopes, moderately eroded. Its permeability is moderate, and it has high capacity to hold moisture for plants. Natural fertility is high, and the reaction ranges from strongly acid to slightly acid. The chief limitation of this soil is its steepness and the risk of erosion.

This soil is suited to pasture and trees. It is a fertile soil, but it is too steep to be used safely for cultivated crops. It would produce good hay, but harvesting the crop would be difficult. The carrying capacity of pasture is not so great on this soil as on soils that are less steep, but it is greater than on any of the other soils of class VI.

CAPABILITY UNIT VIe-2

This unit consists of well-drained, gently sloping to steep soils formed in material that was weathered from shaly limestone, acid shale, siltstone, and sandstone. They are soils of the Bedington, Edom, Hagerstown, Klinesville, and Weikert series. They range from shallow to deep, and they have been moderately to severely eroded. Their permeability is moderately slow to moderately rapid. The capacity is moderate to low for holding moisture that plants can use. Natural fertility is moderate to low, and the reaction ranges from extremely acid to neutral.

The risk of erosion is very high if these soils are cultivated. The soils can be used for pasture and for trees. Because the soils are shallow and eroded, they are droughty. The carrying capacity of pasture is less on these soils than on the other soils of class VI, particularly during hot, dry weather. Pastures can be reseeded, when necessary, with bluegrass, birdsfoot trefoil, and other grasses and legumes. Reseeding should be done in narrow strips on the contour to help control erosion and to retain moisture for the new seedlings.

CAPABILITY UNIT VIs-1

This unit consists of somewhat poorly drained to well-drained, gently sloping to steep, very cherty, rocky, or stony soils. They are moderately deep to deep soils developed in material that was derived from sandstone, shale, siltstone, or limestone. They are soils of the Buchanan, Cookport, Dekalb, Elliber, Hagerstown, Laidig, and Murrill series. The degree of erosion ranges from slight to moderate. Permeability of these soils ranges from moderately slow to rapid. Their capacity is moderate to high for holding moisture that plants can use. Their natural fertility is high or moderate, and the reaction ranges from extremely acid to neutral.

Because of chert, large stones, or rock outcrops, these soils are suited only to pasture or trees. Some areas of Hagerstown and Elliber soils have been cleared and cultivated. Most areas of the other soils are in forest, although a few areas are used for pasture. The areas now forested should remain in trees. In cleared areas where the use of light farm equipment is feasible, pastures of bluegrass and white clover can be developed. The pastures should be fertilized and limed. Control of weeds and brush is generally difficult. Cleared areas that are not being used for pasture should be planted to trees.

CAPABILITY UNIT VIIe-1

This unit consists mostly of shallow, well-drained, moderately steep to very steep soils formed in material that was derived from shale, siltstone, or limestone. The soils are members of the Hagerstown, Klinesville, and Weikert series. Areas of Made land are also in this unit. The named soils have been moderately to severely eroded, and the areas of Made land have been shaped by excavating or by moving soil and rock material. Permeability is moderate to moderately rapid, and the capacity is low for holding moisture that plants can use. Natural fertility is moderate to low, and the reaction ranges from extremely acid to neutral.

The soils and the land type of this unit are not suited to crops or pasture. They are too steep or too severely eroded (fig. 7). They are only fair for trees because they have low available moisture capacity. The areas that have been cleared should be planted to trees or to shrubs or other plants that will provide food and cover for wildlife. With proper protection, the soils are likely to be more productive as forests or as wildlife land than for any other use.

CAPABILITY UNIT VIIs-1

This unit consists mostly of moderately deep to deep, steep to very steep, very stony or very rocky soils. These soils developed in material that was derived from limestone or sandstone. They are soils of the Dekalb, Hagerstown, Laidig, and Lehew series. Some areas of Strip mine spoil are also in this unit. The soils have moderately slow to moderately rapid permeability and moderate to high capacity for holding moisture that plants can use. Their natural fertility ranges from low to high, and their reaction, from extremely acid to neutral.

The soils in this unit are suited to some species of trees, but they are only fair for forestry. Growth of trees is very poor on the areas of Strip mine spoil. The soils are poorly suited to any use except forestry. Logging is difficult in

Figure 7.—**The sloping field is an example of soils in capability unit VIIe-1. The soils are Klinesville-Weikert channery silt loams that have slopes of 25 to 35 percent.**

many places on the soils of this unit. Selective cutting of the trees, if it is feasible, is probably the best method of maintaining a continuous stand of productive trees and a good protective cover on the soils. Logging trails should be protected from erosion, and fire lanes should be cleared in the forests as part of the management.

CAPABILITY UNIT VIIs-2

The soil in this unit is Andover very stony silt loam, 0 to 8 percent slopes. It is a deep, somewhat poorly drained to poorly drained soil that is wet much of the year. Its natural fertility is moderate or low, and its reaction in most places is extremely acid or strongly acid.

This soil is not suited to pasture and is only fairly well suited to trees. It is wet in spring and, as a result, the movement of logs or equipment over it is difficult. Trees should be cut selectively, and cutting should be made to improve the stand. Small areas can be planted to trees and shrubs that provide food and cover for wildlife.

CAPABILITY UNIT VIIIs-1

This unit consists of Rubble land, a rocky land type on the tops and upper slopes of mountains. It has little potential for producing vegetation.

This land type is suited only to use as wildlife land and for scenery. Growth of trees is very poor. Vegetation of any kind can be valuable for watershed protection, although little erosion occurs on the rocky surface. The only economic value of this unit is as a possible source of stones and boulders.

Estimated Productivity of the Soils

Table 1 shows estimated productivity ratings of the soils for representative field crops, hay, and pasture. These ratings are based on the yields of crops grown during an average growing season when rainfall is adequate and other climatic conditions are normal. Each productivity rating denotes the productivity of the soil for a particular crop in relation to a standard index of 100. The standard index represents a high average yield per acre, but not the maximum that is obtainable. The yield per acre that is represented by the standard index of 100 is given at the head of the columns for each crop.

The ratings are given for two levels of management. In columns A are ratings based on the yields to be expected under prevailing or normal management. These ratings are based on records of yields over a period of years and under the average management that is practiced by most of the farmers of the county. In columns B are ratings that indicate yields that may be obtained in an average season when improved management is practiced. Improved management includes the applicable soil and water conservation practices and other agronomic practices designed to produce the highest profitable yields.

Practices that are needed to obtain the yields represented by ratings in columns B include the growing of adapted varieties, the use of high-quality seed, and planting at the optimum rate. Also at this high level of management, the farmers follow a suitable sequence of crops. They grow cover crops and make maximum use of crop residues. They provide for control of surface water, and they make sure that the water-disposal system is adequate. They install adequate surface or subsurface drainage if any is needed. They control weeds, insects, and diseases, and they perform all their farming operations in the proper sequence and at the proper time.

Ratings are not given in table 1 for any soil that is not suited to growing the crop listed at the head of a column.

Woodland [1]

The original forest cover of Fulton County consisted chiefly of various species of oak, chestnut, and pine. Pitch pine was prominent in the high mountain areas. The virgin stands were removed by lumbering, and the chestunt trees were killed by blight between 1912 and 1920. Some sprouts still grow from the chestnut roots that remain, but they, too, are soon killed by the blight.

At the time this soil survey was made, commercial woodland occupied 64 percent of the county. The trees consist entirely of second- and third-growth stands. In the mountains where the forests have been burned repeatedly, as on Sideling Hill near Akersville, the chief trees are aspen and scrub oak. In the intermountain valleys the forest cover is mainly a mixed stand of oak and Virginia pine. In fields that have been farmed and abandoned, the forest cover is almost all Virginia pine until those trees are harvested; then mixed oaks become dominant.

The principal forest types (*15*)[2] that make up the present woodland and the extent of each as given by the U.S. Forest Service (*20*) are as follows:

	Percentage of total woodland in the county
Red oak Northern red oak predominates. Associates are black oak, scarlet oak, chestnut oak, and yellow-poplar.	27
Chestnut oak Chestnut oak is pure or predominates. The common associates are scarlet oak, black oak, pitch pine, blackgum, and red maple.	26
Hard pine-oak Virginia pine and southern red oak predominate. Among the associates are black oak, scarlet oak, and white oak. Associated also are shortleaf pine, blackgum and hickory; and, in the foothills, pitch pine, Table-Mountain pine, and chestnut oak.	17
Oak-white pine Eastern white pine and chestnut oak predominate. Yellow-poplar, red oak, white oak, hemlock, hickory, and other species are associates in the coves and on lower northern exposures. Scarlet oak, red maple, pitch pine, blackgum, and other dry-site species are associates on southern exposures, upper slopes, and ridges.	14
White oak White oak predominates. The common associates are black oak, red oak, shagbark hickory, bitternut hickory, ash, and yellow-poplar.	10
Other forest types	6

[1] By V. C. MILES, woodland specialist, Soil Conservation Service.
[2] Italicized numbers in parentheses refer to Literature Cited, p. 92.

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

[In columns A are productivity ratings for normal management, and in columns B are ratings for improved

Symbol	Soil series	Corn (100=112 bu. of grain or 23 tons of silage per acre)		Oats (100=56 bu. per acre)		Wheat (100=36 bu. per acre)	
		A	B	A	B	A	B
AbB2	Albrights silt loam, 3 to 8 percent slopes, moderately eroded.	50	80	50	100	50	95
AgB2	Allegheny gravelly loam, 3 to 8 percent slopes, moderately eroded.	60	95	55	115	60	110
AnB2	Andover gravelly silt loam, 3 to 8 percent slopes, moderately eroded.	40	75	----------	80	----------	75
AoB	Andover very stony silt loam, 0 to 8 percent slopes	----------	----------	----------	----------	----------	----------
At	Atkins silt loam	55	80	----------	95	----------	80
Ba	Barbour fine sandy loam	75	110	80	130	75	120
Bc	Basher silt loam	70	85	90	115	90	115
BdB2	Bedington-Edom shaly silt loams, 3 to 8 percent slopes, moderately eroded.	55	85	55	100	55	110
BdC2	Bedington-Edom shaly silt loams, 8 to 15 percent slopes, moderately eroded.	55	80	50	90	50	85
BdD2	Bedington-Edom shaly silt loams, 15 to 25 percent slopes, moderately eroded.	50	75	45	80	45	80
BdD3	Bedington-Edom shaly silt loams, 15 to 25 percent slopes, severely eroded.	----------	----------	----------	----------	----------	----------
BeB2	Berks channery silt loam, 3 to 8 percent slopes, moderately eroded.	50	75	50	95	45	90
BeC2	Berks channery silt loam, 8 to 15 percent slopes, moderately eroded.	45	70	45	90	45	85
BeD2	Berks channery silt loam, 15 to 25 percent slopes, moderately eroded.	40	60	40	85	40	80
BrA	Brinkerton silt loam, 0 to 3 percent slopes	35	60	----------	75	----------	75
BrB2	Brinkerton silt loam, 3 to 8 percent slopes, moderately eroded.	45	70	----------	90	----------	85
BuB2	Buchanan gravelly loam, 3 to 8 percent slopes, moderately eroded.	45	70	50	100	50	95
BuC2	Buchanan gravelly loam, 8 to 15 percent slopes, moderately eroded.	35	65	50	95	45	90
BvB	Buchanan very stony loam, 0 to 8 percent slopes	----------	----------	----------	----------	----------	----------
BvD	Buchanan very stony loam, 8 to 25 percent slopes	----------	----------	----------	----------	----------	----------
CaC2	Calvin shaly silt loam, 8 to 15 percent slopes, moderately eroded.	40	65	45	90	45	85
CaD2	Calvin shaly silt loam, 15 to 25 percent slopes, moderately eroded.	40	55	45	85	40	80
CbB2	Calvin-Berks channery silt loams, 3 to 8 percent slopes, moderately eroded.	45	70	50	95	45	90
CbC2	Calvin-Berks channery silt loams, 8 to 15 percent slopes, moderately eroded.	40	70	45	90	45	85
CbD2	Calvin-Berks channery silt loams, 15 to 25 percent slopes, moderately eroded.	40	60	45	85	45	80
CkB2	Calvin and Leck Kill shaly silt loams, 3 to 8 percent slopes, moderately eroded.	45	70	50	95	45	90
CpB	Cookport very stony loam, 0 to 8 percent slopes	----------	----------	----------	----------	----------	----------
DkB	Dekalb very stony sandy loam, 0 to 8 percent slopes	----------	----------	----------	----------	----------	----------
DkD	Dekalb very stony sandy loam, 8 to 25 percent slopes	----------	----------	----------	----------	----------	----------
DkE	Dekalb very stony sandy loam, 25 to 70 percent slopes	----------	----------	----------	----------	----------	----------
EbB2	Elliber very cherty loam, 3 to 8 percent slopes, moderately eroded.	50	80	45	105	45	90
EbC2	Elliber very cherty loam, 8 to 15 percent slopes, moderately eroded.	45	80	50	100	45	90
EbD2	Elliber very cherty loam, 15 to 30 percent slopes, moderately eroded.	----------	----------	----------	----------	----------	----------
ErB2	Ernest silt loam, 3 to 8 percent slopes, moderately eroded.	45	75	50	100	50	95
FrB2	Frankstown cherty silt loam, 3 to 8 percent slopes, moderately eroded.	80	110	70	120	70	120
FrC2	Frankstown cherty silt loam, 8 to 15 percent slopes, moderately eroded.	75	100	70	115	65	115

See footnote at end of table.

specified field and forage crops at two levels of management

management. Dashes indicate that the soil is not suited to the specified crop at the specified level of management]

Barley (100=52 bu. per acre)		Alfalfa-grass hay 100=3.6 tons per acre)		Grass-legume hay (100=2.8 tons per acre)		Bluegrass pasture (100=100 cow-acre-days) [1]		Tall grass pasture (100=100 cow-acre-days) [1]	
A	B	A	B	A	B	A	B	A	B
50	95	50	80	70	120	80	140	90	180
60	110	70	120	65	105	80	140	120	240
----------	80	25	80	45	85	50	100	65	140
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
----------	75	45	100	80	110	100	130	130	175
75	120	80	120	80	120	85	140	120	235
90	115	70	105	75	125	85	135	140	210
55	95	65	95	65	95	60	100	140	220
50	85	65	90	60	95	55	95	130	200
45	80	60	90	55	90	55	90	150	180
----------	----------	----------	----------	----------	----------	45	----------	----------	----------
50	90	60	90	55	95	65	115	90	180
45	85	55	90	55	90	55	110	85	170
40	85	55	85	50	85	60	110	80	160
----------	75	30	70	50	75	40	80	70	125
----------	90	35	85	55	90	50	100	80	160
50	100	55	90	65	110	65	135	90	180
50	90	50	90	70	110	70	130	90	175
----------	----------	----------	----------	----------	----------	30	----------	----------	----------
----------	----------	----------	----------	----------	----------	25	----------	----------	----------
45	85	55	90	55	90	60	120	95	195
40	85	55	85	50	85	60	110	90	180
50	90	60	90	55	95	65	120	100	200
45	85	55	90	55	90	55	115	90	190
40	85	55	90	50	85	60	110	65	130
50	90	65	100	55	95	65	120	100	200
----------	----------	----------	----------	----------	----------	30	----------	----------	----------
----------	----------	----------	----------	----------	----------	45	----------	----------	----------
----------	----------	----------	----------	----------	----------	40	----------	----------	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
50	90	60	90	55	100	65	130	90	190
45	85	55	90	50	80	60	110	95	180
----------	----------	----------	----------	----------	----------	45	90	75	160
50	95	50	80	70	120	65	135	90	180
70	120	80	120	90	120	75	135	135	240
65	115	80	120	90	115	75	135	130	240

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

Symbol	Soil series	Corn (100=112 bu. of grain or 23 tons of silage per acre)		Oats (100=56 bu. per acre)		Wheat (100=36 bu. per acre)	
		A	B	A	B	A	B
FrD2	Frankstown cherty silt loam, 15 to 25 percent slopes, moderately eroded.	70	90	65	110	65	110
FrE2	Frankstown cherty silt loam, 25 to 35 percent slopes, moderately eroded.	--	--	--	--	--	--
HeB2	Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded.	80	110	70	120	70	120
HeC2	Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded.	70	95	70	115	65	115
HeD2	Hagerstown silt loam, 15 to 25 percent slopes, moderately eroded.	65	90	65	110	65	110
HgB3	Hagerstown silty clay loam, 3 to 8 percent slopes, severely eroded.	65	95	60	110	60	110
HhC3	Hagerstown silty clay loam, shallow phase, 5 to 15 percent slopes, severely eroded.	--	--	--	--	--	--
HhD3	Hagerstown silty clay loam, shallow phase, 15 to 25 percent slopes, severely eroded.	--	--	--	--	--	--
HtD2	Hagerstown very rocky silty clay loam, 5 to 25 percent slopes, moderately eroded.	--	--	--	--	--	--
HtE2	Hagerstown very rocky silty clay loam, 25 to 50 percent slopes, moderately eroded.	--	--	--	--	--	--
KaB2	Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded.	30	50	40	75	40	70
KaC2	Klinesville shaly silt loam, 8 to 15 percent slopes, moderately eroded.	30	50	35	70	35	65
KaD2	Klinesville shaly silt loam, 15 to 25 percent slopes, moderately eroded.	--	--	--	--	--	--
KwB2	Klinesville-Weikert channery silt loams, 3 to 8 percent slopes, moderately eroded.	30	50	40	75	40	70
KwC2	Klinesville-Weikert channery silt loams, 8 to 15 percent slopes, moderately eroded.	30	50	35	70	35	65
KwD2	Klinesville-Weikert channery silt loams, 15 to 25 percent slopes, moderately eroded.	--	--	--	--	--	--
KwE2	Klinesville-Weikert channery silt loams, 25 to 60 percent slopes, moderately eroded.	--	--	--	--	--	--
LaB2	Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded.	65	105	60	115	60	115
LaC2	Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded.	65	100	55	110	60	110
LaD2	Laidig gravelly loam, 15 to 25 percent slopes, moderately eroded.	60	95	55	105	55	105
LdB	Laidig very stony sandy loam, 0 to 8 percent slopes	--	--	--	--	--	--
LdD	Laidig very stony sandy loam, 8 to 25 percent slopes	--	--	--	--	--	--
LdE	Laidig very stony sandy loam, 25 to 60 percent slopes	--	--	--	--	--	--
LmB	Laidig and Murrill cobbly loams, 3 to 8 percent slopes	--	--	60	115	60	115
LmC	Laidig and Murrill cobbly loams, 8 to 15 percent slopes.	--	--	55	110	60	110
Ln	Lawrence gravelly silt loam, coarse subsoil variant	55	70	40	75	40	80
LoE	Lehew very stony loam, 25 to 60 percent slopes	--	--	--	--	--	--
Ls	Lindside silt loam	80	95	90	115	90	115
Ma	Made land	--	--	--	--	--	--
Me	Melvin silt loam	60	80	--	95	--	95
MoB2	Monongahela silt loam, 3 to 8 percent slopes, moderately eroded.	55	90	50	100	50	95
MuB2	Murrill gravelly loam, 3 to 8 percent slopes, moderately eroded.	65	105	60	115	60	115
MuC2	Murrill gravelly loam, 8 to 15 percent slopes, moderately eroded.	65	100	55	110	60	110
MvD	Murrill very stony loam, 5 to 25 percent slopes	--	--	--	--	--	--
Ph	Philo silt loam	65	80	90	115	90	115
Pm	Pope fine sandy loam, neutral variant	80	120	75	130	75	120
Po	Pope loam	100	125	100	135	100	125
Ru	Rubble land	--	--	--	--	--	--
St	Strip mine spoil	--	--	--	--	--	--
Ty	Tygart silt loam	45	70	40	75	40	80

See footnote at end of table.

specified field and forage crops at two levels of management—Continued

Barley (100=52 bu. per acre)		Alfalfa-grass hay 100=3.6 tons per acre)		Grass-legume hay (100=2.8 tons per acre)		Bluegrass pasture (100=100 cow-acre-days) [1]		Tall grass pasture (100=100 cow-acre-days) [1]	
A	B	A	B	A	B	A	B	A	B
65	110	80	115	90	110	75	135	125	215
---	---	---	---	---	---	60	105	---	---
70	120	85	120	80	120	75	135	135	235
65	115	80	120	80	120	75	135	130	235
65	110	80	115	80	115	75	135	130	230
60	110	65	105	70	105	60	115	110	200
---	---	---	---	---	---	35	65	60	110
---	---	---	---	---	---	30	---	---	---
---	---	---	---	---	---	30	---	---	---
---	---	---	---	---	---	25	---	---	---
40	75	40	70	45	75	40	80	65	125
35	70	40	65	45	75	35	75	60	115
---	---	---	---	---	---	35	65	55	110
40	75	40	70	45	75	40	80	65	125
35	70	40	65	45	75	35	75	60	115
---	---	---	---	---	---	35	65	55	110
---	---	---	---	---	---	25	---	---	---
60	115	70	115	70	115	60	130	105	210
60	110	70	115	70	110	65	130	110	210
55	105	65	110	70	105	65	125	95	190
---	---	---	---	---	---	30	---	---	---
---	---	---	---	---	---	25	---	---	---
---	---	---	---	---	---	25	---	---	---
60	115	65	105	70	105	75	140	115	220
60	110	65	105	70	105	70	135	115	220
40	80	35	75	50	80	45	95	70	145
---	---	---	---	---	---	25	---	---	---
90	115	70	105	75	110	80	135	130	210
---	95	40	95	85	100	85	130	130	175
50	95	70	100	80	110	65	135	90	180
60	115	70	115	70	115	65	135	120	235
60	110	70	115	70	110	65	135	95	235
---	---	---	---	---	---	30	---	---	---
90	115	70	100	80	120	80	135	130	210
75	120	80	120	80	120	75	130	135	225
100	125	100	125	100	125	100	135	175	235
---	---	---	---	---	---	---	---	---	---
40	80	35	75	50	80	45	95	70	145

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

Symbol	Soil series	Corn (100=112 bu. of grain or 23 tons of silage per acre)		Oats (100=56 bu. per acre)		Wheat (100=36 bu. per acre)	
		A	B	A	B	A	B
Tz	Tygart silt loam, poorly drained variant	35	60	----------	70	----------	70
WcB2	Weikert channery silt loam, 3 to 8 percent slopes, moderately eroded.	30	50	40	75	40	70
WcC2	Weikert channery silt loam, 8 to 15 percent slopes, moderately eroded.	30	50	35	70	35	65
WcD2	Weikert channery silt loam, 15 to 25 percent slopes, moderately eroded.	----------	----------	----------	----------	----------	----------
WgB2	Wiltshire gravelly loam, 3 to 8 percent slopes, moderately eroded.	60	75	40	75	45	90

[1] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single grazing season without injury to the sod. An acre of pasture that provides 30 days of grazing for 2 cows has a carrying capacity of 60 cow-acre-days.

Sawtimber occupies approximately 46 percent of the acreage in commercial forests, and poletimber, 48 percent. Seedlings and saplings grow on the rest (*20*).

In general the soils in this county are capable of supporting a good growth of red oak, yellow-poplar, ash, and white pine. At the present time, however, the stands in many wooded areas are made up predominantly of chestnut oak, scarlet oak, Virginia pine, and red maple.

Studies have been made of the rate at which trees grow on seven soils that are extensive in the county. The results of these studies are on file in the State office of the Soil Conservation Service, Harrisburg, Pa. The trees grew on 32 sample plots. The index of site quality for oak (*13*) for each of the soils is based on the average height obtained by the tallest trees at the age of 50 years.

Other soils in the county that have characteristics similar to those of the soils studied were assumed to have approximately the same site indexes. The volume of timber that a normal stand will produce at different ages can be determined by using this index and applicable yield tables (*13*).

Information about the soils is a basis for planning management of woodland. To help in planning management of the soils of this county as woodland, soils that have similar characteristics have been placed in each of 13 woodland groups. The soils have been grouped mainly according to similarities in depth, drainage, and available moisture capacity. To find the woodland suitability group for each of the soil mapping units, refer to the "Guide to Mapping Units" in the back of this survey.

Some of the factors considered in placing each soil in a woodland group are the potential productivity, the species of trees best suited to the soils of the group, and ratings for the principal hazards and limitations that affect the production of timber. These factors are explained in the paragraphs that follow.

Potential productivity is based on the site index for oak (excluding pin oak, for which the site-growth relationship is different). *Excellent* soils for production of timber have a site index for oak of 75 or more, and the expected yield is 13,750 board feet per acre when a stand is 50 years old. A rating of *good* means that the site index for oak is 65 to 74 and the expected yield is 9,750 board feet per acre when a stand is 50 years old. A rating of *fairly good* means that the site index for oak is 55 to 64 and the expected yield at an age of 50 years is 6,300 board feet per acre. A rating of *poor* means that the site index for oak is 54 or less and the expected yield at 50 years is less than 3,250 board feet per acre.

Species suitability is listed for each woodland group. The listing includes the trees best suited to planting and the native trees to be favored in managing existing stands.

Seedling mortality refers to the loss of naturally occurring or planted tree seedlings as a result of unfavorable characteristics of the soil. The rating is *slight* if the expected loss is less than 25 percent of the seedlings. A rating of *moderate* indicates expected mortality between 25 and 50 percent, and a rating of *severe* indicates expected mortality greater than 50 percent.

Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade the different kinds of soil. It is rated *slight* if competition does not prevent adequate natural regeneration and early growth and does not interfere with adequate development of planted seedlings. It is *moderate* if competition delays the establishment and slows the growth of a natural or a planted stand, but does not prevent the natural development of a fully stocked, natural stand of trees. The rating is *severe* if competition prevents adequate natural or artificial regeneration without intensive preparation of the site and intensive maintenance treatments, such as weeding.

Equipment limitations refer to the degree that characteristics of the soils and topographic features restrict or prevent the use of equipment for harvesting trees or planting seedlings. Steepness of slope, stoniness of the soil, and wetness of the soil are the principal characteristics that restrict the use of equipment. The rating is *slight* if the limitations are very few. A rating of *moderate* indicates that some problems exist, such as stones or boulders, moderately steep slopes, or wetness of the soil during part of the year. A rating of *severe* indicates that the use of equipment is severely limited by steepness, stoniness, or prolonged wetness of the soil. Track-type equipment is *specified field and forage crops at two levels of management*

Barley (100=52 bu. per acre)		Alfalfa-grass hay 100=3.6 tons per acre)		Grass-legume hay (100=2.8 tons per acre)		Bluegrass pasture (100=100 cow-acre-days) [1]		Tall grass pasture (100=100 cow-acre-days) [1]	
A	B	A	B	A	B	A	B	A	B
----------	70	25	65	50	70	40	90	60	125
40	75	40	70	45	80	40	85	65	125
35	70	40	60	45	75	35	80	60	115
----------	----------	----------	----------	----------	----------	35	65	55	110
50	90	80	120	80	120	70	120	115	185

best for general use on the soils that are severely limited, and winches or other special equipment may be needed.

Erosion hazard refers to the risk of erosion and indicates the amount or intensity of practices needed to reduce or control erosion in forest management. A rating of *slight* indicates that the risk of erosion is low when wood products are harvested, and few, if any, practices are needed to control erosion. A rating of *moderate* indicates that measures to control erosion are needed on skid roads and logging roads immediately after wood products are harvested. A rating of *severe* indicates that the risk of erosion, especially gullying, is severe whenever wood products are harvested. Harvesting and other operations should be done across the slope as much as possible. Skid trails and logging roads should be laid out on the lowest possible grades, and water-disposal systems should be maintained with care during logging. Erosion-control measures should be applied on logging roads and skid trails immediately after logging is done.

Windthrow hazard is evaluated after study of the factors that control development of roots of trees and as a result influences the risk that trees will be uprooted by wind. The hazard is rated *slight* if normally there are no trees blown down by wind. It is *moderate* if some trees are expected to be blown down during times when the soil is excessively wet and the velocity of the wind is high. A rating of *severe* indicates that many trees are likely to be blown down when the soil is wet and the velocity of the wind is moderate or high.

WOODLAND SUITABILITY GROUP 1

Group 1 consists of deep, well-drained soils of the Barbour and Pope series. They are nearly level soils on flood plains and are subject to floods of short duration. They have moderate to high available moisture capacity.

The soils of this group are excellent for the production of timber. They have a site index for oak of 75 or more, and the expected yield of oak is 13,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are yellow-poplar, red oak, ash, white pine, and black walnut. The best trees for new plantings are larch, white pine, Norway spruce, Austrian pine, and black walnut.

On these soils seedling mortality is slight; competition from unwanted plants is severe; limitations to the use of woodland equipment are slight; the hazard of erosion is slight; and the hazard of windthrow is slight.

WOODLAND SUITABILITY GROUP 2

Group 2 consists of deep, moderately well drained and somewhat poorly drained soils of the Basher, Lindside, and Philo series. They are nearly level soils on flood plains and are subject to floods of short duration. They have high available moisture capacity.

The soils of this group are good for the production of timber. They have a site index for oak of 65 to 74, and the expected yield of oak is 9,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are yellow-poplar, red oak, ash, white pine, and black walnut. The best trees for new plantings are larch, white pine, Norway spruce, Austrian pine, and black walnut.

On the soils of this group, seedling mortality is slight; competition from unwanted plants is severe; limitations to the use of woodland equipment are moderate; the hazard of erosion is slight; and the hazard of windthrow is slight to moderate.

WOODLAND SUITABILITY GROUP 3

Group 3 consists of deep, somewhat poorly drained to poorly drained soils of the Atkins and Melvin series. They are nearly level soils on flood plains, and most of the areas are subject to floods of short duration. Ponding occurs on some of the areas.

The soils of this group are fairly good for the production of timber. They have a site index for oak of 55 to 64, and the expected yield of oak is 6,300 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are white pine, hemlock, and red maple. The best trees for new plantings are white pine and white spruce.

On the soils of this group, seedling mortality is severe; competition from unwanted plants is severe; limitations to the use of woodland equipment are severe; the hazard of erosion is slight; and the hazard of windthrow is severe.

WOODLAND SUITABILITY GROUP 4

Group 4 consists of deep, well-drained soils of the uplands. They are soils of the Allegheny, Frankstown, Hagerstown, Laidig, and Murrill series that have slopes of less than 25 percent. Their available moisture capacity is mostly high, but in the Laidig soils it is moderate to high.

Most of the acreage of soils in this group is excellent for the production of timber. The Laidig soils, the very stony Murrill soil, and the very rocky Hagerstown soil, however, are rated only good. The excellent soils have a site index for oak of 75 or more, and the expected yield of oak on them is 13,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands on all the soils in this group are yellow-poplar, red oak, ash, white pine, and black walnut. The best trees for new plantings are larch, white pine, Norway spruce, Austrian pine, and black walnut.

On the soils of this group, seedling mortality is slight. Competition from unwanted plants is severe, except on the very stony and the very rocky soils, where it is moderate. Limitations to the use of woodland equipment are slight, except on the very stony and the very rocky soils, where they are moderate. The erosion hazard is slight to moderate, and the windthrow hazard is slight.

WOODLAND SUITABILITY GROUP 5

Group 5 consists of deep, well-drained, steep soils of the uplands. They are soils of the Frankstown, Hagerstown, and Laidig series that have slopes of 25 to 60 percent. Their available moisture capacity is high or moderately high.

The soils of this group are good for the production of timber. They have a site index for oak of 65 to 74, and the expected yield of oak is 9,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are yellow-poplar, red oak, ash, white pine, and black walnut. The best trees for new plantings are larch, white pine, Norway spruce, Austrian pine, and black walnut.

On the soils of this group, seedling mortality is slight. Competition from unwanted plants is severe on the Frankstown soil and moderate on all the other soils. Limitations to the use of woodland equipment are severe on all the soils. The hazard of erosion is severe, and the hazard of windthrow is slight.

WOODLAND SUITABILITY GROUP 6

Group 6 consists of deep, moderately well drained and somewhat poorly drained soils that have a fragipan in the subsoil. They are soils of the uplands, and they have slopes of less than 25 percent. Their available moisture capacity is low or moderate. They are Albrights, Buchanan, Cookport, Ernest, Monongahela, and Wiltshire soils.

The soils of this group are good for the production of timber. The site index for oak is 64 to 74, and the expected yield of oak is 9,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are yellow-poplar, red oak, ash, white pine, and black walnut. The best trees for new plantings are larch, white pine, Norway spruce, Austrian pine, and black walnut.

On these soils seedling mortality is slight; competition from other plants is severe; limitations to the use of woodland equipment are moderate; the hazard of erosion is slight to moderate; and the windthrow hazard is moderate.

WOODLAND SUITABILITY GROUP 7

Group 7 consists of deep, somewhat poorly drained, nearly level soils that have a fragipan or other moderately slowly permeable layer in the subsoil. They are soils of the Tygart series and the coarse subsoil variant of the Lawrence series, and they are on uplands. The available moisture capacity of these soils is moderate to high.

These soils are good for the production of timber. They have a site index for oak of 65 to 74, and the expected yield of oak is 9,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are red oak, yellow-poplar, ash, and white pine. The best trees for new plantings are larch, white pine, and white spruce.

On the soils of this group, seedling mortality is slight; competition from unwanted plants is severe; the limitations to the use of woodland equipment are moderate; the erosion hazard is slight to moderate; and the windthrow hazard is slight to moderate.

WOODLAND SUITABILITY GROUP 8

Group 8 consists of deep, somewhat poorly drained to poorly drained soils that have a slowly permeable fragipan in their subsoil. They are on uplands, and they have slopes of less than 8 percent. They are members of the Andover and Brinkerton series and include the poorly drained variant of the Tygart series. The available moisture capacity of these soils is moderate to high.

The soils of this group are good for the production of timber. They have a site index for oak of 65 to 74, and the expected yield of oak is 9,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are red oak, yellow-poplar, and white pine. The best trees for new plantings are white pine and white spruce.

On the soils of this group, seedling mortality is severe; competition from unwanted plants is moderate; limitations to the use of woodland equipment are severe; the erosion hazard is slight to moderate; and the windthrow hazard is severe.

WOODLAND SUITABILITY GROUP 9

Group 9 consists of moderately deep or deep, well-drained soils that have low to moderate available moisture capacity. They are on uplands, and they have slopes of less than 25 percent. They are Bedington, Berks, Calvin, Dekalb, Edom, Elliber, and Leck Kill soils. Some of the mapping units in this group are complexes or undifferentiated units that have in them soils of two or more of the series just named.

Most of the soils in this group are good for the production of timber. They have a site index of 65 to 74 for oak, and the expected yield is 9,750 board feet per acre when a stand of oak is 50 years old. The Dekalb soils, which are very stony, are rated only fairly good.

The native trees to be favored in existing stands are red oak, yellow-poplar, white pine, and black oak. Trees best suited for new plantings are larch, white pine, Norway spruce, and Austrian pine.

On the soils of this group, seedling morality is slight; competition from other plants is severe; limitations to the use of woodland equipment are slight to moderate; the erosion hazard is slight to moderate; and the windthrow hazard is slight.

WOODLAND SUITABILITY GROUP 10

Group 10 consists of moderately deep to deep, well-drained soils of the uplands. They are Dekalb and Lehew soils that have slopes greater than 25 percent. They have moderate to low available moisture capacity.

The soils of this group are fairly good for the production of timber. They have a site index for oak of 55 to 64, and the expected yield of oak is 6,300 board feet when a stand is 50 years old.

The native trees to be favored in existing stands are red oak, black oak, and white pine. The best trees for new plantings are larch, white pine, and Austrian pine.

On the soils of this group, seedling mortality is slight; competition from unwanted plants is severe; limitations to the use of woodland equipment are severe; the erosion hazard is severe; and the windthrow hazard is slight.

WOODLAND SUITABILITY GROUP 11

Group 11 consists of well-drained, mostly shallow soils of the uplands. They are members of the Bedington, Edom, Hagerstown, Klinesville, and Weikert series. Some of the soil mapping units are complexes that have in them soils of two of these series. The soils of this group have slopes of less than 25 percent. Their available moisture capacity ranges from very low in the Klinesville soils to high in the Hagerstown soils.

The Klinesville and Weikert soils are fairly good for the production of timber. They have a site index for oak of 55 to 64, and the expected yield of oak is 6,300 board feet per acre when a stand is 50 years old. The Bedington, Edom, and Hagerstown soils are good for the production of timber. They have a site index for oak of 65 to 74, and the expected yield of oak is 9,750 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are Virginia pine, black oak, red oak, and white pine. The best trees for new plantings are Virginia pine and white pine.

On the soils of this group, seedling mortality is moderate. Limitations of the use of woodland equipment are slight on slopes up to 15 percent and moderate on slopes greater than 15 percent. The erosion hazard is slight on slopes of up to 8 percent and moderate on slopes greater than 8 percent. The windthrow hazard is slight.

WOODLAND SUITABILITY GROUP 12

In group 12 is only one mapping unit, Klinesville-Weikert channery silt loams, 25 to 60 percent slopes, moderately eroded. These soils are shallow, well drained, and steep, and they are on the uplands. Slopes are greater than 25 percent. The soils of this group have low or very low available moisture capacity.

The soils of this group are poor for the production of timber. They have a site index for oak of 54 or less, and the expected yield of oak is less than 3,250 board feet per acre when a stand is 50 years old.

The native trees to be favored in existing stands are Virginia pine, white pine, and black oak. The best trees for new plantings are Virginia pine and white pine.

On the soils of this group, seedling mortality is severe; competition from unwanted plants is slight; limitations to the use of woodland equipment are severe; the erosion hazard is severe; and the windthrow hazard is moderate.

WOODLAND SUITABILITY GROUP 13

Group 13 consists of three highly variable land types, Made land, Rubble land, and Strip mine spoil. These land types generally are not suitable for growing of commercial tree crops.

Wildlife [3]

In this subsection the suitability of the soils in Fulton County for producing good habitats for wildlife is discussed.

Many species of wildlife exist in the county. Gray squirrels, cottontail rabbits, groundhogs, raccoon, deer, opossum, and skunk are abundant and generally are well distributed over the county. Good numbers of quail, red foxes, gray foxes, grouse, and wild turkeys are in the county. A few beaver, woodcock, muskrat, and mink are in the county, mostly on areas of bottom land. Few waterfowl are in the county. There are many nongame species of birds and animals.

The occurrence and abundance of some kinds of wildlife are related to the kinds of soil. The relation is indirect. The soils influence land use, and they differ in their suitability for growing plants that furnish food and cover for wildlife. Soils that are capable of producing good growth of plants favored by wildlife are the soils that can sustain a good population of wildlife. Nonsoil factors, such as the availability of water, weather, predators, diseases, and activities of man, are also important factors that help determine whether a particular species of wildlife can survive and thrive in a particular area.

In table 2 the soils are rated according to their suitability for eight elements of wildlife habitats and for producing three groups of wildlife. The eight elements are defined in the following paragraphs.

Grain and seed crops consist of domestic grains or seed-producing annual herbaceous plants that are planted to produce food for wildlife. Examples are corn, sorghum, wheat, millet, buckwheat, soybeans, and sunflower.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted to furnish cover and food for wildlife. Examples are fescue, bromegrass, bluegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and sericea lespedeza.

Wild herbaceous upland plants are native or introduced perennial grasses or forbs (weeds) that generally are established naturally and that provide food and cover mainly for upland wildlife. Examples are ragweed, wheatgrass, wild rye, oatgrass, pokeweed, strawberries, beggarweeds, goldenrod, and dandelion.

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

TABLE 2.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitats				
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants
Albrights:					
AbB2	Medium	High	High	High	Low
Allegheny:					
AgB2	Medium	High	High	High	Low
Andover:					
AnB2, AoB	Low	Low	Medium	Medium	Medium
Atkins:					
At	Medium	High	High	High	Medium
Barbour:					
Ba	High	Medium	High	High	Low
Basher:					
Bc	Medium	High	High	High	Low
Bedington:					
BdB2, BdC2	Medium	Medium	High	High	Low
BdD2, BdD3	Not suited	Low	High	High	Low
Berks:					
BeB2, BeC2	Medium	Medium	Medium	Medium	Medium
BeD2	Low	Medium	Medium	Medium	Medium
Brinkerton:					
BrA, BrB2	Low	Low	Medium	Medium	Medium
Buchanan:					
BuB2, BuC2	Medium	High	High	High	Low
BvB, BvD	Not suited	Low	High	High	Low
Calvin:					
CaC2	Medium	Medium	Medium	Medium	Medium
CaD2	Low	Medium	Medium	Medium	Medium
CbB2, CbC2	Medium	Medium	Medium	Medium	Medium
CbD2	Low	Medium	Medium	Medium	Medium
CkB2	Medium	Medium	Medium	Medium	Medium
Cookport:					
CpB	Not suited	Low	High	High	Low
Dekalb:					
DkB, DkD	Not suited	Low	Medium	Medium	Medium
DkE	Not suited	Not suited	Medium	Medium	Medium
Edom (mapped only in soil complexes; see Bedington series).					
Elliber:					
EbB2, EbC2	Low	Low	Low	Low	High
EbD2	Not suited	Low	Low	Low	High
Ernest:					
ErB2	Medium	High	High	High	Low
Frankstown:					
FrB2, FrC2	Medium	High	High	High	Low
FrD2	Low	Medium	High	High	Low
FrE2	Not suited	Medium	High	High	Low
Hagerstown:					
HeB2, HeC2	Medium	High	High	High	Low
HeD2	Low	Medium	High	High	Low
HgB3	Medium	Medium	High	High	Low
HhC3, HhD3	Not suited	Low	Medium	Medium	Medium
HtD2	Not suited	Low	High	High	Low
HtE2	Not suited	Not suited	High	High	Low

of wildlife habitats and for kinds of wildlife

Elements of wildlife habitats			Kinds of wildlife		
Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Not suited	Not suited	Low	High	High	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Low	Not suited	Medium	Low	Medium	Not suited.
Medium	Medium	Not suited	High	High	Medium.
Not suited	Not suited	Not suited	High	Medium	Not suited.
Low	Low	Low	High	High	Low.
Not suited	Not suited	Not suited	High	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Low	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Low	Not suited.
Not suited	Not suited	Not suited	Low	Low	Not suited.
Not suited	Not suited	Not suited	Not suited	Low	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not usited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.

TABLE 2.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitats				
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants
Klinesville:					
KaB2, KaC2	Low	Low	Medium	Medium	Medium
KaD2	Not suited	Low	Medium	Medium	Medium
KwB2, KwC2	Low	Low	Medium	Medium	Medium
KwD2	Not suited	Low	Medium	Medium	Medium
KwE2	Not suited	Not suited	Medium	Medium	Medium
Laidig:					
LaB2, LaC2	Medium	High	High	High	Low
LaD2	Low	Medium	High	High	Low
LdB, LdD	Not suited	Low	High	High	Low
LdE	Not suited	Low	High	High	Low
LmB, LmC	Medium	High	High	High	Low
Lawrence, coarse subsoil variant:					
Ln	Medium	High	High	High	Low
Lehew:					
LoE	Not suited	Not suited	Medium	Medium	Medium
Lindside:					
Ls	Medium	High	High	High	Low
Melvin:					
Me	Low	Medium	Medium	High	Medium
Monongahela:					
MoB2	Medium	High	High	High	Low
Murrill:					
MuB2, MuC2	Medium	High	High	High	Low
MvD	Not suited	Low	High	High	Low
Philo:					
Ph	Medium	High	High	High	Low
Pope, Neutral variant:					
Pm	Medium	High	High	High	Low
Pope:					
Po	Medium	High	High	High	Low
Tygart:					
Ty	Medium	Medium	High	High	Low
Tygart, poorly drained variant:					
Tz	Low	Medium	Medium	Medium	Medium
Weikert:					
WcB2, WcC2	Low	Low	Medium	Medium	Medium
WcD2	Not suited	Low	Medium	Medium	Medium
Wiltshire:					
WgB2	Medium	High	High	High	Low

of wildlife habitats and for kinds of wildlife—Continued

Elements of wildlife habitats—Continued			Kinds of wildlife		
Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	Medium	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	High	Low	Not suited.
Low	Low	Low	High	High	Low.
Not suited	Not suited	Not suited	Low	Low	Not suited.
Low	Low	Low	High	High	Low.
Medium	Medium	Not suited	Medium	High	Medium.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Low	Low	Low	High	High	Low.
Not suited	Not suited	Not suited	High	High	Not suited.
Not suited	Not suited	Not suited	High	High	Not suited.
Medium	Medium	Medium	High	Medium	Medium.
High	High	High	Medium	Medium	High.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Not suited	Low	Medium	Not suited.
Not suited	Not suited	Low	High	High	Not suited.

Hardwood woody plants are deciduous trees, shrubs, and woody vines that produce fruit, nuts, buds, catkins, twigs, or foliage that are used extensively as food by wildlife and that commonly are established naturally but also may be planted. Examples are oak, beech, cherry, hawthorn, dogwood, viburnum, holly, maple, birch, poplar, grape, honeysuckle, blueberry, briers, greenbriers, raspberry, and rose.

Coniferous woody plants are cone-bearing trees and shrubs that are important to wildlife, primarily as cover but that also furnish food in the form of browse, seeds, or cones. These trees and shrubs are commonly established naturally, but they also may be planted. Examples are pine, spruce, white-cedar, hemlock, fir, redcedar, juniper, and yew.

Wetland food and cover plants are annual and perennial, wild, herbaceous plants that grow on moist to wet sites. These plants do not include submerged or floating aquatic plants that produce the food or cover used mainly by wetland wildlife. Examples of wetland plants are smartweed, wild millet, bulrushes, sedges, wild rice, switchgrass, reed canarygrass, and cattails.

Shallow water developments are areas of water that have been made by building low dikes and levees, digging shallow excavations, establishing level ditches, or building devices to control the water level of marshy streams or channels. Generally, the water is not more than 5 feet deep.

Excavated ponds are dug-out areas or a combination of dug-out areas and low dikes that hold water of suitable quality, of suitable depth, and in ample supply for the production of fish or wildlife. Such a pond should have a surface area of at least one-quarter acre and an average depth of 6 feet or more in at least a quarter of the area. Also required is a dependable high water table or another source of unpolluted water of low acidity.

Based on the suitability of the soils for each of the eight habitat elements, the soils were rated according to their suitability for producing three major kinds of wildlife. These ratings indicate only potential suitability. Land use affects greatly the site conditions and the species of wildlife that live in any given area.

Openland wildlife consists of birds and mammals that are commonly found in crop fields, in meadows and pastures, and on nonforested, overgrown land. Among these birds and mammals are bobwhite quail, ring-necked pheasants, mourning doves, woodcock, cottontail rabbits, meadowlarks, killdeer, and field sparrows.

Woodland wildlife consists of birds and mammals that are commonly found in wooded areas. Examples are ruffed grouse, wild turkeys, deer, squirrels, raccoons, wood thrushes, warblers, and vireos.

Wetland wildlife consists of birds and mammals that are commonly found in marshes and swamps. Examples are ducks, geese, herons, snipe, rails, coots, muskrat, mink, and beaver.

A rating of *high* in table 2 indicates that the soil is well suited to the element of wildlife habitat or to the kind of wildlife. The soil is well suited to the creation, improvement, and maintenance of a habitat that produces good growth of a wide variety of desirable plants for food and cover and a dependable supply of food. The desired kinds of wildlife can be expected to thrive without any great cost for maintaining the habitat. On the one soil that is rated high for shallow water developments and excavated ponds, the desired impoundments of water can be made without major problems of construction.

A rating of *medium* in table 2 indicates that the soil is suited to the element or the kind of wildlife but is also limited in some degree. The plants that produce food and cover are fewer than on the soils rated high, or the amount of food produced is less dependable. The desired kinds of wildlife can be expected to thrive if enough effort is made to manage and maintain the habitat. A rating of medium for water developments or ponds means that location of a site is difficult and problems in construction are likely to be encountered.

A rating of *low* in table 2 indicates that the soil is poorly suited to the element of wildlife habitat or the kind of wildlife. The limitations are severe for creating, improving, or maintaining a good habitat. Only a few plants will grow to furnish food and cover, or the amount of food produced is small or is not dependable. The desired kinds

TABLE 3.—*Engineering*

Soil name and location	Parent material	Pennsylvania report number	Depth	Horizon	Moisture-density data [2]	
					Maximum dry density	Optimum moisture
Albrights silt loam:			*Inches*		*Lb. per cu. ft.*	*Percent*
Taylor Township: 3.3 miles NW. of Hustontown, 500 feet W. of Pa. 76 (now Pa. 655), and 100 feet N. of farm lane. (Modal)	Old colluvial and alluvial deposits (Catskill formation).	BJ-40091	14-22	B2t	107	16
		BJ-40092	40-50	IICg	124	11
Wells Township: 2.0 miles E. of Wells Tannery, 0.3 mile S. of Pa. 848, and 450 feet W. of T. 441. (Finer textured than modal)	Colluvium from shale (Mauch Chunk formation).	BJ-40087	15-21	B22t	104	20
		BJ-40088	37-48	Bx2tg	112	15
		BJ-40089	48-60	IIC1	124	11
Taylor Township: 4 miles SSW. of Waterfall. (Coarser textured than modal)	Colluvium from red shale and gray sandstone.	BJ-37502	10-19	B2	116	14
		BJ-37503	30-50	Cg	120	12

See footnotes at end of table.

of wildlife can be expected to thrive only if intensive attention is given to managing and maintaining the habitat. A rating of low for water developments and ponds means that the location of a site is difficult and the problems of construction are likely to be major.

A rating of *not suited* in table 2 indicates that the soil has little or no potential use for the element of wildlife habitat or the kind of wildlife listed.

Three land types are too variable to be rated and are not listed in table 2. These are Made land (Ma), Rubble land (Ru), and Strip mine spoil (St).

Engineering Uses of the Soils [4]

This soil survey contains information that can be used by engineers and geologists to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils in planning agricultural drainage systems, farm ponds, irrigation systems, and water-control practices, including diversions, terraces, and waterways.
3. Make reconnaissance surveys of soil and ground conditions that will aid in locating highways, pipelines, and cables, and in planning detailed investigations at the proposed locations.
4. Correlate performance of pavements with types of soil and thus develop information that will be useful in designing and maintaining pavements.
5. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
6. Supplement information obtained from other published maps and reports and aerial photographs to develop maps and reports that can be used readily by engineers.
7. Estimate the nature of material that will be encountered when excavating for buildings and other structures.
8. Aid in determining the suitability of locations for the disposal of liquid wastes from industries and homes.

Used with the soil map to identify the soils, the engineering interpretations reported here can be useful for many purposes. It should be emphasized, however, that these interpretations do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and at sites where excavations are deeper than the depths of the layers here reported. Also, engineers and others should not apply specific values to the estimated values given for bearing capacity of soils. The soil map is nevertheless useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used by the agricultural soil scientists may be unfamiliar to the engineer, and some terms, for example, soil, clay, silt, sand, and aggregate, may have special meanings in soil science. These and other special terms that are used in the soil survey are defined in the Glossary in the back part of this publication.

Not all of the soils information related to engineering can be obtained in this subsection on engineering. In some instances it will be necessary to refer to other parts of this survey, particularly to the section "Descriptions of the Soils," "Use and Management of the Soils," "Formation and Classification of Soils," and "Physiography, Drainage, and Geology."

Much of the information in this subsection is in tables. Table 3 gives engineering test data obtained on samples of representative soils of soil series in the county. In table 4 are estimates of the physical properties of the soils. In table 5 are engineering interpretations of these properties.

Engineering classification systems

Two systems of classifying soils are in general use among engineers. In table 4 the major horizons of soils in the county are classified according to both systems.

[4] By NORMAN J. CHURCHILL, soil scientist, and JOHN R. JAQUISH, agricultural engineer, Soil Conservation Service.

test data [1]

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—						AASHO [4]	Unified [5]
3-in.	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.				
--------	100	97	93	91	78	75	60	41	31	31	6	A-4(8)	ML
100	88	71	60	48	28	26	19	13	10	24	3	A-2-4(0)	SM
--------	--------	--------	--------	--------	94	91	71	50	39	44	18	A-7-6(12)	ML-CL [6]
100	72	39	29	29	27	26	18	12	10	37	15	A-2-6(1)	GC
100	92	70	62	50	40	37	24	15	11	27	7	A-4(1)	GC-SC
100	85	80	75	69	42	39	29	21	17	28	8	A-4(1)	SC
--------	100	93	90	89	42	32	14	14	12	70	3	A-4(2)	SM

TABLE 3.—*Engineering*

Soil name and location	Parent material	Pennsylvania report number	Depth	Horizon	Moisture-density data [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Atkins silt loam:						
Licking Creek Township: 2 miles S. of Hustontown and 200 feet E. of Licking Creek bridge on T. 442. (Modal)	Alluvium from shale and sandstone.	BJ-38775 BJ-38776	9–18 18–36	B21g B22g	104 105	19 18
Dublin Township: 0.2 mile S. of Burnt Cabins and 250 feet S. of Darcey farmhouse. (Finer textured than modal)	Alluvium from shale and sandstone.	BK-38051 BK-31255	9–19 19–36	C1 C2	102 110	21 20
Licking Creek Township: 25 feet from Patterson Run bridge on T. 405 and 0.5 mile from junction with 29021. (Coarser textured than modal)	Alluvium from shale and sandstone.	BJ-38772 BJ-38771	10–20 20–30	C1 C2	112 107	14 17
Barbour fine sandy loam:						
Taylor Township: Near junction of T. 451 and T. 456. (Modal)	Alluvium from shale and sandstone.	BM-1653 BM-1654	9–30 30–58	B2 C1	122 124	10 11
Wells Township: 300 feet W. of Sideling Hill Creek bridge on Pa. 915. (Finer textured than modal)	Alluvium from shale and sandstone.	BM-837 BM-838	9–32 32–50	C1 C2	110 115	16 14
Wells Township: 4 miles S. of New Grenada and 500 feet above Sideling Hill Creek bridge on T. 445. (Coarser textured than modal)	Alluvium from shale and sandstone.	BJ-37506 BJ-37507	15–37 37–60	C1 C2	114 108	13 15
Basher silt loam:						
Wells Township: 50 feet W. of Sideling Hill Creek bridge on Pa. 915. (Modal)	Sediments from shale and sandstone.	BJ-37504 BJ-37505	9–21 35–50	B21 IIC	105 104	18 17
Wells Township: 0.3 mile S. of T. 441 and 15 feet W. of Pa. 848. (Finer textured than modal)	Sediments from shale and sandstone.	BK-38050 BM-841	10–24 40–65	C1 C3	102 113	20 14
Wells Township: 4 miles S. of New Grenada and 200 feet W. of Sideling Hill Creek bridge on T. 445. (Coarser textured than modal)	Sediments from shale and sandstone.	BJ-38769 BJ-38770	8–20 20–50	C1 C2	108 108	15 15
Berks channery silt loam:						
Licking Creek Township: 1.8 miles NW. of Pa. 76 (Now Pa. 655), 125 feet SW. of T. 419, and 20 feet SE. on Blanche Swope farm. (Modal)	Siltstone and shale (Devonian marine beds).	BJ-44483 BJ-44484	11–15 20–35	B2 C	112 (8)	13 (8)
Licking Creek Township: 3.5 miles S. of Hustontown on T. 442 and 400 feet N. of Church. (Finer textured than modal)	Shale of marine beds	BJ-38773 BJ-38774	9–12 12–20	B2 B3	109 110	17 19
Thompson Township: Road cut and farm lane 0.25 mile N. of junction of lane and T. 463; 0.5 mile east of Pa. 76 (now Pa. 655) (Coarser textured than modal).	Shale of marine beds	BK-40795 BK-40796	10–14 22–30	B2 C	116 (8)	13 (8)
Calvin shaly silt loam:						
Taylor Township: 3.3 miles NW. of Hustontown. (Modal)	Shale and siltstone (Catskill formation).	BJ-38778 BJ-38779	9–19 24–40	B2 C	115 119	15 14
Taylor Township: 0.2 mile N. of T. 425 on W. side of T. 428. (Finer textured than modal)	Red shale (Catskill formation).	BJ-37500 BJ-37501	9–16 23–40	B2 C	111 116	16 15
Road cut on NE. side of junction of Pa. 126 and Pa. 226. (Coarser textured than modal)	Sandstone (Catskill formation).	BK-40793 BK-40794	14–23 23–30	B2 C	120 120	13 12

See footnotes at end of table.

test data [1]—Continued

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—						AASHO [4]	Unified [5]
3-in.	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.				
------	------	------	100	99	86	82	60	38	27	33	7	A-4(8)	ML
------	------	------	------	100	87	82	62	46	37	36	13	A-6(9)	ML-CL
------	------	99	99	98	91	89	77	51	40	46	14	A-7-5(11)	ML
------	------	------	100	99	87	85	73	55	46	41	17	A-7-6(11)	ML-CL
------	------	------	100	98	56	47	33	15	11	22	0	A-4(4)	ML
------	------	100	98	89	55	51	38	20	14	25	1	A-4(4)	ML
------	------	------	100	95	41	37	28	17	14	17	0	A-4(1)	SM
------	------	------	100	95	35	32	24	15	13	[7] NP	[7] NP	A-2-4(0)	SM
------	------	------	100	99	74	69	53	29	17	31	6	A-4(8)	ML
------	------	------	------	100	52	47	34	18	12	23	2	A-4(3)	ML
------	------	------	100	96	46	41	29	12	9	23	0	A-4(2)	SM
------	------	------	100	78	12	11	11	6	5	NP	NP	A-2-4(0)	SP-SM
------	------	------	100	98	82	79	58	36	23	32	7	A-4(8)	ML-CL
------	------	------	100	88	46	43	29	17	12	26	0	A-4(2)	SM
------	------	------	------	100	96	95	78	40	24	38	7	A-4(8)	ML
------	------	------	100	99	73	66	46	25	19	27	4	A-4(8)	ML-CL
------	------	------	100	86	20	16	10	6	5	NP	NP	A-2-4(0)	SM
------	------	------	100	85	16	13	10	5	4	NP	NP	A-2-4(0)	SM
100	84	52	40	28	25	24	22	12	6	35	6	A-1-b(0)	GM
100	57	22	16	11	9	8	8	5	3	32	5	A-1-a(0)	GP-GM
100	73	56	49	42	38	37	31	21	14	32	6	A-4(1)	GM
100	84	56	46	38	34	33	25	18	14	38	11	A-2-6(0)	GM
100	52	26	21	18	16	14	10	5	3	22	0	A-1-b(0)	GM
100	44	36	34	25	21	20	14	7	5	24	3	A-1-b(0)	GM
------	100	86	75	56	47	44	35	22	16	28	5	A-4(2)	SM-SC
100	96	55	43	31	25	24	20	14	10	30	6	A-1-b(0)	GM-GC
------	100	93	89	79	70	67	53	31	21	29	6	A-4(7)	ML-CL
100	73	48	42	38	33	32	25	18	14	38	13	A-2-6(1)	GM-GC
100	95	74	65	59	44	41	31	17	11	23	0	A-4(2)	SM
100	56	44	39	35	25	23	18	11	7	23	3	A-1-b(0)	GM

TABLE 3.—*Engineering*

Soil name and location	Parent material	Pennsylvania report number	Depth	Horizon	Moisture-density data [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Dekalb very stony sandy loam:						
Brush Creek Township: 2 miles NW. of Akersville and 95 feet W. of Akersville Road. (Modal)	Sandstone (Pocono formation).	BJ-40095 BJ-40096	11-20 27-43	B2 C	121 121	10 11
Brush Creek Township: 1 mile NW. of Akersville. (Finer textured than modal)	Sandstone (Pocono formation).	BJ-44481 BJ-44482	11-17 28-45	B2 C	122 126	10 9
Brush Creek Township: 1 mile W. of Whips Cove and 0.1 mile N. of T. 362 on E. side of T. 365. (Coarser textured than modal)	Sandstone (Pocono formation).	BK-30985 BK-30986	9-20 25-30	B2 C	124 127	12 11
Elliber very cherty loam:						
Bethel Township: 2 miles S. of Needmore and 2 miles NE. of 29007, on T. 341. (Modal)	Cherty limestone (Shriver).	BK-30983 BK-30984	16-24 36-40	B21 C	106 108	18 16
Belfast Township: W. side of 29007, 1.3 miles N. of T. 349, and 1.5 miles S. of Pa. 76 (now Pa. 655). (Finer textured than modal)	Cherty limestone (Shriver).	BK-38049 BM-840	17-30 40-50	B2 C	110 108	15 14
Belfast Township: E. side of 29007, 1.4 miles N. of T. 349, and 1.4 miles S. of Pa. 76 (now Pa. 655). (Coarser textured than modal)	Cherty limestone (Shriver).	BM-1655 BM-1656	15-32 38-50	B2 C	106 101	17 21
Frankstown cherty silt loam:						
Bethel Township: W. side of T. 328, 0.6 mile S. of T. 349, and 2.5 miles S. of Needmore (1.1 miles W. of Dott). (Modal)	Cherty limestone.	BK-40799 BK-40800	16-37 43-57	B2t C	110 108	16 17
Bethel Township: 1.1 miles W. of Dott and 0.7 mile S. of T. 349 on W. side of T. 328. (Finer textured than modal)	Limestone (Helderberg formation).	BK-40801 BK-40802	14-30 40-50	B2 C1	101 101	22 21
Bethel Township: 2.8 miles S. of Needmore and 0.5 mile S. of T. 349 on W. side of T. 328. (Coarser textured than modal)	Limestone (Helderberg formation).	BK-40797 BK-40798	11-21 36-40	B2 C	106 ([8])	18 ([8])
Klinesville shaly silt loam:						
Taylor Township: 3 miles N. of Hustontown and 325 feet W. of Pa. 76 (now Pa. 655). (Modal)	Shale and siltstone, arkosic sandstone (Catskill formation).	BJ-40093 BJ-40094	0-9 9-19	Ap B2	114 118	14 13
Wells Township: 2.0 miles W. of Wells Tannery, 0.3 mile S. of T. 441, and 400 feet W. of Pa. 848. (Shallower and coarser textured than modal)	Shale (Mauch Chunk formation).	BJ-40085 BJ-40086	0-7 7-11	Ap B2	115 ([8])	14 ([8])
Belfast Township: 0.1 mile S. of T. 361 on E. side of 29014. (Finer textured than modal)	Shale (Catskill formation).	BK-30987 BM-3708	0-9 9-20	Ap AC	115 120	13 12
Union Township: 0.5 mile W. of Deneen Gap and 50 feet NW. of junction of T. 330 and T. 267. (Coarser textured than modal)	Sandstone and shale (Catskill formation).	BM-829 BM-830	0-8 8-16	Ap AC	120 122	12 12
Laidig very stony sandy loam:						
Licking Creek Township: 0.55 mile W. of T. 428 on S. side of U.S. 30. (Modal)	Colluvium from sandstone.	BM-839 BK-30988	22-36 44-60	B22t Bx	126 128	11 12
Todd Township: 1.2 miles N. of U.S. 30 on 29020. (Finer textured than modal)	Colluvium from sandstone.	BM-831 BM-832	24-32 41-57	B22 Cx	115 118	15 15
Dublin Township: 1.1 miles W. of Fort Littleton on N. side of 29030. (Coarser textured than modal)	Colluvium from sandstone.	BM-835 BM-836	20-28 38-50	B22 Cx	123 121	10 11

See footnotes at end of table.

test data [1]—Continued

Mechanical analysis [3]										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—						Percentage smaller than—							
3-in.	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 [4]	Unified [5]
100	72	66	65	51	24	23	20	13	8	20	2	A-2-4(0)	SM
100	64	56	55	47	25	24	21	11	6	21	3	A-1-b(0)	GM
-----	100	99	95	63	37	36	31	19	12	24	3	A-4(0)	SM
100	87	74	70	44	20	19	17	11	8	17	0	A-1-b(0)	SM
100	69	58	48	40	27	26	20	12	7	23	2	A-2-4(0)	GM
100	60	48	40	32	19	18	15	9	5	21	1	A-1-b(0)	GM
100	82	62	52	41	34	33	25	13	8	24	NP	A-2-4(0)	GM
100	66	48	41	32	27	26	20	11	7	24	1	A-2-4(0)	GM
100	69	54	48	43	34	31	24	13	8	24	0	A-2-4(0)	GM
100	50	40	37	33	25	23	18	11	8	25	2	A-1-b(0)	GM
100	54	39	35	31	21	20	16	10	7	28	1	A-1-b(0)	GM
100	45	32	28	24	19	18	15	10	8	35	5	A-1-b(0)	GM
100	76	65	60	54	48	47	37	22	16	26	3	A-4(3)	GM [6]
100	75	64	59	52	46	45	39	27	21	33	9	A-4(2)	GM-GC
-----	100	98	97	95	91	90	80	58	50	51	23	A-7-6(15)	MH-CH
100	93	88	87	82	78	77	65	48	42	51	22	A-7-6(15)	MH-CH
100	62	46	40	34	30	29	23	13	7	28	1	A-2-4(0)	GM
100	35	18	14	12	10	9	8	4	2	30	2	A-1-a(0)	GP-GM
100	88	68	55	43	33	30	20	10	6	29	3	A-2-4(0)	SM
100	57	42	37	34	24	21	15	9	6	22	0	A-1-b(0)	GM
-----	100	85	64	42	35	33	20	8	5	34	3	A-2-4(0)	SM
100	25	9	7	6	5	5	4	2	1	28	3	A-1-a(0)	GP-GM
100	96	71	58	50	36	32	22	11	7	27	1	A-4(0)	SM
100	72	48	41	35	28	26	19	11	7	24	2	A-2-4(0)	GM
-----	100	74	59	51	34	32	24	11	6	23	1	A-2-4(0)	SM
100	83	56	46	39	28	26	20	10	6	19	1	A-2-4(0)	GM
100	89	70	62	54	34	31	23	14	11	23	4	A-2-4(0)	SM-SC
100	75	60	53	45	30	27	20	12	9	21	2	A-2-4(0)	SM
100	77	65	60	51	40	38	32	24	20	33	11	A-6(1)	GM-GC
100	83	71	66	55	43	41	35	27	22	37	13	A-6(2)	GM-GC
100	59	50	49	46	15	14	12	9	7	NP	NP	A-1-b(0)	GM
-----	85	80	78	74	20	19	17	15	12	14	0	A-2-4(0)	SM

TABLE 3.—*Engineering*

Soil name and location	Parent material	Pennsylvania report number	Depth	Horizon	Moisture-density data [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Leck Kill shaly silt loam:						
Wells Township: 2.0 miles W. of Wells Tannery, 0.3 mile S. of T. 441, and 330 feet W. of Pa. 848. (Modal)	Shale (Mauch Chunk).	BJ-38777 BJ-40090	8–20 35–45	B2t C2	110 116	16 14
Murrill gravelly loam:						
Ayr Township: 0.6 mile S. of 29017 and 0.5 mile S. of Cito on 29038. (Modal)	Sandstone colluvium over limestone.	BK-30989 BK-31250	19–27 30–40	B22t IIB24t	124 105	14 23
Ayr Township: 4 miles N. of Cito and 900 feet N. of T. 381 on 29017. (Finer textured than modal)	Sandstone colluvium over limestone.	BM-3709 BM-842	15–23 36–45	B21 IIBb	108 94	20 27
Todd Township: 2.1 miles N. of McConnellsburg on E. side of U.S. 522. (Coarser textured than modal)	Sandstone colluvium over limestone.	BM-3710 BK-38052	16–30 44–54	B2 IIBb	112 114	17 16
Tygart silt loam, poorly drained variant:						
Belfast Township: 1.4 miles N. of Needmore and 231 feet E. of 29037. (Modal)	Old alluvium from shales, siltstones, and sandstones.	BK-38055 BK-38056	9–20 30–40	B21tg B3g	106 105	20 19
Belfast Township: 1.4 miles N. of Needmore and 291 feet E. of 29037. (Finer textured than modal)	Old alluvium from shales, siltstones, and sandstones.	BK-38057 BK-31254	8–18 28–34	B21g Cg	110 107	18 18
Belfast Township: 1.4 miles N. of Needmore and 33 feet E. of 29037. (Coarser textured than modal)	Old alluvium from acid shales and siltstones.	BK-38053 BK-38054	9–18 32–37	B21g Cg	106 117	19 14
Weikert channery silt loam:						
Dublin Township: 0.8 mile W. of T. 442 and 50 feet W. of T. 452. (Modal)	Shale of marine beds.	BM-825 BM-826	0–7 7–14	Ap B2	118 119	13 14
Bethel Township: 0.15 mile N. of U.S. 522 and T. 349 and 50 feet W. of shale quarry. (Finer textured than modal)	Shale of marine beds.	BM-827 BM-828	0–8 8–15	Ap AC	108 111	18 17
Licking Creek Township: 0.75 mile NE. of Harrisonville and 0.7 mile W. of 29021. (Coarser textured than modal)	Shale with sandstone of marine beds.	BM-833 BM-834	0–7 7–12	Ap AC	110 ([8])	15 ([8])
Wiltshire gravelly loam:						
Ayr Township: About 1 mile NW. of Cito. (Modal)	Sandstone colluvium over limestone.	BM-3711 BK-31253	14–20 40	B21t IIB3t	114 105	14 22
Ayr Township: 1.25 miles SE. of Big Cove Tannery and 0.25 mile SW. of junction of T. 356 and T. 342. (Finer textured than modal).	Sandstone colluvium over limestone.	BJ-44487 BJ-44488	14–20 45–60	B2 IIC	111 107	17 20
Ayr Township: 2,940 feet NE. of junction of 29038 and T. 356. (Coarser textured than modal)	Sandstone colluvium over limestone.	BK-31251 BK-31252	16–25 52–64	B21 C	124 124	13 13

[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.

[3] Mechanical analyses according to the AASHO Designation T 88–57. 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—						Percentage smaller than—						AASHO [4]	Unified [5]
3-in.	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.				
--------	100	89	79	65	57	55	43	31	24	38	11	A-6(5)	ML
--------	--------	--------	100	83	69	65	43	29	23	33	6	A-4(7)	ML
--------	100	95	92	81	47	45	39	28	22	24	6	A-4(2)	SM-SC
--------	100	99	98	94	86	85	82	66	55	46	20	A-7-6(13)	ML-CL [6]
100	96	95	94	87	73	72	67	57	51	44	22	A-7-6(13)	CL
--------	--------	--------	100	98	93	92	86	78	73	64	33	A-7-5(20)	MH-CH
100	92	84	76	60	41	40	34	27	23	35	13	A-6(2)	SM-SC
100	93	84	79	66	47	46	43	35	30	40	14	A-6(4)	SM-SC
--------	--------	--------	100	96	91	90	77	48	34	39	10	A-4(8)	ML
--------	--------	--------	--------	100	99	98	85	62	51	49	20	A-7-6(14)	ML-CL
--------	--------	--------	--------	100	95	93	75	48	39	38	13	A-6(9)	ML-CL
--------	--------	--------	100	99	92	91	80	55	44	43	17	A-7-6(11)	ML-CL
--------	100	99	95	92	87	86	68	34	21	36	9	A-4(8)	ML
--------	100	90	75	66	60	58	46	25	20	31	7	A-4(5)	ML-CL
100	90	63	42	27	22	20	15	7	3	--------	4	A-2-5(0)	SM
100	60	25	18	11	10	9	7	4	2	32	3	A-1-a(0)	GP-GM
--------	100	91	84	75	70	69	63	41	26	44	10	A-5(8)	ML
100	98	89	86	79	75	74	69	50	37	45	12	A-7-5(10)	ML
100	64	46	34	24	22	21	17	10	5	43	5	A-2-5(0)	GM
100	33	18	14	10	9	8	7	4	2	38	4	A-1-a(0)	GP-GM
100	98	92	88	80	63	61	46	29	22	26	7	A-4(6)	ML-CL
--------	--------	--------	100	98	90	85	74	59	54	52	25	A-7-6(16)	MH-CH
100	82	74	70	62	44	43	37	28	23	35	11	A-6(2)	SM-SC
--------	100	95	93	85	68	67	56	46	39	47	20	A-7-6(12)	ML-CL
100	63	52	42	29	18	17	15	11	8	26	6	A-1-b(0)	GM-GC
100	75	57	46	32	22	21	17	12	9	25	4	A-1-b(0)	GM-GC

[4] 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.

[5] Based on the "Unified Soil Classification System," Tech. Memo. No. 3-357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953.

[6] 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. An example is ML-CL.

[7] NP=Nonplastic.

[8] Insufficient material.

296-396—69——3

TABLE 4.—*Estimated engineering*

[Estimates of most properties are not given for the uppermost layer, because the material in this layer generally is not suitable for

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Engineering classification	
	Seasonal high water table	Bed-rock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified	AASHO
	Feet	*Feet*	*Inches*	*Percent*						
Albrights (AbB2)	1-3	3-10	0-14	---	---	---	---	---	---	---
			14-22	---	85-95	85-95	70-90	50-75	ML, CL	A-4, A-6
			22-50	---	65-80	55-65	45-55	25-55	ML, SM	A-2, A-4
Allegheny (AgB2)	3+	4-10	0-8	---	---	---	---	---	---	---
			8-38	---	90-100	90-100	80-90	65-75	ML, CL	A-4
			38-45	---	30-60	20-50	20-40	20-40	GM	A-2, A-4
Andover (AnB2, AoB)	0-1	4-40	0-8	---	---	---	---	---	---	---
			8-42	10	55-65	40-50	35-40	25-35	GM	A-2
Atkins (At)	0-1	3½-5	0-9	---	---	---	---	---	---	---
			9-18	---	100	100	95-100	55-90	ML	A-4, A-6
			18-36	---	100	100	90-100	55-90	ML, CL	A-4, A-6
Barbour (Ba)	3+	3-6	0-9	---	---	---	---	---	---	---
			9-30	---	100	100	95-100	40-70	SM, ML	A-4
			30-58	---	100	100	75-100	10-50	SM	A-2, A-4
Basher (Bc)	1½-2½	4-6	0-9	---	---	---	---	---	---	---
			9-35	---	---	90-100	85-100	25-60	SM, ML	A-2, A-4
			35-50	---	---	100	85-95	20-70	SM, ML	A-2, A-4
Bedington (BdB2, BdC2, BdD2, BdD3). (For properties of Edom soils in all of these mapping units, refer to the Edom series in this table.)	3+	4-8	0-9	---	---	---	---	---	---	---
			9-26	---	90-100	85-95	85-95	45-65	ML, SM	A-4
			26-34	---	45-70	40-65	35-60	30-55	GM, ML	A-2, A-4
Berks (BeB2, BeC2, BeD2)	3+	2-3½	0-9	---	---	---	---	---	---	---
			9-21	---	40-60	35-55	30-45	25-40	GM	A-2, A-4
			21-26	0-5	30-60	25-50	20-40	15-35	GM	A-2
Brinkerton (BrA, BrB2)	0-1	4-8	0-9	---	---	---	---	---	---	---
			9-44	0-10	95-100	90-100	85-95	70-90	CL, ML	A-4, A-6
Buchanan (BuB2, BuC2, BvB, BvD).	1-3	4-60	0-9	---	---	---	---	---	---	---
			9-24	0-10	80-90	75-85	65-80	45-60	SM, CL	A-4
			24-48	10-30	70-90	65-90	55-90	35-75	SM, ML	A-4
Calvin (CaC2, CaD2, CbB2, CbC2, CbD2, CkB2). (For properties of Berks soils in mapping units CbB2, CbC2, and CbD2 and for those of Leck Kill soils in mapping unit CkB2, refer to Berks series and Leck Kill series, respectively, in this table.)	3+	2½-4	0-9	---	---	---	---	---	---	---
			9-24	---	80-95	70-90	60-80	45-65	SM, ML	A-4
			24-40	0-20	45-55	40-50	30-45	25-35	GM, GC	A-2
Cookport (CpB)	1-3	3½-4½	0-8	---	---	---	---	---	---	---
			8-19	7-20	70-90	65-75	45-65	40-50	GM, SC, SM	A-4
			19-40	20-30	65-80	60-70	40-60	35-50	GM, SC, SM	A-4
Dekalb (DkB, DkD, DkE)	3+	2½-4	0-11	---	---	---	---	---	---	---
			11-27	0-15	60-100	50-95	40-65	25-35	SM, GM	A-2
			27-43	0-25	50-95	40-95	30-70	15-25	SM, GM	A-1, A-2
Edom (Edom soils are in Bedington-Edom mapping units).	3+	2½-3½	0-8	---	---	---	---	---	---	---
			8-28	---	95-100	85-100	80-95	70-90	CL	A-7
			28-32	5	30-50	25-45	20-40	15-20	GM, GC	A-2

properties of soils

use in many engineering structures. Estimates of the fraction coarser than 3 inches are given only if the amount is significant]

USDA texture (representative profile)	Range in permeability	Range in available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential (steel)
	Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*		
Silt loam	0.63–2.0	0.20–0.24	4.5–6.0				
Silty clay loam	0.20–0.63	0.12–0.14	4.5–5.0	14	114	Low	Moderate.
Shaly loam and loam	<2.0	0.10–0.14	4.5–5.0	13	122	Low	Moderate.
Gravelly loam	2.0–6.3	0.18–0.21	5.1–6.6				
Gravelly clay loam	0.63–2.0	0.16–0.18	5.1–6.1	13	120	Low	Low.
Gravel, silt, and clay	0.63–6.3	0.05–0.10	5.1–6.1	9	125	Low	Low.
Very stony silt loam	0.63–2.0	0.20–0.25	5.1–5.5				
Very stony clay loam and very stony sandy clay loam.	<0.20	0.08–0.12	4.5–5.0	15	120	Moderate	High.
Silt loam	0.63–2.0	0.13–0.17	4.5–6.6				
Silt loam	0.63–2.0	0.13–0.18	4.5–6.0	14	109	Low	High.
Clay loam	0.20–2.0	0.13–0.18	4.5–6.0	18	107	Moderate	High.
Fine sandy loam	2.0–6.3	0.10–0.15	4.5–6.5				
Fine sandy loam	0.63–6.3	0.08–0.12	4.5–6.0	13	114	Low	Low.
Fine sandy loam	0.63–6.3	0.08–0.12	4.5–6.0	13	114	Low	Low.
Silt loam	0.63–2.0	0.14–0.20	5.1–6.8				
Silt loam	0.63–2.0	0.16–0.20	5.1–6.5	18	104	Low	Moderate.
Sand and silt	0.63–2.0	0.12–0.16	5.1–6.5	14	113	Low	Moderate.
Shaly silt loam	2.0–6.3	0.18–0.22	5.6–7.0				
Shaly clay loam and silty clay loam	0.63–2.0	0.12–0.14	5.6–6.0	19	105	Low	Low.
Very shaly loam	0.63–2.0	0.12–0.18	4.5–5.5	19	105	Low	Low.
Channery silt loam	2.0–6.3	0.13–0.20	4.5–6.6				
Channery and very channery silt loam	0.63–6.3	0.13–0.20	4.5–6.0	15	112	Low	Low.
Shale, silt and clay	2.0–6.3	0.10–0.14	4.5–6.0	17	112	Low	Low.
Silt loam	0.63–2.0	0.22–0.27	4.5–6.6				
Clay loam and silty clay loam	<0.20	0.08–0.13	4.5–6.0	17	110	Moderate	High to moderate.
Very stony loam	2.0–6.3	0.15–0.18	4.0–6.0				
Very stony clay loam	0.20–0.63	0.06–0.15	4.5–5.1	13	117	Low	Moderate.
Very stony loam	<0.20	0.05–0.17	4.5–5.1	14	115	Low	Moderate.
Shaly silt loam	2.0–6.3	0.14–0.20	4.0–5.5				
Shaly loam and very shaly loam	0.63–6.3	0.10–0.16	4.0–5.5	15	115	Low	Low.
Shale fragments, clay, and silt	0.63–6.3	0.05–0.11	4.0–5.5	13	118	Low	Low.
Very stony loam	0.63–2.0	0.16–0.20	4.2–5.5				
Very stony sandy loam	0.20–0.63	0.12–0.16	4.2–5.0	11	122	Low	Moderate.
Very stony sandy clay loam	<0.20	0.10–0.14	4.2–5.0	11	123	Low	Moderate.
Very stony sandy loam	2.0–6.3	0.08–0.12	4.2–5.0				
Very stony sandy loam	2.0–6.3	0.06–0.10	4.2–5.0	11	123	Low	Low.
Very stony sandy loam	2.0–6.3	0.06–0.10	4.2–5.0	11	124	Low	Low.
Silt loam	2.0–6.3	0.20–0.25	6.1–7.3				
Silty clay loam	0.20–2.0	0.12–0.17	6.1–7.3	26	92	Moderate	Low.
Shale, silt, and clay	0.63–2.0	0.12–0.17	6.6–7.3	12	121	Low	Low.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Engineering classification Unified	AASHO
	Feet	*Feet*	*Inches*	*Percent*						
Elliber (EbB2, EbC2, EbD2)	3+	4–10	0–16	--------	--------	--------	--------	--------	--------	--------
			16–36	--------	40–60	35–50	30–45	20–35	GM	A–1, A–2
			36–60	--------	30–50	30–40	25–35	20–25	GM, GC	A–1, A–2
Ernest (ErB2)	1½–2½	3½–10	0–9	--------	--------	--------	--------	--------	--------	--------
			9–40	--------	90–100	90–100	85–95	70–90	ML, CL	A–4, A–6
			40–44	--------	80–90	70–90	65–85	55–65	ML, CL	A–4
Frankstown (FrB2, FrC2, FrD2, FrE2).	3+	3½–6	0–16	--------	--------	--------	--------	--------	--------	--------
			16–43	--------	50–80	45–75	40–70	35–65	GM, ML	A–4
			43–57	0–10	45–85	40–80	30–70	25–65	GM, SM, ML	A–1, A–4
Hagerstown (HeB2, HeC2, HeD2, HgB3, HhC3, HhD3, HtD2, HtE2).	3+	3½–10	0–8	--------	--------	--------	--------	--------	--------	--------
			8–37	0–10	80–100	80–100	70–95	70–90	CL, CH	A–6, A–7
			37–42	0–10	80–100	75–95	65–95	60–90	CL	A–6, A–7
Klinesville (KaB2, KaC2, KaD2, KwB2, KwC2, KwD2, KwE2). (For properties of Weikert soils in mapping units KwB2, KwC2, KwD2, and KwE2, refer to the Weikert series in this table).	3+	1–1½	0–9	--------	--------	--------	--------	--------	--------	--------
			9–19	--------	40–55	35–45	30–40	20–30	GM, GC	A–1, A–2
Laidig (LaB2, LaC2, LaD2, LdB, LdD, LdE, LmB, LmC). (For properties of Murrill soils in mapping units LmB and LmC, refer to the Murrill series in this table).	3+	5–80	0–14	--------	--------	--------	--------	--------	--------	--------
			14–44	--------	50–70	50–60	45–55	15–40	SM, GM	A–1, A–2, A–4
			44–60	--------	60–80	55–75	45–70	20–35	SM, GM	A–2
Lawrence, coarse subsoil variant (Ln).	½–1½	3½–6	0–7	--------	--------	--------	--------	--------	--------	--------
			7–40	--------	75–85	75–80	70–80	50–60	ML, CL	A–4, A–6
			40	--------	85–95	85–90	80–90	45–55	ML, CL, SM	A–4, A–6
Leck Kill (Leck Kill soils are in a Calvin and Leck Kill mapping unit).	3+	3½–5	0–8	--------	--------	--------	--------	--------	--------	--------
			8–26	--------	80–95	70–90	60–80	50–65	ML, SM	A–4
			26–45	0–20	40–60	30–50	25–45	25–35	GM, GC	A–2
Lehew (LoE)	3+	1½–3½	0–7	--------	--------	--------	--------	--------	--------	--------
			7–26	--------	65–75	60–70	55–65	25–40	SM	A–2, A–4
			26–32	--------	50–55	45–50	40–45	20–25	GM	A–1, A–2
Lindside (Ls)	1–2½	3–6	0–9	--------	--------	--------	--------	--------	--------	--------
			9–36	--------	80–100	70–100	60–90	40–60	SM, ML	A–4
			36–60	--------	50–80	50–80	45–75	30–50	GM, SM	A–2, A–4
Melvin (Me)	0–1	3½–5	0–9	--------	--------	--------	--------	--------	--------	--------
			9–44	--------	90–100	65–90	60–85	55–70	ML, CL	A–4, A–6
			44	--------	50–80	50–80	40–70	20–50	GM, SM	A–2, A–1, A–4
Monongahela (MoB2)	1½–2½	3½–10	0–9	--------	--------	--------	--------	--------	--------	--------
			9–44	5–10	85–95	80–95	75–90	75–85	ML, CL	A–4, A–6
			44–48	10–25	80–90	75–90	70–80	40–50	ML, SM	A–4
Murrill (MuB2, MuC2, MvD)	3+	4–10	0–15	--------	--------	--------	--------	--------	--------	--------
			15–30	--------	85–95	75–90	60–80	40–70	SM, CL	A–4, A–6
			30–40	--------	85–100	80–95	65–95	45–85	ML, CL, SM	A–6, A–7

properties of soils—Continued

USDA texture (representative profile)	Range in permeability	Range in available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential (steel)
	Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*		
Very cherty loam	2. 0–6. 3+	0. 10–0. 14	5. 1–6. 6				
Very cherty silt loam	2. 0–6. 3+	0. 12–0. 16	5. 1–6. 0	17	107	Low	Low.
Chert, silt, and sand	2. 0–6. 3+	0. 08–0. 10	5. 1–6. 0	17	106	Low	Low.
Silt loam	0. 63–2. 0	0. 16–0. 20	5. 6–6. 6				
Silty clay loam and clay loam	0. 20–0. 63	0. 14–0. 18	4. 5–6. 0	17	107	Moderate	High.
Clay loam	0. 63–2. 0	0. 10–0. 14	4. 5–6. 0	13	116	Moderate	High.
Cherty silt loam	2. 0–6. 3	0. 20–0. 25	5. 5–7. 0				
Cherty silty clay loam	0. 63–2. 0	0. 12–0. 17	5. 1–6. 1	22	107	Low	Low to moderate.
Chert, silt, and clay	0. 63–2. 0	0. 10–0. 15	5. 1–6. 1	21	107	Low	Low to moderate.
Silt loam	2. 0–6. 3	0. 20–0. 25	6. 1–7. 3				
Silty clay and silty clay loam	0. 63–2. 0	0. 12–0. 17	6. 1–7. 3	20	109	High	Low.
Silty clay loam	0. 63–2. 0	0. 12–0. 17	6. 1–7. 3	18	107	Moderate	Low.
Shaly silt loam	2. 0–6. 3	0. 10–0. 15	5. 0–6. 5				
Very shaly loam	2. 0–6. 3	0. 05–0. 10	4. 5–5. 0	12	120	Low	Low.
Very stony sandy loam and gravelly sandy loam.	2. 0–6. 3	0. 14–0. 18	4. 2–5. 0				
Gravelly sandy clay loam	0. 63–2. 0	0. 12–0. 16	4. 2–5. 0	11	124	Low	Low.
Gravelly loam	0. 20–0. 63	0. 10–0. 14	4. 2–5. 0	11	121	Low	Low.
Gravelly silt loam	2. 0–6. 3	0. 20–0. 24	5. 6–7. 0				
Silty clay loam	0. 20–0. 63	0. 20–0. 24	5. 6–6. 5	13	110	Moderate	High.
Gravelly clay loam	0. 20–2. 0	0. 16–0. 20	5. 6–6. 8	17	106	Moderate	High.
Shaly silt loam	0. 63–2. 0	0. 14–0. 20	5. 0–6. 2				
Shaly clay loam and silt loam	0. 63–2. 0	0. 10–0. 16	4. 4–5. 5	15	114	Moderate	Low.
Shale, silt, and clay	0. 63–2. 0	0. 05–0. 11	4. 4–5. 5	13	117	Low	Low.
Very stony loam	2. 0–6. 3	0. 08–0. 12	4. 2–5. 5				
Gravelly loam	2. 0–6. 3	0. 06–0. 10	4. 2–5. 5	12	121	Low	Low.
Sandstone, silt, and sand	2. 0–6. 3	0. 06–0. 10	4. 2–5. 5	12	121	Low	Low.
Silt loam	2. 0–6. 3	0. 20–0. 24	6. 6–7. 3				
Silt loam and fine sandy loam	0. 63–2. 0	0. 16–0. 20	6. 6–7. 3	12	120	Low	Moderate.
Gravel	0. 63–2. 0	0. 12–0. 16	6. 6–7. 3	12	120	Low	High.
Silt loam	2. 0–6. 3	0. 15–0. 19	6. 6–7. 3				
Silty clay loam and silt loam	0. 20–0. 63	0. 14–0. 18	6. 6–7. 3	15	110	Moderate	High.
Gravel and sand	0. 20–0. 63	0. 08–0. 12	6. 6–7. 3	12	115	Low	High.
Silt loam	2. 0–6. 3	0. 14–0. 18	5. 6–6. 6				
Clay loam, silt loam, and silty clay loam.	0. 20–0. 63	0. 13–0. 17		17	110	Moderate	Moderate.
Sand, silt, and gravel	2. 0–6. 3	0. 08–0. 12	4. 2–5. 5	13	117	Low	Moderate.
Gravelly loam	2. 0–6. 3	0. 19–0. 23	5. 6–6. 8				
Gravelly sandy clay loam and clay loam	0. 63–2. 0	0. 06–0. 11	5. 1–6. 0	15	115	Moderate	Low.
Silty clay loam	0. 63–2. 0	0. 06–0. 12	5. 5–7. 0	22	105	Moderate	Low.

TABLE 4.—*Estimated engineering*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Engineering classification	
	Seasonal high water table	Bedrock			No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Unified	AASHO
	Feet	*Feet*	*Inches*	*Percent*						
Philo (Ph)	1½–2½	4–6	0–9							
			9–37		100	100	95–100	65–85	ML, CL	A-4, A-6
			37		60–90	55–85	50–80	35–45	GM, SM	A-4
Pope, neutral variant (Pm)	3+	4–6	0–9							
			9–38		90–100	80–90	70–80	35–55	ML, SM	A-4
			38–46		85–95	60–80	50–70	10–30	SM	A-2
Pope (Po)	3+	4. 6	0–9							
			9–50		70–100	60–100	45–95	20–55	SM, ML	A-1, A-4
			50	10–20	45–50	35–40	25–30	10–15	GM, GW, GM	A-1
Tygart (Ty)	1–2	4–7	0–8							
			8–23		80–100	65–85	60–80	55–70	ML, CL	A-6
			23–50		90–100	75–90	70–85	60–80	ML, CL	A-6
Tygart, poorly drained variant (Tz).	0–½	4–7	0–9							
			9–30		95–100	95–100	90–100	85–95	ML, CL	A-4, A-6
			30–40		90–100	75–100	70–100	60–95	ML. CL	A-4, A-7
Weikert (WcB2, WcC2, WcD2)	3+	1–1½	0–7							
			7–14	0–10	20–25	15–20	10–15	5–10	GP, GM, GM	A-1, A-2
Wiltshire (WgB2)	1½–3	4–8	0–14							
			14–25		75–90	70–85	60–80	45–60	SM, ML	A-4, A-6
			25–40		95–100	90–100	85–95	70–90	ML, CL	A-7, A-6

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Soil features affecting—
			Topsoil	Sand and gravel	Road fill	Highway location
Albrights:						
AbB2	Poor	Moderate	Fair	Unsuitable	Fair	Seepage; high water table; frost action.
Allegheny:						
AgB2	Good	Low	Good	Poor	Good	No undesirable features.
Andover:						
AnB2	Poor	High	Poor	Unsuitable	Poor	High water table; seepage; frost action.
AoB	Poor	High	Poor	Unsuitable	Fair	High water table; seepage; frost action.

See footnote at end of table.

properties of soils—Continued

USDA texture (representative profile)	Range in permeability	Range in available moisture capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential (steel)
	Inches per hour	*Inches per inch*	*pH*	*Percent*	*Pounds per cubic foot*		
Silt loam	2. 0–6. 3	0. 20–0. 24	5. 6–6. 8				
Silt loam	0. 63–2. 0	0. 16–0. 20	4. 5–6. 0	18	106	Low	Moderate.
Gravel, silt, and sand	0. 63–2. 0	0. 12–0. 16	4. 5–6. 0	17	109	Low	Moderate.
Fine sandy loam	2. 0–6. 3	0. 20–0. 25	6. 1–7. 3				
Fine sandy loam	0. 63–2. 0	0. 12–0. 17	6. 1–7. 3	14	116	Low	Low.
Fine sandy loam	0. 63–2. 0	0. 12–0. 17	6. 6–7. 3	14	116	Low	Low.
Loam	2. 0–6. 3	0. 17–0. 20	5. 6–6. 8				
Loam	0. 63–2. 0	0. 14–0. 16	4. 5–6. 0	14	115	Low	Low.
Gravel and sand	2. 0–6. 3	0. 08–0. 12	4. 5–6. 0	11	123	Low	Low.
Silt loam	0. 63–2. 0	0. 20–0. 24	4. 0–5. 5				
Silty clay loam	0. 63–2. 0	0. 18–0. 20	4. 5–5. 1	17	110	Moderate	Slight.
Silty clay loam	0. 20–0. 63	0. 15–0. 19	4. 5–5. 1	15	115	Moderate	High.
Silt loam	0. 63–2. 0	0. 20–0. 24	5. 6–6. 8				
Silty clay loam	0. 20–0. 63	0. 16–0. 20	4. 5–5. 6	19	105	Moderate	High.
Silty clay loam	0. 20–0. 63	0. 13–0. 17	5. 0–5. 5	16	112	Moderate	High.
Shaly silt loam	2. 0–6. 3	0. 10–0. 15	5. 1–6. 6				
Very shaly silt loam	2. 0–6. 3	0. 05–0. 10	4. 2–5. 5	14	118	Low	Low.
Gravelly loam and silt loam	2. 0–6. 3	0. 20–0. 25	5. 6–6. 8				
Clay loam and silty clay loam	0. 63–2. 0	0. 10–0. 14	5. 6–6. 6	15	113	Moderate	Moderate.
Clay loam	0. 20–0. 63	0. 13–0. 17	6. 6–7. 3	13	120	Moderate	Moderate.

interpretations of the soils

Soil features affecting—Continued					
Construction and maintenance of pipelines	Impoundments of water		Agricultural drainage	Irrigation	Terraces, diversions, or waterways
	Reservoir area	Embankment			
High water table	No undesirable features.[1]	Fair stability	Moderately slowly permeable fragipan.	Moderately slowly permeable fragipan.	Seasonal high water table; seepage on top of fragipan.
No undesirable features.	Rapidly permeable substratum.	Fair stability	Well drained	No undesirable features.	No undesirable features.
High corrosion potential; high water table.	No undesirable features.	Fair stability	Moderately slowly permeable fragipan.	Moderately slowly permeable fragipan.	High water table.
Stones; high corrosion potential; seasonal high water table.	Stones	Fair stability; stones.	Moderately slowly permeable fragipan; stones.	Moderately slowly permeable fragipan; stones.	Stones; seasonal high water table.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill	Soil features affecting— Highway location
Atkins: At	Poor	High	Fair	Unsuitable	Fair	High water table; flooding; frost action.
Barbour: Ba	Fair	Moderate	Good	Poor	Fair	Flooding
Basher: Bc	Poor	High	Fair	Unsuitable	Fair	Flooding; high water table; frost action.
Bedington: BdB2, BdC2, BdD2, BdD3	Fair	Moderate	Fair	Unsuitable	Fair	Bedrock at depth of 2½ to 8 feet.
Berks: BeB2, BeC2, BeD2	Fair	Moderate	Poor	Unsuitable	Fair	Bedrock within 2 to 3½ feet of surface.
Brinkerton: BrA, BrB2	Poor	High	Poor	Unsuitable	Poor	High water table; seepage; frost action.
Buchanan: BuB2, BuC2	Poor	Moderate	Fair	Unsuitable	Fair	Seepage; high water table.
BvB, BvD	Poor	Moderate	Poor	Unsuitable	Fair	Seepage; high water table.
Calvin: CaC2, CaD2, CbB2, CbC2, CbD2, CkB2. (For Berks parts of CbB2, CbC2, and CbD2, see Berks series. For Leck Kill part of CkB2 see Leck Kill series.)	Fair	Moderate	Fair	Unsuitable	Fair	Bedrock within 2½ to 4 feet of surface.
Cookport: CpB	Poor	Moderate	Poor	Unsuitable	Fair	Seepage; seasonal high water table.
Dekalb: DkB, DkD, DkE	Good	Low	Poor	Poor	Good	2½ to 4 feet deep to bedrock.
Edom: (Mapped only in soil complexes; see Bedington series).						

See footnote at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued					
Construction and maintenance of pipelines	Impoundments of water		Agricultural drainage	Irrigation	Terraces, diversions, or waterways
	Reservoir area	Embankment			
High water table; high corrosion potential; flooding.	Possible rapidly permeable layers in underlying material.	High water table	Flooding; poor outlets available.	Flooding; high water table.	Wetness.
Flooding	Flooding	Stable after selective placement.	Well drained	Flooding; moderate to high moisture capacity.	No undesirable features.
High water table	Permeable layers in substratum; flooding.	Stable after selective placement.	Flooding; high water table.	Flooding; high water table.	High water table.
Bedrock at depth of 2½ to 8 feet.	Bedrock at depth of 2½ to 8 feet.	Difficult to compact	Well drained	Medium available moisture capacity.	No undesirable features.
Bedrock within 2 to 3½ feet of surface.	Permeable bedrock within 2 to 3½ feet of surface.	Fair stability	Well drained	Low to medium available moisture capacity.	Bedrock 2 to 3½ feet from surface.
Seasonal high water table; high corrosion potential.	No undesirable features.[1]	Fair stability	Moderately slowly permeable fragipan.	Moderately slowly permeable fragipan.	High water table.
Seasonal high water table.	No undesirable features.[1]	Fair stability	Moderately slowly permeable fragipan.	Moderately slowly permeable fragipan.	Seasonal high water table.
Seasonal high water table; stones.	Stones	Stones; fair stability.	Stones; moderately slowly permeable subsoil.	Moderately slowly permeable subsoil; stones.	Stones; seasonal high water table.
Bedrock within 2½ to 4 feet of surface.	Pervious bedrock within 2½ to 4 feet of surface.	2½ to 4 feet deep to pervious bedrock.	Well drained	Low to moderate available moisture capacity.	Bedrock at depth of 2½ to 4 feet.
Seasonal high water table.	Moderately slow permeability.	No undesirable features.[1]	Moderately slowly permeable fragipan.	Moderately slowly permeable fragipan.	Seasonal high water table.
2½ to 4 feet deep to bedrock.	Bedrock within 2½ to 4 feet of surface; moderately rapid permeability.	Moderately rapid permeability.	Well drained	Low to medium available moisture capacity.	Bedrock at depth of 2½ to 4 feet.
---	---	---	---	---	---

296-396—69——4

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Soil features affecting—
			Topsoil	Sand and gravel	Road fill	Highway location
Elliber: EbB2, EbC2, EbD2	Good	Low	Poor	Fair	Good	No undesirable features.
Ernest: ErB2	Poor	Moderate	Fair	Unsuitable	Fair	Seasonal high water table; seepage.
Frankstown: FrB2, FrC2, FrD2, FrE2	Fair	Moderate	Good	Unsuitable	Fair	Bedrock within 3½ to 6 feet of surface.
Hagerstown: HeB2, HeC2, HeD2	Poor	Moderate	Good	Unsuitable	Fair	Many rock ledges and sinkholes.
HgB3	Poor	Moderate	Fair	Unsuitable	Fair	Many rock ledges and sinkholes.
HhC3, HhD3	Poor	Moderate	Fair	Unsuitable	Poor	Many rock ledges and sinkholes; bedrock at depth of 2 to 3 feet.
HtD2, HtE2	Poor	Moderate	Poor	Unsuitable	Poor	Many rock ledges and sinkholes; rock outcrops.
Klinesville: KaB2, KaC2, KaD2, KwB2, KwC2, KwD2, KwE2. (For Weikert part of KwB2, KwC2, KwD2, and KwE2, see Weikert series.)	Good	Low	Poor	Unsuitable	Fair; limited quantity.	Bedrock at depth of 1 to 1½ feet.
Laidig: LaB2, LaC2, LaD2, LmB, LmC. (For Murrill part of LmB and LmC, see Murrill series.)	Fair	Low	Fair	Unsuitable	Good	No undesirable features.
LdB, LdD, LdE	Fair	Low	Stony	Unsuitable	Good	No undesirable features.
Lawrence, coarse subsoil variant: Ln	Fair	High	Fair	Unsuitable	Fair	Seasonal high water table.
Leck Kill: Part of CkB2	Fair	Moderate	Fair	Unsuitable	Fair	No undesirable features.
Lehew: LoE	Good	Low	Poor	Poor	Good	Bedrock at depth of 1½ to 3½ feet.

See footnote at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued					
Construction and maintenance of pipelines	Impoundments of water		Agricultural drainage	Irrigation	Terraces, diversions, or waterways
	Reservoir area	Embankment			
Abrasive chert	Moderately rapid permeability.	Moderately rapid permeability.	Well drained	Moderate available moisture capacity.	No undesirable features.
Seasonal high water table; high corrosion potential.	No undesirable features.[1]	Instability	Moderately slow permeability in fragipan.	Moderately slow permeability in fragipan.	Seasonal high water table.
Bedrock 3½ to 6 feet from surface.	Bedrock within 3½ feet of surface in many places.	Pervious bedrock	Well drained	High available moisture capacity.	Occasional outcrops of bedrock.
Many rock ledges	Many rock ledges and sinkholes.	Fair stability; high shrink-swell.	Well drained	High available moisture capacity.	Many rock ledges.
Many rock ledges	Many rock ledges and sinkholes.	High shrink-swell; fair stability.	Well drained	High available moisture capacity.	Many rock ledges.
Bedrock at depth of 2 to 3 feet.	Many rock ledges and sinkholes.	High shrink-swell; fair stability.	Well drained	High available moisture capacity.	Many rock ledges.
Many rock ledges; rock outcrops.	Many rock ledges and sinkholes.	High shrink-swell; fair stability.	Well drained	High available moisture capacity.	Numerous rock outcrops.
Bedrock at depth of 1 to 1½ feet.	Moderately rapid permeability; bedrock at depth of 1 to 1½ feet.	Moderately rapid permeability.	Well drained	Very low available moisture capacity.	Bedrock at depth of 1 to 1½ feet.
No undesirable features.	No undesirable features.[1]	Sandy lenses in substratum.	Well drained	Moderately slow permeability in fragipan.	Stones in stony phases.
Numerous stones	Numerous stones	Numerous stones	Well drained	Moderately slow permeability in fragipan.	Numerous stones.
Seasonal high water table.	Bedrock may have solution channels.	Fair stability	Moderately slowly permeable fragipan.	Moderately slowly permeable fragipan.	Seasonal high water table.
No undesirable features.	No undesirable features.[1]	Shale content high in many places.	Well drained	No undesirable features.	No undesirable features.
Bedrock at depth of 1½ to 3½ feet.	Moderately rapid permeability; bedrock at depth of 1½ to 3½ feet.	Moderately rapid permeability.	Well drained	Low available moisture capacity.	Bedrock at depth of 1½ to 3½ feet.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill	Soil features affecting— Highway location
Lindside:						
Ls	Poor	Moderate	Good	Unsuitable	Fair	Flooding; seasonal high water table.
Melvin:						
Me	Unsuitable	High	Good	Unsuitable	Poor	Flooding; high water table.
Monongahela:						
MoB2	Poor	Moderate	Fair	Unsuitable	Fair	Seasonal high water table; highly susceptible to frost action.
Murrill:						
MuB2, MuC2	Fair	Moderate	Fair; poor on stony phases.	Unsuitable	Good	Few sinkholes
MvD	Fair	Moderate	Poor	Unsuitable	Fair	Few sinkholes
Philo:						
Ph	Poor	High	Fair	Unsuitable	Poor	Flooding; seasonal high water table; highly susceptible to frost action.
Pope, neutral variant:						
Pm	Fair	Moderate	Good	Poor	Fair	Flooding
Pope:						
Po	Fair	Moderate	Good	Poor	Fair	Flooding
Tygart:						
Ty	Poor	High	Fair	Unsuitable	Poor	Seasonal high water table; highly susceptible to frost action.
Tygart, poorly drained variant:						
Tz	Poor	High	Fair	Unsuitable	Poor	Seasonal high water table; highly susceptible to frost action.
Weikert:						
WcB2, WcC2, WcD2	Good	Low	Poor	Unsuitable	Fair	Bedrock at depth of 1 to 1½ feet.
Wiltshire:						
WgB2	Unsuitable	High	Fair	Unsuitable	Poor	Seasonal high water table; highly susceptible to frost action.

[1] Leakage can occur if a reservoir area extends into adjacent soils that have undesirable features.

interpretations of the soils—Continued

Soil features affecting—Continued					
Construction and maintenance of pipelines	Impoundments of water		Agricultural drainage	Irrigation	Terraces, diversions, or waterways
	Reservoir area	Embankment			
Flooding; seasonal high water table.	Permeability may be rapid in substratum.	Fair stability; flood hazard.	Moderately slow permeability; seasonal high water table.	Flooding; seasonal high water table.	Seasonal high water table.
Flooding; high water table; high corrosion potential.	Possible permeable layers in substratum; flood hazard.	High organic-matter content; flooding.	Flooding; poor outlets available; seasonal high water table.	Flooding; high water table.	Wetness.
Seasonal high water table.	May have sand lenses in substratum.	Fair stability	Moderately slowly permeable fragipan; seasonal high water table.	Moderately slowly permeable fragipan.	Seasonal high water table.
No undesirable features.	Possible rapid permeability in substratum.	Fair stability	Well drained	No undesirable features.	No undesirable features.
Stones	Possible rapid permeability; stones in substratum.	Fair stability; stones.	Well drained	No undesirable features.	Stones.
Seasonal high water table; flooding.	Possible permeable layers in substratum.	Fair stability	Flooding	Flooding	Seasonal high water table.
Flooding	Possible permeable layers in substratum.	Fair stability	Flooding	Flooding	No undesirable features.
Flooding	Possible permeable layers in substratum.	Fair stability	Flooding	Flooding	No undesirable features.
Seasonal high water table; high corrosion potential.	No undesirable features. [1]	Fair stability	Moderately slowly permeable subsoil; high water table.	Moderately slowly permeable subsoil.	Seasonal high water table.
High water table; high corrosion potential.	No undesirable features. [1]	Fair stability	Moderately slowly permeable subsoil.	Moderately slowly permeable subsoil.	High water table.
Bedrock at depth of 1 to 1½ feet.	Moderately rapid permeability; bedrock at depth of 1 to 1½ feet.	Moderately rapid permeability.	Well drained	Low moisture capacity.	Bedrock at depth of 1 to 1½ feet.
Seasonal high water table.	Possible permeable layers in substratum.	Fair stability	Moderately slowly permeable fragipan.	Moderately slowly permeable fragipan.	Seasonal high water table.

Most highway engineers classify soil material according to the system approved by the American Association of State Highway Officials (AASHO) (*1*). 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 materials is indicated by a group index number. Group indexes range from 0 for the best materials to 20 for the poorest. The group index, when it is used, is shown in parentheses after the symbol for the soil group; for example, A–6 (*1*).

Some engineers prefer the Unified classification system, which was established by the Waterways Experiment Station, Corps of Engineers (*23*). 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.

Engineering test data

To help evaluate the soils for engineering purposes, samples of principal soil series were taken at three or more sites in Fulton County and tested in accordance with established procedures. The test data are given in table 3. The engineering classifications in table 3 are based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits. The mechanical analysis was made by combined sieve and hydrometer methods. Percentages of silt and clay determined by the hydrometer method are not used in naming textural classes for soils (*18*). The test data, however, are useful in determining the general engineering properties of soils.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of soil material. As the moisture content of a clay or silt is increased from a very dry state, the soil material changes from a semisolid to a plastic. As the moisture content is further increased, the soil material changes from a plastic to a liquid. The *plastic limit* is the moisture content, expressed in percentage, at which the soil changes from a semisolid to a plastic. The *liquid limit* is the moisture content at which the soil material changes from a plastic to a liquid. The *plasticity index* is the numerical difference between the plastic limit and the liquid limit. It indicates the range of moisture content within which the soil material is plastic.

Table 3 also gives compaction (moisture-density) data for the tested soils. If a soil is compacted at a successively higher moisture content, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. Moisture-density relations are important in earthwork, for, as a rule, the greatest stability is obtained if the soil is compacted to the maximum dry density at a moisture near the optimum.

Engineering properties and interpretations

The properties of the soils and interpretations that are most significant to engineers are given in tables 4 and 5. Information in these tables, the descriptions of soils, and the soil maps are useful in planning detailed surveys at construction sites. Omitted from table 4 and table 5 are three land types that have variable features. These are Made land (Ma), Rubble land (Ru), and Strip mine spoil (St).

Table 4 gives the estimated engineering properties of the soils. The properties are those of a typical soil profile of the series. Those properties of the dominant layers that are significant in engineering are shown. If engineering test data were obtained and reported in table 3, the estimates in table 4 were based on them. Estimates for the other soils are based on test data obtained from similar soils in other counties and on experience in working with the soils.

The map symbols and the names of the soil series are listed alphabetically in table 4. An explanation of the significance of some column headings in table 4 follows:

Depth to seasonal high water table indicates the depth to which free water will rise at least once a year, measured in feet from the surface.

Depth to bedrock is measured in feet from the surface and is the range in which bedrock is encountered in most areas of a particular soil. Bedrock is considered the solid or fractured rock that generally underlies the soil and other unconsolidated material.

Depth from the surface gives the depth to the significant layers for which properties have been estimated. Those layers are described in the section, "Description of the Soils." The estimates of properties of signficant layers that are given in succeeding columns are ranges of values for a typical soil profile. Variations from these values are to be expected. Many engineering interpretations need to be based on the soil material below a depth of 6 to 10 inches. The soil above this depth ordinarily contains too much organic matter to be used in engineering structures, but it is commonly saved and used as topsoil on shoulders and slopes to promote the growth of vegetation.

The coarse fraction greater than 3 inches was not measured in the mechanical analysis; it is a field observation made at the time the sample was collected.

The *permeability* of the soil refers to the rate of downward movement of water through the soil material in its undisturbed state. This rate depends largely on soil texture, porosity, and structure. Permeability of less than 0.2 inch per hour is rated *slow;* 0.2 to 0.63 inch per hour, *moderately slow;* 0.63 to 2.0 inches per hour, *moderate;* 2.0 to 6.3 inches per hour, *moderately rapid;* and more than 6.3 inches per hour, *rapid.*

Available moisture capacity is expressed in inches of water per inch of soil. It is the approximate amount of capillary water in the soil when it is wet to field capacity. The retention of water by the soil is related to the particle size and to the arrangement and size of soil pores. Factors such as texture, structure, and organic-matter content affect the available moisture capacity.

Reaction of the soil, expressed in pH value, is the degree of acidity or alkalinity. Cropped soils that have had large applications of lime over a period of years are likely to be less acid than in the ranges listed.

Optimum moisture for compaction and *maximum dry density* are explained in the discussion on soil test data. It should be noted that the test data and those estimates apply to that part of the soil that passes a No. 4 sieve. Soils that have a large amount of material larger than that passing a No. 4 sieve would have higher maximum dry density and lower optimum moisture content for compaction.

Shrink-swell potential is an indication of the change in volume to be expected with a change in moisture content. It is estimated mainly on the basis of the amount and type of clay in the soil. In general, soils classed as CH and A–7 have a high shrink-swell potential. Clean sand and gravel (single grain) and soils that contain a small amount of nonplastic to slightly plastic soil material have a low shrink-swell potential.

Corrosion potential is estimated for steel pipe. Factors considered in the rating were total acidity, soil drainage, and soil texture.

In table 5 the soils are rated according to their suitability for winter grading, susceptibility to frost action, and suitability as a source of topsoil and of road fill. Important soil features that affect engineering construction are described briefly. An explanation of the column headings follows:

Suitability for winter grading is based on winter conditions in Fulton County. There is a variation in the county of the suitability for winter grading, depending on the location and the size of the project. Small, slow-moving projects may have difficulties where large, fast-moving jobs would find little difficulty or none. The interpretations in this column are oriented towards the smaller jobs.

Suitability as a source of topsoil was rated with emphasis on quality of material rather than on quantity. The amount of organic matter and coarseness of the material were the major considerations.

The *suitability of soils as a source of sand and gravel* is based on the probability that delineated areas contain deposits of sand and gravel. The ratings do not indicate quality or size of the deposits.

The *suitability of soil material as a source of road fill* depends largely on the soil texture and its natural content of water. Highly plastic soils are rated poor to fair, depending on the natural content of water and the difficulty of handling and compacting the soil.

Features adversely affecting *highway location* are a high water table, flooding, seepage, boulders, rock, and unstable slopes.

Soil features that affect adversely the *construction and maintenance of pipelines* are rock, soil slope, high water table, and the risk of corrosion.

The columns on *water impoundments* list soil features that affect *reservoir areas* and *embankments*. The undisturbed soil was considered in preparing the column for reservoir areas, and the disturbed soil, in preparing the column for embankments. A particular soil might be suitable for one purpose but not the other. Interpretations can also be obtained from these columns for lagoons and sedimentation pools. Impounded water seeps through earth dams or porous substrata in some areas in the county. Before a pond is constructed, the site should be inspected carefully. Special attention should be paid to the possible presence of active sinkholes in limestone areas and to any evidence of settlement. If there is any sign of a sinkhole, the area is unsuitable for a pond. Areas that have ledges or bedrock of shale in the abutments or in the bottom of the pond should be avoided, unless sealing is made a part of the design.

Agricultural drainage includes both surface and subsurface drainage. The main features considered were soil permeability, high water table, and seepage.

Features listed in the *irrigation* column refer only to sprinkler systems. Some of the features affecting irrigation are depth of soil, water-holding capacity, permeability, and stoniness.

The main features affecting the construction and maintenance of *terraces, diversions, or waterways* are restricted depth to bedrock, presence of boulders or cobblestones, seepage, and difficulty in obtaining good vegetative cover.

Selected Nonfarm Uses of the Soils

The soil survey contains basic information about soils that is useful in drafting a land-use plan for the county or its political subdivisions. The maps in this survey are published at a scale that is suitable for many aspects of community planning. Interpretive maps can be made from the soil maps and the information in tables 5 and 6, and these maps then can be used in determining the soil limitations of areas where nonfarm development is planned. Table 6 gives the degree of limitations of the soils for selected nonfarm uses and the chief cause of the limitations if these limitations are moderate or severe. Two land types, Made land (Ma) and Strip mine spoil (St), have variable limitations and are not listed in table 6.

Table 6 was made for general guidance of planning officials and developers who are concerned with using land and with avoiding mistakes and costly changes in plans. Table 6 will also be of general aid to the individual who is looking for a place to live in the country. *Although the maps and these tables serve as a guide and will eliminate some sites from further consideration, they do not supplant direct, detailed, onsite investigation when any development is being planned.* In this survey the soil features are given major consideration. Not considered are the location in relation to established business centers or transportation lines and other economic factors that are important and often decide the ultimate use of an area. This subsection gives ratings based on the limitations of soils when they are used for community developments. The ease or difficulty of making improvements is largely controlled by the characteristics of the soils.

Soil features that are related to nonfarm uses of land are depth of soil, degree of slope, permeability, risk of flooding, depth to a seasonal high water table, soil texture, and stoniness. Limitations of the soils for the specified uses have been rated as *slight*, *moderate*, and *severe*. The most favorable soils have been rated slight because few soils have no limitations in use. A rating of moderate indicates soil properties that make necessary special practices to overcome the limitations. A rating of severe indicates soil limitations that generally are very difficult to overcome or correct. A rating of severe does not imply that the soil cannot be used for the purpose shown. It does imply greater limitations than a rating of slight or moderate.

The nonfarm uses rated in table 6 are discussed in the following paragraphs.

Onsite disposal of sewage effluent.—The main limiting features of the soils for drainage fields are restricted permeability, steepness of slope, shallow depth to bedrock, and the presence of a seasonal high water table. Furthermore, in soils that are underlain by cavernous limestone, underground water may be contaminated by seepage of the effluent through crevices or solution channels in the rock.

TABLE 6.—*Degree of soil limitations for selected*

Soil series and map symbols	Degree and cause of limitation for—			
	Disposal of effluent from septic tanks	Sewage lagoons	Location of homesites (3 stories or less)	Development of homesites (landscaping and lawns)
Albrights:				
AbB2	Severe: moderately slow permeability.	Moderate: slope	Moderate: high water table.	Slight.
Allegheny:				
AgB2	Slight	Moderate: moderate permeability.	Slight	Slight.
Andover:				
AnB2	Severe: high water table.	Moderate: slope	Severe: high water table.	Severe: high water table.
AoB	Severe: high water table.	Moderate: stoniness	Severe: high water table.	Severe: high water table.
Atkins:				
At	Severe: high water table; flooding.	Severe: flooding	Severe: high water table; flooding.	Severe: high water table.
Barbour:				
Ba	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding.
Basher:				
Bc	Severe: flooding	Severe: flooding	Severe: flooding	Slight.
Bedington:				
BdB2	Slight	Severe: moderately rapid permeability.	Slight	Slight.
BdC2	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
BdD2, BdD3	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Berks:				
BeB2	Severe: moderately deep to rock.	Severe: moderately deep to rock.	Moderate: moderately deep to rock.	Moderate: moderately deep to rock.
BeC2	Severe: moderately deep to rock; slope.	Severe: moderately deep to rock; slope.	Moderate: moderately deep to rock.	Moderate: moderately deep to rock.
BeD2	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Brinkerton:				
BrA	Severe: high water table; moderately slow permeability.	Slight	Severe: high water table.	Severe: high water table.
BrB2	Severe: high water table; moderately slow permeability.	Moderate: slope	Severe: high water table.	Severe: high water table.
Buchanan:				
BuB2	Severe: slow permeability.	Moderate: slope	Moderate: high water table.	Slight.
BuC2	Severe: slow permeability.	Severe: slope	Moderate: high water table.	Moderate: slope.
BvB	Severe: slow permeability.	Moderate: slope	Moderate: high water table.	Slight.
BvD	Severe: slow permeability.	Severe: slope	Severe: slope	Severe: slope.
Calvin:				
CaC2	Severe: moderately deep to rock.	Severe: moderately deep to rock; slope.	Moderate: Moderately deep to rock.	Moderate: slope.
CaD2	Severe: slope	Severe: slope	Severe: moderately deep to rock.	Severe: slope.
CbB2	Severe: moderately deep to rock.	Severe: moderately deep to rock.	Moderate: moderately deep to rock.	Severe: moderately deep to rock.
CbC2	Severe: moderately deep to rock.	Severe: moderately deep to rock; slope.	Moderate: moderately deep to rock.	Moderate: moderately deep to rock.
CbD2	Severe: moderately deep to rock; slope.	Severe: slope	Severe: slope	Severe: slope.
CkB2	Severe: moderately deep to rock.	Severe: moderately deep to rock.	Moderate: moderately deep to rock.	Moderate: moderately deep to rock.
Cookport:				
CpB	Severe: slow permeability.	Moderate: slope	Moderate: high water table.	Slight.

See footnote at end of table.

nonfarm uses, and chief limiting properties

Degree and cause of limitation for—Continued				
Streets and parking lots (subdivisions)	Athletic fields	Parks and play areas	Sanitary land fill	Cemeteries
Moderate: high water table.	Moderate: high water table; slope.	Slight	Moderate: high water table.	Moderate: high water table.
Slight	Moderate: slope	Slight	Slight	Slight.
Severe: high water table	Severe: high water table	Moderate: high water table.	Severe: high water table	Severe: high water table.
Severe: high water table	Severe: high water table	Moderate: high water table.	Severe: high water table	Severe: high water table.
Severe: high water table; flooding.	Severe: flooding	Severe: flooding	Severe: high water table; flooding.	Severe: high water table; flooding.
Severe: flooding	Moderate: flooding	Moderate: flooding	Severe: flooding	Severe: flooding.
Severe: flooding	Moderate: flooding	Moderate: flooding	Severe: flooding	Severe: flooding.
Moderate: slope	Moderate: slope	Slight	Slight	Slight.
Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: moderately deep to rock.	Moderate: slope	Slight	Moderate: moderately deep to rock.	Moderate: moderately deep to rock.
Moderate: moderately deep to rock.	Severe: slope	Moderate: slope	Moderate: moderately deep to rock.	Moderate: moderately deep to rock; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: high water table.	Severe: high water table.	Moderate: high water table.	Severe: high water table.	Severe: high water table.
Severe: high water table.	Severe: high water table.	Moderate: high water table.	Severe: high water table.	Severe: high water table.
Moderate: slope; high water table.	Moderate: slope	Slight	Severe: slow permeability.	Severe: slow permeability.
Moderate: slope; high water table.	Severe: slope	Moderate: slope	Severe: slow permeability.	Severe: slow permeability.
Moderate: slope; high water table.	Moderate: slope	Slight	Severe: slow permeability.	Severe: slow permeability.
Severe: slope	Severe: slope	Moderate: slope	Severe: slope; slow permeability.	Severe: slope; slow permeability.
Severe: slope	Severe: slope	Moderate: slope	Severe: moderately deep to rock.	Severe: moderately deep to rock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: moderately deep to rock.	Severe: moderately deep to rock.	Slight	Severe: moderately deep to rock.	Severe: moderately deep to rock.
Severe: moderately deep to rock.	Severe: moderately deep to rock; slope.	Moderate: slope	Severe: moderately deep to rock.	Severe: moderately deep to rock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: moderately deep to rock.	Severe: moderately deep to rock.	Slight	Severe: moderately deep to rock.	Severe: moderately deep to rock.
Moderate: high water table	Moderate: high water table.	Slight	Severe: high water table; slow permeability.	Severe: high water table; slow permeability.

TABLE 6.—*Degree of soil limitations for selected*

Soil series and map symbols	Degree and cause of limitation for—			
	Disposal of effluent from septic tanks	Sewage lagoons	Location of homesites (3 stories or less)	Development of homesites (landscaping and lawns)
Dekalb:				
DkB	Severe: moderately deep to rock.	Severe: moderately deep to rock.	Severe: moderately deep to rock.	Slight.
DkD	Severe: moderately deep to rock; slope.	Severe: slope	Severe: moderately deep to rock.	Severe: slope
DkE	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Edom: (mapped only in soil complexes; see Bedington series).				
Elliber:				
EbB2	Slight [1]	Severe:[1] moderately rapid permeability.	Slight	Slight
EbC2	Moderate: [1] slope	Severe: [1] slope	Moderate: slope	Moderate: slope
EbD2	Severe: [1] slope	Severe: [1] slope	Severe: slope	Severe: slope
Ernest:				
ErB2	Severe: high water table; moderately slow permeability.	Moderate: slope	Moderate: high water table.	Slight
Frankstown:				
FrB2	Moderate: [1] depth to bedrock.	Severe: [1] moderate permeability.	Slight	Slight
FrC2	Moderate: [1] slope	Severe: [1] slope	Moderate: slope	Moderate: slope
FrD2	Severe: [1] slope	Severe: [1] slope	Moderate: slope	Severe: slope
FrE2	Severe: [1] slope	Severe: [1] slope	Severe: slope	Severe: slope
Hagerstown:				
HeB2	Moderate: [1] depth to bedrock.	Moderate: [1] slope; moderate permeability.	Moderate: sinkholes	Slight
HeC2	Moderate: [1] slope; depth to bedrock.	Severe: [1] slope	Moderate: slope; sinkholes.	Moderate: slope
HeD2	Severe: [1] slope	Severe: [1] slope	Severe: slope	Severe: slope
HgB3	Moderate: [1] depth to bedrock.	Moderate: [1] slope	Moderate: sinkholes	Slight
HhC3	Severe: [1] depth to bedrock; slope.	Severe: [1] moderately deep to rock.	Severe: moderately deep to rock.	Moderate: moderately deep to rock.
HhD3	Severe: [1] slope	Severe: [1] moderately deep to rock; slope.	Severe: moderately deep to rock.	Severe: slope
HtD2, HtE2	Severe: [1] slope	Severe: [1] slope	Severe: slope	Severe: slope
Klinesville:				
KaB2	Severe: shallow to rock.	Severe: shallow to rock.	Severe: shallow to rock.	Severe: shallow to rock.
KaC2	Severe: shallow to rock.	Severe: slope	Severe: shallow to rock.	Severe: shallow to rock.
KaD2	Severe: shallow to rock; slope.	Severe: slope	Severe: shallow to rock.	Severe: slope.
KwB2	Severe: shallow to rock.	Severe: shallow to rock.	Severe: shallow to rock.	Severe: shallow to rock.
KwC2	Severe: shallow to rock.	Severe: slope	Severe: shallow to rock.	Severe: shallow to rock.
KwD2	Severe: shallow to rock; slope.	Severe: slope	Severe: shallow to rock.	Severe: slope
KwE2	Severe: shallow to rock; slope.	Severe: slope	Severe: slope	Severe: slope
Laidig:				
LaB2	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight
LaC2	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope
LaD2	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope

nonfarm uses, and chief limiting properties—Continued

Degree and cause of limitation for—Continued				
Streets and parking lots (subdivisions)	Athletic fields	Parks and play areas	Sanitary land fill	Cemeteries
Moderate: slope	Severe: moderately deep to rock.	Moderate: moderately deep to rock.	Severe: moderately deep to rock.	Severe: moderately deep to rock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
------	------	------	------	------
Slight	Moderate: slope	Slight	Slight [1]	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: [1] slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: [1] slope	Severe: slope.
Moderate: high water table.	Moderate: high water table.	Slight	Moderate: high water table.	Moderate: high water table.
Moderate: moderately deep to rock.	Moderate: slope	Slight	Slight [1]	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: [1] slope; depth to bedrock.	Moderate: slope; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: [1] slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: [1] slope	Severe: slope.
Moderate: slope	Moderate: slope; sink-holes.	Slight	Moderate: [1] depth to bedrock.	Moderate: depth to bedrock.
Moderate: slope	Severe: slope	Moderate: slope; depth to bedrock.	Moderate: [1] slope; depth to bedrock.	Moderate: slope; depth to bedrock.
Severe: slope	Severe: slope	Severe: slope	Severe: [1] slope	Severe: slope.
Moderate: slope	Moderate: slope	Moderate: silty clay loam surface texture.	Moderate: [1] depth to bedrock.	Moderate: depth to bedrock.
Severe: moderately deep to rock.	Severe: moderately deep to rock; slope.	Moderate: slope	Severe: [1] moderately deep to rock.	Severe: moderately deep to rock.
Severe: slope	Severe: slope	Severe: slope	Severe: [1] slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: [1] slope	Severe: slope.
Severe: shallow to rock	Severe: shallow to rock	Severe: shallow to rock	Severe: shallow to rock	Moderate: shallow to rock.
Severe: shallow to rock	Severe: slope	Severe: shallow to rock	Severe: shallow to rock	Moderate: shallow to rock.
Severe: slope	Severe: slope	Severe: slope	Severe: shallow to rock; slope.	Severe: slope.
Severe: shallow to rock	Severe: shallow to rock	Severe: shallow to rock	Severe: shallow to rock	Moderate: shallow to rock.
Severe: shallow to rock	Severe: slope	Severe: shallow to rock	Severe: shallow to rock	Moderate: shallow to rock.
Severe: slope	Severe: slope	Severe: slope	Severe: shallow to rock; slope.	Severe: shallow to rock; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: shallow to rock; slope.	Severe: shallow to rock; slope.
Moderate: slope	Moderate: slope	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Moderate: slope; moderately slow permeability.	Moderate: slope; moderately slow permeability.	Moderate: slope; moderately slow permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 6.—*Degree of soil limitations for selected*

Soil series and map symbols	Degree and cause of limitation for—			
	Disposal of effluent from septic tanks	Sewage lagoons	Location of homesites (3 stories or less)	Development of homesites (landscaping and lawns)
Laidig—Continued				
LdB	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight
LdD	Severe: moderately slow permeability.	Severe: slope	Severe: slope	Severe: slope
LdE	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope
LmB	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight
LmC	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope
Lawrence, coarse subsoil variant:				
Ln	Severe: high water table	Moderate: depth to bedrock.	Moderate: high water table.	Moderate: high water table.
Lehew:				
LoE	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Lindside:				
Ls	Severe: flooding	Severe: flooding	Severe: flooding	Slight
Melvin:				
Me	Severe: flooding; high water table.	Severe: flooding	Severe: high water table.	Severe: high water table.
Monongahela:				
MoB2	Severe: moderately slow permeability.	Moderate: slope	Moderate: high water table.	Slight
Murrill:				
MuB2	Slight [1]	Moderate: [1] slope	Slight	Slight
MuC2	Moderate: [1] slope	Severe: [1] slope	Moderate: slope	Moderate: slope
MvD	Severe: [1] stoniness; slope	Severe: [1] slope	Severe: slope	Severe: slope
Philo:				
Ph	Severe: flooding	Severe: flooding	Severe: flooding	Slight
Pope, neutral variant:				
Pm	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding
Pope:				
Po	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding
Rubble land:				
Ru	Servere: stones; slope	Severe: stones; slope	Severe: stones; slope	Severe: stones; slope
Tygart:				
Ty	Severe: moderately slow permeability; high water table.	Slight	Severe: high water table.	Severe: high water table.
Tygart, poorly drained variant:				
Tz	Severe: moderately slow permeability; high water table.	Slight	Severe: high water table.	Severe: high water table.
Weikert:				
WcB2	Severe: shallow to rock.	Severe: shallow to rock.	Moderate: shallow to rock.	Severe: shallow to rock.
WcC2	Severe: shallow to rock.	Severe: slope	Moderate: shallow to rock.	Severe: shallow to rock.
WcD2	Severe: shallow to rock; slope.	Severe: slope	Moderate: shallow to rock.	Severe: slope
Wiltshire:				
WgB2	Severe: moderately slow permeability.	Moderate: slope	Moderate: high water table.	Slight

[1] Ground water may be contaminated as a result of seepage through rapidly permeable fractured rock, open gravel, or cavernous limestone.

nonfarm uses, and chief limiting properties—Continued

Degree and cause of limitation for—Continued				
Streets and parking lots (subdivisions)	Athletic fields	Parks and play areas	Sanitary land fill	Cemeteries
Moderate: slope; stones.	Moderate: slope	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: slope	Moderate: slope	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Moderate: high water table.	Severe: high water table.	Moderate: high water table.	Severe: high water table.	Severe: high water table.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: flooding	Moderate: flooding	Slight	Severe: flooding	Severe: flooding.
Severe: flooding; high water table.	Severe: flooding; high water table.	Moderate: flooding; high water table.	Severe: flooding; high water table.	Severe: flooding; high water table.
Moderate: high water table.	Moderate: slope; moderately slow permeability.	Slight	Moderate: high water table; moderately slow permeability.	Moderate: high water table; moderately slow permeability.
Slight	Moderate: slope	Slight	Slight	Slight.
Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: flooding	Moderate: flooding	Moderate: flooding	Severe: flooding	Severe: flooding.
Severe: flooding	Moderate: flooding	Moderate: flooding	Severe: flooding	Severe: flooding.
Severe: flooding	Moderate: flooding	Moderate: flooding	Severe: flooding	Severe: flooding.
Severe: stones; slope	Severe: stones; slope	Severe: stones; slope	Severe: stones; slope	Severe: stones; slope.
Moderate: high water table.	Severe: high water table.	Moderate: high water table.	Severe: high water table.	Severe: high water table.
Moderate: high water table.	Severe: high water table.	Moderate: high water table.	Severe: high water table.	Severe: high water table.
Moderate: shallow to rock.	Severe: shallow to rock; slope.	Severe: shallow to rock.	Severe: shallow to rock.	Severe: shallow to rock.
Moderate: shallow to rock; slope.	Severe: slope	Severe: shallow to rock; slope.	Severe: shallow to rock.	Severe: shallow to rock.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: high water table.	Moderate: high water table; slope.	Slight	Moderate: high water table; moderately slow permeability.	Moderate: high water table; moderately slow permeability.

The soils that are rated slight generally have few or no limitations that affect their use as disposal fields. Those rated moderate are likely to be borderline soils and should be investigated carefully at the exact site of the installation. On some of the soils that are rated moderate, drainage fields need to be larger than those that are rated slight. All the soils that are rated severe should be very carefully investigated to determine if a disposal field can be expected to function adequately. The ratings in table 7 refer to year-round use of the soils. Some of the soils have limitations less severe than those listed in table 7 if the disposal of sewage effluent is needed only for a summer camp or for other part-time use.

Sewage lagoons.—The limitations of soils for sewage lagoons are much the same as those for farm ponds that are shown in table 5 in the subsection "Engineering Uses of the Soils." Among the features that control the degree of limitation for sewage lagoons are the hazard of flooding, the amount of seepage, the permeability of the substratum, the depth to rock, and the degree of slope.

Sites for homes (with basements).—Table 6 rates degree of limitation of the soils for use as homesites and as locations for service buildings in recreational areas. The ratings are for buildings that are three stories or less in height and have an excavation of less than 8 feet for basements. Considered in rating the soils are the depth to a seasonal high water table, the depth to and the kind of bedrock, the degree of slope, the hazard of flooding, and the need for shaping the land and for other kinds of landscaping. Flooding is a severe hazard for use of a soil as a homesite. Limitations caused by shallow depth to rock and a high water table are less severe than those indicated in table 6 if the building is one that does not have a basement.

Landscaping and development of lawns on homesites.—It is assumed that enough lime and fertilizer are used for the plants that are grown. Need for these materials, therefore, is not considered in the ratings for this use. Suitable soil material is needed in sufficient amounts so that desirable trees and other plants can survive and grow well. Among the important soil properties that determine whether a good lawn can be established are the depth of soil, texture, slope, droughtiness, depth to a seasonal high water table, and the presence of stones or rocks.

Streets and parking lots (subdivisions).—Soil requirements and limitations for streets and parking lots are similar to those for highways. Table 6 shows the depth to and the kind of bedrock and the depth to the water table. In table 5 are shown the suitability of each soil for road fill, the limitations that affect highway location, and the susceptibility to frost action. Other limiting features in the use of soils for streets and parking lots are steepness of slope and the risk of flooding. Soils that have slopes of more than 8 percent are severely limited for use as parking lots.

Athletic fields.—Fairly small areas are used for football, baseball, tennis, volleyball, and other organized sports. Because the areas must be nearly level, considerable shaping may be needed. Normally, a soil that has a clayey or gravelly surface layer is not well suited to athletic fields. Other limiting features are slope, depth to and kind of bedrock, a high water table, rockiness or stoniness, and flooding or local ponding.

Parks and play areas.—This county has areas that when left mostly in their natural state are suitable for hiking, picnicking, and other kinds of recreation. Trails, picnic sites, and other small areas can be cleared and kept in sod. The main features that restrict use of soils for parks and play areas are strong slopes, flooding, a high water table, unfavorable soil texture, and the presence of rocks or stones. Some areas that are steep or rocky, however, can be used as scenic spots or for nature trails.

Sanitary land fill.—A sanitary land fill is an area that is used for the disposal of refuse or garbage. The refuse or garbage is covered with enough soil material to meet the requirements of sanitation and make a stable fill. The main soil requirement is for enough material to cover the refuse and garbage. If trenches are dug, the depth to underlying rock is especially important. Among features that affect use of soils for land fill are the depth to rock, the risk of flooding, a high water table, and the presence of stones or rocks. Sinkholes in limestone areas should not be used for disposal of refuse, because seepage from the refuse can enter solution channels and contaminate the underground water. Esthetic, economic, and sociological factors are important in choosing the site for a sanitary land fill, but they have not been considered in the ratings for this purpose shown in table 6.

Cemeteries.—The requirements for a satisfactory cemetery site are an adequate depth of unconsolidated material that is easily excavated, a seasonal water table that is at least 6 feet beneath the surface, and a location not subject to flooding. A stone-free, medium-textured soil is preferred so that lawns and landscaping can be established and maintained with minimum effort.

Descriptions of the Soils

This section describes the soil series and mapping units of Fulton County. The acreage and proportionate extent of each mapping unit are given in table 7. Their location and extent in the county are shown on the soil map at the back of this survey.

The procedure is first to describe the soil series, and then the mapping units in that series. Thus, to get full information on any mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Made land, for example, is a miscellaneous land type that does not belong to a soil series. It is listed, nevertheless, in alphabetic order along with the soil series. Described along with some mapping units are small areas of contrasting soils that were included in some of the areas mapped.

In comparing a mapping unit with a soil series, many will prefer to read the short description in paragraph form. It precedes the technical description that identifies layers in a typical profile by A, B, C, and R horizons and depth ranges. The technical profile descriptions are mainly for soil scientists and others who want detailed information about soils. Technical terms are defined in the Soil Survey Manual (*18*).

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and the woodland group in which the mapping unit has been placed.

The page on which each of the capability units and woodland groups is described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

Albrights Series

The Albrights series consists of deep, moderately well drained to somewhat poorly drained soils that developed in material weathered from acid red shale, siltstone, and fine-grained sandstone. The material was moved downslope by erosion, gravitational creep, or frost action. The soils are gently sloping and lie at the base of steeper slopes near drainageways. Most of the areas have been cultivated. Albrights soils are moderately permeable in the surface layer and upper subsoil and slowly permeable in the compact fragipan in the lower subsoil. They have moderate capacity for holding moisture available to plants.

A typical Albrights soil has a surface soil of weak-red, granular silt loam about 10 inches thick that is 5 percent coarse fragments. The next layer is 4 inches of reddish-brown, platy silt loam that is 5 percent coarse fragments. The upper subsoil is reddish-brown silty clay loam that is mottled with yellowish red and pinkish gray. Coarse shale fragments make up 10 percent of this layer. Below a depth of 22 inches, the subsoil is a weak-red shaly loam fragipan that has mottles of yellowish red and reddish brown. In it, coarse shale fragments make up 20 to 30 percent of the mass. The substratum from 40 to 50 inches is weak-red very shaly loam that has mottles of reddish brown and pale red and is 50 percent shale and sandstone

TABLE 7.—*Approximate acreage and proportionate extent of the soils.*

Soil	Area	Extent
	Acres	*Percent*
Albrights silt loam, 3 to 8 percent slopes, moderately eroded	3, 322	1. 2
Allegheny gravelly loam, 3 to 8 percent slopes, moderately eroded	235	. 1
Andover gravelly silt loam, 3 to 8 percent slopes, moderately eroded	1, 069	. 4
Andover very stony silt loam, 0 to 8 percent slopes	1, 798	. 6
Atkins silt loam	3, 616	1. 3
Barbour fine sandy loam	1, 527	. 5
Basher silt loam	3, 781	1. 4
Bedington-Edom shaly silt loams, 3 to 8 percent slopes, moderately eroded	900	. 3
Bedington-Edom shaly silt loams, 8 to 15 percent slopes, moderately eroded	2, 297	. 8
Bedington-Edom shaly silt loams, 15 to 25 percent slopes, moderately eroded	926	. 3
Bedington-Edom shaly silt loams, 15 to 25 percent slopes, severely eroded	1, 289	. 5
Berks channery silt loam, 3 to 8 percent slopes, moderately eroded	4, 464	1. 6
Berks channery silt loam, 8 to 15 percent slopes, moderately eroded	7, 599	2. 7
Berks channery silt loam, 15 to 25 percent slopes, moderately eroded	4, 912	1. 8
Brinkerton silt loam, 0 to 3 percent slopes	501	. 2
Brinkerton silt loam, 3 to 8 percent slopes, moderately eroded	2, 104	. 8
Buchanan gravelly loam, 3 to 8 percent slopes, moderately eroded	1, 016	. 1
Buchanan gravelly loam, 8 to 15 percent slopes, moderately eroded	489	. 2
Buchanan very stony loam, 0 to 8 percent slopes	1, 874	. 7
Buchanan very stony loam, 8 to 25 percent slopes	4, 809	1. 7
Calvin shaly silt loam, 8 to 15 percent slopes, moderately eroded	8, 523	3. 1
Calvin shaly silt loam, 15 to 25 percent slopes, moderately eroded	3, 538	1. 3
Calvin-Berks channery silt loams, 3 to 8 percent slopes, moderately eroded	4, 495	1. 6
Calvin-Berks channery silt loams, 8 to 15 percent slopes, moderately eroded	5, 020	1. 8
Calvin-Berks channery silt loams, 15 to 25 percent slopes, moderately eroded	3, 268	1. 2
Calvin and Leck Kill shaly silt loams, 3 to 8 percent slopes, moderately eroded	8, 990	3. 2
Cookport very stony loam, 0 to 8 percent slopes	2, 361	. 8
Dekalb very stony sandy loam, 0 to 8 percent slopes	2, 398	. 9
Dekalb very stony sandy loam, 8 to 25 percent slopes	10, 117	3. 6
Dekalb very stony sandy loam, 25 to 70 percent slopes	16, 830	6. 0
Elliber very cherty loam, 3 to 8 percent slopes, slopes, moderately eroded	101	(1)
Elliber very cherty loam, 8 to 15 percent slopes, moderately eroded	370	. 1
Elliber very cherty loam, 15 to 30 percent slopes, moderately eroded	379	. 1
Ernest silt loam, 3 to 8 percent slopes, moderately eroded	866	. 3
Frankstown cherty silt loam, 3 to 8 percent slopes, moderately eroded	747	. 3
Frankstown cherty silt loam, 8 to 15 percent slopes, moderately eroded	1, 107	. 4
Frankstown cherty silt loam, 15 to 25 percent slopes, moderately eroded	713	. 3
Frankstown cherty silt loam, 25 to 35 percent slopes, moderately eroded	448	. 2
Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded	1, 955	. 7
Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded	1, 425	. 5
Hagerstown silt loam, 15 to 25 percent slopes, moderately eroded	211	. 1
Hagerstown silty clay loam, 3 to 8 percent slopes, severely eroded	213	. 1
Hagerstown silty clay loam, shallow phase, 5 to 15 percent slopes, severely eroded	285	. 1
Hagerstown silty clay loam, shallow phase, 15 to 25 percent slopes, severely eroded	82	(1)
Hagerstown very rocky silty clay loam, 5 to 25 percent slopes, moderately eroded	385	. 1
Hagerstown very rocky silty clay loam, 25 to 50 percent slopes, moderately eroded	296	. 1
Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded	1, 949	. 7
Klinesville shaly silt loam, 8 to 15 percent slopes, moderately eroded	11, 929	4. 3
Klinesville shaly silt loam, 15 to 25 percent slopes, moderately eroded	7, 208	2. 6
Klinesville-Weikert channery silt loams, 3 to 8 percent slopes, moderately eroded	994	. 4
Klinesville-Weikert channery silt loams, 8 to 15 percent slopes, moderately eroded	5, 953	2. 1
Klinesville-Weikert channery silt loams, 15 to 25 percent slopes, moderately eroded	3, 859	1. 4
Klinesville-Weikert channery silt loams, 25 to 60 percent slopes, moderately eroded	37, 742	13. 6

See footnote at end of table.

TABLE 7.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded	667	0. 2	Murrill gravelly loam, 3 to 8 percent slopes, moderately eroded	1, 943	0. 7
Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded	1, 212	. 4	Murrill gravelly loam, 8 to 15 percent slopes, moderately eroded	1, 377	. 5
Laidig gravelly loam, 15 to 25 percent slopes, moderately eroded	392	. 1	Murrill very stony loam, 5 to 25 percent slopes	409	. 1
Laidig very stony sandy loam, 0 to 8 percent slopes	379	. 1	Philo silt loam	753	. 3
Laidig very stony sandy loam, 8 to 25 percent slopes	25, 224	9. 1	Pope fine sandy loam, neutral variant	343	. 1
Laidig very stony sandy loam, 25 to 60 percent slopes	18, 344	6. 6	Pope loam	438	. 2
Laidig and Murrill cobbly loams, 3 to 8 percent slopes	573	. 3	Rubble land	2, 999	1. 1
Laidig and Murrill cobbly loams, 8 to 15 percent slopes	1, 035	. 4	Strip mine spoil	354	. 1
Lawrence gravelly silt loam, coarse subsoil variant	1, 217	. 4	Tygart silt loam	273	. 1
Lehew very stony loam, 25 to 60 percent slopes	1, 690	. 6	Tygart silt loam, poorly drained variant	274	. 1
Lindside silt loam	358	. 1	Weikert channery silt loam, 3 to 8 percent slopes, moderately eroded	2, 176	. 8
Made land	94	(1)	Weikert channery silt loam, 8 to 15 percent slopes, moderately eroded	10, 033	3. 6
Melvin silt loam	700	. 3	Weikert channery silt loam, 15 to 25 percent slopes, moderately eroded	6, 735	2. 4
Monongahela silt loam, 3 to 8 percent slopes, moderately eroded	1, 499	. 5	Wiltshire gravelly loam, 3 to 8 percent slopes, moderately eroded	2, 836	1. 0
			Water	629	. 2
			Quarry	28	(1)
			Gravel pit	1	(1)
			Total	278, 400	100. 0

[1] Less than 0. 05 percent.

fragments. Bedrock is encountered below a depth of 50 inches.

Profile of Albrights silt loam, 3 to 8 percent slopes, moderately eroded, in a field 3 miles north of Hustontown; profile S62–Pa–29–12(1–6) in tables 9 and 10 in the section "Laboratory Data:"

Ap—0 to 10 inches, weak-red (2.5YR 4/2) silt loam; weak fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 5 percent coarse fragments; strongly acid (pH 5.1); abrupt, wavy lower boundary; 8 to 11 inches thick.

A2—10 to 14 inches, reddish-brown (5YR 5/4) heavy silt loam; weak, thin, platy structure; friable when moist, slightly sticky and slightly plastic when wet; 5 percent coarse fragments; very strongly acid (pH 4.8); clear, wavy lower boundary; 3 to 5 inches thick.

B2t—14 to 22 inches, reddish-brown (5YR 5/4) silty clay loam; few, medium, distinct, yellowish-red (5YR 5/8) and pinkish-gray (5YR 6/2) mottles; moderate, fine, prismatic structure; firm when moist, slightly sticky and plastic when wet; 10 percent coarse fragments; common patches of thin clay films; very strongly acid (pH 4.7); clear, wavy lower boundary; 7 to 10 inches thick.

Bx1—22 to 35 inches, weak-red (10R 4/3) shaly loam; few, fine, faint, weak-red (2.5YR 5/2) and yellowish-red (5YR 5/6) mottles; weak, medium, platy structure breaking to moderate, fine, blocky; brittle; very firm when moist, slightly sticky and slightly plastic when wet; 20 percent hard, coarse fragments; common patches of clay films; very strongly acid (pH 4.7); gradual, wavy lower boundary; 11 to 16 inches thick.

Bx2—35 to 40 inches, weak-red (10R 4/3) shaly loam; few, fine, distinct, reddish-brown (5YR 4/4) mottles and common black coatings; weak, medium, platy structure breaking to moderate, fine, blocky; brittle; very firm when moist, slightly sticky when wet; 30 percent hard coarse fragments; very strongly acid (pH 4.6); gradual, wavy lower boundary; 4 to 7 inches thick.

IICg—40 to 50 inches +, weak-red (10R 4/2) very shaly loam; common, medium, distinct, reddish-brown (5YR 4/4) and pale-red (2.5YR 6/2) mottles and some black coatings; weak, medium, platy structure; very firm when moist; 50 percent coarse fragments, mostly less than one-fourth of an inch in diameter; a few clay films in pores; very strongly acid (pH 4.7).

The color of the subsoil ranges from weak red to reddish brown. The depth to mottling ranges from 11 to 30 inches. Texture of the upper subsoil ranges from clay loam to silty clay loam. Texture of the lower subsoil ranges from loam to clay loam. The subsoil is extremely acid to medium acid.

The amount of coarse fragments ranges from 0 to 20 percent in the A horizon, from 0 to 60 percent in the B horizon, and from 45 to 75 percent in the C horizon. Depth to the substratum ranges from 30 to 48 inches. The depth to bedrock ranges from 3 to 10 feet.

The Albrights soils are in the drainage sequence that includes the somewhat poorly drained to poorly drained Brinkerton soils. Nearby soils are the well-drained Klinesville, Calvin, Berks, and Weikert soils and the somewhat poorly drained to poorly drained Brinkerton soils.

Albrights silt loam, 3 to 8 percent slopes, moderately eroded (AbB2).—A profile of this soil is the one described as typical for the series. This is a gently sloping soil at the base of steeper slopes in the intermountain valleys. This soil is underlain by bedrock of red shale. Most areas are below areas of Calvin, Klinesville, and Lehew soils and below areas of Calvin-Berks and Klinesville-Weikert complexes. Surface drainage is medium. Included with this soil in mapping were some shallow gullies, small seep spots, small, severely eroded spots, some soils that are shallower to bedrock than typical, and some small, unmappable areas of a well-drained colluvial soil.

This Albrights soil is well suited to all tilled crops that do not require a deep root zone, and to hay, pasture, trees, and wildlife. It stays cold and wet later in spring than nearby well-drained soils. Wetness and slow permeability restrict its use somewhat for homes and for industrial sites. (Capability unit IIe–3; woodland group 6)

Allegheny Series

The Allegheny series consists of well-drained, deep soils that developed in acid material of old stream terraces along major streams. These are gently sloping soils on landforms separated from the flood plains by narrow, steep areas of Calvin, Berks, Weikert, or Klinesville soils. They are from 10 to 100 feet above the present flood plains. Allegheny soils have moderate permeability and high capacity to hold moisture that plants can use.

A typical Allegheny soil has a brown gravelly loam surface layer that is 8 inches thick and contains about 20 percent gravel. The subsoil is brown to yellowish-brown, blocky gravelly clay loam that is about 20 percent gravel. The substratum below a depth of about 38 inches consists of layers of gravel, silt, and clay.

Profile of Allegheny gravelly loam, 3 to 8 percent slopes, moderately eroded, one-fourth of a mile south of Big Cove Tannery:

Ap—0 to 8 inches, brown (10YR 4/3) gravelly loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone and shale gravel; neutral (pH 6.6) (limed); abrupt, smooth lower boundary; 8 to 10 inches thick.

B1—8 to 12 inches, brown (10YR 5/3) gravelly clay loam; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 20 percent sandstone gravel; thin, discontinuous clay films; medium acid (pH 5.8); gradual, wavy lower boundary; 3 to 6 inches thick.

B2t—12 to 24 inches, yellowish-brown (10YR 5/4 to 5/6) gravelly clay loam; moderate, medium, subangular blocky structure; friable when moist, sticky and plastic when wet; 20 percent sandstone gravel; thin, continuous clay films; medium acid (pH 5.8); gradual, wavy lower boundary; 11 to 14 inches thick.

B3—24 to 38 inches, yellowish-brown (10YR 5/4) gravelly clay loam; moderate, medium and coarse, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 20 percent sandstone gravel; thin, discontinuous clay films; medium acid (pH 5.8); clear, wavy lower boundary; 12 to 16 inches thick.

IIC—38 to 45 inches, stratified gravel, silt, and clay; 40 percent gravel; strongly acid (pH 5.4).

The color of the B horizon ranges from reddish brown to yellowish brown. The texture of the B horizon ranges from gravelly silty clay loam to gravelly sandy clay loam. The amount of gravel in the A horizon ranges from 10 to 30 percent; in the B horizon, from 20 to 30 percent; and in the C horizon, from 40 to 85 percent. In a few places the B horizon has a few faint mottles at depths below 36 inches. Depth to the C horizon ranges from 36 to 40 inches. Depth to bedrock ranges from 4 to 10 feet.

The Allegheny soils are in a drainage sequence that includes the moderately well drained Monongahela soils, the somewhat poorly drained Tygart soils, and a poorly drained variant of the Tygart series. Nearby soils are the well drained Calvin, Berks, Weikert, and Klinesville soils and the moderately well drained Monongahela soils.

Allegheny gravelly loam, 3 to 8 percent slopes, moderately eroded (AgB2).—This soil has the profile described as typical for the series. It is on terraces near the flood plains along the major streams in the county. Calvin, Berks, Weikert, and Klinesville soils are in the nearby uplands. Monongahela and Tygart soils and the poorly drained variant of the Tygart series are nearby or on similar landscapes. Included with this soil in mapping were a few areas that are severely eroded, some small areas, 70 to 100 feet above the streams, in which the soil is redder than that described, and a few acres of a reddish soil adjoining areas of Calvin and Klinesville soils.

Surface runoff is medium. The slopes are fairly short and uniform.

This Allegheny soil is well suited to most crops grown in the county. The gravel is troublesome when the soil is cultivated. This soil is also suited to pasture, hay, trees, and wildlife. It has few limitations for use as homesites and industrial sites. (Capability unit IIe–2; woodland group 4)

Andover Series

The Andover series consists of deep, somewhat poorly drained to poorly drained, grayish-brown, stony and gravelly soils that developed in acid sandstone material. The soil material has been moved downslope by erosion, gravitational creep, and frost action. These are nearly level to gently sloping soils on mountain foot slopes and in drainageways. Most of the areas have not been cultivated. The Andover soils have a slowly permeable fragipan about 7 inches thick in their subsoil. They have moderate capacity to hold moisture that is available to plants.

A typical Andover soil has a surface layer, about 2 inches thick, of dark grayish-brown, platy very stony silt loam that is 30 percent sandstone gravel and boulders. The next layer, extending from a depth of 2 to 8 inches, is light brownish-gray, platy gravelly silt loam, about 20 percent of which is sandstone gravel and boulders. The subsoil from a depth of 8 to 17 inches is gray, blocky gravelly clay loam that has mottles of yellowish brown and is about 25 percent sandstone gravel and boulders. The lower subsoil from a depth of 17 to 24 inches is a fragipan that is gray, prismatic gravelly sandy clay loam, strongly mottled, and about 30 percent sandstone gravel and boulders. The substratum from a depth of 24 to 42 inches is yellowish-brown, massive gravelly sandy clay loam that has gray mottles and is about 45 percent coarse fragments.

Profile of an Andover very stony silt loam in woods in Brush Creek Township about 4½ miles south of Emmaville:

O2—1 inch to 0, very dark gray (N 3/0) organic layer; abrupt, smooth lower boundary; 0 to 2 inches thick.

A1—0 to 2 inches, dark grayish-brown (2.5Y 4/2) very stony silt loam; weak, thin, platy structure; friable when moist, nonsticky and nonplastic when wet; 30 percent sandstone gravel and boulders; strongly acid (pH 5.4); clear, smooth lower boundary; 1 to 3 inches thick.

A2g—2 to 8 inches, light brownish-gray (2.5Y 6/2) gravelly silt loam; moderate, medium, platy structure; friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone gravel and boulders; strongly acid (pH 5.4); clear, wavy lower boundary; 5 to 7 inches thick.

B2tg—8 to 17 inches, gray (N 6/0) gravelly clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; friable when moist, sticky and plastic when wet; 25 percent sandstone gravel and boulders; thin, continuous clay films; very strongly acid (pH 5.0); clear, wavy lower boundary; 8 to 10 inches thick.

Bxtg—17 to 24 inches, gray (N 6/0) gravelly sandy clay loam; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure breaking to moderate, medium, subangular blocky and platy; brittle; very firm when moist, slightly sticky and slightly plastic when wet; 30 percent sandstone gravel and boulders; very strongly acid (pH 4.8); gradual, wavy lower boundary; 6 to 8 inches thick.

C—24 to 42 inches +, yellowish-brown (10YR 5/4) gravelly sandy clay loam; common, medium, distinct, light-gray (2.5Y 7/2) mottles; massive; friable when moist, slightly sticky and slightly plastic when wet; 45 percent sandstone gravel and boulders; very strongly acid (pH 4.8).

The texture of the surface soil ranges from gravelly silt loam to very stony loam. Texture of the subsoil ranges from gravelly sandy clay loam to gravelly silty clay loam. The amount of coarse fragments ranges from 30 to 40 percent in the surface soil, 10 to 40 percent in the subsoil, and 45 to 60 percent in the substratum. The color of the subsoil ranges from gray to light olive gray. Reaction of the subsoil is extremely acid to strongly acid. The structure in the subsoil is prismatic breaking to platy and blocky. Depth to the C horizon ranges from 21 to 36 inches. Depth to bedrock ranges from 4 to 40 feet.

The Andover soils are in the drainage sequence that includes the well drained Laidig soils and the moderately well drained to somewhat poorly drained Buchanan soils. Nearby soils are the well drained Laidig, Dekalb, and Lehew soils and the moderately well drained to somewhat poorly drained Buchanan and Cookport soils.

Andover gravelly silt loam, 3 to 8 percent slopes, moderately eroded (AnB2).—This soil has a profile similar to the one described as typical for the series, except that it has fewer boulders and the surface layer has been mixed with the subsoil by plowing. It is on mountain foot slopes and on colluvial fans or drainageways near the mountains. Generally, it lies below areas of Laidig and Buchanan soils. Most of the acreage is in pasture.

This is the best Andover soil in the county for crops or pasture. It is well suited to pasture or hay and is suited to cultivated crops if adequate drainage is provided. Surface runoff is medium. This soil stays cold and wet later in spring than the nearby moderately well drained soils. This soil is well suited to trees or wildlife. Wetness restricts its use for most homesites and industrial sites. (Capability unit IVw-1; woodland group 8)

Andover very stony silt loam, 0 to 8 percent slopes (AoB).—This soil has a profile similar to the one described as typical for the series. This soil lies on wooded foot slopes of mountains, in drainageways, and on colluvial fans. In many places areas of Laidig, Cookport, and Buchanan soils are nearby. Surface runoff is slow to medium. Included with this soil in mapping were a few areas that are wetter than the typical soil.

This Andover soil has too many stones for cultivation. It is generally too stony and wet for pasture. Most of the acreage is in woods. This soil is well suited to trees and wildlife. Wetness and stones limit its use for most homesites and industrial sites. (Capability unit VIIs-2; woodland group 8)

Atkins Series

The Atkins series consists of nearly level, deep, somewhat poorly drained to poorly drained soils on the flood plains along the major streams. They formed in sediments that were washed from hills of acid shale, siltstone, and sandstone. They have moderately slow to moderate permeability and a high water table part of the time. They have high capacity for holding moisture that is available to plants. Most of the areas have been cultivated.

A typical Atkins soil has a surface soil of dark grayish-brown, granular silt loam about 9 inches thick. The subsoil, to a depth of 36 inches, is light brownish-gray to gray, blocky silt loam to clay loam that is mottled with yellowish brown and yellowish red. The substratum below a depth of 36 inches is stratified sand, silt, and gravel.

Profile of Atkins silt loam in an abandoned field 2 miles south of Hustontown on Licking Creek; engineering data are reported in table 3 under Pennsylvania report numbers BJ–38775 and BJ–38776:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist, slightly sticky and nonplastic when wet; very strongly acid (pH 5.0); clear, smooth lower boundary; 8 to 10 inches thick.

B21g—9 to 18 inches, light brownish-gray (10YR 6/2) fine silt loam; common, medium, prominent, yellowish-brown (10YR 5/4) and yellowish-red (5YR 5/8) mottles; moderate, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; few thin clay films; strongly acid (pH 5.2); gradual, wavy lower boundary; 8 to 10 inches thick.

B22g—18 to 36 inches, gray (10YR 6/1) clay loam; many, medium, prominent, gray (N 6/0) and strong-brown (7.5YR 5/8) mottles; weak, medium and coarse, subangular blocky structure; firm when moist, sticky and plastic when wet; few thin patches of clay film; strongly acid (pH 5.2).

IIC—36 inches +, stratified sand, silt, and gravel.

Reaction ranges from very strongly acid to medium acid. The color of the subsoil ranges from gray to grayish brown. Texture of the subsoil ranges from silty clay loam to fine sandy loam. The depth to bedrock is 3½ to 5 feet.

The Atkins soils are in the drainage sequence that includes the well drained Pope soils and the moderately well to somewhat poorly drained Philo soils. The Atkins soils are on flood plains with the well drained Pope and Barbour soils and the moderately well drained to somewhat poorly drained Philo and Basher soils.

Atkins silt loam (At).—This soil has the profile described as typical for the series. It is a nearly level soil on flood plains. Included with this soil in mapping were a few areas of a very poorly drained, dark-gray soil.

This Atkins soil is fairly well suited to all but deep-rooted crops. It is also suited to pasture, trees, and wildlife. It is subject to occasional flooding, usually late in winter or early in spring. The hazard of flooding limits its use for buildings. (Capability unit IIIw-2; woodland group 3)

Barbour Series

The Barbour series consists of deep, well-drained, reddish soils that developed in sediments washed from hills of acid red shale, siltstone, and sandstone. They are nearly level soils on flood plains along major streams. Most areas of Barbour soils have been cultivated. Permeability is moderate to moderately rapid. The soils have moderate to high capacity for holding moisture available to plants.

Typically, the surface soil is dark reddish-brown, granular fine sandy loam about 9 inches thick. The subsoil is reddish-brown, blocky fine sandy loam to a depth of 30 inches. The substratum is reddish-brown fine sandy loam that grades to stratified gravel and cobblestones at about 58 inches.

Profile of Barbour fine sandy loam in a cropped field in Taylor Township 1 mile east of Dublin Mills; engineering data are reported in table 3 under Pennsylvania report numbers BM–1653 and BM–1654:

Ap—0 to 9 inches, dark reddish-brown (5YR 3/4) fine sandy loam; very weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet;

strongly acid (pH 5.4) ; clear, wavy lower boundary; 8 to 10 inches thick.

B2—9 to 30 inches, reddish-brown (5YR 4/4) fine sandy loam; weak, medium, subangular blocky structure; friable when moist; nonsticky and nonplastic when wet; few thin clay films; very strongly acid (pH 5.0) ; diffuse, wavy lower boundary ; 13 to 24 inches thick.

C1—30 to 58 inches, reddish-brown (5YR 4/4) fine sandy loam; very weak, medium and coarse, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; few thin clay films; very strongly acid (pH 4.6) ; clear, wavy lower boundary; 26 to 32 inches thick.

IIC2—58 inches +, stratified coarse gravel and cobblestones.

Reaction in the surface soil ranges from very strongly acid to strongly acid, and in the subsoil, from very strongly acid to medium acid. The color of the subsoil ranges from reddish brown to dusky red. Texture of the subsoil is loam, silt loam, or fine sandy loam. Texture of the substratum ranges from loamy sand to silt loam and gravel. Depth to bedrock ranges from 3 to 6 feet.

The Barbour soils are in the drainage sequence that includes the moderately well drained Basher soils. Next to many areas of Barbour soils are areas of Basher and of Atkins soils.

Barbour fine sandy loam (Ba).—This is the only Barbour soil mapped in the county. It is a nearly level soil on flood plains. It is subject to occasional flooding, usually late in winter or early in spring.

This soil is well suited to any crop grown in the county, and to pasture, trees, and wildlife. The hazard of flooding limits its use for buildings. (Capability unit I–1; woodland group 1)

Basher Series

The Basher series consists of deep, moderately well drained soils formed in sediments that were washed from hills of acid red shale, siltstone, and sandstone. They are nearly level soils on flood plains along major streams. Most areas of Basher soils have been cultivated. Basher soils are moderately permeable and have high capacity to hold moisture available to plants.

The surface layer of a typical Basher soil is reddish-gray, granular silt loam about 9 inches thick. The subsoil is weak-red, blocky silt loam to a depth of 35 inches. Below a depth of 21 inches it has mottles of red, pale red, pinkish gray, and brown. The substratum, from a depth of 35 to 50 inches, consists of layers of dark reddish-brown sand and silt.

Profile of Basher silt loam in a pasture 2 miles east of Wells Tannery; engineering data are reported in table 3 under Pennsylvania report numbers BJ–37504 and BJ–37505:

Ap—0 to 9 inches, reddish-gray (5YR 5/2) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.8) ; abrupt, smooth lower boundary; 7 to 10 inches thick.

B21—9 to 21 inches, weak-red (2.5YR 4/2) silt loam; weak, fine and medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; few thin clay films; medium acid (pH 5.0) ; clear, wavy lower boundary; 10 to 15 inches thick.

B22g—21 to 35 inches, weak-red (2.5YR 5/2) silt loam; common, medium, distinct, pale-red (2.5YR 6/2) and brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; few thin clay films; medium acid (pH 6.0) ; clear, wavy lower boundary; 12 to 16 inches thick.

IIC—35 to 50 inches +, dark reddish-brown (5YR 3/2), stratified sand and silt; strongly acid (pH 5.2).

Reaction ranges from strongly acid to slightly acid. The color of the subsoil ranges from weak red to reddish gray. Depth to mottling ranges from 16 to 30 inches. Texture of the subsoil ranges from silt loam to sandy loam. Depth to bedrock ranges from 4 to 6 feet.

The Basher soils are in the drainage sequence that includes the well-drained Barbour soils. Near many areas of Basher soils are Barbour and Atkins soils. Basher soils are less well drained than Barbour soils but are better drained than Atkins soils.

Basher silt loam (Bc).—This is the only Basher soil mapped in the county. It is a nearly level soil on flood plains. It is subject to occasional flooding, usually late in winter or early in spring.

This soil is well suited to all but very deep rooted crops and to pasture, trees, or wildlife. The hazard of flooding limits building. (Capability unit IIw–1; woodland group 2)

Bedington Series

The Bedington series consists of well-drained, shaly soils that developed in weathered, calcareous shale. They are gently sloping to moderately steep soils on ridges and hillsides in the intermountain valleys near Warfordsburg, Needmore, and Fort Littleton. Bedington soils are moderately permeable. They have moderate capacity to hold moisture available to plants.

Where a Bedington soil is cultivated, the typical surface soil is dark grayish-brown, granular shaly silt loam about 9 inches thick. About 20 percent of the surface soil is shale fragments. The upper subsoil extends from 9 to about 26 inches and is a strong-brown, blocky shaly silty clay loam and shaly clay loam. As much as 40 percent of its mass is shale chips. The lower subsoil reaches to a depth of about 34 inches; it is yellowish-brown very shaly loam. The substratum, below a depth of 34 inches, is a mass of weathered, olive-brown shale.

Profile of Bedington shaly silt loam, 8 to 15 percent slopes, moderately eroded, in a cultivated field near the outskirts of Needmore:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) shaly silt loam; weak, fine, granular structure; friable when moist; nonsticky and nonplastic when wet; 20 percent shale fragments up to 3 inches in diameter; neutral (pH 6.6) (limed) ; abrupt, smooth lower boundary; 7 to 10 inches thick.

B21t—9 to 15 inches, strong-brown (7.5YR 5/6) shaly silty clay loam; moderate, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 25 percent shale fragments; thin, continuous clay films; medium acid (pH 5.8) ; clear, wavy lower boundary; 5 to 9 inches thick.

B22t—15 to 26 inches, strong-brown (7.5YR 5/6) shaly clay loam; moderate, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 40 percent shale fragments; common, thin clay films; medium acid (pH 5.6) ; clear, wavy lower boundary; 6 to 14 inches thick.

B3—26 to 34 inches, yellowish-brown (10YR 5/6) very shaly loam; 80 percent shale fragments; weak, fine, subangular blocky structure, obscured by shale fragments; friable when moist; strongly acid (pH 5.4) ; gradual, wavy lower boundary; 6 to 12 inches thick.

C—34 to 50 inches +, deeply weathered and fractured, olive-brown (2.5Y 4/4) shale.

The volume of coarse fragments ranges from 20 to 30 percent in the surface soil, from 20 to 80 percent in the subsoil, and from 60 to 90 percent in the substratum. The texture of the subsoil ranges from shaly silty clay loam to clay loam or loam. Depth to the substratum is more than 30 inches. The depth to hard rock ranges from 4 to 8 feet. The lower solum and the substratum are strongly to very strongly acid.

The Bedington soils lie in an intricate pattern with areas of Edom soils and were mapped only in complexes with those soils. In many places they are near areas of Berks soils.

Bedington-Edom shaly silt loams, 3 to 8 percent slopes, moderately eroded (BdB2).—Areas of this complex consist of narrow strips of Bedington silt loam, 3 to 8 percent slopes, moderately eroded, mingled with strips of the more shallow Edom shaly silt loam, 3 to 8 percent slopes, moderately eroded. Most of this complex is in Pigeon Cove, near Warfordsburg, and near Fort Littleton. The soils are on long, convex, gentle slopes and on ridgetops. Surface runoff is medium. In some areas the shale underlying the Bedington soil is not weathered so deep as in the typical profile. Included in the mapping were some small, severely eroded areas and a few shallow gullies. In a few places in Pigeon Cove, some very narrow strips of a shallow, sandy soil were also included in the mapped areas of this complex.

These soils are well suited to any crop grown in the county and to pasture, hay, trees, and wildlife. Most of the areas have been cleared and are farmed. (Capability unit IIe-4; woodland group 9)

Bedington-Edom shaly silt loams, 8 to 15 percent slopes, moderately eroded (BdC2).—The soils in this complex are slightly shallower than the typical soils of the two series. They are sloping soils on hillsides and ridgetops. The slopes are short, and surface runoff is medium. Included in mapping of this complex were some shallow gullies and some small, severely eroded spots at the heads of drainageways.

These soils are well suited to most crops grown in the county, and to trees, pasture, hay, and wildlife. Most of the areas have been cleared and farmed. They have few limitations for use as building sites. (Capability unit IIIe-3; woodland group 9)

Bedington-Edom shaly silt loams, 15 to 25 percent slopes, moderately eroded (BdD2).—The soils in this complex are shallower than typical soils of the two series. They are moderately steep soils on ridges and hillsides. The slopes are uniform and fairly short. Surface runoff is rapid. Included with this complex in mapping were a few small gullies and some very small, severely eroded areas near the heads of drainageways.

These soils are poorly suited to row crops but are well suited to pasture, hay, trees, or wildlife. They are generally suitable for homesites, but are too steep for most industrial buildings. (Capability unit IVe-2; woodland group 9)

Bedington-Edom shaly silt loams, 15 to 25 percent slopes, severely eroded (BdD3).—These soils are shallower than typical soils of the two series. Erosion has removed so much of the original surface soil that little of it remains, and the plow layer is mostly yellowish-brown material from the subsoil. The depth to the substratum is less than 16 inches. Surface runoff is rapid. The capacity to hold moisture available to plants is lower than in the less sloping and less eroded soils. Gullies are common.

These Bedington and Edom soils are so droughty, so subject to erosion, and so steep that their use is generally limited to pasture, trees, or wildlife. They are fairly well suited to these uses. Slope and restricted depth to bedrock limit their use for homesites. These soils are generally too steep to be suited to industrial building sites. (Capability unit VIe-2; woodland group 11)

Berks Series

The Berks series consists of moderately deep, well-drained, medium-textured soils that formed in weathered, acid, gray, yellowish-brown, and olive shale and siltstone, interbedded in places with thin layers of sandstone. Berks soils are gently sloping to moderately steep soils in the intermountain valleys. They are moderately permeable and have moderate to low capacity to hold moisture available to plants. About half the acreage of Berks soils has been cleared.

Typically, a Berks soil has a 9-inch surface soil of dark-brown, granular channery silt loam. Flat fragments make up about 25 percent of the mass. The subsoil is strong-brown to yellowish-brown channery silt loam, 35 to 70 percent of which is flat fragments. The substratum, below a depth of 21 inches, is 95 percent yellowish-brown and olive siltstone and shale. The depth to fractured bedrock is about 26 inches.

Profile of Berks channery silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field about 2 miles west of Harrisonville; profile S62-Pa-29-18 (1-4) in tables 9 and 10 in the section "Laboratory Data:"

Ap—0 to 9 inches, dark-brown (10YR 4/3) channery silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 25 percent coarse fragments; very strongly acid (pH 4.8); abrupt, smooth lower boundary; 8 to 10 inches thick.

B2—9 to 14 inches, strong-brown (7.5YR 5/6) channery silt loam; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 35 percent coarse fragments; few thin clay films; extremely acid (pH 4.4); clear, wavy lower boundary; 4 to 7 inches thick.

B3—14 to 21 inches, yellowish-brown (10YR 5/6) very channery silt loam; 70 percent shale and siltstone; moderate, fine, subangular blocky structure modified by coarse chips of shale; firm when moist, slightly sticky and slightly plastic when wet; few thin clay films; extremely acid (pH 4.4); gradual, irregular lower boundary; 6 to 12 inches thick.

C—21 to 26 inches, 95 percent yellowish-brown (10YR 5/6) and olive (5Y 5/4) siltstone and shale; 5 percent yellowish-red (5YR 5/8) and black silt and clay coatings in pockets along bedding planes; extremely acid (pH 4.4); clear, irregular lower boundary; 4 to 10 inches thick.

R—26 inches +, yellowish-brown (10YR 5/6) and olive (5Y 5/4) siltstone.

Reaction ranges from very strongly acid to medium acid. Thickness of the solum ranges from 20 to 30 inches. The depth to fractured bedrock ranges from 26 to 40 inches and is variable in a short distance.

The texture of the surface soil is silt loam or channery silt loam. The texture of the subsoil ranges from channery silt loam to clay loam. Color of the subsoil ranges from strong brown to light olive brown. The amount of shaly or channery fragments ranges from 20 to 40 percent in the surface soil, from 30 to 80 percent in the subsoil, and from 60 to 95 percent in the substratum.

Near Berks soils are areas of Calvin, Ernest, and Brinkerton soils. The Berks soils are less red than the Calvin soils. The Ernest and Brinkerton soils are generally in drainageways.

Berks channery silt loam, 3 to 8 percent slopes, moderately eroded (BeB2).—This soil has the profile described as typical for the series. It is a gently sloping soil on hilltops, wide ridges, and benchlike positions on hillsides. Slopes are fairly short. Surface drainage is medium. Small areas of a Calvin soil were included in the areas mapped. Also included were some small, severely eroded areas at the head of drainageways and a few shallow gullies. In Big Cove there are small areas of this soil where natural lime occurs in the bedrock below.

This Berks soil is suitable for any crop grown in the county and for hay, trees, or wildlife. It is generally suitable for homesites and for industrial sites. (Capability unit IIe-4; woodland group 9)

Berks channery silt loam, 8 to 15 percent slopes, moderately eroded (BeC2).—This soil has a profile slightly shallower than the one described as typical for the series. It is a sloping soil on hillsides and ridgetops. Surface drainage is medium. Included in the areas mapped were a few shallow gullies and severely eroded spots near the heads of drainageways. Small areas of a Calvin soil were also included in the areas mapped. In Big Cove there are small areas of this soil where natural lime occurs in the underlying bedrock.

This Berks soil is suitable for any crop grown in the county and for hay, trees, or wildlife. It is generally suitable for homesites and for industrial uses. (Capability unit IIIe-3; woodland group 9)

Berks channery silt loam, 15 to 25 percent slopes, moderately eroded (BeD2).—This soil has a profile shallower than the one described as typical for the series. It is a moderately steep soil on hillsides and edges of drainageways. The slopes are fairly short. Surface drainage is medium. Included with this soil in mapping were a few shallow gullies and severely eroded spots near the heads of drainageways. Also included were some small areas of a Calvin soil. In Big Cove there are small areas of this soil where natural lime occurs in the underlying bedrock.

This Berks soil is suitable for most crops grown in the county and for hay, trees, or wildlife. It is generally too steep for homesites and for industrial sites. (Capability unit IVe-2; woodland group 9)

Brinkerton Series

The Brinkerton series consists of deep, somewhat poorly drained to poorly drained soils that developed in acid colluvial material. Their parent material has been moved downslope by erosion, gravitational creep, and frost action. These are nearly level to gently sloping soils at the base of steep slopes near or in drainageways. Most areas have been cultivated. Brinkerton soils have a slowly permeable fragipan in the subsoil. They have moderate capacity to hold moisture available for plants.

A typical Brinkerton soil has a very dark grayish-brown silt loam surface soil, about 9 inches thick, that contains a few shale fragments. The subsoil, from a depth of 9 to about 21 inches, is dark-gray silty clay loam that has mottles of yellowish red. From 21 to 44 inches, the subsoil is a fragipan of gray silty clay loam and clay loam that has mottles of strong brown to yellowish brown. The substratum is weathered chips of acid, gray shale.

Typical profile of Brinkerton silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field 2 miles northeast of Warfordsburg near Tonoloway Creek:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 10 percent shale fragments; many roots; medium acid (pH 5.6) (limed); abrupt, smooth lower boundary; 7 to 10 inches thick.

B2tg—9 to 21 inches, dark-gray (10YR 4/1) silty clay loam; common, medium, prominent, yellowish-red (5YR 5/8) mottles; moderate, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; thin, continuous clay films; medium acid (pH 5.6); clear, wavy lower boundary; 9 to 13 inches thick.

Bx1g—21 to 32 inches, gray (N 6/0) silty clay loam; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky; brittle; firm when moist, sticky and plastic when wet; common patches of clay film; strongly acid (pH 5.4); gradual, wavy lower boundary; 10 to 12 inches thick.

Bx2g—32 to 44 inches, gray (N 6/0) clay loam; common medium, prominent, yellowish-brown (10YR 5/8) mottles; weak, coarse, prismatic structure breaking to weak, medium, subangular blocky and some platy structure; brittle; firm when moist, sticky and plastic when wet; 10 percent coarse fragments; thin, discontinuous clay films; medium acid (pH 5.8); clear, wavy lower boundary; 8 to 16 inches thick.

IIC—44 inches +, weathered, gray shale fragments.

Reaction ranges from very strongly acid to medium acid. The color of the subsoil ranges from gray to grayish brown. Texture of the subsoil ranges from clay loam to silty clay loam. Structure of the subsoil is moderate, medium, prismatic to moderate, medium, subangular blocky. The depth to the substratum ranges from 40 inches to 6 feet or more. The depth to bedrock ranges from 4 to 8 feet.

The Brinkerton soils are in the drainage sequence that includes the moderately well drained to somewhat poorly drained Ernest soils. They lie near areas of the well drained Calvin, Berks, Weikert, and Klinesville soils and the moderately well drained to somewhat poorly drained Ernest and Albrights soils.

Brinkerton silt loam, 0 to 3 percent slopes (BrA).—This soil lies at the base of steep slopes, or in drainageways in the intermountain valleys, below areas of the well-drained Calvin, Berks, Klinesville, or Weikert soils and near Albrights or Ernest soils. Surface drainage is slow. Included in mapping this soil were a few areas that are very poorly drained.

This Brinkerton soil is well suited to hay, pasture, trees, and wildlife. Wetness slightly limits the soil for crops and limits it severely for homesites and for industrial sites. In most places this soil has good sites for farm ponds if other factors are suitable. (Capability unit IVw-1; woodland group 8)

Brinkerton silt loam, 3 to 8 percent slopes, moderately eroded (BrB2).—This soil lies at the base of steep slopes or in drainageways in the intermountain valleys, below well-drained Calvin, Berks, and Klinesville soils and near Albrights and Ernest soils. Surface runoff is medium. In mapping this soil, a few areas were included that are very poorly drained.

This soil is well suited to hay, pasture, trees, and wildlife, and is moderately well suited to crops. Wetness restricts its use for most homesites and industrial sites. (Capability unit IVw-1; woodland group 8)

Buchanan Series

The Buchanan series consists of deep, moderately well drained to somewhat poorly drained, gravelly and stony soils that developed in sandstone material. Their parent material was moved downslope by erosion, gravitational creep, and frost action. These soils are gently sloping to moderately steep soils of the mountain foot slopes. Most of the areas have not been cultivated. The soils are moderately permeable in the upper subsoil and slowly permeable in the fragipan layer. They have low to moderate capacity for holding moisture that plants can use.

A typical Buchanan soil has a surface layer of dark grayish-brown very stony loam to a depth of 2 inches. The layer extending from a depth of 2 to 9 inches is light yellowish-brown very stony loam. The subsoil, beginning at about 9 inches, is light yellowish-brown gravelly clay loam. At a depth of 18 inches is yellowish-brown gravelly clay loam that has mottles of light brownish gray and brown. From a depth of 24 to 48 inches the subsoil is yellowish-brown gravelly loam and very stony loam that has mottles of light brownish gray and yellowish red. This layer is fragipan.

Profile of Buchanan very stony loam, 0 to 8 percent slopes, in Allen Valley, Todd Township, about 3 miles west of McConnellsburg:

O2—1 inch to 0, black (N 2/0) organic layer; 50 percent sandstone gravel and boulders; extremely acid (pH 4.2); abrupt, wavy lower boundary; 0 to 2 inches thick.

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) very stony loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone gravel and boulders; extremely acid (pH 4.2); clear, wavy lower boundary; 1 to 3 inches thick.

A2—2 to 9 inches, light yellowish-brown (2.5Y 6/4) very stony loam; moderate, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone gravel and boulders; extremely acid (pH 4.4); clear, wavy lower boundary; 5 to 8 inches thick.

B21t—9 to 18 inches, light yellowish-brown (2.5Y 6/4) gravelly clay loam; moderate, medium, subangular blocky structure; friable when moist, sticky and plastic when wet; 20 percent sandstone gravel and boulders; thin, continuous clay films; extremely acid (pH 4.4); clear, wavy lower boundary; 8 to 12 inches thick.

B22t—18 to 24 inches, yellowish-brown (10YR 5/6) gravelly clay loam; common, medium, distinct, light brownish-gray (2.5Y 6/2) and brown (7.5YR 5/4) mottles; moderate, medium, subangular blocky structure; friable when moist, sticky and plastic when wet; 30 percent sandstone gravel and boulders; thin, continuous clay films; extremely acid (pH 4.4); clear, wavy lower boundary; 4 to 8 inches thick.

Bx1—24 to 36 inches, yellowish-brown (10YR 5/6) gravelly loam; many, medium, prominent, light brownish-gray (2.5Y 6/2) and yellowish-red (5YR 5/8) mottles; moderate, very coarse, prismatic structure that breaks to weak, coarse, blocky or prismatic; brittle; firm when moist, slightly sticky and slightly plastic when wet; 40 percent sandstone gravel and boulders; thin, continuous clay films; very strongly acid (pH 4.6); gradual, wavy lower boundary; 9 to 14 inches thick.

Bx2—36 to 48 inches +, yellowish-brown (10YR 5/4) very stony loam; many, medium, prominent, light brownish-gray (2.5Y 6/2) and yellowish-red (5YR 5/8) mottles; very weak, very coarse, prismatic structure that breaks to platy and blocky; brittle; firm when moist, nonsticky and nonplastic when wet; 40 percent sandstone gravel and boulders; very strongly acid (pH 4.6).

Reaction ranges from strongly acid to extremely acid. The color of the subsoil ranges from yellowish brown to light olive brown. Texture of the subsoil is loam, clay loam, or sandy loam. The amount of coarse fragments ranges from 10 to 50 percent in the surface soil, from 10 to 40 percent in the upper subsoil, and from 25 to 80 percent in the substratum. The structure of the subsoil in most places is prismatic breaking to blocky. Depth to the substratum ranges from 3 to 4 feet. Depth to bedrock ranges from 4 to 60 feet.

The Buchanan soils are in the drainage sequence that includes the well-drained Laidig soils and the somewhat poorly drained to poorly drained Andover soils. Near the Buchanan soils are areas of Dekalb, Laidig, Cookport, Lehew, and Andover soils. Buchanan soils are not so well drained as the Dekalb, Lehew, and Laidig soils.

Buchanan gravelly loam, 3 to 8 percent slopes, moderately eroded (BuB2).—This soil has a profile similar to the one described as typical for the series, except there are fewer boulders throughout the profile. This is a gently sloping soil on foot slopes of mountains and on colluvial fans between areas of Dekalb, Laidig, and Andover soils and areas of Calvin and Berks soils. Surface runoff is medium. Included in the areas mapped were some shallow gullies and small, severely eroded spots at the heads of drainageways.

This Buchanan soil is well suited to all but deep-rooted crops. The soil stays cold and wet later in spring than the well-drained soils. It is well suited to hay, pasture, trees, and wildlife. Wetness restricts its use for some homesites and industrial sites. (Capability unit IIe-3; woodland group 6)

Buchanan gravelly loam, 8 to 15 percent slopes, moderately eroded (BuC2).—This soil has a profile similar to the one described as typical for the series, except it has fewer boulders. It is on mountain foot slopes and colluvial fans between areas of Dekalb, Laidig, and Andover soils and areas of Calvin and Berks soils. Surface runoff is rapid. Included in the areas mapped were some shallow gullies and small, severely eroded spots at the heads of small drainageways.

This soil is well suited to all but deep-rooted crops. The soil stays cold and wet late in spring. It is suited to hay, pasture, trees, and wildlife. Slope and wetness restrict its use for some homesites and industrial sites. (Capability unit IIIe-2; woodland group 6)

Buchanan very stony loam, 0 to 8 percent slopes (BvB).—This soil has the profile that is described as typical for the series. It is on wooded mountain foot slopes and colluvial fans. Dekalb, Laidig, Andover, Cookport, Calvin, or Berks soils are nearby in many areas. Surface runoff is medium. Included in the areas mapped were a few gullies and a few short, steep slopes.

This Buchanan soil has too many stones for cultivation. It is fairly well suited to pasture and well suited to trees and wildlife. Wetness and stones limit its use for homesites and industrial sites. (Capability unit VIs-1; woodland group 6)

Buchanan very stony loam, 8 to 25 percent slopes (BvD).—This soil is slightly shallower than the typical Buchanan soil and has more stones on the surface. It is sloping to moderately steep and is on wooded mountain foot slopes and colluvial fans, mostly between areas of Laidig and Andover soils. Surface runoff is rapid. Included in the areas mapped were a few gullies and a few short, steep slopes.

This Buchanan soil has too many stones for cultivation. It is fairly well suited to pasture and well suited to trees and wildlife. Wetness and stones limit its use for some homesites and industrial sites. (Capability unit VIs-1; woodland group 6)

Calvin Series

The Calvin series consists of deep and moderately deep, well-drained, medium-textured shaly soils that developed in weathered, dusky-red, acid shale, siltstone, and fine-grained sandstone. They are gently sloping to sloping soils of the intermountain valleys. The Calvin soils are moderately to moderately rapidly permeable and have low to moderate capacity to hold moisture that plants can use.

Typically, a Calvin soil has a surface soil of dark reddish-gray, granular shaly silt loam about 9 inches thick. About 15 percent of this layer is shale and siltstone. The subsoil is weak-red, blocky shaly loam and is 20 to 60 percent shale. The substratum at a depth of about 24 inches and below is about 90 percent shale and siltstone and 10 percent weak-red silt and clay. Bedrock of shale and siltstone is generally encountered at a depth of 40 inches.

Profile of Calvin shaly silt loam, 3 to 8 percent slopes, moderately eroded, in a hayfield in Taylor Township 3.3 miles northwest of Hustontown; profile S62–Pa–29–14 (1–4) in tables 9 and 10 in the section "Laboratory Data;" engineering data are reported in table 3 under Pennsylvania report numbers BJ–38778 and BJ–38779:

Ap—0 to 9 inches, dark reddish-gray (5YR 4/2) shaly silt loam; weak, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; 15 percent shale and siltstone; medium acid (pH 5.6); abrupt, smooth lower boundary; 8 to 10 inches thick.

B2—9 to 19 inches, weak-red (10R 4/3) shaly loam; moderate, medium and fine, subangular blocky structure; hard when dry, firm when moist, sticky and slightly plastic when wet; 20 percent shale and siltstone; few thin patches of clay film; extremely acid (pH 4.4); clear, wavy lower boundary; 7 to 11 inches thick.

B3—19 to 24 inches, weak-red (10R 4/2) very shaly loam; moderate, fine, subangular blocky structure; hard when dry, firm when moist, sticky and slightly plastic when wet; 60 percent shale and siltstone; few patches of clay film; extremely acid (pH 4.3); clear, wavy lower boundary; 3 to 7 inches thick.

C—24 to 40 inches, fragments of shale and siltstone that have weak-red (10R 4/2) silt and clay along bedding planes and filling voids; 90 percent shale and siltstone fragments up to 5 inches in diameter; extremely acid (pH 4.4); gradual, wavy lower boundary; 12 to 20 inches thick.

R—40 inches +, dusky-red (10R 3/2), acid shale and siltstone.

Reaction in the subsoil ranges from extremely acid to strongly acid. The color of the subsoil ranges from weak red to reddish brown. Texture of the subsoil ranges from clay loam to loam. The amount of coarse fragments ranges from 15 to 30 percent in the surface soil, from 15 to 60 percent in the subsoil, and from 75 to 95 percent in the substratum. Depth to the C horizon ranges from 24 to 36 inches. Depth to fractured shale, siltstone, or sandstone bedrock ranges from 30 to 45 inches.

Near areas of Calvin soils are areas of Berks, Weikert, Albrights, Klinesville, and Brinkerton soils.

Calvin shaly silt loam, 8 to 15 percent slopes, moderately eroded (CaC2).—This soil has a profile slightly shallower than the one described as typical for the series. It is a sloping soil on hillsides and ridgetops. Surface drainage is medium. Included with this soil in mapping were a few shallow gullies and severely eroded spots near the heads of drainageways. Small areas of Berks soils were also included in some of the areas mapped. In a few areas near Brush Creek, Wells Tannery, and Allen Valley, natural lime in the bedrock has influenced the soil.

This Calvin soil is suited to any crop grown in the county. It is also suited to hay, trees, or wildlife. It has moderate to severe limitations for some nonfarming uses because of moderate slopes and restricted depth to bedrock. (Capability unit IIIe–3; woodland group 9)

Calvin shaly silt loam, 15 to 25 percent slopes, moderately eroded (CaD2).—This soil has a profile shallower than the one described as typical for the series. It is a moderately steep soil on hillsides and the edges of drainageways. The slopes are fairly short. Surface drainage is medium. Included in the areas mapped were a few shallow gullies and severely eroded spots near the heads of drainageways. Small areas of a Berks soil were also included in some areas. In a few areas near Brush Creek and Wells Tannery and in Allen Valley, natural lime is in the bedrock and has influenced the soil.

With proper management, this Calvin soil is suited to any crop grown in the county. It is also suited to hay, trees, or wildlife. The soil has moderate to severe limitations for some nonfarming uses because of moderately steep slopes and restricted depth to bedrock. (Capability unit IVe–2; woodland group 9)

Calvin-Berks channery silt loams, 3 to 8 percent slopes, moderately eroded (CbB2).—The two soils in this complex are much alike, except for color. The Calvin soils are reddish, and the Berks soils are brownish. When this complex is freshly plowed, the surface soil shows strips, 5 to 50 feet wide, of reddish and brownish soil materials. These are gently sloping soils on hilltops, wide ridges, and benchlike positions on hillsides. Slopes are fairly short, and surface drainage is medium. In some areas the soils in this complex are more sandy than those typical of their series. Some small, severely eroded areas at the heads of drainageways, and a few shallow gullies, were included in the areas mapped.

This Calvin-Berks complex is suited to most crops grown in the county. It is also suited to hay, trees, or wildlife. The soils have moderate limitations for some nonfarming uses because of the restricted depth to bedrock. (Capability unit IIe–4; woodland group 9)

Calvin-Berks channery silt loams, 8 to 15 percent slopes, moderately eroded (CbC2).—The soils of this complex have profiles slightly shallower than those described for their respective series. They are sloping soils on hillsides and ridgetops. Surface drainage and internal drainage are medium. Included in the areas mapped were a few shallow gullies and severely eroded spots near the heads of drainageways.

This Calvin-Berks complex is suited to most of the crops grown in the county. The soils are also suited to hay, trees, or wildlife. The soils have moderate to severe limitations for nonfarming uses because of moderate slopes and restricted depth to bedrock. (Capability unit IIIe–3; woodland group 9)

Calvin-Berks channery silt loams, 15 to 25 percent slopes, moderately eroded (CbD2).—The soils of this complex have profiles shallower than those described as typical for their respective series. They are moderately steep soils on hillsides and edges of drainageways. The slopes are fairly short, and surface drainage is medium. The areas mapped include a few shallow gullies and severely eroded spots near the heads of drainageways.

This Calvin-Berks complex is suited to hay, trees, or wildlife. The soils have moderate to severe limitations for nonfarming uses because of moderately steep slopes and restricted depth to bedrock. (Capability unit IVe-2; woodland group 9)

Calvin and Leck Kill shaly silt loams, 3 to 8 percent slopes, moderately eroded (CkB2).—Some areas of this mapping unit contain only Leck Kill soils. Others contain Calvin and Leck Kill soils in areas too small to be shown separately at the scale of the soil map. Each soil has a profile similar to the one described as typical for its series. Calvin soils are somewhat less deep to bedrock than Leck Kill soils. They are gently sloping soils on hilltops, wide ridges, and benchlike positions on hillsides. Slopes are fairly short, and surface drainage is medium.

The areas mapped include some small, severely eroded spots at the heads of drainageways and a few shallow gullies. Near Brush Creek and Wells Tannery and in Allen Valley, the soils have been slightly influenced by natural lime from the bedrock.

These soils are suited to any crop grown in the county and to hay, trees, and wildlife. They have moderate limitations for most nonfarming uses because bedrock lies from 2½ to 5 feet beneath the surface. (Capability unit IIe-4; woodland group 9)

Cookport Series

The Cookport series consists of moderately well drained to somewhat poorly drained stony soils that developed from weathered, acid, gray sandstone. They are nearly level to gently sloping soils on broad ridgetops and mountaintops. Most of the areas are on Broad Top Mountain in the northwestern corner of the county. Cookport soils are moderately permeable in the surface soil and upper subsoil, but they have a slowly permeable fragipan beginning at a depth of about 19 inches. They have moderate capacity to hold moisture that plants can use.

The surface layer, under a very dark gray organic layer 1 inch thick, is very dark grayish-brown very stony loam about 3 inches thick. It is about 30 percent sandstone gravel and boulders. The next layer, from a depth of about 3 to 8 inches, is light yellowish-brown very stony loam and is about 30 percent sandstone gravel and boulders. The subsoil is light yellowish-brown gravelly sandy loam and is about 35 percent sandstone gravel and boulders. At a depth of about 13 inches, it is mottled with light gray and brownish yellow. From 19 to 40 inches, it is a fragipan that is light yellowish-brown gravelly sandy clay loam mottled with light gray and strong brown and that is about 40 percent sandstone gravel and boulders. The substratum is weathered, gray sandstone at a depth of 40 to 43 inches, and acid, gray sandstone bedrock is below 43 inches.

Profile of a Cookport very stony loam in woods on Sideling Hill about 4 miles north of Akersville:

O2—1 inch to 0, very dark gray (N 3/0) organic layer; abrupt, smoth lower boundary; 0 to 1 inch thick.

A1—0 to 3 inches, very dark grayish-brown (2.5Y 3/2) very stony loam; very weak, very fine, granular structure; very friable; 30 percent sandstone gravel and boulders; extremely acid (pH 4.4); clear, smooth lower boundary; 2 to 4 inches thick.

A2—3 to 8 inches, light yellowish-brown (2.5Y 6/4) very stony loam; weak, medium, platy structure; friable; 30 percent sandstone gravel and boulders; very strongly acid (pH 4.6); clear, wavy lower boundary; 5 to 8 inches thick.

B21t—8 to 13 inches, light yellowish-brown (2.5Y 6/4) gravelly sandy loam; moderate, medium, platy structure; friable when moist, nonsticky and nonplastic when dry; common, thin clay films on peds and lining pores; 35 percent sandstone gravel and boulders; extremely acid (pH 4.4); gradual, wavy lower boundary; 3 to 6 inches thick.

B22t—13 to 19 inches, light yellowish-brown (2.5Y 6/4) gravelly sandy loam; many, medium, distinct, light-gray (2.5Y 7/2) and brownish-yellow (10YR 6/8) mottles; moderate, medium, platy structure; friable when moist, nonsticky and nonplastic when wet; common, thin clay films on peds and lining pores; 35 percent sandstone gravel and boulders; extremely acid (pH 4.4); gradual, wavy lower boundary; 4 to 8 inches thick.

Bx—19 to 40 inches, light yellowish-brown (2.5Y 6/4) gravelly sandy clay loam; many, medium, prominent, light-gray (2.5Y 7/2) and strong-brown (7.5YR 5/8) mottles; moderate, medium, platy structure; brittle; very firm when moist, nonsticky and nonplastic when wet; common, thin patches of clay film; 40 percent sandstone gravel and boulders; extremely acid (pH 4.4); gradual, wavy lower boundary; 15 to 25 inches thick.

C—40 to 43 inches, weathered, shattered, gray sandstone and conglomerate; sandy loam material in cracks and voids; extremely acid (pH 4.4); gradual, wavy boundary; 2 to 7 inches thick.

R—43 inches +, hard, gray, acid sandstone.

Reaction ranges from extremely to very strongly acid. The subsoil ranges from light olive brown to brownish yellow and is mottled below a depth of 10 to 18 inches. The texture of the subsoil ranges from sandy loam to sandy clay loam. The amount of coarse fragments in the subsoil ranges from 20 to 40 percent. The structure of the subsoil in most places is a combination of prismatic, platy, and subangular blocky. The depth to bedrock ranges from 40 to 50 inches.

The Cookport soils are in a drainage sequence that includes the well-drained Dekalb soils. Near Cookport soils are areas of Dekalb, Buchanan, and Andover soils.

Cookport very stony loam, 0 to 8 percent slopes (CpB).—This soil is on wooded mountaintops and benches and near the heads of drainageways. Stony Dekalb and Buchanan soils are nearby. Surface runoff is medium.

This soil has too many stones for cultivation and is better for pasture or trees than for crops. It is fairly well suited to pasture and well suited to trees and wildlife. Wetness and stones limit its use on some homesites and industrial sites if a septic tank is to be installed. (Capability unit VIs-1; woodland group 6)

Dekalb Series

The Dekalb series consists of moderately deep, brown to yellowish-brown, stony soils formed from gray, yellowish-brown, and brown siltstone, acid sandstone, and shale. The dominant rock is sandstone, interbedded in most places with a few thin strata of siltstone and shale. Most Dekalb soils are from 20 to 40 percent sandstone gravel and boulders (fig. 8). They are generally on the heavily wooded mountaintops and upper slopes. They have moderately rapid permeability and moderate to low available moisture capacity.

Typically, the surface layer, under a 2-inch, dark-gray layer of organic matter, is light brownish-gray, granular very stony sandy loam 1 to 2 inches thick. The subsurface layer, accounting for the next 10 inches, is yellowish-brown, granular very stony sandy loam and blocky sandy loam. The subsoil, beginning at 11 inches, is brown sandy loam. The lower subsoil, below 20 inches, is yellowish-brown sandy loam. The substratum at 27 inches and below is brown sandy loam that is 80 percent weathered

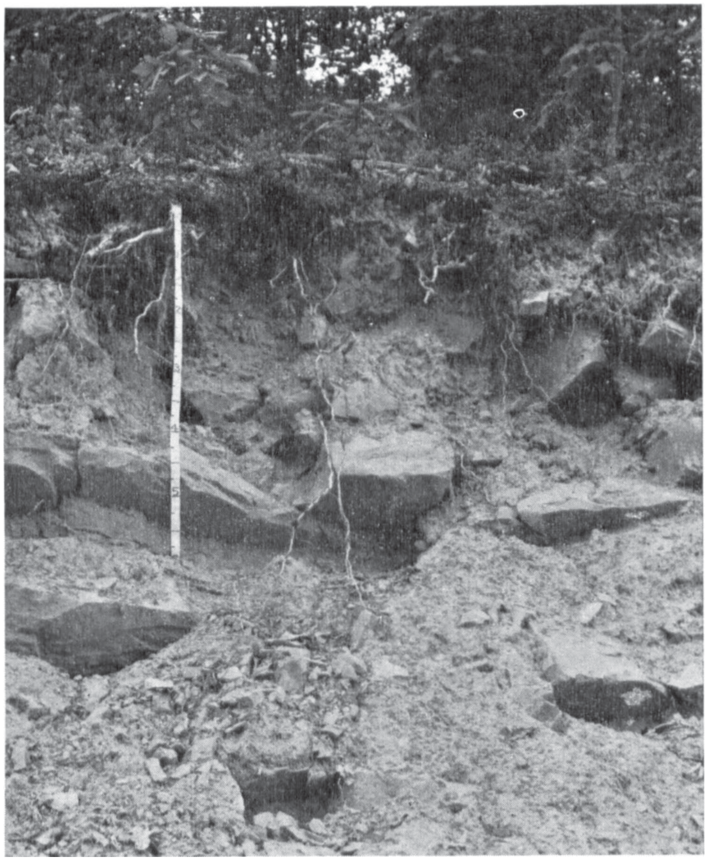

Figure 8.—**Dekalb soil exposed in a roadcut.**

sandstone fragments. The depth to sandstone bedrock is about 43 inches.

Profile of Dekalb very stony sandy loam, 0 to 8 percent slopes, in woods near Akersville Road about 2 miles northwest of Akersville; profile S62–Pa–29–16 (1–7) in tables 9 and 10 in the section, "Laboratory Data;" engineering data are reported in table 3 under Pennsylvania report numbers BJ–40095 and BJ–40096:

O2—2 inches to 0, very dark gray (10YR 3/1) decomposed organic matter; extremely acid (pH 3.7); abrupt, smooth lower boundary; 1 to 2 inches thick.

A21—0 to 1 inch, light brownish-gray (10YR 6/2) very stony sandy loam; very weak, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone fragments; extremely acid (pH 4.0); abrupt, smooth lower boundary; 1 to 2 inches thick.

A22—1 to 6 inches, yellowish-brown (10YR 5/4) very stony sandy loam; weak, medium, granular structure; friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone fragments; very strongly acid (pH 4.6); clear, wavy lower boundary; 4 to 7 inches thick.

A3—6 to 11 inches, yellowish-brown (10YR 5/4) sandy loam; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone fragments; very strongly acid (pH 4.7); clear, wavy lower boundary; 4 to 8 inches thick.

B2—11 to 20 inches, brown (10YR 5/3) sandy loam; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 25 percent sandstone fragments; few, very thin clay films and some clay bridges; very strongly acid (pH 4.7); gradual, wavy lower boundary; 7 to 12 inches thick.

B3—20 to 27 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 40 percent sandstone fragments; few very thin clay films and some clay bridges; very strongly acid (pH 4.6); gradual, wavy lower boundary; 5 to 12 inches thick.

C—27 to 43 inches, brown (7.5YR 5/4) sandy loam; structureless; friable when moist, nonsticky and nonplastic when wet; 80 percent sandstone fragments; very strongly acid (pH 4.7); gradual, wavy lower boundary; 12 to 20 inches thick.

R43 inches +, pinkish-gray (7.5YR 7/2), noncalcareous sandstone.

Reaction ranges from extremely acid to very strongly acid. The color of the subsoil ranges from brown to yellowish brown. Texture of the subsoil ranges from very stony sandy loam to sandy loam. The amount of coarse fragments in the surface soil ranges from 20 to 40 percent; in the subsoil from 20 to 50 percent; and in the substratum from 50 to 80 percent. The structure in the subsoil is weak, fine to coarse, subangular blocky. The depth to the substratum ranges from 23 to 36 inches. The depth to bedrock ranges from 30 to 45 inches.

Near the Dekalb soils are areas of Lehew, Laidig, Buchanan, Cookport, and Andover soils.

Dekalb very stony sandy loam, 0 to 8 percent slopes (DkB).—This is a nearly level to gently sloping soil on wooded mountaintops. Its profile is the one described for the series. The slopes are fairly short. Surface drainage is slow.

If cleared, this soil would provide only a small amount of pasture. The areas are generally better suited to trees and wildlife than to any other use. (Capability unit VIs–1; woodland group 9)

Dekalb very stony sandy loam, 8 to 25 percent slopes (DkD).—This soil is sloping to moderately steep and is on mountaintops. The slopes are fairly short. Surface drainage is good.

If cleared, this soil would provide only a small amount of pasture. This soil is best suited to trees and wildlife. (Capability unit VIs–1; woodland group 9)

Dekalb very stony sandy loam, 25 to 70 percent slopes (DkE).—This soil is steep and very steep and is on slopes of mountains. Surface drainage is good. It can be used for trees or wildlife. (Capability unit VIIs–1; woodland group 10)

Edom Series

The Edom series consists of well-drained soils that developed in weathered products of shaly limestone. They are gently sloping to moderately steep soils on ridges in the intermountain valleys near Warfordsburg and Fort Littleton. Edom soils have moderate to moderately slow permeability and have moderate capacity to hold moisture available to plants.

Where Edom soils are cultivated, the typical surface soil is dark yellowish-brown silt loam that is 8 inches thick and about 10 percent shale and limestone fragments. The subsoil is yellowish-brown to strong-brown silty clay loam, about 10 to 15 percent of which is shale and limestone fragments. It extends to a depth of 28 inches. The substratum, from a depth of 28 to 32 inches, is light olive-brown, weathered, shaly limestone that has some silt and clay between the fragments. Bedrock of gray, shaly limestone is encountered at about 32 inches.

Profile of a moderately eroded Edom shaly silt loam on slopes of 8 to 15 percent, in a cultivated field about 2½ miles north of Warfordsburg:

Ap—0 to 8 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 5 percent shale fragments less than ½ inch in diameter, and 5 percent limestone fragments up to 6 inches in diameter; neutral (pH 6.8) (limed); abrupt, smooth lower boundary; 7 to 9 inches thick.

B1—8 to 11 inches, yellowish-brown (10YR 5/4) coarse silty clay loam; moderate, fine, subangular blocky to blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 5 percent shale fragments less than ½ inch in diameter, and 5 percent limestone fragments up to 6 inches in diameter; few thin clay films; neutral (pH 6.6); clear, wavy lower boundary; 2 to 4 inches thick.

B21t—11 to 18 inches, strong-brown (7.5YR 5/6) silty clay loam to silty clay; moderate to strong, medium, blocky structure; friable when moist, sticky and plastic when wet; 5 percent shale fragments less than ½ inch in diameter, and 5 percent limestone fragments up to 6 inches in diameter; thin, continuous clay films; neutral (pH 6.6); gradual, wavy lower boundary; 5 to 9 inches thick.

B22t—18 to 24 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, blocky structure; friable when moist, sticky and plastic when wet; 10 percent shale and limestone fragments up to 6 inches across; thin, continuous clay films; neutral (pH 6.6); clear, wavy lower boundary; 5 to 8 inches thick.

B3—24 to 28 inches, yellowish-brown (10YR 5/6) shaly silty clay loam; moderate, medium, blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 15 percent shale and limestone fragments up to 6 inches across; thin, discontinuous clay films; neutral (pH 6.8); clear, wavy lower boundary; 3 to 5 inches thick.

C—28 to 32 inches, 85 percent limestone fragments; light olive-brown (2.5Y 5/6) silt and clay between coarse fragments; neutral (pH 6.8); abrupt, wavy lower boundary; 2 to 6 inches thick.

R—32 inches, gray (N 6/0) shaly limestone.

Reaction ranges from slightly acid to neutral. The color of the subsoil ranges from strong brown to yellowish brown. The texture of the subsoil ranges from silty clay loam to silty clay. The amount of coarse fragments ranges from 5 to 10 percent in the surface soil, 5 to 20 percent in the subsoil, and 75 to 95 percent in the substratum. The depth to the substratum ranges from 23 to 32 inches. The depth to bedrock ranges from 30 to 40 inches.

Edom soils are mingled with Bedington soils and have been mapped only in Bedington-Edom complexes.

Elliber Series

The Elliber series consists of deep, well-drained, dark-brown, medium-textured, very cherty soils developed from weathered, very cherty limestone. They are gently sloping to moderately steep soils on cherty ridges in the intermountain valleys. Most of the Elliber soils are on Tonoloway and Stillwell Ridges between Pigeon Cove and the Maryland State line. They have moderately rapid to rapid permeability and have moderate capacity to hold moisture that is available to plants.

Typically, where an Elliber soil is cultivated, the surface soil, about 9 inches thick, is very dark brown very cherty loam, about 50 percent of which is chert fragments. The subsoil, from a depth of about 9 to 16 inches, is very pale brown very cherty loam, about 50 percent of which is chert fragments. From a depth of 16 to 36 inches is light yellowish-brown very cherty silt loam that is 60 to 70 percent chert fragments. The substratum, from a depth of 36 to 60 inches, is a light yellowish-brown mass of chert fragments. Silt and sand coat about 5 percent of the fragments.

Profile of Elliber very cherty loam, 3 to 8 percent slopes, moderately eroded, in Bethel Township 2 miles south of Needmore; engineering data are reported in table 3 under Pennsylvania report numbers BK-30983 and BK-30984:

AP—0 to 9 inches, very dark brown (10YR 2/2) very cherty loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 50 percent chert fragments; medium acid (pH 6.0); abrupt, smooth lower boundary; 8 to 10 inches thick.

B1—9 to 16 inches, very pale brown (10YR 7/4) very cherty loam; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 50 percent chert fragments; medium acid (pH 5.6); gradual, wavy lower boundary; 6 to 8 inches thick.

B21—16 to 24 inches, light yellowish-brown (10YR 6/4) very cherty coarse silt loam; moderate, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 60 percent chert fragments; few thin clay films; medium acid (pH 5.6); gradual, wavy lower boundary; 7 to 9 inches thick.

B22—24 to 36 inches, light yellowish-brown (10YR 6/4) very cherty coarse silt loam; weak, medium, platy structure; friable when moist, nonsticky and nonplastic when wet; 70 percent chert fragments; few thin patches of clay films; medium acid (pH 5.6); gradual, wavy lower boundary; 10 to 14 inches thick.

C—36 to 60 inches +, chert fragments coated with light yellowish-brown silt and sand; 95 percent chert; medium acid (pH 5.6).

Reaction of the subsoil ranges from strongly acid to medium acid. The color of the subsoil ranges from strong brown to light yellowish brown. The texture of the subsoil ranges from very cherty clay loam to sandy loam. The content of coarse fragments ranges from 50 to 70 percent in the surface soil, 50 to 70 percent in the subsoil, and 80 to 98 percent in the substratum. The depth to the substratum ranges from 36 to 50 inches. Depth to the bedrock ranges from 4 to 10 feet.

Dekalb and Frankstown soils are the chief soils near the areas of Elliber soils.

Elliber very cherty loam, 3 to 8 percent slopes, moderately eroded (EbB2).—This is a gently sloping, very cherty soil on ridgetops. It has the profile described as typical for the series. The slopes are short and uniform. Surface runoff is medium.

This soil is fairly well suited to most crops grown in the county and is well suited to pasture, orchards, forest trees, and wildlife. It has some limitations for homesites and industrial sites because of the chert fragments. (Capability unit IIIs-1; woodland group 9)

Elliber very cherty loam, 8 to 15 percent slopes, moderately eroded (EbC2).—This soil has a profile slightly thinner than the one described as typical for the series. It is on very cherty ridges. The slopes are short and uniform. Surface runoff is fairly rapid.

This soil is not well suited to most cultivated crops. It is well suited to pasture, hay, orchards, forest trees, and wildlife. Slopes limit its use for homesites and industrial sites. (Capability unit IVs-1; woodland group 9)

Elliber very cherty loam, 15 to 30 percent slopes, moderately eroded (EbD2).—This is a moderately steep, very cherty soil on ridges. The slopes are short and uniform. Surface runoff is rapid.

This soil is not suited to most cultivated crops. It is well suited to pasture, orchards, forest trees, or wildlife. Chert fragments and slopes limit its use for homesites. (Capability unit IIIs–1; woodland group 9)

Ernest Series

The Ernest series consists of deep, moderately well drained to somewhat poorly drained soils developed in acid shale material that has been moved downslope by erosion, gravitational creep, and frost action. These soils are gently sloping, and they lie at the base of steeper slopes near or in drainageways. Ernest soils are moderately permeable in the surface soil and moderately slowly permeable in the subsoil. They have moderate capacity to hold moisture that is available to plants.

Typically, the plow layer is dark yellowish-brown silt loam about 9 inches thick. The subsoil, from a depth of 9 to about 14 inches, is yellowish-brown clay loam. From a depth of 14 to 26 inches is brown silty clay loam that has mottles of strong brown and light brownish gray. From 26 to 40 inches, the lower subsoil is a fragipan that is harder to dig than the upper layers and has mottles of yellowish brown and gray. The substratum, which extends from a depth of 40 to 44 inches, is grayish-brown clay loam that has mottles of yellowish brown and gray. Bedrock of weathered, gray shale is at a depth of about 44 inches.

Profile of Ernest silt loam, 3 to 8 percent slopes, moderately eroded, about 1 mile eastof Clear Ridge:

Ap—0 to 9 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.8) (limed); abrupt, smooth lower boundary; 7 to 10 inches thick.

B1—9 to 14 inches, yellowish-brown (10YR 5/4) clay loam; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; few patches of clay films; medium acid (pH 5.8); clear, wavy lower boundary; 3 to 6 inches thick.

B2t—14 to 26 inches, brown (10YR 5/3) silty clay loam; common, medium, distinct, strong-brown (7.5YR 5/6) and light brownish-gray (2.5Y 6/2) mottles; moderate, medium, subangular blocky structure, but some tendency toward prismatic structure; firm when moist, sticky and plastic when wet; thin, continuous clay films; medium acid (pH 5.6); gradual, wavy lower boundary; 8 to 14 inches thick.

Bx—26 to 40 inches, brown (10YR 5/3) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/8) and gray (N 6/0) mottles; moderate, coarse, prismatic structure breaking to blocky; brittle; very firm when moist, slightly sticky and slightly plastic when wet; common patches of clay films; medium acid (pH 5.6); gradual, wavy lower boundary; 12 to 20 inches thick.

Cg—40 to 44 inches, grayish-brown (10YR 5/2) clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) and gray (N 6/0) mottles; massive to weak, very coarse, prismatic structure; firm when moist, slightly sticky and slightly plastic when wet; 15 percent shale fragments; strongly acid (pH 5.4); clear, wavy lower boundary; 2 to 8 inches thick.

R—44 inches, weathered, gray shale.

Reaction in the subsoil ranges from medium acid to very strongly acid. The color of the subsoil ranges from light olive brown to yellowish brown. The subsoil is mottled below a depth that ranges from 10 to 20 inches. Texture of the subsoil ranges from clay loam to silty clay loam. In some places the subsoil is 25 to 50 percent shale fragments. Structure is subangular blocky or prismatic in the upper subsoil. The depth to the substratum ranges from 40 to 45 inches. The depth to bedrock ranges from 3½ to 10 feet.

The Ernest soils are in the drainage sequence that includes the somewhat poorly drained to poorly drained Brinkerton soils. Near Ernest soils are areas of Klinesville, Calvin, Berks, Weikert, and Brinkerton soils.

Ernest silt loam, 3 to 8 percent slopes, moderately eroded (ErB2).—This soil lies at the base of steeper slopes and in upland drainageways of the intermountain valleys. It has the profile described as typical for the series. Surface drainage is medium. Included in mapping this soil were some shallow gullies, small seep spots, small, severely eroded spots, some soils that are shallower to bedrock than typical, and some small areas of a well-drained colluvial soil.

This Ernest soil is well suited to all but deep-rooted crops. It stays cold and wet late in spring. It is well suited to hay, pasture, trees, and wildlife. Wetness limits its use for some homesites and industrial sites. (Capability unit IIe–3; woodland group 6)

Frankstown Series

The Frankstown series consists of deep, well-drained, cherty soils developed from cherty limestone. They are gently sloping to steep soils on cherty ridges and foot slopes in the intermountain valleys. The largest area is between Pigeon Cove and the Maryland State line on the edges of Tonoloway and Stillwell Ridges. A smaller area is on the sides and foot slopes of the first ridge west of Fort Littleton. A very small area is in the center of Big Cove. Frankstown soils are moderately permeable and have high capacity to hold moisture available to plants.

Typically, where a Frankstown soil is cultivated, the surface soil is dark yellowish-brown, granular cherty silt loam about 9 inches thick and is about 20 percent chert fragments. The upper subsoil is yellowish-brown cherty silt loam, about 25 percent chert. At a depth of 16 inches, it grades to yellowish-brown cherty silty clay loam that is about 30 percent chert. At 37 inches, it grades to yellowish-brown cherty fine silt loam, about 40 percent chert. At a depth of 43 inches, the substratum is 90 percent chert and has light yellowish-brown and red silt and clay between the chert fragments. Bedrock of cherty limestone is encountered at 57 inches.

Profile of Frankstown cherty silt loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field 2.5 miles south of Needmore on Tonoloway Ridge; engineering data are reported in table 3 under Pennsylvania report numbers BK–40799 and BK–40800:

Ap—0 to 9 inches, dark yellowish-brown (10YR 4/4) cherty silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 20 percent chert fragments; many roots; medium acid (pH 6.0) (limed); abrupt, smooth lower boundary; 8 to 10 inches thick.

A2—9 to 12 inches, yellowish-brown (10YR 5/6) cherty silt loam; weak, thin, platy structure; friable when moist, nonsticky and nonplastic when wet; 20 percent chert fragments; many roots; medium acid (pH 5.6); clear, wavy lower boundary; 2 to 6 inches thick.

B1—12 to 16 inches, yellowish-brown (10YR 5/4) cherty coarse silt loam; moderate, firm, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; 25 percent chert fragments; few roots; few, thin clay films; medium acid (pH 5.6); gradual, wavy lower boundary; 2 to 6 inches thick.

B2t—16 to 37 inches, yellowish-brown (10YR 5/6) cherty coarse silty clay loam; moderate, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; 30 percent chert fragments; few roots;

thick, continuous clay films; medium acid (pH 5.6); gradual, wavy lower boundary; 10 to 24 inches thick.

B3—37 to 43 inches, yellowish-brown (10YR 5/6) cherty fine silt loam; weak, medium and coarse, subangular blocky structure; firm when moist, sticky and plastic when wet; 40 percent chert fragments; some roots; thin, discontinuous clay films; medium acid (pH 5.6); gradual, wavy lower boundary; 4 to 15 inches thick.

C—43 to 57 inches, 90 percent chert; light yellowish-brown (10YR 3/6) and red (2.5YR 4/8) silt and clay in cracks and voids of chert fragments; medium acid (pH 5.6); gradual, wavy lower boundary; 12 to 20 inches thick.

R—57 inches, gray (N 6/0), cherty limestone.

Reaction in the subsoil ranges from strongly acid to slightly acid. The color of the subsoil ranges from strong brown to yellowish brown. The texture of the subsoil ranges from silt loam to silty clay loam. The content of chert fragments in the surface soil ranges from 10 to 20 percent; in the subsoil, from 10 to 40 percent; and in the substratum, from 50 to 90 percent. The depth to the substratum ranges from 40 to 50 inches. The depth to bedrock ranges from 3½ to 6 feet.

Near areas of Frankstown soils are areas of Elliber, Wiltshire, Edom, Bedington, and Hagerstown soils.

Frankstown cherty silt loam, 3 to 8 percent slopes, moderately eroded (FrB2).—This soil is on ridgetops below areas of Elliber soils and on foot slopes. It has the profile described as typical of the series. The slopes are uniform and fairly short. Surface runoff is medium. Included in mapping this soil were some shallow gullies, some small, severely eroded spots at the head of drainageways, and a few small areas of a Frankston silt loam that has less chert on the surface than described as typical.

This soil is well suited to most crops grown in the county, and to pasture, trees, and wildlife. It has few limitations for use as homesites or industrial sites. (Capability unit IIe–1; woodland group 4)

Frankstown cherty silt loam, 8 to 15 percent slopes, moderately eroded (FrC2).—This soil is on the cherty ridges. Included in some of the areas mapped were small, severely eroded areas near drainageways and some areas of a Frankstown silt loam that has less chert on the surface than typical. In some places small areas of a well-drained colluvial soil were also included.

This cherty Frankstown soil is well suited to most crops grown in the county, and to pasture, trees, wildlife, and homesites. (Capability unit IIIe–1; woodland group 4)

Frankstown cherty silt loam, 15 to 25 percent slopes, moderately eroded (FrD2).—This soil has a profile slightly shallower than the one described as typical for the series. It is moderately steep and lies on the sides of cherty ridges. The slopes are uniform, and most of them are fairly short. Included in the areas mapped are some small spots near drainageways that have been severely eroded, and also some less cherty areas. In some areas below Elliber soils, small spots of a well-drained colluvial soil are included in the areas mapped.

This cherty Frankstown soil is well suited to any crop grown in the county. The soil is well suited to trees, pasture, or wildlife. It is suitable for homesites but is too steep for industrial sites. (Capability unit IVe–1; woodland group 4)

Frankstown cherty silt loam, 25 to 35 percent slopes, moderately eroded (FrE2).—This soil has a profile more shallow than the one described as typical for the series. It is steep, and it lies on the sides of cherty ridges. The slopes are uniform, and most of them are fairly short. Included in mapping this soil were some small spots, near drainageways, that are severely eroded, and also some less cherty spots. In some places below areas of Elliber soils, small amounts of a well-drained colluvial soil were included in mapping this soil.

This cherty, steep Frankstown soil is fairly well suited to pasture, trees, and wildlife. Slopes are too steep for most homesites and industrial sites. (Capability unit VIe–1; woodland group 5)

Hagerstown Series

The Hagerstown series consists of deep, well-drained, brown to reddish-brown, slightly acid to neutral soils that developed in weathered products of relatively pure limestone. They are gently sloping to moderately steep soils of the intermountain limestone valleys. Most of these soils are in Big Cove, between McConnellsburg and Webster Mills. Small areas are near Warfordsburg and Fort Littleton. Hagerstown soils are moderately permeable and have a high capacity to hold moisture available for plants.

In a typical Hagerstown soil, the surface soil is brown, granular silt loam about 8 inches thick. The upper part of the subsoil is reddish-brown silty clay loam and is about 3 percent chert. At a depth of about 12 inches, it grades to yellowish-red silty clay. At about 37 inches, the lower subsoil is yellowish-red silty clay loam. Limestone bedrock is at a depth of about 42 inches.

Profile of Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded, about 1 mile northwest of Cito:

Ap—0 to 8 inches, brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 3 percent chert fragments 2 inches or less in diameter; neutral (pH 6.6); abrupt, smooth lower boundary; 7 to 10 inches thick.

B1t—8 to 12 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, fine blocky structure; hard when dry, friable when moist, sticky and plastic when wet; 3 percent chert fragments 2 inches or less in diameter; thick, continuous clay films; neutral (pH 6.6); clear, wavy lower boundary; 3 to 5 inches thick.

B21t—12 to 22 inches, yellowish-red (5YR 4/6) silty clay; few black (10YR 2/1) coatings; strong, fine and medium, blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few chert fragments; prominent, continuous clay films; neutral (pH 6.6); clear, wavy lower boundary; 5 to 12 inches thick.

B22t—22 to 37 inches, yellowish-red (5YR 5/8) silty clay; common, black (10YR 2/1) coatings; strong, medium, blocky structure; hard when dry, friable when moist, sticky when wet; few chert fragments; thick, continuous clay films; neutral (pH 6.6); gradual, wavy lower boundary; 12 to 17 inches thick.

B3—37 to 42 inches, yellowish-red (5YR 5/6) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist, sticky and plastic when wet; neutral (pH 7.0); abrupt, irregular lower boundary; 2 to 10 inches thick.

R—42 inches, light-gray (N 6/0) limestone.

Texture of the surface soil ranges from silt loam to silty clay loam, and that of the subsoil, from silty clay loam to clay. Reaction of the subsoil ranges from slightly acid to neutral. The color of the subsoil ranges from yellowish red to reddish yellow. The amount of coarse fragments is less than 5 percent. The depth to bedrock ranges from 3½ to 10 feet.

Near the Hagerstown soils are areas of Frankstown, Lawrence, and Murrill soils.

Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded (HeB2).—This soil is on hilltops above more sloping Hagerstown soils. It has the profile described as typical for the series. The slopes are uniform and fairly short. Surface runoff is medium. Included in mapping this soil were some shallow gullies; some small, severely eroded spots; some short, steep slopes; a few small areas that have more chert on the surface than the amount described as typical; and a few rock outcrops and sinkholes.

This Hagerstown soil is well suited to most crops grown in the county. It is also well suited to pasture, trees, and wildlife. It has few limitations for use as homesites and industrial sites. (Capability unit IIe–1; woodland group 4)

Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded (HeC2).—This soil has a profile slightly thinner than the one described as typical for the series. It lies below gently sloping Hagerstown soils. Surface runoff is medium. Included in mapping this soil were small areas of a severely eroded soil; a few very short, steep slopes; a few areas that have more chert on the surface than typical; and a few rock outcrops and sinkholes.

This Hagerstown soil is well suited to most crops grown in the county. It is also a good soil for pasture, trees, and wildlife. Most homesites prove to be satisfactory. (Capability unit IIIe–1; woodland group 4)

Hagerstown silt loam, 15 to 25 percent slopes, moderately eroded (HeD2).—This soil has a profile thinner than the one described as typical for the series. It generally lies below gently sloping or sloping Hagerstown soils, in many places on the sides of drainageways. The slopes are uniform, and most of them are fairly short. Surface runoff is rapid. Included in mapping this soil were small, severely eroded areas; a few slopes steeper than 25 percent; a few areas that have more chert on the surface than the amount described as typical; and small areas having scattered rock outcrops.

This Hagerstown soil is suited to most crops grown in the county. It is also a good soil for pasture, trees, or wildlife. It is generally suitable for homesites, but most areas are too steep for industrial sites. (Capability unit IVe–1; woodland group 4)

Hagerstown silty clay loam, 3 to 8 percent slopes, severely eroded (HgB3).—Erosion of this soil has progressed to such an extent that hardly any of the original surface soil remains. The present surface soil is mostly reddish-brown silty clay loam that was formerly part of the subsoil. The organic-matter content is extremely low. Runoff is rapid, and gullies are common. In some places limestone crops out at the surface.

This soil is moderately well suited to most crops grown in the county. It is also suited to pasture, trees, or wildlife. It has few limitations for homesites or for industrial sites. (Capability unit IIIe-1; woodland group 4)

Hagerstown silty clay loam, shallow phase, 5 to 15 percent slopes, severely eroded (HhC3).—This soil is on hilltops and hillsides. It has a profile that ranges from 20 to 42 inches in thickness and is generally thinner than the one described as typical for the series. The surface soil has been almost completely removed by erosion, and the exposed plow layer is mostly reddish-brown silty clay loam of the former subsoil. The organic-matter content is extremely low, and runoff is rapid. Gullies are common. This soil has limestone outcrops.

This soil is generally not suited to row crops. It is well suited to hay, pasture, trees, or wildlife. Most areas are satisfactory for homesites. (Capability unit VIe-2; woodland group 11)

Hagerstown silty clay loam, shallow phase, 15 to 25 percent slopes, severely eroded (HhD3).—This soil is moderately steep and is on hillsides. It has a profile that ranges from 20 to 42 inches in thickness and is generally thinner than the one described as typical for the series. The surface soil has been almost completely removed by erosion, and the present plow layer is mostly reddish-brown silty clay loam of the former subsoil. The organic-matter content is extremely low. Runoff is very rapid, and gullies are common. This soil has limestone outcrops. The areas mapped include small areas of an Edom silt loam near Warfordsburg.

This moderately steep, severely eroded Hagerstown soil can be used for trees or for wildlife. (Capability unit VIIe-1; woodland group 11)

Hagerstown very rocky silty clay loam, 5 to 25 percent slopes, moderately eroded (HtD2).—This soil has a profile similar to the one described as typical for the series, except that all the horizons are a little more clayey. As much as 40 percent of the surface consists of limestone rocks or outcropping ledges of limestone (fig. 9). This soil is sloping to moderately steep and is on hilltops and hillsides. The slopes are fairly uniform and short. Surface runoff is rapid. Included in mapping this soil were a few areas in woods that have even more rocks and ledges on the surface than typical, and some areas of a shallow, very stony and rocky soil.

This Hagerstown soil is fairly well suited to pasture, trees, and wildlife. Rockiness and slopes limit its use for homesites and for industrial sites. (Capability unit VIs-1; woodland group 4)

Hagerstown very rocky silty clay loam, 25 to 50 percent slopes, moderately eroded (HtE2).—This is a steep and very steep soil on hillsides. The profile is similar to the one described as typical for the series, but it is thinner and all the horizons are a little more clayey. As much as 40 percent of the surface consists of limestone rocks or outcropping ledges of limestone. The slopes are uniform and fairly short. Surface runoff is very rapid. Included in

Figure 9.—Typical landscape of a Hagerstown very rocky silty clay loam.

mapping this soil were a few areas that have more rocks and ledges on the surface than typical and a few areas that are mostly a shallow soil over bedrock.

The best use of this Hagerstown soil is for trees. (Capability unit VIIs-1; woodland group 5)

Klinesville Series

The Klinesville series consists of shallow, well-drained, reddish soils that developed from dusky-red shale, siltstone, and fine-grained sandstone. They are gently sloping to steep soils of the intermountain valleys. The Klinesville soils have moderately rapid permeability and very low capacity to hold moisture available to plants.

Where a Klinesville soil is cultivated, the typical surface soil is weak-red shaly silt loam about 9 inches thick; it is about 35 percent fine shale chips. The subsoil is reddish-brown very shaly loam, about 70 percent shale. Bedrock of dusky-red shale is encountered at a depth of 19 inches.

Profile of a Klinesville shaly silt loam, about 3 miles north of Hustontown; profile S62–Pa–29–15 (1–2) in tables 9 and 10 in the section, "Laboratory Data;" engineering data are reported in table 3 under Pennsylvania report numbers BJ–40093 and BJ–40094:

Ap—0 to 9 inches, weak-red (2.5YR 4/2) shaly silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 35 percent coarse fragments mostly less than ½ inch across, but some up to 4 inches; very strongly acid (pH 5.0); abrupt, wavy lower boundary; 7 to 11 inches thick.

B2—9 to 19 inches, reddish-brown (2.5YR 4/4) very shaly loam; weak, fine and medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 70 percent coarse fragments up to 4 inches across; very strongly acid (pH 4.7); gradual, irregular lower boundary; 6 to 15 inches thick.

R—19 inches +, dusky-red (2.5YR 3/2) shale; reddish-brown (2.5YR 4/4) soil films along bedding planes.

Reaction ranges from extremely acid to very strongly acid. Texture of the surface soil ranges from shaly silt loam to channery silt loam. The texture of the subsoil ranges from very shaly silt loam to channery fine sandy loam. The content of coarse fragments ranges from 25 to 50 percent in the surface soil and from 50 to 80 percent in the subsoil. The color of the subsoil ranges from reddish brown to weak red. The depth to shale, siltstone, or fine-grained sandstone bedrock ranges from 11 to 20 inches.

Near areas of Klinesville soils are areas of Calvin, Berks, and Weikert soils in the uplands and Albrights and Brinkerton soils in drainageways.

Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded (KaB2).—This soil is on hilltops, wide ridges, and benchlike positions on hillsides. It has a profile similar to the one described as typical for the series. The slopes are fairly short, and surface drainage is medium. Included in mapping this soil were small areas of Weikert soils, some shallow gullies, and a few severely eroded areas at the heads of drainageways. In the Brush Creek and Wells Tannery areas, this Klinesville soil has been influenced by natural lime from the bedrock.

This soil has limitations but can be used for crops or pasture. It is well suited to trees and wildlife. (Capability unit IIIe-3; woodland group 11)

Klinesville shaly silt loam, 8 to 15 percent slopes, moderately eroded (KaC2).—This soil is on hillsides and ridgetops. It has a profile similar to the one described as typical for the series. The slopes are fairly short, and surface drainage is medium. Small areas of a Weikert soil were included in the areas mapped. Also included were some shallow gullies and a few severely eroded areas at the heads of drainageways. In the Brush Creek and Wells Tannery areas, this Klinesville soil has been influenced by natural lime from the bedrock.

This Klinesville soil is fairly good for pasture and is well suited to trees and wildlife. (Capability unit IVe-2; woodland group 11)

Klinesville shaly silt loam, 15 to 25 percent slopes, moderately eroded (KaD2).—This soil has a profile slightly more shallow than the one described as typical for the Klinesville soils. It is moderately steep and is on hillsides and edges of drainageways. The slopes are fairly short, and surface drainage is medium. Small areas of Weikert soils were included in mapping this soil. Also included were some small gullies and a few severely eroded areas at the head of drainageways. In the Brush Creek and Wells Tannery areas, this Klinesville soil has been influenced by natural lime from the bedrock.

This Klinesville soil is suited to trees and wildlife. (Capability unit VIe-2; woodland group 11)

Klinesville-Weikert channery silt loams, 3 to 8 percent slopes, moderately eroded (KwB2).—This mapping unit consists of Klinesville and Weikert soils in a pattern so intricate that they cannot be shown separately at the scale of the soil map. A plowed field of this complex shows strips 5 to 50 feet wide of the red Klinesville and the brown Weikert soils. The areas are gently sloping, and they are on hilltops, wide ridges, and benchlike positions on hillsides (fig. 10). The slopes are fairly short, and surface drainage is medium. Included in mapping this complex were some shallow gullies and a few severely eroded areas at the heads of drainageways.

The soils of this complex are fair for crops and for pasture. They are suited to trees and wildlife. (Capability unit IIIe-3; woodland group 11)

Klinesville-Weikert channery silt loams, 8 to 15 percent slopes, moderately eroded (KwC2).—This complex consists of sloping soils on hillsides and ridgetops. Most of the slopes are short. Surface drainage is good.

The soils of this complex are suited to pasture, trees, and wildlife. (Capability unit IVe-2; woodland group 11)

Figure 10.—Typical landscape of Klinesville-Weikert channery silt loams.

Klinesville-Weikert channery silt loams, 15 to 25 percent slopes, moderately eroded (KwD2).—This complex consists of moderately steep soils on hillsides and edges of drainageways. The slopes are fairly short. Surface drainage is good.

The soils are fairly well suited to pasture, trees, and wildlife. (Capability unit VIe–2; woodland group 11)

Klinesville-Weikert channery silt loams, 25 to 60 percent slopes, moderately eroded (KwE2).—Each of the soils in this complex has a profile more shallow than the one described for its series. They are steep to very steep soils on hillsides and in areas above drainageways and streams. The slopes are fairly short, and surface runoff is rapid. On the very steep soils, there are small outcrops of bedrock. On very steep escarpments above the streams, these soils consist of small areas of moderately deep soil material alternating with outcrops of bedrock.

Because these soils are steep, erodible, and generally droughty, they are best suited to trees. (Capability unit VIIe–1; woodland group 12)

Laidig Series

The Laidig series consists of deep, well-drained, brown, gravelly and stony soils that are moderately coarse textured and extremely acid or very strongly acid. They developed in sandstone material that has been moved downslope by erosion, gravitational creep, and frost action. These gently sloping to steep soils are on the mountains and the foot slopes of mountains. Laidig soils are moderately permeable in the surface soil and upper subsoil. They have moderately slow permeability in the fragipan layer of the subsoil. They have moderate to high moisture-holding capacity.

In a typical Laidig soil, the surface layer is dark grayish-brown very stony sandy loam to a depth of 2 inches. From 2 to 9 inches, it is brown very stony sandy loam. The upper subsoil, at a depth of 9 inches, is brown gravelly sandy loam. From 14 to about 44 inches, the subsoil is brown gravelly sandy clay loam that is friable and very strongly acid. From 44 to 60 inches, it is a brown gravelly loam fragipan that is mottled with strong brown and pale brown. The substratum, from a depth of 60 to 70 inches, is brown very gravelly sandy loam.

Profile of a Laidig very stony sandy loam in woods in Licking Creek Township, on Sideling Hill, about 1¼ miles west of Saluvia; engineering data are reported in table 3 under Pennsylvania report numbers BM–839 and BK–30988:

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) very stony sandy loam; very weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 15 percent sandstone gravel and boulders; extremely acid (pH 4.4); abrupt, smooth lower boundary; 1 to 2 inches thick.

A2—2 to 9 inches, brown (7.5YR 5/2) very stony sandy loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 15 percent sandstone gravel and boulders; extremely acid (pH 4.4); clear, wavy lower boundary; 6 to 8 inches thick.

B1—9 to 14 inches, brown (7.5YR 5/4) gravelly sandy loam; weak, fine subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 15 percent sandstone gravel; thin, discontinuous clay films; very strongly acid (pH 4.6); clear, wavy lower boundary; 0 to 6 inches thick.

B21t—14 to 22 inches, brown (7.5YR 5/4) gravelly sandy clay loam; moderate, medium and fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 25 percent sandstone gravel; thin, continuous clay films; very strongly acid (pH 4.6); gradual, wavy lower boundary; 6 to 10 inches thick.

B22t—22 to 36 inches, strong-brown (7.5YR 5/6) gravelly sandy clay loam; moderate, medium, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; 20 percent sandstone gravel; thin, continuous clay films; very strongly acid (pH 4.6); gradual, wavy lower boundary; 10 to 16 inches thick.

B23t—36 to 44 inches, brown (7.5YR 4/4) gravelly sandy clay loam; moderate, coarse, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 20 percent sandstone gravel and boulders; thin, continuous clay films; very strongly acid (pH 4.8); abrupt wavy lower boundary; 14 to 20 inches thick.

Bx—44 to 60 inches, brown (7.5YR 5/4) gravelly loam; common, medium, distinct, strong-brown (7.5YR 5/8) and pale-brown (10YR 6/3) mottles; massive; brittle; firm when moist, nonsticky and nonplastic when wet; 20 percent sandstone gravel; very strongly acid (pH 4.8); gradual, wavy lower boundary; 15 to 25 inches thick.

C—60 to 70 inches, brown (7.5YR 5/4) very gravelly sandy loam; single grain; 50 percent coarse fragments; very strongly acid.

The texture of the surface soil ranges from gravelly loam or cobbly loam to very stony sandy loam. The subsoil is extremely acid to very strongly acid. The texture of the subsoil ranges from gravelly to very stony clay loam to coarse sandy clay loam. The amount of coarse fragments ranges from 10 to 30 percent in the surface soil, 10 to 40 percent in the subsoil, and 20 to 50 percent in the substratum. The depth of the C horizon ranges from 40 to 70 inches. The depth to bedrock ranges from 5 to 80 feet.

Laidig soils are in a drainage sequence that includes the moderately well drained to somewhat poorly drained Buchanan soils and the somewhat poorly drained to poorly drained Andover soils. Near the Laidig soils are areas of Dekalb, Lehew, Cookport, Buchanan, Murrill, and Andover soils.

Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded (LaB2).—This soil has a profile similar to the typical one described, except that the surface soil has been mixed into a brownish plow layer and the soil contains fewer stones and boulders. This soil is gently sloping and lies on foot slopes of mountains and colluvial fans between areas of stony or cobbly Laidig soils and areas of Calvin, Berks, and Bedington soils. The slopes are fairly short and uniform. Surface runoff is medium. Included in mapping this soil were some shallow gullies, some small areas that are severely eroded, and some small areas of a Laidig gravelly sandy loam.

Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded, is well suited to most crops grown in the county. The gravel is troublesome, but it does not prevent cultivation. The soil is well suited to crops, pasture, hay, trees, and wildlife. It has few limitations for use as homesites and industrial sites. (Capability unit IIe–2; woodland group 4)

Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded (LaC2).—This soil has a profile similar to the one described as typical, except that the surface soil has been mixed into a brownish plow layer and there are fewer stones and boulders. This soil is sloping and is on foot slopes of mountains and colluvial fans, between areas of stony or cobbly Laidig soils and areas of Calvin, Berks, and Bedington soils. The slopes are fairly short and uniform. Surface runoff is fairly rapid. Included in mapping this soil were some shallow gullies, some small areas that are severely eroded, and some small areas of a Laidig gravelly sandy loam.

Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded, is well suited to most crops grown in the county. The sandstone gravel is troublesome, but does not prevent cultivation. The soil is also well suited to pasture, hay, trees, and wildlife. It has few limitations for homesites and industrial sites. (Capability unit IIIe–1; woodland group 4)

Laidig gravelly loam, 15 to 25 percent slopes, moderately eroded (LaD2).—This soil has a profile similar to the one described as typical, but the surface soil has been mixed by plowing and there are fewer stones and boulders. This soil is moderately steep and is on foot slopes of mountains and colluvial fans, between stony or cobbly Laidig soils and areas of Calvin, Berks, and Bedington soils. The slopes are fairly short and uniform. Surface runoff is rapid. Included in mapping this soil were some shallow gullies, some small areas that are severely eroded, and some areas of a Laidig gravelly sandy loam.

Laidig gravelly loam, 15 to 25 percent slopes, moderately eroded, is generally not suited to cultivated crops. It is well suited to pasture, hay, trees, and wildlife. Moderately steep slopes limit its use for homesites and industrial sites. (Capability unit IVe–1; woodland group 4)

Laidig very stony sandy loam, 0 to 8 percent slopes (LdB).—This soil is slightly deeper than a typical Laidig soil. It is a nearly level or gently sloping soil on mountain slopes and on foot slopes, below areas of steeper Laidig or Dekalb soils. The slopes are fairly short and are uniform. Surface runoff is medium. Included in mapping this soil were a few gullies, a few short, steep slopes, and some small areas that are less well drained than a typical Laidig soil and have seepage water or springs.

Laidig very stony sandy loam, 0 to 8 percent slopes, has too many stones for cultivation. It is fairly well suited to pasture and well suited to trees and wildlife. Stones limit its use for some homesites and industrial sites. (Capability unit VIs–1; woodland group 4)

Laidig very stony sandy loam, 8 to 25 percent slopes (LdD).—This soil is slightly deeper than a typical Laidig soil. It is sloping to moderately steep and is on mountain slopes and foot slopes below steeper Laidig or Dekalb soils. The slopes are fairly short and uniform. Surface runoff is rapid. Included in mapping this soil were a few gullies, a few short, steep slopes, and a few small areas that are less well drained than a typical Laidig soil and have seepage water or springs.

Laidig very stony sandy loam, 8 to 25 percent slopes, has too many stones for cultivation. It is fairly well suited to pasture and well suited to trees and wildlife. Stones and slopes limit its use for some homesites and industrial sites. (Capability unit VIs–1; woodland group 4)

Laidig very stony sandy loam, 25 to 60 percent slopes (LdE).—This soil has a profile similar to the one described as typical for the series. It is steep or very steep and is on mountain slopes below areas of Dekalb soils. Most of the slopes are fairly short. Surface runoff is rapid. Included in mapping this soil were a few gullies, some moderately steep, very short slopes, and a few seep spots and springs.

This soil is too steep and has too many stones for cultivated crops or for pasture. It is well suited to trees and wildlife. Steep slopes and stones limit its use for most homesites. (Capability unit VIIs–1; woodland group 5)

Laidig and Murrill cobbly loams, 3 to 8 percent slopes (LmB).—This mapping unit contains Laidig cobbly loam and Murrill cobbly loam. Some areas contain only one of the soils, and others contain both in varying proportions. Each of the soils has a profile like the one described for its series, but they have fewer large stones and boulders on the surface and more stones 3 to 10 inches in diameter. These soils are gently sloping and are on wooded foot slopes of mountains, between areas of very stony Laidig, gravelly Laidig, Calvin, or Berks soils.

The slopes are fairly short and uniform. Surface runoff is medium. Included in the areas mapped were some areas in which part of the surface soil has been removed by erosion. There are also some scattered sinkholes.

The soils of this mapping unit are well suited to pasture, hay, trees, and wildlife. (Capability unit IVs–1; woodland group 4)

Laidig and Murrill cobbly loams, 8 to 15 percent slopes (LmC).—Areas of this mapping unit consist of one or both of the soils. Each of the soils has a profile similar to the one described for its series, but they have fewer stones and boulders and more cobblestones 3 to 10 inches in diameter than typical. These soils are sloping and are on foot slopes of mountains, between areas of stony Laidig, gravelly Laidig, Calvin, or Berks soils. The slopes are fairly short and uniform. Surface runoff is fairly rapid. Included in the areas mapped were some areas that have had part of the surface soil removed by erosion, and some scattered sinkholes.

These soils are well suited to pasture, hay, trees, and wildlife. Cobbles and slopes limit their use for industrial sites. (Capability unit IVs–1; woodland group 4)

Lawrence Series, Coarse Subsoil Variant

The soils of this variant from the Lawrence series are deep and are somewhat poorly drained. They developed in limestone, sandstone, or shale material that has been moved downslope by erosion, gravitational creep, and frost action and deposited over limestone. They are nearly level soils of the intermountain valleys where the bedrock is limestone. These soils have moderately slowly permeable subsoil. They have moderate capacity to hold moisture that is available to plants, but they are slow to dry out in spring and stay cold longer than the better drained soils.

Typically the surface soil is dark grayish-brown gravelly silt loam, about 7 inches thick, that is 15 percent gravel. The upper subsoil, from a depth of 7 to 11 inches, is yellowish-brown silty clay loam that has mottles of grayish brown and is about 10 percent sandstone gravel. From 11 to 15 inches, the subsoil is yellowish-brown silty clay loam that has mottles of strong brown and is about 10 percent sandstone gravel. From 15 to 24 inches, the subsoil is a fragipan of brown silt loam that has mottles of yellowish brown and gray and is about 12 percent sandstone gravel. From 24 to 40 inches, the subsoil is a fragipan of gray gravelly silty clay loam that has mottles of olive brown and is 15 percent sandstone gravel. The substratum, at 40 inches, is gray gravelly clay loam that has mottles of olive brown.

Profile of Lawrence gravelly silt loam, coarse subsoil variant, about 1 mile south of Knobsville:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 15 percent sandstone gravel; medium acid (pH 6.0); abrupt, smooth lower boundary; 7 to 9 inches thick.

B1—7 to 11 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, faint, grayish-brown (10YR 5/2) mottles; moderate, fine, subangular blocky structure; friable when moist, sticky and plastic when wet; 10 percent sandstone gravel; few patches of clay film; medium acid (pH 5.8); clear, wavy lower boundary; 3 to 5 inches thick.

B2t—11 to 15 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, strong-brown (7.5 YR 5/8) mottles; moderate, medium, prismatic structure; friable when moist, sticky and plastic when wet; 10 percent sandstone gravel; thin, continuous clay films; medium acid (pH 5.8); clear, wavy lower boundary; 2 to 6 inches thick.

Bx1—15 to 24 inches, brown (10YR 5/3) silt loam; many, medium, distinct, yellowish-brown (10YR 5/8) and gray (N 5/0) mottles; moderate, medium to coarse, prismatic structure breaking to weak, medium, platy and blocky; brittle; firm when moist, slightly sticky and plastic when wet; 12 percent sandstone gravel; common patches of clay film; medium acid (pH 5.8); clear, wavy lower boundary; 5 to 12 inches thick.

Bx2g—24 to 40 inches, gray (N 5/0) gravelly silty clay loam; many, prominent, light olive-brown (2.5Y 5/6) mottles; moderate, coarse, prismatic structure breaking to weak, medium, platy and blocky; brittle; firm when moist, slightly sticky and plastic when wet; 15 percent sandstone gravel; common patches of clay film; medium acid (pH 6.0); clear, wavy lower boundary; 10 to 20 inches thick.

Cg—40 inches+, gray (N 5/0) gravelly clay loam; many, medium, prominent, light olive-brown (2.5Y 5/6) mottles; massive; firm when moist, slightly sticky and slightly plastic when wet; 30 percent sandstone and limestone gravel; slightly acid (pH 6.2).

The mottled subsoil ranges from yellowish brown to gray clay loam. The subsoil is medium acid to slightly acid. The amount of coarse fragments ranges from 15 to 25 percent in the surface soil, from 10 to 20 percent in the subsoil, and from 5 to 30 percent in the substratum. The structure of the upper subsoil is moderate, fine, subangular blocky; structure of the lower subsoil is mostly moderate, medium to coarse, prismatic, but is partly platy. The depth to the substratum ranges from 40 to 50 inches. The depth to bedrock ranges from 3½ to 6 feet.

The coarse subsoil variants of the Lawrence series are in a drainage sequence that includes the well drained Murrill and the moderately well drained Wiltshire soils. Hagerstown, Frankstown, and Murrill soils are in the uplands near areas of Lawrence soils.

Lawrence gravelly silt loam, coarse subsoil variant (Ln).—This is the only variant from the Lawrence series mapped in the county. Its profile is the one described as typical. This soil is nearly level and is on colluvial fans and in drainageways near Wiltshire soils. Surface runoff is slow. Included in mapping this soil were some shallow gullies, some moderately sloping areas, some small, severely eroded spots, a few limestone outcrops, and some areas near Warfordsburg and Fort Littleton in which the surface soil is not gravelly.

This variant of the Lawrence series is poorly suited to deep-rooted crops. It stays cold and wet in spring. It is well suited to some shallow-rooted crops, and to hay, pasture, trees, and wildlife. Wetness restricts its use for most homesites and industrial sites. (Capability unit IIIw-1; woodland group 7)

Leck Kill Series

The Leck Kill series consists of well-drained soils that formed in materials weathered from red, interbedded shale, siltstone, and fine-grained sandstone. The Leck Kill soils have moderate permeability and moderate capacity to hold moisture available to plants.

Typically, Leck Kill soils have a dark reddish-brown, granular shaly silt loam surface soil, 8 inches thick, that is 15 percent shale. The subsoil is weak-red blocky shaly clay loam to shaly silt loam to a depth of about 26 inches. It is 25 to 30 percent shale. The substratum, below 26 inches, is weak-red very shaly silt loam that is 90 to 95 percent shale. The depth to bedrock is more than 45 inches.

Profile of Leck Kill shaly silt loam, 3 to 8 percent slopes, moderately eroded, in a hayfield in Wells Township 2 miles east of Wells Tannery; profile S62-Pa-29-11(1-5) in tables 9 and 10 in the section "Laboratory Data;" engineering data are reported in table 3 under Pennsylvania report numbers BJ-38777 and BJ-40090:

Ap—0 to 8 inches, dark reddish-brown (2.5YR 3/4) shaly silt loam; weak, medium and fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; 15 percent soft shale chips to one-half inch in size; medium acid (pH 5.8); abrupt, wavy lower boundary; 7 to 9 inches thick.

B2t—8 to 20 inches, weak-red (10R 4/4) shaly clay loam; moderate, medium to fine, subangular blocky structure; firm when moist, slightly sticky and plastic when wet; 25 percent soft shale and siltstone chips; thin, continuous clay films; very strongly acid (pH 4.6); clear, wavy lower boundary; 10 to 15 inches thick.

B3t—20 to 26 inches, weak-red (10R 4/3) shaly silt loam; moderate to weak, medium and fine, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; 30 percent soft shale chips and siltstone to 1 inch in diameter; thin, discontinuous clay films; very strongly acid (pH 4.5); abrupt, wavy lower boundary; 4 to 9 inches thick.

C1—26 to 35 inches, weak-red (10R 4/3) very shaly silt loam; weak, thick, platy structure; few black coatings; 90 percent soft, weathered shale and siltstone; thin clay films along bedding planes; very strongly acid (pH 4.5); gradual, wavy, lower boundary; 7 to 12 inches thick.

C2—35 to 45 inches, weak-red (10R 4/3), weathered shale; soil coatings on fragments along bedding planes; few of the coatings black; 95 percent weathered shale and siltstone; very strongly acid (pH 4.6); clear, wavy lower boundary; 7 to 13 inches thick.

R—45 inches +, dusky red (10R 3/3 to 3/2) shale

The color of the subsoil ranges from weak red to reddish brown. Texture of the subsoil ranges from loam to clay loam. The amount of coarse fragments ranges from 10 to 30 percent in the surface soil, from 20 to 50 percent in the subsoil, and from 40 to 95 percent in the substratum. Thickness of the solum ranges from 24 to 40 inches. The depth to bedrock ranges from 3½ to 5 feet.

Near areas of Leck Kill soils are Klinesville and Albrights soils. Leck Kill soils are intermingled with Calvin soils and were mapped only in an undifferentiated unit of Calvin and Leck Kill shaly silt loams.

Lehew Series

The Lehew series consists of well-drained, moderately deep, reddish-brown stony loams that are moderately steep to steep and are on the mountains around Big Cove and Fort Littleton. They have moderately rapid permeability and moderate to low capacity to hold moisture that is available to plants.

The surface layer of a typical Lehew soil is very dark gray very stony loam about 1 inch thick and is about 40 percent red and gray sandstone gravel and boulders. From a depth of 1 to 7 inches, the next layer is dark reddish-gray very stony loam that is about 20 percent sandstone gravel and boulders. The subsoil, from a depth of 7 to about 26 inches, is reddish-brown gravelly loam and is about 20 to 45 percent sandstone gravel and boulders. The substratum, from a depth of 26 to 32 inches, is a mass of reddish sandstone that has reddish-brown silt and sand in cracks in the rock. Bedrock of weak-red sandstone is at a depth of about 32 inches.

Profile of Lehew very stony loam, 25 to 60 percent slopes, about 2 miles southwest of McConnellsburg on Pennsylvania Route 16:

A1—0 to 1 inch, very dark gray (5YR 3/1) very stony loam; weak, fine, granular structure; loose when moist, nonsticky and nonplastic when wet; 40 percent sandstone gravel and boulders; strongly acid (pH 5.4); clear, wavy lower boundary; 1 to 2 inches thick.

A2—1 to 7 inches, dark reddish-gray (5YR 4/2) very stony loam; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 20 percent red sandstone gravel and boulders; strongly acid (pH 5.2); clear, wavy lower boundary; 4 to 7 inches thick.

B1—7 to 11 inches, reddish-brown (2.5YR 4/4) gravelly loam; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 20 percent red sandstone gravel and boulders; strongly acid (pH 5.2); gradual, wavy lower boundary; 3 to 6 inches thick.

B2—11 to 21 inches, reddish-brown (2.5YR 4/4) gravelly loam; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 25 percent reddish sandstone gravel and boulders; few patches of clay film; strongly acid (pH 5.2); gradual, wavy lower boundary; 7 to 12 inches thick.

B3—21 to 26 inches, reddish-brown (2.5YR 4/4) gravelly loam; weak, coarse, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; 45 percent reddish sandstone gravel and boulders; very strongly acid (pH 5.0); gradual, wavy lower boundary; 2 to 7 inches thick.

C—26 to 32 inches, 85 percent reddish sandstone gravel and boulders; reddish-brown (2.5YR 4/4) silt and sand in cracks and voids between rocks; very strongly acid (pH 5.0); clear, wavy lower boundary; 2 to 10 inches thick.

R—32 inches +, weak-red (2.5YR 4/2), fine-grained sandstone bedrock.

Reaction ranges from strongly acid to extremely acid. The color of the subsoil ranges from reddish brown to weak red. The texture of the subsoil ranges from gravelly loam to fine sandy loam. The amount of coarse fragments ranges from 20 to 50 percent in the surface soil and from 20 to 50 percent in the subsoil. Most of the coarse fragments are reddish sandstone gravel and boulders, but some are gray sandstone. The depth to the substratum ranges from 20 to 28 inches. The depth to bedrock ranges from 20 to 40 inches in a short distance.

Near the Lehew soils are areas of Dekalb and Laidig soils. Lehew soils are redder than the Dekalb soils and redder and shallower than the Laidig soils.

Lehew very stony loam, 25 to 60 percent slopes (LoE).—This soil has the profile described as typical for the Lehew series. It is very steep to steep and is on wooded slopes of the mountains. Surface runoff is rapid.

This soil is limited to use for trees or wildlife. (Capability unit VIIs-1; woodland group 10)

Lindside Series

The Lindside series consists of deep, moderately well drained to somewhat poorly drained, medium-textured soils of the flood plains. They are along streams that receive drainage from the limestone valleys. They devolepd in sediments that were washed, at least partly, from materials that weathered from limestone. They are nearly level and are near major streams. Lindside soils are moderately permeable and have high capacity to hold moisture available to plants.

Typically, a Lindside surface soil is brown silt loam about 9 inches thick. From a depth of 9 to about 21 inches, the upper subsoil is brown silt loam. From 21 to 36 inches, the subsoil is dark grayish-brown and dark-gray silt loam and fine sandy loam and has mottles of yellowish red. Stratified gravel consisting of limestone and sandstone is present at a depth of about 36 inches.

Profile of Lindside silt loam about 2 miles south of McConnellsburg:

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; slightly acid (pH 6.4); abrupt, smooth lower boundary; 7 to 10 inches thick.

B21—9 to 21 inches, brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.6); clear, wavy lower boundary; 10 to 14 inches thick.

B22g—21 to 30 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, distinct, yellowish-red (5YR 5/8) mottles; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.8); gradual, wavy lower boundary; 7 to 10 inches thick.

IIC1g—30 to 36 inches, dark-gray (10YR 4/1) fine sandy loam; common, medium, distinct, yellowish-red (5YR 5/8) mottles; weak, medium and coarse, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.8); clear, wavy lower boundary; 4 to 8 inches thick.

IIIC2—36 inches +, stratified gravel consisting of limestone and sandstone.

Reaction is nearly neutral or slightly acid. The texture of the surface soil ranges from silt loam to fine sandy loam. The texture of the subsoil ranges from silt loam to fine sandy loam. The color of the subsoil ranges from brown to very dark gray. The subsoil is mottled below a depth of 10 to 28 inches. The substratum is massive or has coarse, subangular blocky structure. The depth to bedrock ranges from 3 to 6 feet.

Lindside soils are in a drainage sequence that includes the well-drained Pope soils, neutral variant, and the somewhat poorly drained to poorly drained Melvin soils. Areas of Hagerstown, Elliber, Murrill, Edom, and Frankstown soils are in the nearby uplands. Wiltshire and Lawrence soils occupy nearby drainageways above the flood plains.

Lindside silt loam (Ls).—The profile of this soil is the one described as typical for the series. The soil is nearly level and is on flood plains along streams that drain areas of limestone. Most of this soil is in Big Cove and Pigeon Cove. Surface runoff is slow. This Lindside soil is flooded occasionally, usually early in spring or late in winter when crops are dormant. Included in mapping this soil were a few areas that have a surface layer of fine sandy loam.

This Lindside soil is well suited to most crops and to pasture, trees, or wildlife. The hazard of flooding limits its use for buildings and septic systems. (Capability unit IIw-1; woodland group 2)

Made Land

Made land (Ma) is a land type that consists of disturbed soil material. The surface soil and subsoil have been removed or mixed with underlying material or with pieces of rock. Most Made land in Fulton County has been formed by grading for building sites or for removal of sand. Sand has been taken from pits on Stillwell Ridge.

These areas are highly variable. The surface layer is shaly, gravelly, or bouldery, depending on the type of soil material that was worked. In some places bedrock is exposed at the surface, and in others it is many feet deep. Slopes range from nearly level to very steep. Permeability is variable. Surface runoff in most areas is rapid.

Some of the areas have been shaped for use as building sites. The sand pits, when they are no longer worked, may have some use for trees or wildlife. (Capability unit VIIe-1; woodland group 13)

Melvin Series

The Melvin series consists of deep, somewhat poorly drained to poorly drained, grayish-brown soils on flood plains in the limestone intermountain valleys or along streams that receive drainage from the limestone valleys. They developed in sediments that were washed from soils underlain by limestone. They are nearly level. Melvin soils have moderately slow permeability and have a water table near the surface part of the time. They have high capacity to hold moisture that is available to plants.

The surface soil of a typical Melvin soil is dark grayish-brown silt loam about 9 inches thick. The subsoil, from a depth of 9 to 15 inches, is dark-gray silt loam that has mottles of strong brown. From 15 to 29 inches, the subsoil is gray silt loam that has mottles of strong brown. From 29 to 44 inches, the lower subsoil is gray silty clay loam that has mottles of strong brown and yellowish brown. Stratified gravel and sand consisting of limestone and sandstone are below 44 inches.

Profile of Melvin silt loam about 2 miles north of Warfordsburg:

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; neutral (pH 6.6); abrupt, smooth lower boundary; 7 to 10 inches thick.

B21g—9 to 15 inches, dark-gray (10YR 4/1) silt loam; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.6); clear, wavy lower boundary; 5 to 8 inches thick.

B22g—15 to 29 inches, gray (10YR 5/1) fine silt loam; common, medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; few, thin patches of clay film; neutral (pH 6.6); clear, wavy lower boundary; 12 to 16 inches thick.

B23g—29 to 44 inches, gray (10YR 6/1) silty clay loam; many, medium, prominent, strong-brown (7.5YR 5/8) and yellowish-brown (10YR 5/8) mottles; weak, medium and coarse, subangular blocky structure; friable when moist, sticky and plastic when wet; few, thin patches of clay films; neutral (pH 6.8); clear, wavy lower boundary; 10 to 17 inches thick.

IIC—44 inches +, stratified gravel and sand of limestone and sandstone.

The color of the subsoil ranges from mottled dark grayish brown to gray. The texture of the subsoil ranges from silty clay loam to silt loam. The depth to bedrock ranges from 3½ to 5 feet.

Melvin soils are in a drainage sequence that includes the well drained neutral variant of the Pope series, and the moderately well drained to somewhat poorly drained Lindside soils. Hagerstown, Frankstown, Elliber, Edom, and Murrill soils are nearby soils in the uplands, and Wiltshire and Lawrence soils are in the drainageways.

Melvin silt loam (Me).—The profile of this soil is the one described as typical for the series. The soil is nearly level and is on flood plains of streams that drain areas of soils on limestone. Most of this soil is in Big Cove and Pigeon Cove. Surface runoff is slow. The soil is flooded occasionally, usually early in spring or late in winter.

This soil is suited to all but deep-rooted crops. It is well suited to shallow-rooted crops, pasture, trees, and wildlife. Wetness and flooding limit its use for homesites, for industrial sites, or for septic systems. (Capability unit IIIw-2; woodland group 3)

Monongahela Series

The Monongahela series consists of moderately well drained, deep soils that developed in old, acid materials on terraces along major streams. These soils are gently sloping and lie on landforms that are separated from the flood plains by escarpments of short, fairly steep, well-drained Calvin, Berks, Weikert, or Klinesville soils. The Monongahela soils are from 10 to 100 feet above the present flood plains. Monongahela soils are moderately permeable in the surface soil and upper subsoil but have a moderately slowly permeable fragipan in the lower subsoil. These soils have moderate capacity to hold moisture that is available to plants.

Typically, a Monongahela soil has a surface layer about 9 inches thick that is very dark grayish-brown silt loam and is about 5 percent sandstone and shale gravel. The subsoil, from 9 to 15 inches, is yellow silt loam and is about 5 percent sandstone and shale gravel. From 15 to 22 inches, the subsoil is yellow silty clay loam and is about 5 percent sandstone and shale gravel. From 22 to 44 inches, the lower subsoil is a fragipan of yellow clay loam that has mottles of light gray and strong brown. The upper part of the fragipan is about 5 percent and the lower part is 10 percent sandstone and shale gravel. The substratum, below 44 inches, is stratified sand, silt, and gravel.

Profile of Monongahela silt loam, 3 to 8 percent slopes, moderately eroded, about one-fourth mile northwest of Franklin Mills:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 5 percent sandstone and shale gravel; medium acid (pH 5.8); abrupt, smooth lower boundary; 8 to 10 inches thick.

B21t—9 to 15 inches, yellow (10YR 7/6) silt loam; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 5 percent sandstone and shale gravel; common patches of clay film; very strongly acid (pH 4.6); gradual, wavy lower boundary; 5 to 7 inches thick.

B22t—15 to 22 inches, yellow (10YR 7/6) silty clay loam; moderate, medium, subangular blocky structure; friable when moist, sticky and plastic when wet; 5 percent sandstone and shale gravel; thin, coninuous clay films; very strongly acid (pH 4.6); gradual, wavy lower boundary; 10 to 14 inches thick.

Bx1—22 to 34 inches, yellow (10YR 7/6) clay loam; common, medium, prominent, light-gray (2.5Y 7/2) and strong-brown (7.5YR 5/6) mottles; moderate, medium, platy structure; brittle; firm to very firm when moist, slightly sticky and slightly plastic when wet; 5 percent shale and sandstone gravel; common patches of clay films; very strongly acid (pH 4.8); gradual, wavy lower boundary; 10 to 14 inches thick.

Bx2—34 to 44 inches, yellow (10YR 7/6) clay loam; many, medium, prominent, light-gray (2.5Y 7/2) and strong-brown (7.5YR 5/6) mottles; weak, coarse, blocky structure to massive; brittle; firm to very firm when moist, slightly sticky and slightly plastic when wet; 10 percent shale and sandstone gravel; very strongly acid (pH 4.8); gradual, wavy lower boundary; 9 to 15 inches thick.

IIC—44 inches +, stratified sand, silt, and gravel.

Reaction ranges from extremely acid to strongly acid. The color of the subsoil ranges from yellow to yellowish brown. The subsoil is mottled below 16 to 24 inches. The texture of the subsoil ranges from silty clay loam to loam. The amount of coarse fragments in the surface soil ranges from 0 to 10 percent; in the subsoil, from 5 to 10 percent; and in the substratum, from 10 to 20 percent. The structure of the upper subsoil, in most places, is moderate, fine and medium, subangular blocky. The structure in the fragipan is moderate to weak, medium and thick platy, and there is a tendency towards prismatic. The depth to the C horizon ranges from 40 to 45 inches. The depth to bedrock ranges from 3½ to 10 feet.

Monongahela soils are in a drainage sequence that includes the well-drained Allegheny soils, the somewhat poorly drained Tygart soils, and the poorly drained variant of the Tygart series. Berks, Calvin, Weikert, and Klinesville soils are on the nearby uplands. On the flood plains below Monongahela soils are Barbour, Basher, Pope, Philo, and Atkins soils.

Monongahela silt loam, 3 to 8 percent slopes, moderately eroded (MoB2).—This soil has the profile described as typical for the series. It is gently sloping and is on terraces near flood plains of the larger streams. Surface runoff is medium. The slopes are fairly short and uniform. Included in mapping this soil were a few areas that are severely eroded near drainageways, and some areas that are steeper than 8 percent.

This Monongahela soil is well suited to all but deep-rooted crops. It is also well suited to pasture, hay, trees, and wildlife. It has some limitations for homesites and industrial sites because of the slowly permeable lower subsoil. (Capability unit IIe-3; woodland group 6)

Murrill Series

The Murrill series consists of deep, well-drained, brownish, gravelly, cobbly, and stony soils. These soils developed in sandstone material that was moved downslope by erosion, gravitational creep, and frost action. They are gently sloping to moderately steep soils on mountain foot slopes that are underlain by limestone. Filled-in sinkholes are common. Murrill soils are moderately permeable in the surface soil and subsoil. They have high capacity to hold moisture that is available to plants.

Typically, where a Murrill soil is cultivated, the surface soil is brown gravelly loam about 9 inches thick. From a depth of 9 to 15 inches, the soil is strong-brown gravelly loam. The subsoil, from 15 to 19 inches, is yellowish-red gravelly loam, and from 19 to 27 inches, it is yellowish-red gravelly sandy clay loam. The lower subsoil, from 27 to 30 inches, is reddish-brown clay loam. From 30 to 40 inches, there is reddish-brown silty clay loam that contains fragments of weathered limestone.

Profile of Murrill gravelly loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field about one-half mile south of Cito in Ayr Township; engineering data are reported in table 3 under Pennsylvania report numbers BK-30989 and BK-31250:

Ap—0 to 9 inches, brown (10YR 4/3) gravelly loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 30 percent sandstone gravel, mostly 3 to 4 inches in size; slightly acid (pH 6.4) (limed); abrupt, smooth lower boundary; 8 to 10 inches thick.

A2—9 to 15 inches, strong-brown (7.5YR 5/6) gravelly loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 30 percent sandstone gravel, mostly 3 to 4 inches in size; medium acid (pH 5.8); clear, wavy lower boundary; 5 to 7 inches thick.

B21t—15 to 19 inches, yellowish-red (5YR 5/6) gravelly fine loam; weak, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 30 percent sandstone fragments, mostly 3 to 4 inches in size; thin, continuous clay films; medium acid (pH 5.8); wavy lower boundary; 6 to 12 inches thick.

B22t—19 to 27 inches, yellowish-red (5YR 5/6) gravelly sandy clay loam; moderate, medium, subangular blocky structure; 30 percent sandstone fragments, mostly 3 to 4 inches in size; thick, continuous clay films; firm when moist, sticky and plastic when wet; medium acid (pH 5.6); gradual, wavy lower boundary; 6 to 12 inches thick.

B23t—27 to 30 inches, reddish-brown (5YR 5/4) clay loam; moderate, medium, blocky structure; 10 percent sandstone gravel, mostly 3 to 4 inches in size; thick, continuous clay films; firm when moist, sticky and plastic when wet; medium acid (pH 5.6); clear, wavy lower boundary; 2 to 10 inches thick.

IIB24t—30 to 40 inches +, reddish-brown (5YR 4/4) silty clay loam; strong, medium, blocky structure; thick, continuous clay films; some fragments of weathered limestone; firm when moist, sticky and plastic when wet; medium acid (pH 5.8).

The texture of the surface soil ranges from gravelly loam to loam. Some areas are stony. The texture of the subsoil ranges from sandy clay loam to clay loam. Color of the subsoil ranges from reddish brown to strong brown and yellowish red. The reaction of the upper subsoil ranges from strongly acid to slightly acid, and that of the lower subsoil, from medium acid to neutral. The amount of coarse fragments ranges from 25 to 35 percent in the surface soil, from 5 to 40 percent in the upper subsoil, and from 0 to 20 percent in the lower subsoil. The depth to bedrock ranges from 4 to 10 feet.

Near Murrill soils are areas of Hagerstown, Lawrence, Berks, Weikert, and Laidig soils.

Murrill gravelly loam, 3 to 8 percent slopes, moderately eroded (MuB2).—This soil has the profile described as typical for the Murrill series. It is a gently sloping soil on mountain foot slopes and colluvial fans between areas of Berks, Weikert, and Hagerstown soils. In many places this Murrill soil is dotted by few to many shallow depressions that are filled sinkholes. The slopes are short and undulating. Surface drainage is medium. Included in mapping this soil were a few areas that are nearly level and a few areas that are severely eroded.

This Murrill soil is well suited to most crops grown in the county. It is also well suited to pasture, hay, trees, and wildlife. It has few limitations for use as homesites and industrial sites. (Capability unit IIe-1; woodland group 4)

Murrill gravelly loam, 8 to 15 percent slopes, moderately eroded (MuC2).—This soil is slightly shallower than a typical Murrill soil. It is a sloping soil on mountain foot slopes and colluvial fans, between areas of Berks, Weikert, and Hagerstown soils. In many places the microrelief is marked by scattered sinkholes, some of which have been partly filled with soil material to form shallow depressions. The slopes are short and rolling. Surface runoff is fairly rapid. Included in mapping this soil were a few areas that are moderately steep and a few areas that are severely eroded.

This Murrill soil is well suited to most crops grown in the county. It is also suited to pasture, hay, trees, and wildlife. It has few limitations for homesites and industrial sites. (Capability unit IIIe–1; woodland group 4)

Murrill very stony loam, 5 to 25 percent slopes (MvD).—This soil has a profile similar to the one that is described for the Murrill series, but it contains stones and boulders. It is sloping to moderately steep and is on wooded mountain foot slopes near areas of Laidig, Berks, and Weikert soils. In many places this soil has microrelief marked by scattered sinkholes. Some of the sinkholes have been partly filled with soil material to form shallow depressions.

This soil is fairly well suited to pasture and well suited to trees and wildlife. Stones and slope limit its use for some homesites and industrial sites. (Capability unit VIs–1; woodland group 4)

Philo Series

The Philo series consists of deep, moderately well drained to somewhat poorly drained, medium-textured, brown soils. They are on flood plains of streams in the intermountain valleys. The streams flow from areas that are predominantly gray and yellow shale. The Philo soils developed in sediments washed mainly from Berks and Weikert soils. They are nearly level and moderately permeable. They have high capacity to hold moisture available to plants.

In a typical Philo soil, the surface layer is brown silt loam about 9 inches thick. The subsoil, from a depth of 9 to 14 inches, is dark-brown silt loam. From 14 to 21 inches, the subsoil is brown silt loam that has mottles of yellowish red. From 21 to 37 inches, the lower subsoil is dark-gray silt loam that has mottles of yellowish brown and olive brown. The substratum, below 37 inches, is stratified gravel, silt, and sand.

Profile of Philo silt loam near Mellots Mill on Licking Creek:

Ap—0 to 9 inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.6); abrupt, smooth lower boundary; 7 to 10 inches thick.

B21—9 to 14 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.4); clear, wavy lower boundary; 4 to 10 inches thick.

B22—14 to 21 inches, brown (10YR 5/3) silt loam; common, medium, distinct, yellowish-red (5YR 5/6) mottles; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.4); clear, wavy lower boundary; 5 to 9 inches thick.

B23g—21 to 37 inches, dark-gray (10YR 4/1) silt loam; common, medium, distinct, yellowish-brown (10YR 5/8) and light olive-brown (2.5Y 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.4); clear, wavy lower boundary; 14 to 18 inches thick.

IIC—37 inches +, stratified gravel, silt, and sand.

Reaction ranges from strongly acid to very strongly acid. In some profiles the B22 horizon has a few gray mottles. The texture of the subsoil ranges from silt loam to clay loam. The depth to the substratum ranges from 40 to more than 50 inches. The depth to bedrock ranges from 4 to 6 feet.

Philo soils are in a drainage sequence that includes the well-drained Pope soils and the somewhat poorly drained to poorly drained Atkins soils. Berks and Weikert soils are in the nearby uplands, and Ernest and Brinkerton soils are in the drainageways.

Philo silt loam (Ph).—This soil is nearly level and is on flood plains in the shaly intermountain valleys. Its profile is the one described as typical for the series. Surface runoff is slow. The soil is flooded occasionally, usually early in spring or late in winter.

This soil is well suited to all but deep-rooted crops and to pasture, trees, or wildlife. The hazard of flooding limits its use for building sites and for septic systems. (Capability unit IIw–1; woodland group 2)

Pope Series

The Pope series consists of deep, well-drained, medium-textured, brown soils of flood plains. These soils are along streams that drain areas that are predominantly gray and yellow shale. They developed in sediments washed mainly from areas of Berks and Weikert soils. Pope soils are nearly level and are moderately permeable. They have high capacity to hold moisture available to plants.

Typically, a Pope soil has a dark grayish-brown loam surface soil that is about 9 inches thick. The subsoil, extending from a depth of 9 to 37 inches, is dark-brown loam. The substratum, reaching from 37 down to 50 inches, is brown loam that has mottles of yellowish brown. Stratified sand and gravel are below a depth of 50 inches.

Profile of Pope loam about 2½ miles south of Needmore on Tonoloway Creek:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; medium acid (pH 5.6); abrupt, smooth lower boundary; 7 to 10 inches thick.

B1—9 to 19 inches, dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; strongly acid (pH 5.2); gradual, wavy lower boundary; 9 to 14 inches thick.

B2—19 to 37 inches, dark-brown (10YR 4/3) loam; weak, medium and coarse, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; very strongly acid (pH 4.8); gradual, wavy lower boundary; 12 to 19 inches thick.

C—37 to 50 inches, brown (10YR 4/3) loam; few, fine, faint, yellowish-brown (10YR 5/8) mottles; massive; friable when moist, nonsticky and nonplastic when wet; very strongly acid (pH 4.6); clear, wavy lower boundary; 11 to 16 inches thick.

IIC2—50 inches +, stratified gravel and sand.

Reaction ranges from very strongly acid to strongly acid. The texture of the subsoil ranges from coarse silt loam to gravelly loam. The color of the subsoil ranges from dark brown to dark yellowish brown. In many places the substratum is mottled.

Pope soils are in a drainage sequence that includes the moderately well drained to somewhat poorly drained Philo soils and the somewhat poorly drained to poorly drained Atkins soils. Berks and Weikert soils are in the nearby uplands, and Ernest and Brinkerton soils are in drainageways near the flood plains.

Pope loam (Po).—This soil is nearly level and is on flood plains adjacent to large streams. Its profile is the one described as typical for the Pope series. In most places areas of Philo and Atkins soils are nearby. Runoff is slow. The soil is subject to occasional flooding, usually late in winter or early in spring.

This soil is well suited to most crops grown in the county. It is also well suited to pasture, trees, and wildlife. The hazard of flooding limits its use for housing and for industrial sites. (Capability unit I–1; woodland group 1)

Pope Series, Neutral Variant

The soils of this variant from the Pope series are deep, well-drained, brownish soils on flood plains in the limestone intermountain valleys and on other flood plains of streams that receive drainage from areas of limestone rocks. These soils are nearly level. They are moderately permeable and have high capacity to hold moisture available to plants.

Typically, the surface layer of a Pope soil, neutral variant, is dark yellowish-brown fine sandy loam about 9 inches thick. The subsoil, extending from a depth of 9 to 38 inches, is brown fine sandy loam. From a depth of 38 to 46 inches, the substratum is brown fine sandy loam that has mottles of yellowish red. At a depth of about 46 inches, the substratum grades to stratified layers of gravel and sand.

Profile of Pope fine sandy loam, neutral variant, about 1¼ miles south of Big Cove Tannery on Cove Creek:

Ap—0 to 9 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.8); abrupt, smooth lower boundary; 7 to 10 inches thick.

B21—9 to 19 inches, brown (10YR 4/3) fine sandy loam; weak, medium, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.8); gradual, wavy lower boundary; 9 to 13 inches thick.

B22—19 to 38 inches, brown (10YR 4/3) fine sandy loam; weak, medium and coarse, subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; neutral (pH 6.8); clear, wavy lower boundary; 16 to 21 inches thick.

C1—38 to 46 inches, brown (10YR 4/3) fine sandy loam; common, medium, distinct, yellowish-red (5YR 5/8) mottles; massive; friable when moist, nonsticky and nonplastic when wet; neutral (pH 7.0); clear, wavy lower boundary; 6 to 12 inches thick.

IIC2—46 inches +, stratified gravel and sand.

The reaction is slightly acid to neutral to a depth of 18 inches and neutral below 18 inches. The texture of the subsoil ranges from fine sandy loam to gravelly fine sandy loam. The color of the subsoil ranges from brown to dark grayish brown. The depth to bedrock ranges from 4 to 6 feet.

The neutral variants of the Pope series are in a drainage sequence that includes the moderately well drained to somewhat poorly drained Lindside soils and the somewhat poorly drained to poorly drained Melvin soils. The well-drained Hagerstown, Frankstown, Elliber, Edom, and Murrill soils are on the nearby uplands. The moderately well drained Wiltshire and the somewhat poorly drained Lawrence soils are in drainageways adjacent to the flood plains.

Pope fine sandy loam, neutral variant (Pm).—This soil is the only neutral variant from the Pope series mapped in the county. Its profile is the one described as typical for the neutral variant. This soil is nearly level. It is on flood plains adjacent to large streams and near areas of Lindside and Melvin soils. Runoff is slow. The soil is subject to occasional flooding, usually late in winter or early in spring. Included in mapping this soil were some areas of more silty soils that are in narrow bands along drainageways and in depressions in the Big Cove area, and some areas that have a surface layer of loam or gravelly sandy loam.

This neutral variant of Pope soil is well suited to most crops grown in the county and to pasture, trees, and wildlife. The hazard of flooding limits its use for housing and for industrial sites. (Capability unit I–1; woodland group 1)

Rubble Land

Rubble land (Ru) is a land type that consists of steep or very steep areas on the tops and upper slopes of mountains. The areas are covered with a mantle of stones and boulders. In some places there are outcrops of bedrock. There is little or no soil material between the rocks, and little or no vegetation grows there. The rocks are chiefly sandstone of the Pocono and Tuscarora formations.

Use of Rubble land is very limited. Where the rock materials are accessible, they can be removed for use as subgrade in building roads. (Capability unit VIIIs–1; woodland group 13)

Strip Mine Spoil

Strip mine spoil (St) is a land type that was formed by open-pit mining of coal or other material (fig. 11). The natural soils have been mixed with rock, and the material now is a variable mixture of large sandstone rocks, sandstone and shale fragments, and some silt, clay, and sand.

The surface in many places is very shaly or stony. The thickness of the disturbed material ranges from a few feet to many feet. Slopes range from 8 to 90 percent and are short and irregular. Some of the gentle or moderate slopes were produced by backfilling. Permeability of the material is variable. Runoff is mostly rapid, but flooding occurs in some places.

Few of these areas can be used for crops or pasture. Some might be suited to trees or wildlife. (Capability unit VIIs–1; woodland group 13)

Figure 11.—Typical area of unleveled Strip mine spoil.

Tygart Series

The Tygart series is made up of somewhat poorly drained, deep, medium-textured soils that developed in acid materials of old flood plains that are above present overflows of major streams. These soils are gently sloping and are on terrace landforms that in most places are separated from the present flood plains by short, fairly steep escarpments 3 to 10 feet high. Tygart soils have moderate permeability in the upper subsoil and moderately slow permeability in the lower subsoil. They have high capacity to hold moisture that plants can use.

The surface layer of a typical Tygart soil is dark grayish-brown fine silt loam about 8 inches thick. The upper subsoil, extending from a depth of 8 to 10 inches, is light olive-brown silty clay loam that has light brownish-gray mottles. From a depth of 10 to 23 inches, the subsoil is light yellowish-brown silty clay loam that has mottles of light gray and yellowish brown. From 23 to 50 inches, the lower subsoil is light brownish-gray silty clay loam that has mottles of light gray and yellowish brown. Stratified gravel, silt, sand, and clay lie at depths below 50 inches.

Profile of Tygart silt loam 2½ miles southeast of Hustontown on Licking Creek:

Ap—0 to 8 inches, dark grayish-brown (2.5Y 4/2) fine silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; extremely acid (pH 4.4); abrupt, smooth lower boundary; 6 to 9 inches thick.

B1t—8 to 10 inches, light olive-brown (2.5Y 5/4) coarse silty clay loam; common, fine, faint, light brownish-gray (2.5Y 6/2) mottles; weak, thin, platy structure; firm when moist, slightly sticky and slightly plastic when wet; thin, continuous clay films; very strongly acid (pH 4.8); clear, wavy lower boundary; 2 to 4 inches thick.

B21t—10 to 16 inches, light yellowish-brown (2.5Y 6/4) silty clay loam; many, medium, distinct, light-gray (2.5Y 7/2) and yellowish-brown (10YR 5/6) mottles; modderate, medium, blocky structure; firm when moist, sticky and plastic when wet; thin, continuous clay films; very strongly acid (pH 4.6); gradual, wavy lower boundary; 5 to 7 inches thick.

B22t—16 to 23 inches, light yellowish-brown (2.5Y 6/4) silty clay loam; many, medium, distinct, light-gray (2.5Y 7/2) and yellowish-brown (10YR 5/6) mottles; moderate, coarse and medium, blocky structure; firm when moist, sticky and plastic when wet; thin, continuous clay films; very strongly acid (pH 4.6); gradual, wavy lower boundary; 5 to 12 inches thick.

B3g—23 to 50 inches, light brownish-gray (2.5Y 6/2) silty clay loam; many, medium, distinct, light-gray (10YR 7/1) and yellowish-brown (10YR 5/6) mottles; moderate, coarse, blocky structure in the upper part and very coarse blocky structure in the lower part; firm when moist, sticky and plastic when wet; thin, continuous clay films; very strongly acid (pH 4.6); abrupt, wavy lower boundary; 12 to 28 inches thick.

IIC—50 inches +, stratified gravel, silt, sand, and clay.

The color of the subsoil ranges from light olive brown to grayish brown. The subsoil is mottled throughout. The texture of the subsoil ranges from silty clay loam to clay. The depth to the substratum ranges from 40 to 50 inches. The depth to bedrock ranges from 4 to 7 feet.

Tygart soils are in a drainage sequence that includes the well drained Allegheny and the moderately well drained Monongahela soils. Berks, Calvin, Weikert, and Klinesville soils are in the uplands above Tygart soils. The soils on the flood plains below Tygart soils are Barbour, Basher, Pope, Philo, and Atkins.

Tygart silt loam (Ty).—This is a nearly level soil on terraces above the present flood plains along the large streams. Its profile is the one described as typical for the series. Surface drainage is slow. Included in mapping this soil were a few areas that have neutral reaction in the lower subsoil.

This Tygart soil is poorly suited to deep-rooted crops. It stays cold and wet late in spring. The soil is fairly well suited to shallow-rooted crops and well suited to hay, pasture, trees, and wildlife. Wetness restricts its use for most homesites and industrial sites and for septic systems. (Capability unit IIIw-1; woodland group 7)

Tygart Series, Poorly Drained Variant

The soils of this variant from the Tygart series are deep, poorly drained, and medium textured. They developed in old, acid alluvium that was washed from areas of sandstone, siltstone, and shale. These soils are nearly level and are on terraces that in most places are separated from the flood plains by short, steep escarpments from 3 to 10 feet high. These soils have moderately slow permeability. They have high capacity to hold moisture that is available to plants.

In a typical soil of this variant, the surface soil is dark grayish-brown silt loam about 9 inches thick. The subsoil extends from a depth of 9 to about 40 inches and is gray silty clay loam that has mottles of yellowish brown. It has structure in the upper part and is almost structureless in the lower part.

Profile of Tygart silt loam, poorly drained variant, in a hayfield in Belfast Township 1½ miles north of Needmore; engineering data are reported in table 3 under Pennsylvania report numbers BK-38055 and BK-38056:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; medium acid (pH 6.0) (limed); abrupt, smooth lower boundary; 8 to 10 inches thick.

B21tg—9 to 20 inches, gray (10YR 6/1) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; firm when moist, sticky and plastic when wet; thin continuous clay films; medium acid (pH 5.6); clear, wavy lower boundary; 9 to 12 inches thick.

B22tg—20 to 30 inches, gray (N 6/0) silty clay loam; many, coarse, prominent, yellowish-brown (10YR 5/8) mottles; moderate, coarse, blocky structure; firm when moist, sticky and plastic when wet; thin, continuous clay films; strongly acid (pH 5.4); clear, wavy lower boundary; 10 to 14 inches thick.

B3g—30 to 40 inches, gray (N 5/0) silty clay loam; few, medium, prominent, yellowish-brown (10YR 5/8) mottles; moderate, coarse, subangular blocky to massive structure; firm when moist, sticky and plastic when wet; strongly acid (pH 5.4).

Reaction is medium acid to very strongly acid. The color of the subsoil ranges from gray to light gray. The subsoil is mottled. The texture of the subsoil ranges from silty clay to silty clay loam. In some places the lower subsoil and substratum contain up to 20 percent sandstone and shale gravel. The depth to the substratum ranges from 40 to 45 inches. The depth to bedrock ranges from 4 to 7 feet.

The poorly drained variants of the Tygart series are in a drainage sequence that includes the well drained Allegheny soils, the moderately well drained Monongahela soils, and the somewhat poorly drained Tygart soils. In the nearby uplands are Berks, Calvin, Weikert, and Klinesville soils. On the nearby flood plains are Barbour, Basher, Pope, Philo, and Atkins soils.

Tygart silt loam, poorly drained variant (Tz).—This is the only variant from the Tygart series mapped in the county. This soil is nearly level and is on terraces above the present flood plains along large streams. Its profile is the one described as typical for this variant of the Tygart series. Surface drainage is slow. Included in mapping this soil were a few very small areas that are very poorly drained and have a darker surface soil than that described, and a few areas that have a neutral subsoil.

Tygart silt loam, poorly drained variant, is poorly suited to cultivated crops, because of wetness. It is well suited to hay, pasture, trees, and wildlife. Wetness severely limits its use for homesites or industrial sites or for septic systems. (Capability unit IVw–1; woodland group 8)

Weikert Series

The Weikert series consists of shallow, well-drained, brownish soils that developed from yellow and olive shale, siltstone, and fine-grained sandstone. They are in gently sloping to very steep parts of the intermountain valleys. Weikert soils have moderately rapid permeability and have low capacity to hold moisture that is available to plants.

Where a Weikert soil has been cultivated, the typical surface soil is dark-brown shaly silt loam about 7 inches thick and is about 40 percent channery shale fragments. The subsoil is thin, brownish-yellow very shaly silt loam, and is about 80 percent shale fragments. Bedrock of olive shale is at a depth of about 14 inches.

Profile of Weikert channery silt loam, 15 to 25 percent slopes, moderately eroded, in an abandoned field one-half mile east of Camp Sinoquipe in Dublin Township; engineering data are reported in table 3 under Pennsylvania report numbers BM–825 and BM–826:

Ap—0 to 7 inches, dark-brown (10YR 4/3) shaly silt loam; weak, fine, granular structure; friable when moist, nonsticky and nonplastic when wet; 40 percent channery shale fragments to ½ inch in size; strongly acid (pH 5.2); clear, smooth lower boundary; 6 to 9 inches thick.

B2—7 to 14 inches, brownish-yellow (10YR 6/6) very shaly silt loam; weak, medium, subangular blocky structure, largely obscured by shale fragments; friable when moist, nonsticky and nonplastic when wet; 80 percent channery shale fragments to 4 inches in size; strongly acid (pH 5.1); clear, wavy lower boundary; 4 to 10 inches thick.

R—14 inches +, olive (5Y 5/4) shale bedrock; silt coats on bedding planes.

In some places the surface soil rests directly on the shale. The color of the subsoil ranges from yellowish brown to brownish yellow. The texture of the subsoil ranges from very shaly silt loam to very channery loam. The amount of coarse fragments ranges from 20 to 45 percent in the surface soil and from 50 to 85 percent in the subsoil. The depth to bedrock ranges from 10 to 20 inches.

Downslope from the Weikert soils are areas of Ernest and Brinkerton soils.

Weikert channery silt loam, 3 to 8 percent slopes, moderately eroded (WcB2).—This soil has a profile slightly deeper than the one described for the Weikert series. This soil is gently sloping and is on hilltops, wide ridges, and benchlike positions on hillsides. The slopes are fairly short, and surface drainage is good. Where this soil is near Calvin or Klinesville soils, small areas of Klinesville soils were included in the mapping. Some shallow gullies and a few severely eroded areas at the heads of drainageways were also included in mapping this soil.

This Weikert soil has limited use for crops or for pasture. It is well suited to trees, to wildlife, to homesites, and to industrial sites. (Capability unit IIIe–3; woodland group 11)

Weikert channery silt loam, 8 to 15 percent slopes, moderately eroded (WcC2).—This soil has a profile slightly deeper than the one described for the Weikert series. It is sloping and is on hillsides and ridgetops. The slopes are mostly short, and surface drainage is good. Small areas of Klinesville soils were included in mapping this soil.

This Weikert soil is suited to trees, to wildlife, and to homesites. (Capability unit IVe–2; woodland group 11)

Weikert channery silt loam, 15 to 25 percent slopes, moderately eroded (WcD2).—This soil has the profile described as typical for the Weikert series. It is a moderately steep soil on hillsides and edges of drainageways. The slopes are fairly short. Surface drainage is good. Small areas of Klinesville soils were included in mapping this soil. In the Brush Creek and Wells Tannery areas, the Klinesville inclusions are less acid than typical, because the bedrock under them contains some lime.

This Weikert soil is suited to trees and wildlife. (Capability unit VIe–2; woodland group 11)

Wiltshire Series

The Wiltshire series consists of deep, moderately well drained soils that developed in material that was derived from limestone, sandstone, or shale. The soil material has been moved downslope by erosion, gravitational creep, and frost action and has been deposited over limestone. These gently sloping soils are in the intermountain valleys. They are moderately permeable in the upper subsoil and moderately slowly permeable in the lower subsoil. They have moderate capacity to hold moisture available to plants.

In a typical Wiltshire soil, the surface layer is dark yellowish-brown gravelly loam about 9 inches thick. The upper subsoil is yellowish-brown silt loam. Some gravel is in the subsoil. At about 14 inches, the silt loam grades to silty clay loam. Below 14 inches, the subsoil is mottled. Between 25 and 40 inches, the subsoil is a fragipan of clay loam texture. At a depth of 40 inches and below, the subsoil is yellowish-brown, mottled silty clay loam.

Profile of Wiltshire gravelly loam, 3 to 8 percent slopes, moderately eroded, in a cultivated field in Ayr Township about 1 mile northwest of Cito; engineering data are reported in table 3 under Pennsylvania report numbers BM–3711 and BK–31253:

Ap—0 to 9 inches, dark yellowish-brown (10YR ¾) gravelly loam; weak, fine, granular structure; very friable when moist, nonsticky and nonplastic when wet; 20 percent sandstone gravel; medium acid (pH 5.6) (limed); clear, smooth lower boundary; 7 to 10 inches thick.

B1—9 to 14 inches, yellowish-brown (10YR 5/4) silt loam; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 10 percent sandstone gravel; few thin clay films; medium acid (pH 5.8); clear, wavy lower boundary; 3 to 7 inches thick.

B21t—14 to 20 inches, yellowish-brown (10YR 5/6) gritty silty clay loam; common, fine, faint, yellowish-brown (10YR 5/4) and yellow (10YR 7/8) mottles; moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 15 percent sandstone gravel; thin, continuous clay films; slightly acid (pH 6.4); gradual, wavy lower boundary; 4 to 6 inches thick.

B22t—20 to 25 inches, yellowish-brown (10YR 5/8) clay loam; common, medium, distinct, reddish-yellow (7.5YR 7/8) and yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; 15 percent sandstone gravel; thick, continuous clay films; neutral (pH 6.6); gradual, wavy lower boundary; 4 to 6 inches thick.

Bx—25 to 40 inches, yellowish-brown (10YR 5/8) clay loam; many, medium, distinct, light-gray (10YR 7/2) and strong-brown (7.5YR 5/8) mottles; moderate, medium, platy structure breaking to subangular blocky; brittle; firm when moist, slightly sticky and slightly plastic when wet; 15 percent sandstone gravel; neutral (pH 6.6); gradual, wavy lower boundary; 15 to 30 inches thick.

IIB3t—40 to 48 inches +, yellowish-brown (10YR 5/4) silty clay loam; common, medium, distinct, gray (N 5/0) and strong-brown (7.5YR 5/8) mottles; moderate, coarse, subangular blocky structure; firm when moist, sticky and plastic when wet; a few fragments of weathered sandstone and limestone of gravel size; thick, continuous clay films; neutral (pH 6.8).

Reaction ranges from medium acid to neutral. The color of the subsoil ranges from yellowish brown to brownish yellow. The texture of the subsoil ranges from gravelly sandy clay loam to coarse silty clay loam. The structure of the fragipan is moderate, medium, platy to moderate, coarse, prismatic breaking to platy. The amount of coarse fragments in the surface soil ranges from 15 to 30 percent; in the subsoil, from 15 to 40 percent; and in the substratum, from 15 to 80 percent. The depth to the substratum ranges from 40 to 50 inches. The depth to bedrock ranges from 4 to 8 feet.

Wiltshire soils are on mountain foot slopes and in drainageways near areas of the deep, well-drained Hagerstown and Frankstown soils. In some places they are in a landscape and also in a drainage sequence that includes the well-drained Murrill soils and the somewhat poorly drained Lawrence soils.

Wiltshire gravelly loam, 3 to 8 percent slopes, moderately eroded (WgB2).—This soil has the profile described as typical for the series. It is a gently sloping soil on mountain foot slopes and colluvial fans near areas of Murrill and Lawrence soils. Surface runoff is medium. Included in mapping this soil were some shallow gullies, some small, severely eroded spots, a few limestone outcrops, and some areas that are only slightly eroded.

This Wiltshire soil is well suited to all but deep-rooted crops. It stays cold and wet late in spring. It is well suited to hay, pasture, trees, and wildlife. Wetness restricts its use for some homesites and industrial sites. (Capability unit IIe-3; woodland group 6)

Formation and Classification of Soils

This section tells how the soils of Fulton County were formed, and describes the factors that influence soil formation. Table 8 gives the classification of each soil series in the new, comprehensive system that was adopted in 1965. Figure 12 is a diagram that shows representative soils in a landscape in the eastern part of the county.

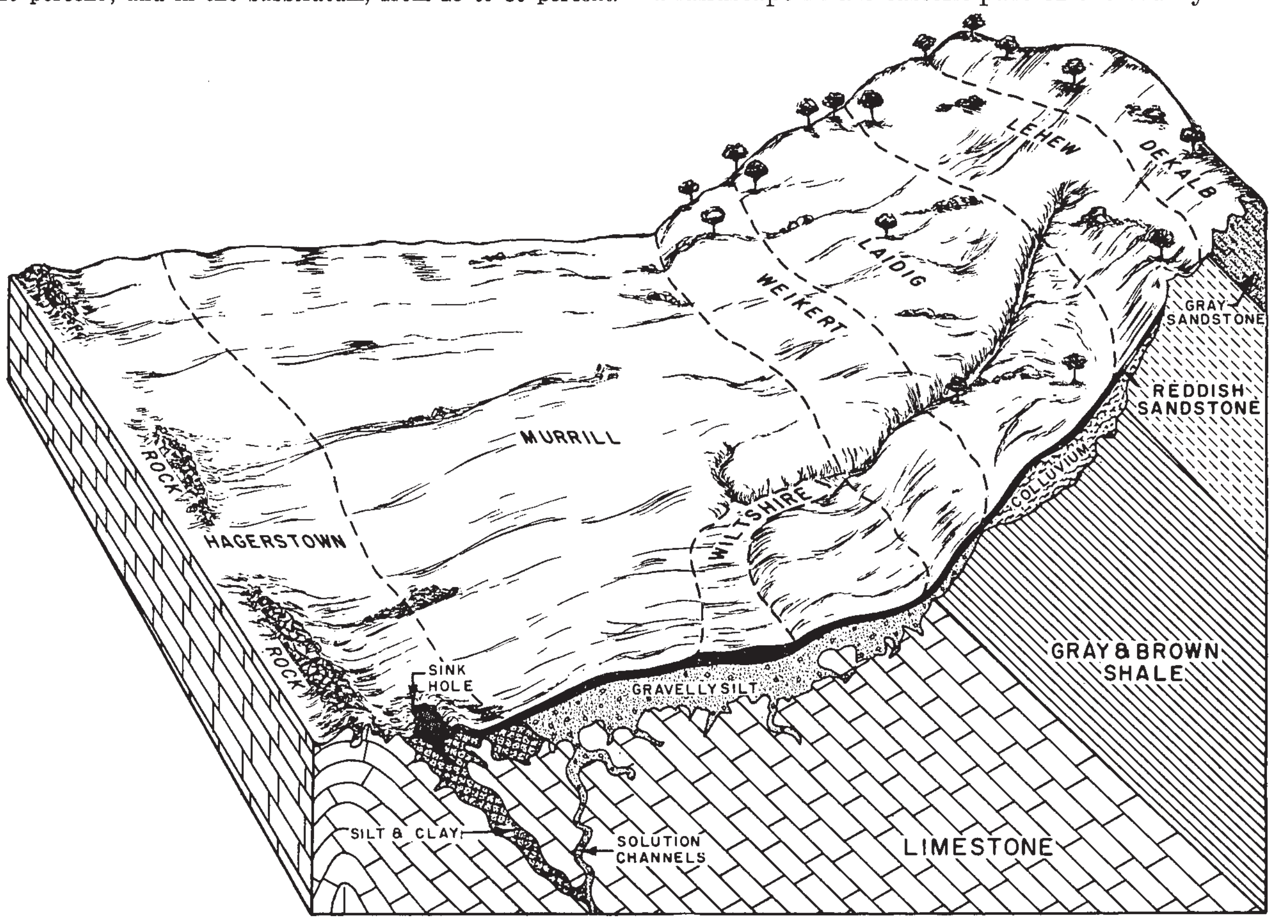

Figure 12.—Diagram showing pattern of soils and their parent material on a mountain slope and in an adjacent valley in eastern Fulton County.

Factors of Soil Formation

Soils are complex mixtures of weathered rock, primary minerals, secondary minerals, organic matter, water, and air in varying quantities. Soil is formed through the action of climate and of plants and animals on chemically and physically weathered geologic materials.

The characteristics of all soils depend on the nature of the parent material, the climate of the area, the relief or lay of the land, the plant and animal life, and the length of time the materials have been exposed.

In Fulton County, where vegetation and climate are nearly uniform, the nature of the parent material is the cause of most of the local differences in texture and in mineral content. Climate influences the nature of the weathering processes. Relief affects drainage, aeration, runoff, erosion, and exposure to sun and wind. Plant and animal life influence soil characteristics by both physical and chemical removals and additions. Time is required for all of the other soil-forming factors to exert their influence. The soil is constantly changing, and it is only after long periods of time that changes in the soil become apparent.

The *parent materials* of the soils were varied. The soils of Fulton County were formed primarily in residuum from shale, siltstone, sandstone, and limestone.

Residuum derived from limestone and calcareous shale is the parent material for some soils. For example, the Hagerstown soils formed in material derived from limestone. Residuum from acid siltstone, sandstone, and shale is the parent material for the Weikert and the Berks soils. Acid sandstone was weathered to form the parent material of the Dekalb soils. The residuum derived from the coarse-grained sandstone influences the Dekalb soils and causes them to be coarse textured. Slightly calcareous red shale, siltstone, and sandstone were weathered to form the parent material of the Calvin soils. The red color of Calvin soils is inherited from the residuum that was weathered from the red shale. Sediments deposited on terraces and flood plains by streams formed the parent material for several soils, among them the Philo, Atkins, Melvin, and Lindside. The characteristics of those soils are influenced by the characteristics of the alluvial material.

The *climate* of Fulton County is the humid, temperate, continental type characteristic of the Middle Atlantic States. Some characteristics of the soils in the county indicate that the present climate is similar to the one in which the soils developed. Most of the soils are acid and have been leached of bases. The effect of climate on soils has been relatively uniform throughout the county, but microclimates caused by differences in relief probably influenced some of the individual soils.

Relief or topography is controlled, to a large extent, by the nature of the underlying rocks in this county. The rocks that are most resistant to weathering form the highest ridges. The streams of the county have played a large part in dissecting and eroding the landscape. Relief affects surface runoff, and the accumulation of materials at the foot of slopes is an important factor in the formation of such soils as the Laidig, Brinkerton, and Buchanan.

Plant and animal life have had their effects on the soils. Most of the county was covered by hardwood forests of the oak-hickory type. There were small areas of hemlock and pine forests on the cooler, wetter sites at high elevations. The soils of the county are typical of soils developed under forest vegetation. Where undisturbed they have leaf litter over a 1- to 3-inch, black 02 horizon; then a 1- to 2-inch, dark A1 horizon; and under that a 5- to 9-inch, light-colored A2 horizon. As the forests were cleared and farmed, the organic layers were mixed into the plow layer or were burned. In many places the soil was left exposed to wind and rain, which produced accelerated erosion. Man, through such practices as plowing, cultivation, artificial drainage, manuring, and maintenance of perennial grasses and legumes, has caused and will continue to cause major changes in the soils.

It takes *time* for soils to be formed. Soils in alluvial materials, such as the Philo, Atkins, Melvin, and Lindside, are considered to be young or recent soils because their parent materials have been in place for a shorter time than the parent materials of most other soils. The soils in alluvium generally have less distinct horizons than many of the older soils of the uplands. Weikert and Klinesville soils of the uplands have horizons that show that some changes have taken place, but their horizons do not reflect the full influence of soil-forming processes. Weathering and profile development in these soils have been slowed by the effects of sloping to steep topography and resistant parent materials. Bedington, Laidig, Ernest, Tygart, and Monongahela soils are examples of soils in the county that, with the passage of time, have developed profiles that have distinct horizons.

Processes of Soil Formation

As weathering proceeds and plants develop on a young soil, several processes take place that tend to form layers or horizons in the soil (*21*). *Gains* occur as leaves and plant remains accumulate on the surface of a soil. The layer of organic remains is easily seen in an unplowed area of a soil such as Dekalb, which was formed in woodland. Gains of organic matter, nutrients, and mineral material may be brought about by animals, floods, wind, or gravity. *Losses* from the soil occur when minerals are decomposed and some of the weathering products are leached from the soil in solution. This process has been active in the Hagerstown soils, from which calcium carbonate has been leached. Losses also occur when nutrient elements are removed in harvested plants. Fine particles of soil are removed by erosion. Gases escape whenever organic matter is decomposed.

Transfers of material from one part of the soil to the other are common in most soils. Organic matter is moved from the upper part of the profile to the lower part in suspension or in solution. Calcium is leached from the surface layer and is held by the clay of the subsoil, is moved farther into the underlying material, or is carried away in solution by the ground water. The increased amount of clay in the B horizon of some soils, such as the Monongahela and Allegheny, was produced by transfer of clay from horizons higher in the profile. Bases and nutrients are moved when they are absorbed by plant roots and rise in the stems to be stored in the leaves and stems of plants. When the plants die and decay, the nutrients are returned to the soil.

Transformations occur as chemical weathering takes place. For example, iron, aluminum, calcium, and other elements are released from the primary and secondary minerals in the soil. In well-drained soils the gray and black colors of the parent materials gradually are replaced by red, brown, and yellow colors of more weathered and oxidized iron compounds. The colors indicate the release of iron or the oxidation of ferrous oxides to ferric oxides in the presence of an adequate supply of oxygen.

The sequence of horizons in the profile of a mature soil under forest vegetation can be described as follows:

The O1 and O2 horizons are generally the first horizons to form on the accumulated weathered parent materials. The O1 horizon is leaf litter. The O2 horizon is the horizon of accumulated, partly decomposed organic matter.

The A horizon, or surface layer of mineral soil, is under the O2 horizon. Its formation parallels that of the O2 horizon. In uncultivated areas the A horizon is commonly subdivided into the A1 and the A2 horizons. The A1 horizon consists of mixed organic and mineral soil material that is dark colored. The A2 horizon under the A1 horizon is evident in soils in which weathering and leaching have removed soluble substances from the upper A horizon. It is lighter colored than the A1 horizon and is called an eluviated horizon. If the A horizons are mixed in plowing, and crop residues and manure are incorporated into the surface layer, the horizon thus formed is designated Ap. One example of an Ap horizon is the one described in the profile of a typical Allegheny soil.

The B horizon, or subsoil, is that part of the soil profile beneath the A horizon. Its formation follows that of the A horizon. It is often called the illuviated horizon, which means the horizon that has accumulated some of the substances that moved out of the A horizon, such as clay, oxides of iron and aluminum, and organic colloids. It is also a horizon that contains many secondary minerals. These are dominantly silicate clays formed from altered primary minerals or inherited from the original sedimentary rock. Some people consider this horizon to be the result of both illuviation and transformation. In most soils the B horizon contains more clay and less organic matter than the A horizon.

The B horizon has three main subdivisions, B1, B2, and B3. The B1 horizon has weakly developed features of the B horizon. The B2 horizon in most soils is the layer that has the greatest amount of accumulated clay. The analytical data and the technical description of a typical Albrights soil, for example, show the characteristics of a textural B2 horizon. The B3 horizon has some of the properties of the substratum. It generally shows less clay accumulation and less alteration of primary minerals than the B2 horizon.

The A and B horizons constitute the solum, which is the zone in which most of the organic matter and mineral matter have been added, removed, transferred, or translocated through soil-forming processes. Below the solum is the C horizon, or partly weathered parent material. It is commonly coarser textured and lighter colored than the B horizon. It may contain some of the weathered materials that have leached out of either the A or the B horizon. It is composed mainly of partly weathered minerals and rock fragments.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First, through classification, and then through use of soil maps, we can apply our knowledge to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other applications. They are placed in broad classes to facilitate study and comparison in large areas, such as counties, regions, and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and revised later (*4*, *16*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study (*14*, *22*). Therefore, readers interested in developments of the system should search for the latest literature available on the subject.

Under the current system of classification, six categories are recognized. Beginning with the broadest and most inclusive, these are the order, the suborder, the great group, the subgroup, the family, and the series. Table 8 gives the family, subgroup, and order for each series in the county under the current classification, as well as the great soil group of the 1938 classification.

Laboratory Data [5]

The physical and chemical properties of six soil series at selected sites in Fulton County are given in tables 9 and 10. The series sampled are Albrights, Berks, Calvin, Dekalb, Klinesville, and Leck Kill. The sites were located in areas that were most nearly representative of the soil series in internal characteristics and in slope, erosion, and land use. At each site a pit was dug through the solum and into the parent material. Descriptions were taken and samples were collected from each described horizon.

A description of the profile of each series that was sampled is given in the section "Description of the Soils." The profile sample numbers are given.

Methods of Analysis

Air-dry samples were crushed with a rolling pin so that the soil material would pass through a 2-millimeter, round-hole sieve. Care was taken to avoid breaking the nonsoil material into fragments that would pass through the sieve. The percentage by weight of fragments coarser than 2 millimeters was determined. All laboratory determinations, except those for bulk density and moisture retained at a tension of 1/3 atmosphere, were made on the part of the sample consisting of soil material less than 2 millimeters in diameter and results are reported on the basis of the ovendry soil.

Particle-size distribution was determined by the pipette method after dispersion by sodium hexametaphosphate and mechanical shaking (*8*, *9*).

[5] Laboratory analyses and interpretations were made at the Soil Characterization Laboratory of the Pennsylvania State University by R. P. MATELSKI, C. F. ENGLE, and L. J. JOHNSON.

TABLE 8.—*Soil series classified according to the current system of classification and the 1938 system with its later revisions*

Series	Current classification [1]			Great soil groups of the 1938 classification
	Family	Subgroup	Order	
Albrights	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols	Red-Yellow Podzolic soils intergrading toward Gray-Brown Podzolic soils.
Allegheny	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.
Andover	Fine-loamy, mixed, mesic	Typic Fragiaquults [2]	Ultisols	Low-Humic Gley soils.
Atkins	Fine-loamy,[2] mixed, acid, mesic	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils.
Barbour	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic.	Fluventic Dystrochrepts.	Inceptisols	Alluvial soils.
Basher	Coarse-loamy, mixed, mesic	Aquic Fluventic Dystrochrepts.	Inceptisols	Alluvial soils.
Bedington	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils intergrading toward Gray-Brown Podzolic soils.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides intergrading toward Lithosols.
Brinkerton	Fine-silty, mixed, mesic	Typic Fragiaqualfs [2]	Alfisols	Low-Humic Gley soils.
Buchanan	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols	Red-Yellow Podzolic soils.
Calvin	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Cookport	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.
Dekalb	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Edom	Fine, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.
Elliber	Loamy-skeletal, mixed,[2] mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Ernest	Fine-loamy, mixed, mesic	Aquic Fragiudults [2]	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.
Frankstown	Fine-loamy, mixed, mesic	Typic Hapludults [2]	Ultisols	Red-Yellow Podzolic soils.
Hagerstown	Fine, mixed, mesic	Typic Paleudalfs	Alfisols	Reddish-Brown Lateritic soils intergrading toward Gray-Brown Podzolic soils.
Klinesville	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols	Lithosols intergrading toward Sols Bruns Acides.
Laidig	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils.
Lawrence, variant	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols	Low-Humic Gley soils.
Leck Kill	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils intergrading toward Gray-Brown Podzolic soils.
Lehew	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Lindside	Fine-silty,[2] mixed, mesic	Aquic Fluventic Eutrochrepts.[2]	Inceptisols	Alluvial soils.
Melvin	Fine-silty, mixed, nonacid, mesic.	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils.
Monongahela	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils intergrading toward Gray-Brown Podzolic soils.
Murrill	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils intergrading toward Red-Yellow Podzolic soils.
Philo	Coarse-loamy,[2] mixed, mesic	Aquic Fluventic Dystrochrepts.	Inceptisols	Alluvial soils.
Pope	Coarse-loamy, mixed,[2] mesic	Fluventic Dystrochrepts	Inceptisols	Alluvial soils.
Pope, variant	Coarse-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Tygart	Clayey, mixed, mesic	Aquic Hapludults [2]	Ultisols	Red-Yellow Podzolic soils intergrading toward Low-Humic Gley soils.
Tygart, variant	Clayey, mixed, mesic	Typic Ochraquults	Ultisols	Low-Humic Gley soils.
Weikert	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols	Lithosols intergrading toward Sols Bruns Acides.
Wiltshire	Fine-loamy, mixed, mesic	Typic Fragiudalfs [2]	Alfisols	Gray-Brown Podzolic soils.

[1] Placement of some soil series in the current system of classification, especially in families, may change as more precise information becomes available.

[2] Classification is tentative and subject to change.

Bulk density, expressed in grams per cubic centimeter, was determined on 1- by 2-inch cylindrical core samples. The samples were taken with the Salinity Laboratory modified Uhland core sampler (*17*, *19*).

Moisture retained at 1/3 atmosphere of tension was determined by using the pressure-plate apparatus on the core samples (*19*). Moisture retained at 15 atmospheres of tension was determined by using the pressure-membrane apparatus on the fragmented samples (*12*).

Organic carbon was determined by using a modification of the Walkley-Black method (*11*). A semimicro adaptation of the Kjeldahl method (*2*) was used to determine total nitrogen. The pH was determined with a glass electrode in soil paste having a soil-water ratio of 1:1.

Exchangeable calcium, magnesium, sodium, and potassium were determined after extraction with neutral, normal ammonium acetate (*11*). Exchangeable hydrogen was determined by titration of a barium chloride-triethanol buffer solution that had been leached through the soil (*10*). The cation-exchange capacity was determined by the summation of the exchangeable cations. Exchangeable sodium and potassium were determined by using a model 52a Perkin-Elmer flame photometer.

Free iron oxide was determined by the method of Jeffries and Johnson (*7*).

Clay minerals were identified by means of a Norelco X-ray spectrometer equipped with a Geiger counter and chart recorder and using a copper target. Flat oriented clay samples (less than 2 microns), in the form of a thin film on a glass slide, were analyzed as magnesium saturated-water solvated, as magnesium saturated-glycol solvated, and as potassium saturated-water solvated specimens and heated to 300° C. and 550° C. Prior to saturation, organic matter was removed from the clay by treatment with 10 percent hydrogen peroxide, and free iron oxides were removed by the method developed by Jeffries (*6*).

The physical data obtained from these analyses can be used to aid in determining engineering properties of soils, their response to tillage, and their ability to absorb, transmit, and hold moisture for plant use.

Chemical data are an aid in determining the degree of leaching of soils and their ability to hold and release plant nutrients. The data are also helpful in determining the amount of lime needed to adjust soil acidity. The amount and kind of extractable cations furnish a basis from which to estimate the kinds and amounts of fertilizer needed.

Characteristics, such as texture, reaction, and base saturation, are used in placing soils in various categories of the soil classification system.

Summary of Data

Some of the data reported in tables 9 and 10 are summarized and explained in the following paragraphs by soil series.

Albrights series: The soils of the Albrights series are moderately well drained to somewhat poorly drained, fine-loamy, mixed, mesic Aquic Fragiudalfs. They developed in colluvium from acid red shale, siltstone, and fine-grained sandstone, and they occur on lower slopes below areas of Calvin and Klinesville soils. Albrights soils are in a drainage sequence that includes the somewhat poorly drained to poorly drained Brinkerton soils.

A textural B horizon is shown by the increased content of clay in the B horizon between a depth of 14 and 22 inches in the profile reported. In another profile that is finer textured than typical, the textural B horizon extends from 11 to 48 inches.

The bulk density is high in these soils, particularly in the Bx horizons. The moisture-holding capacity was found to be high in the A horizons and the B horizons. The soil holds more than 5 inches of available moisture in the upper 30 inches.

Base saturation in the B horizons ranges from 35 to about 55 percent. Reaction ranges from very strongly acid to strongly acid in the profile reports in table 10 and from extremely acid to medium acid in the other. The effect of liming is shown in the higher calcium-magnesium ratio in the Ap horizon.

The cation-exchange capacity ranges from 9.6 to 20.3 milliequivalents per 100 grams of soil, and there is an abrupt decrease from the Ap horizon to the A2 horizon. This change is the result of organic matter having been mixed into the Ap horizon. Except for the Ap horizon, cation-exchange capacity varies in close relationship to the clay content.

Organic carbon is highest in the plow layer because of the high content of organic matter. Illite is the most abundant component of the clay fraction, although interstratified montmorillonite-vermiculite-chlorite is prominent in the surface layer.

Berks series: The Berks soils are well-drained, loamy-skeletal, mixed, mesic Typic Dystrochrepts. They developed in residuum from gray, yellowish-brown, or olive, acid shale and siltstone, interbedded in places with thin strata of sandstone. They occur on the uplands.

The Berks soils are medium textured throughout. The amount of coarse fragments is moderate in the upper horizons and increases with depth. The amount of silt is greatest in the upper horizons and decreases with depth.

These soils hold a moderate amount of moisture available to plants in the horizons for which data were obtained. These soils, therefore, are more droughty than the Albrights soils.

Base saturation is highest in the plow layer but ranges from 18 to 53 percent throughout the profile. Liming has influenced the higher base saturation and higher calcium-magnesium ratio in the Ap horizon.

The cation-exchange capacity ranges from 17.1 to 19.6 milliequivalents per 100 grams of soil in the Ap horizon and from 8.5 to 11.4 in the B2 horizon. The higher values in the Ap horizon are the result of mixing large amounts of organic matter in the plow layer.

The mineral composition of the clay fraction shows kaolinite and illite present in the solum in moderate amounts and interstratified vermiculite-chlorite present in dominant to moderate amounts.

Calvin series: Calvin soils are well-drained, loamy-skeletal, mixed, mesic Typic Dystrochrepts. They developed from dusky-red, acid shale, siltstone, and fine-grained sandstone and occur in the uplands of the intermountain valleys.

The entire profile of Calvin soil is medium textured. The amount of coarse fragments is moderate and is greatest in the lower horizons. These soils hold a moderate amount of water available to plants in the horizons for which the

TABLE 9.—*Mechanical analyses and*

[Absence of data indicates

Soil series and sample number	Horizon	Depth from surface	Particle-size distribution			
			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.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*
Albrights:						
S62Pa-29-12-1	Ap	0-10	3.8	3.5	2.2	5.0
S62Pa-29-12-2	A2	10-14	2.4	3.5	3.1	6.0
S62Pa-29-12-3	B2t	14-22	1.6	1.5	2.1	6.8
S62Pa-29-12-4	Bx1	22-35	8.8	5.6	6.7	15.2
S62Pa-29-12-5	Bx2	35-40	11.6	6.8	6.4	15.1
S62Pa-29-12-6	IICg	40-50	12.2	9.4	8.8	13.9
Berks:						
S62Pa-29-18-1	Ap	0-9	9.6	5.6	2.8	1.8
S62Pa-29-18-2	B2	9-14	9.2	7.6	4.1	2.4
S62Pa-29-18-3	B3	14-21	10.2	9.6	5.1	3.0
S62Pa-29-18-4	C	21-26	13.4	9.5	5.4	3.0
Calvin:						
S62Pa-29-14-1	Ap	0-9	8.9	8.0	3.9	3.9
S62Pa-29-14-2	B2	9-19	13.1	12.1	4.7	3.5
S62Pa-29-14-3	B3	19-24	15.2	15.8	6.9	4.1
S62Pa-29-14-4	C	24-40	13.8	14.2	6.6	3.6
Dekalb:						
S62Pa-29-16-1 (not sampled)	O2	2-0	----------	----------	----------	----------
S62Pa-29-16-2	A21	0-1	.5	13.5	37.8	11.0
S62Pa-29-16-3	A22	1-6	.8	11.0	33.2	9.6
S62Pa-29-16-4	A3	6-11	1.9	11.4	31.4	10.3
S62Pa-29-16-5	B2	11-20	2.2	12.3	34.5	11.6
S62Pa-29-16-6	B3	20-27	2.5	9.3	31.4	13.9
S62Pa-29-16-7	C	27-43	1.4	7.5	29.5	12.4
Klinesville:						
S62Pa-29-15-1	Ap	0-9	14.4	7.3	4.3	8.4
S62Pa-29-15-2	B2	9-19	6.4	4.5	4.6	5.6
Leck Kill:						
S62Pa-29-11-1	Ap	0-8	12.3	8.2	4.4	4.4
S62Pa-29-11-2	B2t	8-20	8.5	8.5	4.6	2.8
S62Pa-29-11-3	B3t	20-26	7.0	7.5	4.5	2.0
S62Pa-29-11-4	C1	26-35	12.0	10.2	6.1	2.8
S62Pa-29-11-5	C2	35-45	11.4	9.5	5.1	3.1

data were obtained. Calvin soils are similar to the Berks soils in drought resistance and are more droughty than the Albrights soils.

Base saturation ranges from 61 percent in the A horizon to less than 40 percent in the B horizons. The effect of liming is shown by the less acid reaction and the higher calcium-magnesium ratio in the plow layer. Reaction ranges from medium to extremely acid in the profile.

The cation-exchange capacity in the Ap horizon ranges from 18.4 to 9.1 milliequivalents per 100 grams of soil. The high exchange capacity in the Ap horizon is the result of the large amount of organic matter that was mixed in the soil by plowing.

The mineral composition of the clay fraction of this soil shows moderate to dominant amounts of illite, with interstratified vermilculite-chlorite abundant in the surface layer.

Dekalb series: Dekalb soils are well-drained, loamy-skeletal, mixed, mesic Typic Dystrochrepts. Dekalb soils developed in residuum from acid, gray, yellowish-brown, or strong-brown sandstone, interbedded in some places with a few thin strata of shale and siltstone. These soils are on heavily wooded mountain tops and upper slopes, above areas of deep Laidig soils and in association with the moderately well drained to somewhat poorly drained Cookport soils.

Dekalb soils are moderately coarse textured. These soils hold a moderate to low amount of moisture available to plants in the horizons sampled. They are more droughty than the Calvin, Berks, and Albrights soils.

Base saturation is highest in the deepest layers of these soils, showing the effect of thorough leaching. These soils were sampled in a forest that had not been disturbed. The cation-exchange capacity decreases from 17.2 milliequivalents per 100 grams of soil in the A horizon to 4.7 in the C horizon. It is highest in the A1 horizon because of higher content of organic matter. Cation-exchange capacity is less than that of any other soil sampled in the county. Dekalb soils are among the most strongly weathered soils in the county.

physical properties of selected soils

determination not made]

Particle-size distribution—Continued			Coarse fragments (greater than 2.0 mm.)	Textural class	Bulk density	Moisture held at—		Available moisture capacity
Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)				Tension of ⅓ atmosphere	Tension of 15 atmospheres	
Percent	*Percent*	*Percent*	*Percent by weight*		*Grams per cc.*	*Percent*	*Percent*	*Inches per inch*
7.9	53.1	24.5	17	Silt loam	1.43	25.3	8.8	0.24
9.2	55.2	20.6	3	Silt loam	1.48	22.5	8.4	.21
11.2	51.7	25.1	29	Silt loam	1.52	22.4	10.0	.19
16.7	30.3	16.7	48	Fine sandy loam	1.68	15.0	8.2	.11
18.6	27.9	13.6	57	Fine sandy loam	------	------	7.5	------
13.6	27.0	15.1	52	Fine sandy loam	------	------	7.3	------
1.9	64.9	13.4	54	Silt loam	1.24	25.0	9.2	.20
2.1	56.4	18.2	65	Silt loam	------	------	9.0	------
2.0	45.7	24.4	79	Loam	------	------	11.6	------
3.0	44.4	21.3	72	Loam	------	------	10.4	------
9.1	50.0	16.2	27	Loam	1.24	23.0	10.3	.16
10.1	40.8	15.7	31	Loam	1.55	18.6	8.0	.16
8.2	34.2	15.6	53	Loam	------	------	8.4	------
4.6	37.9	19.3	75	Loam	------	------	9.0	------
------	------	------	------	------	------	------	------	------
4.2	23.8	9.2	16	Sandy loam	------	------	6.5	------
3.9	31.3	10.2	19	Sandy loam	------	------	5.7	------
4.0	34.2	6.8	21	Sandy loam	------	------	4.3	------
4.9	27.2	7.3	43	Sandy loam	------	------	3.1	------
6.2	30.8	5.9	52	Sandy loam	------	------	3.0	------
5.6	37.5	6.1	67	Sandy loam	------	------	3.4	------
17.4	39.9	8.3	51	Loam	------	------	6.0	------
26.0	40.3	12.6	48	Loam	------	------	5.3	------
10.5	42.2	18.0	24	Loam	1.52	18.3	8.1	.16
4.3	42.3	29.0	42	Clay loam	1.71	18.2	12.4	.10
2.3	43.3	33.4	54	Clay loam	1.69	18.7	13.3	.09
4.3	34.4	30.2	69	Clay loam	1.69	19.0	12.5	.11
8.7	42.6	19.6	62	Loam	------	------	9.3	------

These soils are extremely to very strongly acid. The mineral composition of the clay fraction shows moderate amounts of kaolinite, low to moderate amounts of illite, and abundant to dominant amounts of interstratified vermiculite-chlorite.

Klinesville series: Klinesville soils are well-drained, loamy-skeletal, mixed, mesic Lithic Dystrochrepts. They developed in residuum from acid, dusky-red shale, siltstone, and fine-grained sandstone. Klinesville soils are in a drainage sequence that includes the moderately well drained to somewhat poorly drained Albrights soils and the somewhat poorly drained to poorly drained Brinkerton soils.

Klinesville soils are medium textured. The texture and the shallow depth to shale indicate low capacity to hold moisture that is available to plants. These characteristics make the soils droughty.

Base saturation is lower and the reaction is more acid in the B2 horizon than in the Ap horizon, indicating that the soil has been influenced by liming. The reaction is very strongly acid to medium acid.

The cation-exchange capacity of the subsoil is lower than that of the surface soil because there is less organic matter in the subsoil. Organic carbon is higher in the Ap horizon because crop residues have been plowed under.

These soils have abundant quantities of illite. The typical profile sampled has moderate amounts of kaolinite and abundant interstratified vermiculite-chlorite. Another profile for which data are not recorded here has moderate amounts of vermiculite and chlorite but no kaolinite or interstratified minerals.

Leck Kill series: Leck Kill soils are well-drained, fine-loamy, mixed, mesic Typic Hapludults. They formed from interbedded red shale, siltstone, and sandstone, and they occur in the uplands.

The Ap horizon is medium textured, and the subsoil and upper substratum are moderately fine textured. The amount of coarse fragments ranges from 24 percent in the

TABLE 10.—*Chemical properties*

[Absence of data indicates sample

Soil series and sample number	Horizon	Depth from surface	Organic carbon	Nitrogen	Carbon-nitrogen ratio	Calcium-magnesium ratio	Extractable cations (milliequivalents per 100 grams of soil)				
							Calcium	Magnesium	Sodium	Potassium	Hydrogen
Albrights:		*Inches*	*Percent*	*Percent*							
S62Pa-29-12-1	Ap	0-10	1.33	0.142	9.0	2.5	6.4	2.6	0.1	0.1	9.8
S62Pa-29-12-2	A2	10-14	.40	.068	6.0	1.0	2.6	2.5	.1	.1	4.5
S62Pa-29-12-3	B2t	14-22	.19			1.0	2.5	2.5	.1	.1	4.4
S62Pa-29-12-4	Bx1	22-35	.09			.8	2.2	2.9	.1	.1	4.5
S62Pa-29-12-5	Bx2	35-40	.08			.8	2.7	3.6	.1	.1	3.9
S62Pa-29-12-6	IICg	40-50	.04			.9	3.3	3.5	.1	.1	6.6
Berks:											
S62Pa-29-18-1	Ap	0-9	2.03	.066	31	5.0	5.3	1.1	.1	.3	10.3
S62Pa-29-18-2	B2	9-14	.54	.071	8		.9	1.0	.1	.1	7.9
S62Pa-29-18-3	B3	14-21	.38	.072	5		1.0	.7	.1	.2	6.5
S62Pa-29-18-4	C	21-26	.31	.068	5		.7	.9	.1	.2	8.4
Calvin:											
S62Pa-29-14-1	Ap	0-9	1.44	.129	11.2	9.0	9.9	1.1	.1	.2	7.1
S62Pa-29-14-2	B2	9-19	.37	.054	6.8		2.5	.9	.1	.2	6.5
S62Pa-29-14-3	B3	19-24	.22			1.8	2.0	1.1	.1	.2	5.7
S62Pa-29-14-4	C	24-40	.17			1.0	1.9	1.8	.1	.2	6.5
Dekalb:											
S62Pa-29-16-1	O2	2-0									
S62Pa-29-16-2	A21	0-1	2.87	.118	24		.4	.9	.1	.1	15.7
S62Pa-29-16-3	A22	1-6	1.35	.069	20		.3	.8	.1	.1	9.8
S62Pa-29-16-4	A3	6-11	.70	.042	17		.2	.8	.1	.1	5.7
S62Pa-29-16-5	B2	11-20	.30	.025	12		.5	.8	.1	.1	3.5
S62Pa-29-16-6	B3	20-27	.24				.4	.7	.1	<.1	3.3
S62Pa-29-16-7	C	27-43	.22				.4	.8	.1	<.1	3.3
Klinesville:											
S62Pa-29-15-1	Ap	0-9	1.08	.102	11		5.3	.9	.1	.2	4.8
S62Pa-29-15-2	B2	9-19	.30	.043	7		2.1	.9	.1	.1	3.9
Leck Kill:											
S62Pa-29-11-1	Ap	0-8	2.04	.128	15.9	4.4	7.5	1.7	.1	.2	3.3
S62Pa-29-11-2	B2t	8-20	.68	.064	10.6	1.6	3.0	1.9	.1	.2	3.0
S62Pa-29-11-3	B3t	20-26	1.08	.061	17.7	.9	2.0	2.3	.1	.2	3.3
S62Pa-29-11-4	C1	26-35	.99	.057	17.4	.8	1.4	1.7	.1	.1	5.7
S62Pa-29-11-5	C2	35-45	.70	.048	14.6		1.4	.4	.1	.1	7.9

[1] Values given indicate only relative abundance.
[2] Montmorillonite (and vermiculite)/intergrade chlorite.

Ap horizon to 69 percent in the lower B horizon. These soils can hold a moderate amount of available moisture.

Base saturation ranges from 74 percent in the Ap horizon to 20 percent below 35 inches. The effect of liming is indicated by the less acid reaction in the plow layer and the higher calcium-magnesium ratio. Reaction ranges from very strongly acid to medium acid.

The cation-exchange capacity ranges from 7.9 milliequivalents per 100 grams of soil in the B horizon to 12.8 in the Ap horizon.

Organic carbon is highest in the plow layer because of the high content of organic matter.

The mineral composition of the clay fraction is dominated by illite. Moderate amounts of chlorite are present. Low amounts of vermiculite and of interstratified minerals are present.

General Nature of the County

This section provides general information about the county. It describes the physiography, drainage, geology, climate, and water supply. It also discusses the history and development and gives recent information about the transportation and agriculture. The agricultural statistics used are mainly from records of the U.S. Bureau of the Census.

Physiography, Drainage, and Geology

Fulton County is in the Ridge and Valley Provinces of the Appalachian Highlands (*5*). The area has three major landforms. They are steep, high, generally narrow, mountainous ridges that run in a north-south direction and have large amounts of colluvial material at their bases;

and clay minerals of selected soils

not taken or material not present]

Cation-exchange capacity (sum)	Base saturation (sum)	Reaction, field (electrometric)	Free iron oxides (Fe_2O_3)	Mineral composition of clay fraction [1]					
				Kaolinite	Illite	Vermiculite	Chlorite	Montmorillonite	Interstratified
Meq./100 gms. soil	*Percent*	*pH*	*Percent*						
19. 0	48	5. 1	9. 1	Moderate	Abundant	--	--	--	Abundant.[2]
9. 8	54	4. 8	6. 6	Moderate	Abundant	--	--	--	Moderate.[2]
9. 6	54	4. 7	7. 4	--	--	--	--	--	
9. 8	54	4. 7	7. 2	Moderate	Dominant	--	--	--	Low.[2]
10. 4	62	4. 6	7. 4	--	--	--	--	--	
13. 6	51	4. 7	7. 2	Moderate	Dominant	--	--	--	Low.[2]
17. 1	40	4. 8	8. 8	Moderate	Moderate	--	--	--	Dominant.[3]
10. 0	21	4. 4	9. 5	Moderate	Moderate	Low	--	--	Moderate.[3]
8. 5	24	4. 4	9. 2	--	--	--	--	--	
10. 3	18	4. 4	11. 1	Moderate	Abundant	Low	--	--	Low.[3]
18. 4	61	5. 6	7. 4	Low	Moderate	--	--	--	Abundant.[4]
10. 2	36	4. 4	6. 9	Low	Dominant	--	--	--	Moderate.[4]
9. 1	37	4. 3	8. 3	--	--	--	--	--	
10. 5	38	4. 4	9. 1	Low	Dominant	--	--	--	Low.[4]
--	--	3. 7	--	--	--	--	--	--	
17. 2	9	4. 0	1. 7	--	--	--	--	--	
11. 1	12	4. 6	1. 1	Moderate	Low	--	--	--	Dominant.[4]
6. 9	17	4. 7	2. 6	--	--	--	--	--	
5. 0	30	4. 7	2. 6	Moderate	Moderate	--	--	--	Dominant.[4]
4. 6	28	4. 6	3. 4	--	--	--	--	--	
4. 7	30	4. 7	4. 0	--	--	--	--	--	
11. 3	58	5. 0	6. 0	Moderate	Abundant	--	--	--	Abundant.[4]
7. 1	45	4. 7	6. 3	Moderate	Abundant	--	--	--	Abundant.[4]
12. 8	74	5. 8	7. 4	--	Abundant	Low	Moderate	--	Low.[3]
8. 2	63	4. 6	10. 2	--	Dominant	Low	Moderate	--	
7. 9	58	4. 5	11. 1	--	--	--	--	--	
9. 0	37	4. 5	10. 2	--	Dominant	Low	Moderate	--	
9. 9	20	4. 6	8. 0	--	--	--	--	--	

[3] Vermiculite/intergrade chlorite.
[4] Vermiculite/intergrade chlorite, 1:1 ratio.

rolling intermountain valleys that are underlain by shale; and, in the vicinity of McConnellsburg, moderately rolling uplands that are underlain by limestone.

The highest place in the county is the crest of Big Mountain, a part of Tuscarora Mountain, which has an elevation of 2,458 feet. The lowest place is the point where Tonoloway Creek leaves the county at an elevation of about 430 feet.

Some of the streams flow southward to the Potomac River, and some flow northward to the Susquehanna. The most important streams that flow to the Potomac River are Licking Creek, Little Tonoloway Creek, Tonoloway Creek, Cove Creek, Sideling Hill Creek, and Patterson Run. Streams that drain to the Susquehanna River are Little Aughwick Creek, Sideling Creek, Wooden Bridge Creek, and Brush Creek.

Along the streams there are moderate-sized areas of flood plains and alluvial terraces. The flood plains are nearly level, and they lie at or just above the normal flood stages of the streams. The terraces are older flood plains that are now considerably above the level of the streams and rivers.

Soils in most of the county are well drained. There are some areas of poorly drained soils, but they are small and generally not significant.

The rocks of the county are sedimentary. They were deposited in level or gently sloping beds, like layers in a cake, in the inland ocean that covered the area during the Paleozoic era. Near the end of that era, about the end of the Carboniferous period, the area was subjected to pressures and disturbances that folded and faulted the geologic strata. About the same time, the region was uplifted above the water. Erosion and further uplifts took place, and gradually the present ridges and valleys were formed.

The bedrock consists of three major groups of sedimentary rocks. These are hard sandstone, which is exposed on the tops and sides of the mountains; shale and siltstone, of various kinds and colors, that crop out at steep angles and underlie much of the farmland; and limestone that underlies the rolling areas consisting of the most productive soils of the county.

Soils of the uplands are closely related to the type of bedrock. Soils underlain by sandstone generally are sandy and moderately deep, and have moderate to low capacity to hold moisture that is available to plants. Soils underlain by siltstone or shale generally are moderately deep or shallow and have moderate or low capacity to hold available moisture. Most of the soils underlain by limestone are deep, have high available moisture capacity, and have a considerable content of clay in their subsoil.

Climate [6]

The climate of Fulton County is one of warm summers and cold winters. An ample supply of precipitation is received throughout the year. The mountains to the west protect the area in some degree from the more extreme weather that is experienced farther to the north and west. Prevailing westerly winds, nevertheless, bring weather systems through the region every few days and subject the county to a wide variety of weather conditions. Temperature, rainfall, and humidity often change rapidly from day to day and from week to week. Seasonal weather varies from year to year. Periodically, however, relatively constant weather conditions persist for a few days, for a week, or for a longer time.

Climatic variations within the county are caused chiefly by differences in local topography and elevation. Differences in topography and elevation over a short distance can produce significant modifications of the local climate. The average temperature is somewhat higher and precipitation is less in the valleys than on the ridges. During any particular night, however, especially if the weather is calm and clear, the lowest temperatures are likely to be in the valleys and other low spots because cool air drains to those places. As a result, freezing temperatures occur in the valleys somewhat later in spring and earlier in fall than on adjacent hillsides.

No long-term records of temperature and precipitation have been obtained in Fulton County, but data collected at Chambersburg are shown in tables 11 and 12. This station is located in the Cumberland Valley of adjacent Franklin County, at an elevation of 640 feet. The data, however, are representative of valley areas in Fulton County that have similar elevation and orientation.

Temperature

The warmest section of the county is in the south-central part, in the valley, where the average annual temperature is 53°F. The mountainous areas, especially along the eastern and western edges of the county, are several degrees colder. A temperature differential of 3° to 4° between the valleys and the mountainous areas is normally maintained throughout the year. The average temperature during

[6] By NELSON M. KAUFFMAN, State climatologist, Weather Bureau, Environmental Science Services Administration, U.S. Dept. of Commerce, Harrisburg, Pa.

TABLE 11.—*Temperature and precipitation at Chambersburg, Pa.*

Month	Temperature				Precipitation					
	Average daily maximum	Average daily minimum	Average extreme maximum	Average extreme minimum	Average total	One year in 10 will have—		Snow		
						Less than—	More than—	Average monthly total	Average number of days with depth of—	
									1 inch or more	6 inches or more
	°F.	*°F.*	*°F.*	*°F.*	*Inches*	*Inches*	*Inches*	*Inches*		
January	40	24	58	6	3.0	1.6	5.4	7.6	12	2
February	41	24	61	7	2.3	.9	3.6	5.8	11	3
March	50	30	72	14	3.8	2.3	5.5	7.3	6	2
April	63	39	84	27	3.5	1.6	6.2	.2	(1)	
May	75	50	90	33	4.1	1.5	6.7			
June	83	58	95	44	4.1	1.9	6.6			
July	87	63	98	50	4.0	1.8	6.6			
August	85	61	96	47	4.1	1.3	8.1			
September	78	54	93	37	3.3	1.4	6.4			
October	67	43	84	27	3.2	.8	6.3	.1		
November	53	33	72	18	3.1	.9	5.2	1.5	(1)	
December	41	25	60	7	3.0	1.0	4.9	6.0	7	2
Year	64	42	(2) 107	(3) −13	41.5	34.3	50.6	28.5	36	9

(1) Less than 0.5 day.
(2) Highest maximum during period 1931–1960.
(3) Lowest minimum during period 1931–1960.

TABLE 12.—*Probabilities of last freezing temperature in spring and first in fall at Chambersburg, Pa.*

Probability	Dates for given probability at 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 23	April 2	April 13	April 29	May 17
2 years in 10 later than	March 18	March 27	April 8	April 24	May 11
5 years in 10 later than	March 8	March 16	March 28	April 15	May 1
Fall:					
1 year in 10 earlier than	November 20	November 14	October 30	October 10	October 1
2 years in 10 earlier than	November 25	November 21	November 4	October 16	October 4
5 years in 10 earlier than	December 5	November 28	November 14	October 26	October 12

January, the coldest month, is 28° to 32°. During July, the warmest month, it is 71° to 75°. From early in May until the end of September, the temperature in the valleys usually remains above 50°. The maximum reading reaches 90° or more on an average of 31 days. From the first of October until early in May, the minimum temperature drops to the freezing point or lower on an average of 120 days, but to zero or lower on an average of only 1 day per year.

The interval between the last temperature of 32° in spring and the first in fall is known as the growing season. It normally extends from the first week in May through the middle of October in the valleys, for an average total of 164 days. Variations from year to year are appreciable, however, and the growing season has ranged from 119 days to 196 days during the period of record. The probabilities of various threshold temperatures after specified dates in spring and before specified dates in fall at Chambersburg are given in table 12. They are applicable to the valley sections of Fulton County.

Precipitation

Although the ridges receive more rain and snow than the valleys, the entire county normally receives more than 40 inches of precipitation annually. Yearly totals, however, have ranged from 31 to 47 inches during the period of record. Precipitation normally is well distributed throughout the year. The average monthly totals range from 2.3 to 4.1 inches. Fluctuations in weather patterns have produced monthly totals of less than 0.2 inch and more than 10.0 inches. Nearly half the annual precipitation normally falls during the growing season of about 5 months, from the early part of May to the middle of October. Occasional dry spells, however, have resulted in rainfall during some growing seasons of less than 13 inches. The total during some wet growing seasons has been more than 24 inches.

Rainfall during the warm season is usually the result of scattered showers and thunderstorms that last for only a few hours or less. Thunderstorms, generally about 30 to 35 per year, are responsible for most of the heavy, short-period rainfall. Some of the storms produce rapid runoff, especially from the steeper hillsides. Maximum amounts of 2.1 inches in 1 hour have been recorded and can be expected once every 10 years. Precipitation during fall, winter, and spring is usually less intense, of longer duration, and more widespread than the summer storms. Amounts of 1.0 inch per day are fairly common. Precipitation of 2.3 inches or more in 24 hours can be expected about once a year, and 3.7 inches in 24 hours, about once every 5 years.

From December through March, much of the precipitation is in the form of snow. The average seasonal total snowfall ranges from 28 inches in the valleys to 35 inches on the mountain ridges. The amount from year to year, however, has ranged from 12 inches to 71 inches over the period of record. In most of the winter seasons, snow amounting to 20 to 40 inches can be expected at lower elevations, and snow amounting to 25 to 45 inches, on the mountains. Measurable snowfall is fairly frequent during the winter season, but the amount from an individual storm is generally less than 6 inches. As much as 19 inches of snow, however, has been measured in 24 hours. Snow usually covers the ground on 35 to 45 days during each winter, and to a depth of 6 inches or more on 7 to 12 days. During some of the most severe seasons, snow covers the ground on 70 to 80 days.

Water Supply

In many places in the county, springs furnish enough water to supply the farmhouses and barns. Many springs are located on foot slopes of the mountains. Springs, small brooks, and farm ponds furnish water for most of the pastures. About 190 farm ponds supply water for livestock. Wells generally are drilled if the supply from springs or ponds is not adequate. On a few farms, rainwater stored in cisterns is used.

Ground water in most of the county is fairly deep. Water is nearest the surface in a few places in Big Cove, and comes to the surface in several places there to form large springs. Throughout the county, ground water in most places is 100 to 200 feet below the surface.

History and Development

Settlers came to the county as early as 1729. In 1741 and 1742 a settlement was attempted near the present site of Burnt Cabins. That settlement was considered an illegal one, and the Secretary of the Province of Pennsylvania ordered in 1750 that it should be destroyed. The village of Fort Littleton is named for a fort that was built for protection of settlers from the Indians.

Early Scotch-Irish settlers came to Big Cove, and English and French settlers located in some of the shale valleys. The first school was begun at Big Spring, south of the present town of McConnellsburg, in 1777. The county developed rapidly. It was governed as part of Cumberland County until 1771, when it was set up as part of Bedford County. It was made a separate county in 1850 and was named in honor of Robert Fulton.

Parts of the county were occupied by Confederate soldiers during the Civil War. Confederate raiding parties visited McConnellsburg on two occasions. In the county is the scene of the last bivouac of the Confederates north of the Mason-Dixon line.

Except for McConnellsburg, none of the towns or villages had a population as large as 120 at the time this survey was made. The chief industries, other than farming, are a sewing factory and some limestone and sandstone quarries. Several small sawmills are active in various parts of the county. Many of the people work in adjoining counties.

Transportation

The Pennsylvania Turnpike crosses the northern part of the county, and the interchanges at Breezewood and Fort Littleton permit access to Pittsburgh and to Harrisburg, the State capital. Interstate Highway 70 connects with the Turnpike at Breezewood. U.S. Highway No. 30 crosses the county from east to west, and U.S. Highway No. 522 extends near the eastern side from north to south. Both pass through McConnellsburg. Local traffic is carried on 636 miles of improved roads.

Agriculture

Farming has been the leading occupation since the county was settled. The main crops are corn, wheat, and hay, which are fed to livestock on the farms and are marketed in the form of meat, dairy products, and poultry. In the southeastern part of the county, there are some orchards.

Many of the early farmers rotated crops and made use of hay and manure to help maintain the fertility of their soils. When the farmers began to sell more of their produce, they also began to add lime and commercial fertilizer to their soils and to use improved varieties of seed. The early farms were small, but as farm machinery and farming techniques improved, the size of farms increased. At present, almost half of the farms in the county are commercial farms.

As farming became more complex and technical, various programs were developed to help promote good farming practices. During the Second World War, farmers in Fulton County were assisted in conservation work by conscientious objectors who were guided by the Soil Conservation Service in establishing diversion terraces, contour strips, and other practices on the farms. During this period the first farm pond in Pennsylvania that was laid out by the Soil Conservation Service was built in this county. In December 1945 the Fulton County Soil and Water Conservation District was established to advance the conservation of soil and water.

Other agencies that offer assistance and information to farmers in the county are the Agricultural Extension Service of the Pennsylvania State University, the Pennsylvania Game Commission, the Pennsylvania Department of Forests and Waters, the Pennsylvania Fish Commission, the Pennsylvania Department of Highways, and the Pennsylvania Department of Agriculture. The Soil Conservation Service, the Agricultural Stabilization and Conservation Service, and the Farmers Home Administration of the U.S. Department of Agriculture, as well as vocational agricultural departments of the schools and other State and Federal agencies, also help the farmers.

The land in farms in 1959 amounted to 152,110 acres, or 54.6 percent of the county. There were 901 farms, and the average size was 168.8 acres. More than half of the farms, 477 of them, were listed as miscellaneous, not classified as to type of farming. The others were classified as dairy farms, 271; poultry farms, 61; livestock farms other than dairy or poultry, 50; general farms, 25; field crop farms other than fruit or nut, 10; and fruit or nut farms, 6.

In 1959 about 41,038 acres was classified as cropland harvested. Cleared pastures amounted to about 11,329 acres, and woodland, 62,593 acres. Cropland pasture amounted to 9,793 acres, and woodland pasture to 4,829 acres. Grasses and legumes were grown to improve the soils on 1,624 acres. Idle land amounted to 13,328 acres. An additional 7,576 acres was in roads, building sites, wasteland, and other land.

The recent trend suggests that the number of farms will decrease and the total acreage in farms will become smaller than that reported for 1959. The average size of the farms probably will become larger.

Corn for all purposes was grown on 9,068 acres in 1959. Wheat, threshed or combined, was reported on 5,910 acres; oats, threshed or combined, on 5,184 acres; barley, threshed or combined, on 1,728 acres; and rye, threshed or combined, on 182 acres. Alfalfa and alfalfa mixtures cut for hay were reported on 5,940 acres; and clover, timothy, and mixtures of clover and grasses cut for hay, on 9,778 acres. Also in 1959, forest products were sold from 153 farms.

The raising of livestock is the main farming enterprise. In 1960 13,321 cattle and calves, including 6,236 milk cows; 250 horses and mules; 8,397 hogs and pigs; 1,402 sheep and lambs; and 105,165 chickens 4 months old or more were reported in the county.

Glossary

Acidity. See Reaction, soil.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of defined and named soil units that are geographically associated and occur in a characteristic pattern. The soils in an association may be derived from the same kind of parent material and be similar in characteristics, or they may be derived from different kinds of parent material and be dissimilar in characteristics.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in a soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Bedding. Plowing, grading, or otherwise elevating the surface of a flat field into a series of broad beds, or "lands," so as to leave shallow surface drains between the beds.

Bedrock. The solid or fractured rock that underlies the soils and other earthy surface formations.

Channery soil. A soil that contains 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.

Clay. (1) As a soil separate, the mineral soil particles less than 0.002 millimeter (0.000079 inch) in diameter. (2) As a soil textural class, soil material that contains 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Cobbly. Containing between 15 and 50 percent rounded or partly rounded fragments of rock ranging from 3 to 10 inches in diameter.

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

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

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; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil 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 maintained in permanent sod.

Erosion. The wearing away of the land surface by the action of water or wind.

Fertility, soil. The quality that enables a soil to provide the proper elements in the proper amounts and in the proper balance for the growth of specified plants when other factors, such as light, moisture, temperature, and the physical condition (or tilth) of the soil, are favorable.

Flood plain. A nearly level area, subject to overflow unless it is protected, that occurs along a stream.

Fragipan. A loamy, brittle subsurface horizon that is low in content of organic matter and clay but rich in silt or very fine sand. The layer is seemingly cemented when dry, has hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. This layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Gleyed horizon. A strongly mottled or gray horizon that occurs in wet soils. In the soil profile, it is designated by the symbols Ag, Bg, or Cg.

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

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water from cropland.

Gully. A steep-sided channel cut by running water and through which water ordinarily runs only after rains. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage.

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

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

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

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

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

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

Inclusion. An area of soil or other material mapped with a soil of a different mapping unit because it is too small to be mapped separately on a map of the scale used.

Internal drainage. That quality of a soil that permits the downward flow of excess water through it.

Mapping unit, soil. An area of a soil, miscellaneous land type, soil complex, or undifferentiated soil group that is enclosed by a boundary on a soil map and identified by a symbol.

Morphology, soil. The makeup of the soil, including the texture, structure, consistence, color, and other physical, mineralogical, and biological properties of the various horizons of the soil profile.

Mottling, soil. Contrasting color patches that vary in number and size. Descriptive terms are as follows: Contrast—*faint, distinct,* and *prominent;* and abundance—*few, common,* and *many;* size—fine, medium, and coarse. The size measurements are the following: *Fine,* less than 5 millimeters along the greatest dimension; *medium,* ranging from 5 to 15 millimeters along the greatest dimension; and *coarse,* more than 15 millimeters along the greatest dimension.

Munsell color notation. A system for designating color by degree of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4 (*18*).

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

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Productivity, soil. The present capability of a soil for producing a specified plant or sequence of plants under a specified system of management.

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

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

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

Residual material. Unconsolidated and partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

Runoff. Water that flows off the surface of the soil without sinking in.

Sand. As a soil textural class, soil material that contains 85 percent or more sand and not more than 10 percent clay. As a soil separate, the individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters.

Sedimentary rock. A rock formed from an accumulation of sediment in water. Though there are many intermediate types, the principal groups of sedimentary rocks are (1) conglomerate (from gravel), (2) sandstone (from sand), (3) shale (from clay), and (4) limestone (from deposits of calcium carbonate).

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Sheet erosion. The removal of a fairly uniform layer of soil material from the surface of the land by the action of rainfall and runoff water without the formation of rills and gullies.

Silt. As a soil textural class, soil material that contains 80 percent or more silt and less than 12 percent clay. As a soil separate, the individual mineral particles in a soil that range from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter).

Soil. A natural, three-dimensional body on the earth's surface; it is made up of conformable horizons that result from modification of the parent material by physical, chemical, and biological forces through periods of time.

Solum. The upper part of the soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement in which strips, or bands, of close-growing crops are alternated with strips of clean-tilled crops or of fallow. The strips or bands form a vegetative barrier that protects the soil from erosion by wind and water.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. Structureless soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

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

Substratum. Any layer lying beneath the solum, or true soil; the C or R horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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; Sand; and Silt.

Tilth, soil. The physical properties of the soil that affect the ease of cultivating it or its suitability for crops; it implies the presence or absence of favorable soil structure.

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

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Upland (geologic). An area consisting of materials not worked by water in recent geologic time and ordinarily lying at a higher elevation than the alluvial plains in the vicinity.

Watershed. In the United States, this term refers to the total area above a given point on a stream that contributes water to the flow at that point. Synonyms are "drainage basin" and "catchment basin."

Water table. The upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

Weathering, soil. The physical and chemical disintegration and decomposition of rocks and minerals.

Literature Cited

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

(2) Association of Official Agricultural Chemists.
1955. Official methods of analysis. Ed. 8, illus.

(3) Baldwin, Mark, Kellogg, Charles E., and Thorp, James.
1938. Soil classification. U.S. Dept. Agr. Ybk.: 979–1001.

(4) Baur, A. J. and Lyford, W. H.
1957. Sols bruns acides of the northeastern United States. Soil Sci. Soc. Amer. Proc. 21: 533–536.

(5) Fenneman, N. M.
1938. Physiography of eastern United States. 714 pp., illus.

(6) Jeffries, C. D.
1946. A rapid method for the removal of free iron oxides in soil prior to petrographic analysis. Soil Sci. Soc. Amer. Proc. 11: 211–212.

(7) ——— and Johnson, L. J.
1961. Determination of the easily reduced iron oxides in soils. Soil Sci. 92: 402–403.

(8) Kilmer, V. J. and Alexander, L. T.
1949. Methods of making mechanical analyses of soils. Soil Sci. 68: 15–24.

(9) ———and Mullins, J. F.
1954. Improved stirring and pipetting apparatus for mechanical analysis of soils. Soil Sci. 77: 437–441, illus.

(10) Mehlich, Adolf.
1938. Use of triethanolamine acetate-barium hydroxide buffer for the determination of some base exchange properties and lime requirement of soil. Soil Sci. Soc. of Amer. Proc. 3: 162–166, illus.

(11) Peech, M., Alexander, L. T., and others.
1947. Methods of soil analysis for soil-fertility investigations. U.S. Dept. Agr. Cir. No. 757, 25 pp.

(12) Richards, L. A.
1947. Pressure-membrane apparatus—construction and use. Agr. Eng. 28: 451–454, 460, illus.

(13) Schnur, G. Luther.
1937. Yield, stand, and volume tables for even-aged upland oak forests. U.S. Dept. Agr. Tech. Bul. 560, 88 pp., illus. (Reprinted 1961)

(14) Simonson, Roy W.
1962. Soil classification in the United States. Sci. 137: 1027–1034.

(15) Society of American Foresters.
1954. Forest cover types of North America. Rpt. of the Committee on Forest Types. 67 pp., illus.

(16) Thorp, James and Smith, Guy D.
1949. Higher categories of soil classification: order, suborder, and great soil groups. Soil Sci. v. 67: 117–126.

(17) Uhland, R. E. and O'Neal, A. M.
1951. Soil permeability determinations for use in soil and water conservation. SCS–TP–101. 36 pp., illus.

(18) UNITED STATES DEPARTMENT OF AGRICULTURE.
1951. SOIL SURVEY MANUAL. Agr. Handbook No. 18, 503 pp., illus. Supplement issued May 1962.

(19) ———
1954. DIAGNOSIS AND IMPROVEMENT OF SALINE AND ALKALI SOILS. Agr. Handbook No. 60, 160 pp., illus.

(20) ———
1954. PRELIMINARY FOREST SURVEY STATISTICS FOR FULTON COUNTY, PA. Forest Service, Northeastern Forest Expt. Sta. 2 pp.

(21) ———
1957. SOIL. Agr. Ybk., 784 pp., illus.

(22) ———
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7th approximation. 265 pp., illus. [Supplement issued March 1967]

(23) WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS.
1953. THE UNIFIED SOIL CLASSIFICATION SYSTEM. Tech. Memo. No. 3-357, v. 1.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. Other information is given in tables as follows:

Estimated productivity ratings of the soils, table 1, p. 12.
Suitability of the soils for wildlife, table 2, p. 20.
Engineering uses of the soils, tables 3, 4, and 5, pp. 24 through 43.
Use of soils for nonfarm uses, table 6, p. 46.
Approximate acreage and proportionate extent of the soils, table 7, p. 53.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
AbB2	Albrights silt loam, 3 to 8 percent slopes, moderately eroded	54	IIe-3	7	6	18
AgB2	Allegheny gravelly loam, 3 to 8 percent slopes, moderately eroded	55	IIe-2	7	4	18
AnB2	Andover gravelly silt loam, 3 to 8 percent slopes, moderately eroded	56	IVw-1	9	8	18
AoB	Andover very stony silt loam, 0 to 8 percent slopes	56	VIIs-2	11	8	18
At	Atkins silt loam	56	IIIw-2	8	3	17
Ba	Barbour fine sandy loam	57	I-1	6	1	17
Bc	Basher silt loam	57	IIw-1	7	2	17
BdB2	Bedington-Edom shaly silt loams, 3 to 8 percent slopes, moderately eroded	58	IIe-4	8	9	18
BdC2	Bedington-Edom shaly silt loams, 8 to 15 percent slopes, moderately eroded	58	IIIe-3	8	9	18
BdD2	Bedington-Edom shaly silt loams, 15 to 25 percent slopes, moderately eroded	58	IVe-2	9	9	18
BdD3	Bedington-Edom shaly silt loams, 15 to 25 percent slopes, severely eroded	58	VIe-2	10	11	19
BeB2	Berks channery silt loam, 3 to 8 percent slopes, moderately eroded	58	IIe-4	7	9	18
BeC2	Berks channery silt loam, 8 to 15 percent slopes, moderately eroded	59	IIIe-3	8	9	18
BeD2	Berks channery silt loam, 15 to 25 percent slopes, moderately eroded	59	IVe-2	9	9	18
BrA	Brinkerton silt loam, 0 to 3 percent slopes	59	IVw-1	9	8	18
BrB2	Brinkerton silt loam, 3 to 8 percent slopes, moderately eroded	59	IVw-1	9	8	18
BuB2	Buchanan gravelly loam, 3 to 8 percent slopes, moderately eroded	60	IIe-3	7	6	18
BuC2	Buchanan gravelly loam, 8 to 15 percent slopes, moderately eroded	60	IIIe-2	8	6	18
BvB	Buchanan very stony loam, 0 to 8 percent slopes	60	VIs-1	10	6	18
BvD	Buchanan very stony loam, 8 to 25 percent slopes	60	VIs-1	10	6	18
CaC2	Calvin shaly silt loam, 8 to 15 percent slopes, moderately eroded	61	IIIe-3	8	9	18
CaD2	Calvin shaly silt loam, 15 to 25 percent slopes, moderately eroded	61	IVe-2	9	9	18
CbB2	Calvin-Berks channery silt loams, 3 to 8 percent slopes, moderately eroded	61	IIe-4	7	9	18
CbC2	Calvin-Berks channery silt loams, 8 to 15 percent slopes, moderately eroded	61	IIIe-3	8	9	18
CbD2	Calvin-Berks channery silt loams, 15 to 25 percent slopes, moderately eroded	61	IVe-2	9	9	18
CkB2	Calvin and Leck Kill shaly silt loams, 3 to 8 percent slopes, moderately eroded	62	IIe-4	7	9	18
CpB	Cookport very stony loam, 0 to 8 percent slopes	62	VIs-1	10	6	18
DkB	Dekalb very stony sandy loam, 0 to 8 percent slopes	63	VIs-1	10	9	18
DkD	Dekalb very stony sandy loam, 8 to 25 percent slopes	63	VIs-1	10	9	18
DkE	Dekalb very stony sandy loam, 25 to 70 percent slopes	63	VIIs-1	10	10	19
EbB2	Elliber very cherty loam, 3 to 8 percent slopes, moderately eroded	64	IIIs-1	9	9	18

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
EbC2	Elliber very cherty loam, 8 to 15 percent slopes, moderately eroded	64	IVs-1	9	9	18
EbD2	Elliber very cherty loam, 15 to 30 percent slopes, moderately eroded	64	IIIs-1	9	9	18
ErB2	Ernest silt loam, 3 to 8 percent slopes, moderately eroded	65	IIe-3	7	6	18
FrB2	Frankstown cherty silt loam, 3 to 8 percent slopes, moderately eroded	66	IIe-1	6	4	18
FrC2	Frankstown cherty silt loam, 8 to 15 percent slopes, moderately eroded	66	IIIe-1	8	4	18
FrD2	Frankstown cherty silt loam, 15 to 25 percent slopes, moderately eroded	66	IVe-1	9	4	18
FrE2	Frankstown cherty silt loam, 25 to 35 percent slopes, moderately eroded	66	VIe-1	10	5	18
HeB2	Hagerstown silt loam, 3 to 8 percent slopes, moderately eroded	66	IIe-1	6	4	18
HeC2	Hagerstown silt loam, 8 to 15 percent slopes, moderately eroded	67	IIIe-1	8	4	18
HeD2	Hagerstown silt loam, 15 to 25 percent slopes, moderately eroded	67	IVe-1	9	4	18
HgB3	Hagerstown silty clay loam, 3 to 8 percent slopes, severely eroded	67	IIIe-1	8	4	18
HhC3	Hagerstown silty clay loam, shallow phase, 5 to 15 percent slopes, severely eroded	67	VIe-2	10	11	19
HhD3	Hagerstown silty clay loam, shallow phase, 15 to 25 percent slopes, severely eroded	67	VIIe-1	10	11	19
HtD2	Hagerstown very rocky silty clay loam, 5 to 25 percent slopes, moderately eroded	67	VIs-1	10	4	18
HtE2	Hagerstown very rocky silty clay loam, 25 to 50 percent slopes, moderately eroded	67	VIIs-1	10	5	18
KaB2	Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded	68	IIIe-3	8	11	19
KaC2	Klinesville shaly silt loam, 8 to 15 percent slopes, moderately eroded	68	IVe-2	9	11	19
KaD2	Klinesville shaly silt loam, 15 to 25 percent slopes, moderately eroded	68	VIe-2	10	11	19
KwB2	Klinesville-Weikert channery silt loams, 3 to 8 percent slopes, moderately eroded	68	IIIe-3	8	11	19
KwC2	Klinesville-Weikert channery silt loams, 8 to 15 percent slopes, moderately eroded	68	IVe-2	9	11	19
KwD2	Klinesville-Weikert channery silt loams, 15 to 25 percent slopes, moderately eroded	69	VIe-2	10	11	19
KwE2	Klinesville-Weikert channery silt loams, 25 to 60 percent slopes, moderately eroded	69	VIIe-1	10	12	19
LaB2	Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded	69	IIe-2	7	4	18
LaC2	Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded	69	IIIe-1	8	4	18
LaD2	Laidig gravelly loam, 15 to 25 percent slopes, moderately eroded	70	IVe-1	9	4	18
LdB	Laidig very stony sandy loam, 0 to 8 percent slopes	70	VIs-1	10	4	18
LdD	Laidig very stony sandy loam, 8 to 25 percent slopes	70	VIs-1	10	4	18
LdE	Laidig very stony sandy loam, 25 to 60 percent slopes	70	VIIs-1	10	5	18
LmB	Laidig and Murrill cobbly loams, 3 to 8 percent slopes	70	IVs-1	9	4	18
LmC	Laidig and Murrill cobbly loams, 8 to 15 percent slopes	70	IVs-1	9	4	18
Ln	Lawrence gravelly silt loam, coarse subsoil variant	71	IIIw-1	8	7	18
LoE	Lehew very stony loam, 25 to 60 percent slopes	72	VIIs-1	10	10	19
Ls	Lindside silt loam	72	IIw-1	7	2	17
Ma	Made land	73	VIIe-1	10	13	19

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group	
			Symbol	Page	Number	Page
Me	Melvin silt loam	73	IIIw-2	8	3	17
MoB2	Monongahela silt loam, 3 to 8 percent slopes, moderately eroded	74	IIe-3	7	6	18
MuB2	Murrill gravelly loam, 3 to 8 percent slopes, moderately eroded	74	IIe-1	6	4	18
MuC2	Murrill gravelly loam, 8 to 15 percent slopes, moderately eroded	74	IIIe-1	8	4	18
MvD	Murrill very stony loam, 5 to 25 percent slopes	75	VIs-1	10	4	18
Ph	Philo silt loam	75	IIw-1	7	2	17
Pm	Pope fine sandy loam, neutral variant	76	I-1	6	1	17
Po	Pope loam	75	I-1	6	1	17
Ru	Rubble land	76	VIIIs-1	11	13	19
St	Strip mine spoil	76	VIIs-1	10	13	19
Ty	Tygart silt loam	77	IIIw-1	8	7	18
Tz	Tygart silt loam, poorly drained variant	78	IVw-1	9	8	18
WcB2	Weikert channery silt loam, 3 to 8 percent slopes, moderately eroded	78	IIIe-3	8	11	19
WcC2	Weikert channery silt loam, 8 to 15 percent slopes, moderately eroded	78	IVe-2	9	11	19
WcD2	Weikert channery silt loam, 15 to 25 percent slopes, moderately eroded	78	VIe-2	10	11	19
WgB2	Wiltshire gravelly loam, 3 to 8 percent slopes, moderately eroded	79	IIe-3	7	6	18

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at (800) 457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

Nondiscrimination Statement

Nondiscrimination Policy

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the basis of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, whether all or part of an individual's income is derived from any public assistance program, or protected genetic information. The Department prohibits discrimination in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081.wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).