SOIL SURVEY

Brooke, Hancock, and Ohio Counties, West Virginia

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION
Issued November 1974

Major fieldwork for this soil survey was done in the period 1964-68. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service and the West Virginia University Agricultural Experiment Station. It is part of the technical assistance furnished to the Northern Panhandle Soil Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

All the soils of Brooke, Hancock, and Ohio Counties are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

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

Finding and Using Information

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

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

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the woodland suitability groups.

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

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

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

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

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

Newcomers in Brooke, Hancock, and Ohio Counties 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 Area," which gives additional information about the counties.

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SOIL SURVEY OF BROOKE, HANCOCK, AND OHIO COUNTIES, WEST VIRGINIA

BY WALTER J. ELLYSON, MERRILL KUNKLE, JOSEPH D. RUFFNER AND JOHN WEBB, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH WEST VIRGINIA UNIVERSITY AGRICULTURAL EXPERIMENT STATION

BROOKE, HANCOCK, AND OHIO COUNTIES make up a part of the northern panhandle of West Virginia (fig. 1). They are bounded on the north and west by the Ohio River, into which all drainage of the Area flows. Pennsylvania is to the east. The total area of the three counties is 177,920 acres, or 278 square miles.

Wheeling is the county seat of Ohio County and is the largest city. Wellsburg is the county seat of Brooke County, and New Cumberland, one of the smaller towns in the Area, is the county seat of Hancock County.

About one-half of the area of the three counties is wooded. Most of the farming is in Ohio County and in the southern part of Brooke County, where dairying is the main enterprise. Some dairying and some vegetable farming is carried on in Hancock County. Corn, small grain, and grass and legume mixtures for hay are grown in alternating strips on many farms. The steel and coal industries furnish work for many farmers and rural residents.

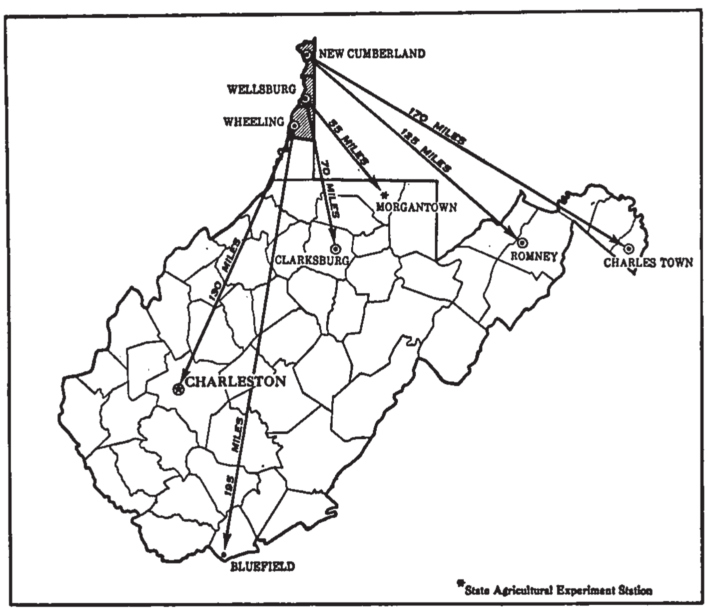

Figure 1.—**Location of Brooke, Hancock, and Ohio Counties in West Virginia.**

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Brooke, Hancock, and Ohio Counties, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the 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 the action of plant roots.

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

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

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Westmoreland silt loam, 3 to 10 percent slopes, is one of several phases within the Westmoreland series.

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

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

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Strip mines or Made land are land types in these counties.

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

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

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

General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

Soil association names shown on the general soil map do not agree with those shown on previously published maps for adjacent counties. These differences are attributed largely to refinement of series criteria and to allowable ranges in characteristics consequent to adoption of the present system of soil classification.

The seven soil associations in Brooke, Hancock, and Ohio Counties are discussed in the following pages.

1. Chagrin-Chavies-Lakin Association

Deep, well-drained, mostly nearly level soils on flood plains and deep, excessively drained, gently sloping and strongly sloping soils on terraces along the Ohio River

This association occurs along the Ohio River, and on islands in the Ohio River. It consists mainly of nearly level soils on flood plains and of gently sloping and strongly sloping soils on terraces. Within this association are parts of the towns of Wheeling, Wellsburg, Weirton, and other small towns and industrial areas.

This association makes up slightly more than 5 percent of the survey area. Towns and industrial areas make up about 80 percent of the association, but those areas are not mapped or classified by soil series on the maps. Chagrin soils make up about 6 percent of the association, Chavies soils 5 percent, Lakin soils 4 percent, and minor soils the remaining 5 percent.

Chagrin soils are on flood plains. These are deep, well-drained, fertile soils that formed in alluvial material washed from acid and lime-influenced soils on uplands. Chagrin soils have a dark grayish-brown, moderately coarse textured surface layer and a dark yellowish-brown to dark-brown, medium-textured to moderately coarse textured subsoil.

Chavies soils also are on flood plains. They are deep, well-drained, fertile soils that formed in alluvial material washed from acid and lime-influenced soils on uplands. Chavies soils have a dark grayish-brown, moderately coarse textured surface layer and a dark-brown, moderately coarse textured subsoil. They flood less frequently than Chagrin soils.

Lakin soils are on terraces and are not subject to flooding. These are deep, excessively drained soils that formed in alluvial and windblown material that is underlain at a depth of 4 feet or more by sand or sand and gravel.

Lakin soils have a dark grayish-brown, coarse-textured surface layer and a dark-brown, coarse-textured subsoil.

Minor soils in this association are the moderately well drained Lindside soils and the poorly drained Dunning soils. They are on flood plains.

Most of this association is cleared. Little farming is done on these soils. Farming is mostly confined to an area north of New Cumberland in Hancock County. Lakin soils are suitable for industrial sites and homesites. The hazard of flooding needs to be considered when planning building sites on soils on flood plains.

2. Berks-Allegheny-Monongahela Association

Moderately deep, well-drained, mostly very steep soils on bluffs facing the Ohio River and deep, well drained and moderately well drained, gently sloping and strongly sloping soils on dissected terraces

This association is mainly along the Ohio River in Hancock County. It is adjacent to association 1 in Hancock County and northern Brooke County. It consists of gently sloping to strongly sloping soils on terraces and of very steep and steep soils along bluffs that face the river.

This association makes up slightly less than 5 percent of the survey area. Berks soils make up about 53 percent of the association. Allegheny soils 12 percent, Monongahela soils 9 percent, and minor soils and urban built-up areas the remaining 26 percent.

Berks soils are along the bluffs that face the river and in local dissected areas. These are moderately deep, well-drained soils that formed in material weathered from interbedded acid shale, siltstone, and sandstone. Berks soils have a dark-brown, shaly, medium-textured surface layer and a brown to dark-brown, shaly to very shaly, medium-textured subsoil.

Allegheny soils are on terraces. These are deep and well-drained soils that formed in alluvial material washed from soils on uplands that are underlain by interbedded acid shale, siltstone, and sandstone. Allegheny soils have a dark-brown, medium-textured surface layer and a strong-brown to yellowish-brown, moderately fine textured subsoil.

Monongahela soils are also on terraces and formed in alluvial material washed from soils on uplands that are underlain by interbedded acid shale, siltstone, and sandstone. These are deep, moderately well drained soils that have a fragipan in the lower part of their subsoil, through which the movement of water and air is moderately slow. Monongahela soils have a dark-brown, medium-textured surface layer and a yellowish-brown to strong-brown, medium-textured subsoil that is mottled in the lower part.

Minor soils in this association are the well-drained Gilpin soils and the moderately well drained Wharton soils on uplands, the moderately well drained Ernest soils on foot slopes, and the moderately well drained Philo soils and the poorly drained Atkins soils on narrow flood plains.

Most of the areas of the soils on old terraces are cleared; however, some areas are idle and are becoming weedy. The Allegheny soils are well suited to homesites. Many areas near Chester, Weirton, and Follansbee are no longer used for farming. In areas that are farmed, small grain and hay are the main crops. Most of the areas along the bluffs that face the Ohio River are wooded.

3. Westmoreland-Allegheny-Monongahela Association

Deep, well-drained, mostly very steep soils on bluffs facing the Ohio River and deep, well drained and moderately well drained, gently sloping and strongly sloping soils on dissected terraces

This association is mainly along the Ohio River in Brooke County and in one small area north of Wheeling in Ohio County. It is adjacent to association 1 in Brooke and Ohio Counties. It consists of gently sloping to strongly sloping soils on terraces and of very steep and steep soils along the bluffs that face the Ohio River.

This association makes up about 2 percent of the survey area. Westmoreland soils make up about 50 percent of the association, Allegheny soils 25 percent, Monongahela soils 9 percent, and minor soils, urban built-up areas, and miscellaneous land types make up the remaining 16 percent.

Westmoreland soils are along bluffs that face the river and in local dissected areas. These are deep, well-drained soils that formed in material weathered from interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone. Westmoreland soils have a brown, medium-textured surface layer and a brown to yellowish-brown, medium-textured to moderately fine textured subsoil that is channery in the lower part.

Allegheny soils are on terraces. These are deep, well-drained soils that formed in material washed from soils on uplands that are underlain by interbedded acid shale, siltstone, and sandstone. Allegheny soils have a dark-brown, medium-textured surface layer and a strong-brown to yellowish-brown, moderately fine textured subsoil.

Monongahela soils also are on terraces. They formed in material washed from soils on uplands that are underlain by interbedded acid shale, siltstone, and sandstone. These are deep, moderately well drained soils that have a fragipan in the lower part of their subsoil, through which the movement of water and air is moderately slow. Monongahela soils have a dark-brown, medium-textured surface layer and a yellowish-brown to strong-brown, medium-textured subsoil that is mottled in the lower part.

Minor soils in this association are the well-drained Brooke soils and the moderately well drained Guernsey soils on uplands, the well-drained Chagrin and Huntington soils, and the moderately well drained Lindside soils on narrow flood plains.

Most areas of the soils on old terraces in this association are cleared, and areas on bluffs that face the river are wooded. The Allegheny and Monongahela soils are well suited to housing developments. They make good homesites if sanitary sewers are provided. Farming is not extensive; but where soils are used for farming, grain, corn, and hay are the main crops.

4. Huntington-Clarksburg-Monongahela Association

Deep, well-drained, mostly nearly level soils on flood plains and deep, moderately well drained, gently sloping to moderately steep soils on foot slopes and terraces

This association occurs along Buffalo, Cross, and Wheeling Creeks in Brooke and Ohio Counties. It consists mainly of nearly level soils on flood plains, gently sloping to strongly sloping soils on terraces, and gently sloping to moderately steep soils on foot slopes. A part of the city of Wheeling covers most of this association in Ohio County. Many of the small towns along Buffalo and Cross Creeks in Brooke County are on soils of this association.

This association makes up slightly more than 3 percent of the survey area. Towns and urban built-up areas make up about 41 percent of the association, but these areas are not mapped or classified by soil series on the maps. Huntington soils make up about 15 percent of the association, Clarksburg soils 10 percent, Monongahela soils 9 percent, and minor soils the remaining 25 percent.

Huntington soils are on flood plains. These are deep, well-drained, fertile soils that formed in alluvial material washed from lime-influenced soils on uplands. Huntington soils have a very dark grayish-brown, medium-textured surface layer and a dark grayish-brown and brown, medium-textured subsoil.

Clarksburg soils are on foot slopes. These are deep, moderately well drained soils that formed in colluvial material that moved downslope mainly from Westmoreland soils on uplands. Clarksburg soils have a fragipan in the lower part of their subsoil, through which the movement of water and air is moderately slow. These soils have a dark-brown, medium-textured surface layer and a brown to yellowish-brown, moderately fine textured subsoil that is mottled in the lower part.

Monongahela soils are on old high terraces above flood plains. These are deep, moderately well drained soils that formed in material washed from soils on uplands that are underlain by interbedded acid shale, siltstone, and sandstone. Monongahela soils have a fragipan in the lower part of their subsoil, through which the movement of water and air is moderately slow. These soils have a dark-brown, medium-textured surface layer and a yellowish-brown to strong-brown, medium-textured subsoil that is mottled in the lower part.

Minor soils in this association are the well-drained Chagrin and Chavies soils, the moderately well drained Lindside soils, and the poorly drained Dunning soils on flood plains; the well-drained Allegheny soils on terraces; the well-drained Brookside soils on foot slopes; and the well-drained Westmoreland soils in sloping areas that separate the isolated areas of older terraces from the younger terraces and flood plains.

This association is important to farming in the survey area. It is almost entirely cleared. The soils on flood plains and terraces are used mainly for corn, small grain, and hay, and the soils on the adjacent foot slopes are used for hay and pasture. The Monongahela soils make good homesites if sanitary sewers are provided. The hazard of flooding needs to be considered when planning building sites on soils of the flood plains.

5. Westmoreland-Guernsey-Clarksburg Association

Deep, well drained and moderately well drained, gently sloping to very steep soils on uplands and deep, moderately well drained, gently sloping to moderately steep soils on foot slopes

This association is in hilly areas and narrow valleys in Ohio County and the southern part of Brooke County. The soils are generally strongly sloping to moderately steep but they range from gently sloping on broad ridgetops to very steep on lower slopes (fig. 2).

This association makes up about 50 percent of the survey area. Westmoreland soils make up about 80 percent of the association, Guernsey soils 4 percent, Clarksburg soils 2 percent, and minor soils and miscellaneous land types make up the remaining 14 percent.

Westmoreland soils generally are on uplands. These are deep, well-drained soils that formed in material weathered from interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone. Westmoreland soils have a brown, medium-textured surface layer and a brown to yellowish-brown, medium-textured to moderately fine textured subsoil that is channery in the lower part.

Guernsey soils are deep, moderately well drained soils on uplands. They formed in material weathered from interbedded limestone, limy shale, acid shale, siltstone, and sandstone. Guernsey soils have a dark-brown, medium-textured surface layer and a strong-brown, moderately fine textured to fine textured subsoil.

Clarksburg soils are on foot slopes. These are deep, moderately well drained soils that formed in colluvial material that moved down mainly from Westmoreland soils on uplands. They have a fragipan in the lower part of their subsoil, through which the movement of water and air is moderately slow. Clarksburg soils have a dark-brown, medium-textured surface layer and a brown, yellowish-brown to strong-brown, moderately fine textured subsoil that is mottled in the lower part.

Minor soils in this association are the well-drained Berks, Brooke, and Gilpin soils on uplands; the well-drained Brookside soils on foot slopes; the well-drained Allegheny soils and moderately well drained Monogahela soils on remnants of terraces; and the well-drained Chagrin and Huntington soils, moderately well drained Lindside soils, and poorly drained Dunning soils on narrow flood plains.

This association is mostly cleared and is important to farming in the survey area. The soils are suited to grasses and legumes and are used mainly for hay and pasture. Corn and small grain, however, generally are grown in alternating strips with hay on many small farms throughout the association. Steepness of slope, moderate, moderately slow, or slow permeability, and the hazard of slipping need to be considered when planning homesites and road locations on these soils.

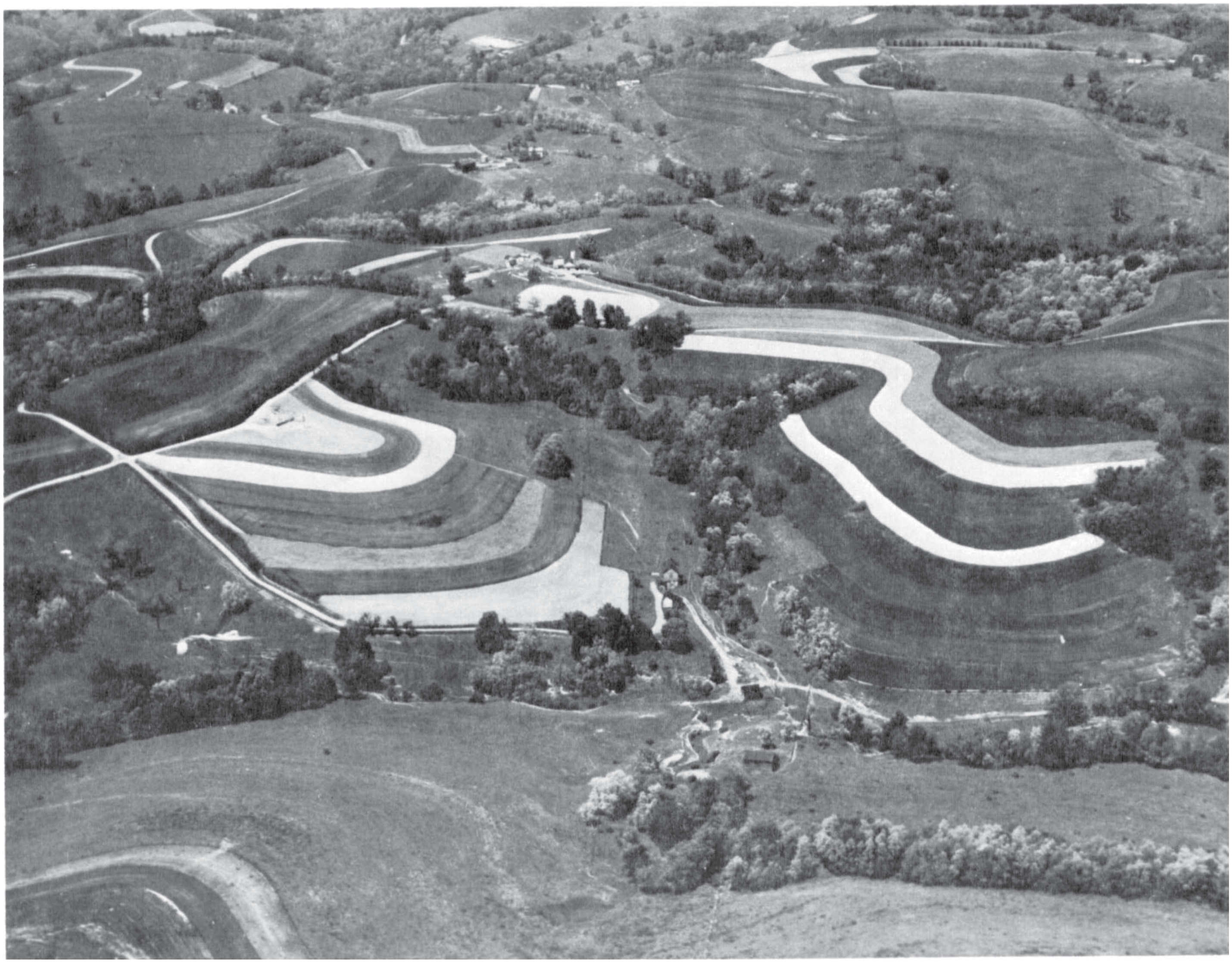

***Figure 2.*—A landscape in association 5. Westmoreland and Guernsey soils are on the uplands and Clarksburg soils are along the foot slopes.**

6. Westmoreland-Strip Mines-Gilpin Association

Deep and moderately deep, well-drained, gently sloping to very steep soils on uplands and associated surface-mined areas

This association is in hilly areas and narrow valleys. Surface mining is common over most of the association. This association occupies the area east of association 3 and areas between State Route No. 27 and U.S. Highway No. 22. Most of the soils are strongly sloping to moderately steep, but they range from gently sloping on broad ridgetops to very steep on lower slopes.

This association makes up about 14 percent of the survey area. Westmoreland soils make up about 54 percent of the association, strip-mined areas 20 percent, Gilpin soils 16 percent, and minor soils the remaining 10 percent.

Westmoreland soils are deep and well drained. These soils formed in material weathered from interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone. Westmoreland soils have a brown, medium-textured surface layer and a brown to yellowish-brown, medium-textured to moderately fine textured subsoil that is channery in the lower part.

Strip mines, a miscellaneous land type, consist of graded and ungraded areas of spoil and the adjacent high wall that resulted from surface mining. The spoil is a mixture of soil, rock fragments, and coal chips.

Gilpin soils are moderately deep and well drained. These soils formed in material weathered from interbedded acid shale, siltstone, and sandstone. They have a dark grayish-brown, medium-textured surface layer and a yellowish-brown, medium-textured to moderately fine textured subsoil that generally is channery.

Minor soils in this association are the well-drained Brooke soils and moderately well drained Guernsey soils on uplands; the well-drained Brookside soils and moderately well drained Clarksburg soils on foot slopes; the well-drained Allegheny soils and moderately well drained Monongahela soils on terraces; and the well-drained Huntington soils and moderately well drained Lindside soils on narrow flood plains.

The soils in this association are suited to grasses and legumes. Many farms, however, are operated on a part-time basis because surface mining has made large areas unsuitable for farming. Steepness of slope, moderate permeability, and the hazard of slipping need to be considered when planning homesites and road locations on the Westmoreland and Gilpin soils in this association.

7. Berks-Gilpin-Ernest Association

Moderately deep, well-drained, gently sloping to very steep soils on uplands and deep, moderately well drained, gently sloping and strongly sloping soils on foot slopes

This association is in hilly areas on uplands and in narrow valleys in Hancock County. It consists mainly of gently sloping to moderately steep soils, but some soils along lower slopes range to very steep.

This association makes up 21 percent of the survey area. Berks soils make up about 48 percent of the association, Gilpin soils 32 percent, Ernest soils 7 percent, and minor soils the remaining 13 percent.

Berks soils are on uplands. These are moderately deep, well-drained soils that formed in material weathered from interbedded acid shale, siltstone, and sandstone. Berks soils have a dark-brown, shaly, medium-textured surface layer and a brown to dark-brown, shaly to very shaly, medium-textured subsoil.

Gilpin soils also are on uplands. These are moderately deep, well-drained soils that formed in material weathered from interbedded acid shale, siltstone, and sandstone. Gilpin soils have a dark grayish-brown, medium-textured surface layer and a yellowish-brown, medium-textured to moderately fine textured subsoil that is generally channery.

Ernest soils are on foot slopes throughout the association. These are deep, moderately well drained soils that formed in colluvial material that moved downslope, mainly from the Berks and Gilpin soils on uplands. They have a fragipan in the lower part of their subsoil, through which the movement of water and air is moderately slow. Ernest soils have a dark grayish-brown, medium-textured surface layer and a yellowish-brown to brown, medium textured to moderately fine textured subsoil that is mottled in the lower part.

Minor soils in this association are the well-drained Brooke, Dekalb, Upshur, and Westmoreland soils and moderately well drained Wharton soils on uplands; moderately well drained Monongahela soils on a few isolated terraces; and the moderately well drained Philo soils and poorly drained Atkins soils on flood plains.

Most farming in this association is in areas north of New Cumberland. The soils are low to moderate in natural fertility, but they respond to good management. They are used for crops, hay, and pasture. Row crops generally are grown in alternating strips with hay and small grain. Many farms are operated on a part-time basis. Steepness of slope, limited depth to bedrock, and moderate and moderately rapid permeability of the soils on uplands and foot slopes and the high water table and hazard of flooding of the soils on flood plains need to be considered when using these soils for building sites and road locations.

Descriptions of the Soils

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

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

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Strip mines, for example, do not belong to a soil series, but this mapping unit is, nevertheless, listed in alphabetic order along with the soil series.

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

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*7*).[1]

Allegheny Series

The Allegheny series consists of deep, well-drained soils on old high terraces. These soils are mainly along the Ohio River. They formed in alluvial material washed from soils on uplands that are underlain by interbedded acid shale, siltstone, and sandstone. Slopes range from 3 to 15 percent.

In a representative profile, the surface layer is dark-brown, silt loam about 10 inches thick. The subsurface

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[1] Italic numbers in parentheses refer to Literature Cited, p. 61.

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

Mapping unit	Brooke County		Hancock County		Ohio County		Total	
	Acres	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*
Allegheny silt loam, 3 to 8 percent slopes	350	0.6	760	1.4	60	0.1	1,170	0.7
Allegheny silt loam, 8 to 15 percent slopes	560	1.0	350	.7	100	.1	1,010	.6
Atkins silt loam			250	.5			250	.1
Berks shaly silt loam, 3 to 10 percent slopes			600	1.1			600	.4
Berks shaly silt loam, 10 to 20 percent slopes	10	(1)	2,850	5.4			2,860	1.6
Berks shaly silt loam, 10 to 20 percent slopes, severely eroded			350	.7			350	.2
Berks shaly silt loam, 20 to 30 percent slopes	30	.1	4,950	9.4			4,980	2.8
Berks shaly silt loam, 20 to 40 percent slopes, severely eroded			2,410	4.6	30	(1)	2,440	1.4
Berks soils, 30 to 65 percent slopes	540	.9	12,150	23.1	20	(1)	12,710	7.2
Brooke silty clay loam, 3 to 10 percent slopes	70	.1	110	.2	60	.1	240	.1
Brooke silty clay loam, 10 to 20 percent slopes	390	.7			200	.3	590	.3
Brooke silty clay loam, 20 to 30 percent slopes	200	.4			60	.1	260	.1
Brookside silt loam, 15 to 25 percent slopes	620	1.1			680	1.1	1,300	.7
Chagrin fine sandy loam	150	.3	400	.8	80	.1	630	.4
Chavies fine sandy loam	150	.3	350	.7			500	.3
Clarksburg silt loam, 3 to 8 percent slopes	120	.2	40	(1)	130	.2	290	.2
Clarksburg silt loam, 8 to 15 percent slopes	690	1.2	140	.3	1,030	1.5	1,860	1.0
Clarksburg silt loam, 15 to 25 percent slopes	150	.3			260	.4	410	.2
Cut and fill land	140	.3	400	.8	420	.6	960	.5
Dekalb channery sandy loam, 3 to 10 percent slopes			310	.6			310	.2
Dekalb channery sandy loam, 10 to 20 percent slopes			880	1.7			880	.5
Dekalb channery sandy loam, 20 to 30 percent slopes			970	1.8			970	.5
Dunning silt loam	100	.2	50	.1	70	.1	220	.1
Ernest silt loam, 3 to 8 percent slopes			820	1.6			820	.5
Ernest silt loam, 8 to 15 percent slopes	40	.1	2,030	3.9			2,070	1.2
Gilpin silt loam, 3 to 10 percent slopes	320	.6	3,610	6.9	60	.1	3,990	2.2
Gilpin silt loam, 10 to 20 percent slopes	2,900	5.0	6,690	12.7	70	.1	9,660	5.4
Gilpin silt loam, 10 to 20 percent slopes, severely eroded	10	(1)	500	1.0			510	.3
Gilpin silt loam, 20 to 30 percent slopes	1,550	2.7	1,750	3.3	10	(1)	3,310	1.9
Gilpin silt loam, 20 to 30 percent slopes, severely eroded			420	.8	10	(1)	430	.2
Guernsey silt loam, 3 to 10 percent slopes	1,350	2.4	60	.1	340	.5	1,750	1.0
Guernsey silt loam, 10 to 20 percent slopes	1,040	1.8			860	1.2	1,900	1.1
Guernsey silt loam, 20 to 30 percent slopes	260	.5			320	.5	580	.3
Guernsey silt loam, 20 to 30 percent slopes, severely eroded	100	.2			90	.1	190	.1
Huntington silt loam	970	1.7			460	.7	1,430	.8
Lakin loamy sand, 3 to 10 percent slopes	30	.1	200	.4			230	.1
Lakin loamy sand, 10 to 20 percent slopes	40	.1	100	.2			140	.1
Lindside silt loam	820	1.4	240	.5	630	.9	1,690	.9
Made land	1,010	1.8	30	.1	230	.3	1,270	.7
Monongahela silt loam, 3 to 8 percent slopes	570	1.0	750	1.4	60	.1	1,380	.8
Monongahela silt loam, 8 to 15 percent slopes	200	.4	180	.3	70	.1	450	.3
Philo silt loam			600	1.1			600	.3
Strip mines	5,750	10.1	500	1.0	120	.2	6,370	3.6
Upshur silty clay loam, moderately shallow variant, 3 to 8 percent slopes			250	.5			250	.1
Upshur silty clay, moderately shallow variant, 8 to 15 percent slopes, severely eroded			430	.8			430	.2
Westmoreland silt loam, 3 to 10 percent slopes	650	1.1	170	.3	1,190	1.7	2,010	1.1
Westmoreland silt loam, 10 to 20 percent slopes	8,830	15.5	380	.7	14,950	21.8	24,160	13.6
Westmoreland silt loam, 10 to 20 percent slopes, severely eroded	190	.3	40	.1	330	.4	560	.3
Westmoreland silt loam, 20 to 30 percent slopes	8,840	15.5	30	.1	16,530	24.1	25,400	14.3
Westmoreland silt loam, 30 to 40 percent slopes	4,380	7.7	20	(1)	9,390	13.8	13,790	7.8
Westmoreland silt loam, 40 to 55 percent slopes	10,250	17.8	10	(1)	13,880	20.4	24,140	13.6
Wharton silt loam, 3 to 10 percent slopes			400	.8			400	.2
Wharton silt loam, 10 to 20 percent slopes			100	.2			100	.1
Miscellaneous—including towns, urban built-up areas, water, etc.	2,590	4.5	3,850	7.3	5,680	8.3	12,120	6.8
Total	56,960	100.0	52,480	100.0	68,480	100.0	177,920	100.0

1 Less than 0.05 percent.

layer, about 3 inches thick, is brown, very friable silt loam. The subsoil extends to a depth of 39 inches. It is strong-brown, friable light clay loam in the upper part, yellowish-brown, friable clay loam in the middle part, and mottled yellowish-brown light clay loam in the lower part. The underlying material, to a depth of 60 inches or more, is mottled, dark yellowish-brown, friable very fine sandy loam.

Available moisture capacity is moderate to high in these soils, and permeability is moderate in the subsoil. Natural fertility is low.

Allegheny soils are easily worked and are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for crops and hay. When planning homesites or locating roads, steepness of slope is the major concern, but the hazard of flooding needs to be considered in low areas along Buffalo and Cross Creeks. Flood records need to be checked before planning homesites in low areas. Several acres of the Allegheny soils that were formerly used as farmland are now being used for homesites.

Representative profile of Allegheny silt loam, 3 to 8 percent slopes, in Hancock County, in a hayfield along State Route No. 66/5, about three-fourths mile northeast of State Route No. 2:

Ap—0 to 10 inches, dark-brown (10YR 4/3) light silt loam; weak; weak, fine, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

A2—10 to 13 inches, brown (10YR 5/3) silt loam; weak, thin, platy structure; very friable; many roots; medium acid; clear, wavy boundary.

B21t—13 to 20 inches, strong-brown (7.5YR 5/6) light clay loam; weak to moderate, fine and medium, subangular blocky structure; friable; common roots; few, discontinuous, dark-brown (7.5YR 4/4) clay films on ped faces; strongly acid; clear, wavy boundary.

B22t—20 to 35 inches, yellowish-brown (10YR 5/6) clay loam; moderate, medium, subangular blocky structure; friable; common roots; common, discontinuous, dark-brown (7.5YR 4/4) clay films on ped faces; strongly acid; clear, wavy boundary.

B3—35 to 39 inches, yellowish-brown (10YR 5/6) light clay loam; few, medium mottles of strong brown (7.5YR 5/6) and pale brown (10YR 6/3); weak, fine and medium, subangular blocky structure; friable; few roots; few discontinuous clay films; very strongly acid; clear, wavy boundary.

C—39 to 60 inches, dark yellowish-brown (10YR 4/4) very fine sandy loam; few mottles and streaks of strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2); massive; friable; very strongly acid.

Depth to bedrock generally is more than 5 feet. The Ap horizon is dark brown, brown, or dark grayish brown. The B horizon is generally dark yellowish-brown, yellowish-brown, or strong-brown clay loam or sandy clay loam, but it ranges to loam in the upper part of some profiles. Unlimed soils are strongly acid or very strongly acid.

Allegheny soils are next to moderately well drained Monongahela soils. They are better drained than Monongahela soils, and they lack the fragipan layer of those soils.

Allegheny silt loam, 3 to 8 percent slopes (AhB).—This soil commonly is on broad terraces. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Included in mapping are small areas of Monongahela soils and small areas that are less sloping than this soil. Also included on low terraces along Buffalo and Cross Creeks are soils that have a gravelly profile and some soils that are more silty and less acid than this soil.

This Allegheny soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe-4; woodland suitability group 1.

Allegheny silt loam, 8 to 15 percent slopes (AhC).—This soil commonly is along the outer edges of terraces and along slopes above drainageways. It generally is less deep than the soil described as representative for the series. Included in mapping are small areas that are steeper than this soil, small areas that are severely eroded, and some areas that are more silty and less acid. Also included are some areas that are underlain by stratified sand and gravel.

This Allegheny soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIIe-4; woodland suitability group 1.

Atkins Series

The Atkins series consists of deep, poorly drained soils on narrow flood plains along small streams north of Kings Creek in Hancock County. These soils formed in alluvial material washed from acid soils on uplands. Slopes range from 0 to 3 percent.

In a representative profile, the surface layer is silt loam about 8 inches thick. It is mottled dark gray in the upper part and mottled gray silt loam in the lower part. The subsoil is friable silt loam about 28 inches thick; it is mottled dark gray in the upper part and mottled gray in the lower part. The underlying material, to a depth of 52 inches or more, is mixed-gray and strong-brown, friable, light silt loam, which contains thin layers of silty clay loam and fine sandy loam.

These soils have a seasonal high water table, and they are subject to flooding. In places low areas flood every year. Available moisture capacity is high, and permeability is moderately slow in the subsoil. Natural fertility is moderate.

Atkins soils are wet most of the year. They are limited in their suitability for cultivated crops and deep-rooted legumes. Most areas are cleared and are used mainly for pasture, but undrained areas have little value. The seasonal high water table, moderately slow permeability, and the hazard of flooding are major concerns when planning homesites or locating roads on these soils.

Representative profile of Atkins silt loam, in Hancock County, in a pasture west of State Route No. 8, about 2½ miles north of New Manchester:

Ap1—0 to 5 inches, dark-gray (10YR 4/1) silt loam; common, fine mottles of reddish brown (5YR 4/4); weak, fine, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

Ap2g—5 to 8 inches, gray (10YR 5/1) silt loam; common, fine mottles of reddish brown (5YR 4/4); weak, fine, granular structure; friable; common roots; strongly acid; clear, wavy boundary.

B21g—8 to 25 inches, dark-gray (10YR 4/1) silt loam; common, fine mottles of reddish brown (5YR 4/4); weak, medium and coarse, subangular blocky structure; friable; few roots; few dark-brown (7.5YR 4/2) concretions; strongly acid; clear, wavy boundary.

B22g—25 to 36 inches, gray (10YR 5/1) silt loam; many, coarse mottles of strong brown (7.5YR 5/6); weak, coarse, subangular blocky structure; friable; strongly acid; gradual, wavy boundary.

Cg—36 to 52 inches, mixed gray (10YR 5/1) and strong-brown (7.5YR 5/6) light silt loam; massive; friable; common thin layers of silty clay loam and fine sandy loam; strongly acid.

Depth to bedrock generally is more than 4 feet. The B horizon generally is silt loam, but it ranges to fine sandy loam, loam, or silty clay loam. It is dark gray, gray, or grayish brown. Unlimed soils are strongly acid or very strongly acid.

Atkins soils are next to moderately well drained Philo soils. They are less well drained than Philo soils, and they generally have slower surface runoff and a less sandy B horizon than those soils.

Atkins silt loam (At).—This soil is nearly level. It has a water table at or near the surface in winter and early in spring. This soil has poor surface drainage, and in places the areas are ponded for long periods. Included in mapping are small areas of Philo soils and some areas of poorly drained soils that are darker than this soil.

Artificial drainage is needed on this soil if desirable crops are to be grown. Suitable outlets, however, are lacking in some areas. In places diversions are helpful in intercepting runoff from higher lying areas. If this soil is drained, it can be used for cultivated crops, hay, and pasture plants that can tolerate some wetness, but crops are subject to damage from flooding. Delaying pasturing or tilling of this wet soil until it is reasonably dry and firm helps to prevent compaction and to reduce loss of tilth. Capability unit IIIw-1; woodland suitability group 2.

Berks Series

The Berks series consists of moderately deep, well-drained soils on uplands. These soils are commonly on broad ridgetops and hillsides throughout Hancock County. They formed in material weathered from interbedded acid shale, siltstone, and sandstone. Slopes range from 3 to 65 percent.

In a representative profile the surface layer is dark-brown shaly silt loam about 8 inches thick. The subsoil extends to a depth of 22 inches. It is brown, friable shaly silt loam in the upper part and dark-brown, friable, very shaly silt loam in the lower part. The underlying material is dark-brown, friable, very shaly loam that extends to bedrock at a depth of 30 inches.

Available moisture capacity is low in these soils, and permeability is moderately rapid. Natural fertility is low.

The less sloping Berks soils are suited to crops, hay, and pasture. Most areas are cleared. They are used mainly for hay and pasture, but some areas are idle or are reverting to woods. The steeper Berks soils are mostly wooded or are in pasture. In places the growth of short-rooted pasture plants is hindered by a lack of water during periods of low rainfall. These droughty soils need special management to limit water losses and to maintain fertility and tilth. The limited depth to bedrock and steepness of slope are main concerns when planning homesites or locating roads on these soils.

Representative profile of Berks shaly silt loam, 20 to 30 percent slopes, in Hancock County, in an idle field, north and east of intersection of Licks Run Road and Ridge road and about 1½ miles north of Kings Creek:

Ap—0 to 8 inches, dark-brown (10YR 4/3) shaly silt loam; weak, fine, granular structure; loose; many roots; very strongly acid; abrupt, smooth boundary.

B2—8 to 17 inches, brown (7.5YR 5/4) shaly silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; about 20 to 30 percent shale and siltstone fragments; strongly acid; gradual, wavy boundary.

B3—17 to 22 inches, dark-brown (7.5YR 4/2) very shaly silt loam; weak, fine, subangular blocky structure; friable; few roots; about 50 to 70 percent shale and siltstone fragments; strongly acid; gradual, wavy boundary.

C—22 to 30 inches, dark-brown (10YR 4/3) very shaly loam; massive; friable; about 80 percent shale and siltstone fragments; strongly acid; clear, wavy boundary.

R—30 inches, interbedded acid shale and siltstone.

Depth to bedrock ranges from 20 to 34 inches, but it is generally about 24 to 26 inches. The Ap horizon is dark brown or brown. Coarse fragments make up about 15 to 25 percent of the Ap horizon. The B horizon is silt loam or loam. It is shaly in the upper part and very shaly in the lower part. It is yellowish brown, dark yellowish brown, dark brown, or brown. The B horizon generally is less than 50 percent coarse fragments in the upper part and as much as 75 percent in the lower part. Unlimed soils are strongly acid or very strongly acid.

Berks soils are near well-drained Dekalb, Gilpin, and Upshur, moderately shallow variant, soils and moderately well drained Ernest and Wharton soils. Berks soils contain more coarse fragments than any of these associated soils. They are less clayey in the B horizon than Ernest, Gilpin, Upshur, or Wharton soils and are less sandy than Dekalb soils. Berks soils are better drained than Ernest or Wharton soils, and they lack the fragipan layer that is characteristic of Ernest soils.

Berks shaly silt loam, 3 to 10 percent slopes (BeB).—This soil is commonly on broad ridgetops. It has a slightly thicker subsoil than the soil described as representative for the series. Included in mapping are small areas of Dekalb and Gilpin soils. Also included are soils that have a thin, silty clay loam layer in their subsoil.

This Berks soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion, to reduce water losses, and to maintain fertility and good tilth. Dividing long slopes into strips also helps to reduce water losses. Capability unit IIIe-32; woodland suitability group 3.

Berks shaly silt loam, 10 to 20 percent slopes (BeC).—This soil is most commonly on broad ridgetops. It has a slightly thicker subsoil than the soil described as representative for the series. Included in mapping are small areas of Dekalb and Gilpin soils. Also included are soils that have a thin silty clay loam layer in their subsoil.

This Berks soil has only limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is severe in unprotected areas. Keeping tillage to a minimum, growing crops in contour strips, using a sequence that includes hay crops, returning crop residue to the soil, and maintaining natural drainageways in sod are practices that help to control erosion, to reduce water losses, and to maintain fertility and tilth. Diversions help to reduce soil and water losses on long slopes. Capability unit IVe-32; woodland suitability group 3.

Berks shaly silt loam, 10 to 20 percent slopes, severely eroded (BeC3).—This soil is most commonly on the southern and western exposures of upper parts of uplands. Erosion has removed most of the original surface layer, and a few shallow gullies or gall spots are present in places. The soil is more eroded, is more shallow to bedrock, and contains more coarse fragments in the surface layer than the soil described as representative for the series. Included in mapping are small areas of Gilpin soils.

This Berks soil is not suited to cultivated crops, but it can be used for pasture. Steepness of slope is not a limitation to many uses. The hazard of erosion is very severe in unprotected areas. Good pasture management, such as rotational grazing, mowing, and proper stocking rates, is needed to help control erosion and to reduce water losses. Capability unit VIe-31; woodland capability group 3.

Berks shaly silt loam, 20 to 30 percent slopes (BeD).—This soil is on strongly dissected uplands. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Included in mapping are small areas of Dekalb and Gilpin soils.

This Berks soil is not suited to cultivated crops, but it can be used for pasture. The hazard of erosion is severe in unprotected areas. Good pasture management, that includes practices such as rotational grazing, mowing, and proper stocking rates, is needed to control erosion and to reduce water losses. Capability unit VIe-31; woodland suitability group, north aspect, 3, and south aspect, 4.

Berks shaly silt loam, 20 to 40 percent slopes, severely eroded (BeE3).—This soil is mostly on southern and western exposures of strongly dissected uplands and along lower parts of uplands in areas that have been heavily grazed. Erosion has removed most of the original surface layer, and a few shallow gullies or gall spots are present in places. This soil is more eroded, is more shallow to bedrock, especially on the upper part of long slopes, and contains more coarse fragments in the surface layer than the soil described as representative for the series. Included in mapping are small areas that have rock outcrops and some soils that are very steep.

This Berks soil is not suited to cultivated crops and hay, and it has only limited suitability for pasture. The hazard of erosion is very severe in unprotected areas. Controlling soil and water losses and establishing and maintaining pastures on this soil are difficult. This soil is better suited to woodland than to other uses. Capability unit VIIe-2; woodland suitability group, north aspect, 3, and south aspect, 4.

Berks soils, 30 to 65 percent slopes (BkF).—These soils most commonly are in wooded, lower areas on uplands. In places they have a surface layer of shaly silt loam or very stony silt loam. They are steeper and slightly deeper than the soil described as representative for the series. The very stony soils are mainly along the bluffs facing the Ohio River. Included in mapping are small areas that have a channery surface layer and a few areas that contain rock outcrops. Also included are narrow bands of Westmoreland soil in the Kings Creek section, and some soils that are severely eroded.

These soils are not suited to cultivated crops and hay, but some areas have limited suitability for pasture. The hazard of erosion is very severe in unprotected areas. Controlling soil and water losses and establishing and maintaining pastures on these soils are difficult. These soils are better suited to woodland than to other uses. Capability unit VIIe-2; woodland suitability group, north aspect, 3, and south aspect, 4.

Brooke Series

The Brooke series consists of moderately deep, well-drained soils on uplands. These soils are in small areas, mainly on knolls and saddles along ridgetops and narrow bands around hillsides. They formed in material weathered from limy shale and limestone. Slopes range from 3 to 30 percent.

In a representative profile the surface layer, about 6 inches thick, is very dark grayish-brown, firm heavy silty clay loam in the upper part and dark grayish-brown, firm silty clay in the lower part. The subsoil is dark-brown, firm clay about 13 inches thick. The underlying material is mixed dark-brown and olive-gray, firm silty clay that extends to bedrock at a depth of 36 inches.

Available moisture capacity is high in these soils, and permeability is slow in the subsoil. Natural fertility is high.

Brooke soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. They are difficult to work, and they puddle if worked when too wet. Grass and legume mixtures grow well. The high shrink-swell potential, limited depth to bedrock, slow permeability, and the hazard of slipping where slopes are moderately steep are main concerns when planning homesites or locating roads on these soils.

Representative profile of Brooke silty clay loam, 10 to 20 percent slopes, in Brooke County, in an idle field, 1½ miles north of West Liberty along State Route No. 28/3:

Ap1—0 to 2 inches, very dark grayish-brown (10YR 3/2) heavy silty clay loam; strong, coarse, granular structure; firm; many roots; about 10 percent small limestone fragments; neutral; abrupt, wavy boundary.

Ap2—2 to 6 inches, dark grayish-brown (2.5Y 4/2) heavy silty clay loam; strong, fine, angular blocky structure; firm, plastic and slightly sticky when wet; many roots; about 10 percent small limestone fragments and a few rounded limestone cobbles 4 to 6 inches across; neutral; abrupt, smooth boundary.

B2t—6 to 19 inches, dark-brown (7.5YR 4/4) clay; moderate to strong, medium, angular blocky structure; firm, very plastic and sticky when wet; common roots; common discontinuous clay films on ped faces; strong-brown (7.5YR 5/6) remnants of soft, impure limestone; about 15 percent limestone cobbles 4 to 6 inches across; mildly alkaline; abrupt, wavy boundary.

C—19 to 36 inches, mixed dark-brown (10YR 4/3) and olive-gray (5Y 5/2) silty clay; massive; firm; 40 percent limestone fragments and cobbles; mildly alkaline; abrupt, irregular boundary.

R—36 to 40 inches, fractured limestone.

Depth to bedrock ranges from 20 to 40 inches. The B horizon is clay or silty clay. It is dark brown, olive brown, or dark yellowish brown. Coarse fragments in the B horizon range from a few to about 20 percent. Unlimed soils are mostly neutral in reaction, but they range from slightly acid to mildly alkaline.

Brooke soils are near well-drained Westmoreland soils and moderately well drained Guernsey soils. They are more clayey, less acid, and more shallow than the associated soils. Brooke soils are better drained than Guernsey soils.

Brooke silty clay loam, 3 to 10 percent slopes (BoB).—This soil is on broad knolls and saddles along ridgetops. It has a thicker subsoil than the soil described as representative for the series. Included in mapping are small areas of Guernsey and Westmoreland soils and a few areas that are severely eroded.

This Brooke soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIIe–30; woodland suitability group 3.

Brooke silty clay loam, 10 to 20 percent slopes (BoC).—This soil generally is on knolls and saddles along broad ridgetops. Most areas are in Brooke County. This soil has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Included in mapping are small areas of Westmoreland soils and small areas of Guernsey soils, especially in small depressions. Also included are a few areas that are less steep than this soil and a few areas that are severely eroded.

This Brooke soil has limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is severe in unprotected areas, and gall spots are in some areas. Keeping tillage to a minimum, growing crops in contour strips, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IVe–30; woodland suitability group 3.

Brooke silty clay loam, 20 to 30 percent slopes (BoD).—This soil most commonly is on high knolls and in narrow bands around hillsides. It has a slightly thinner surface layer and subsoil and generally contains more coarse fragments than the soil described as representative for the series. Included in mapping are small areas of Westmoreland soils and a few areas that are severely eroded.

This Brooke soil is not suited to cultivated crops. It is better suited to pasture than to other uses. The hazard of erosion is severe in unprotected areas, and gall spots are in some areas. Good pasture management is needed to help control erosion and to maintain fertility. Capability unit VIe–1; woodland suitability group 3.

Brookside Series

The Brookside series consists of deep, well-drained soils on foot slopes. These soils formed in colluvial material that moved downslope, mainly from Westmoreland soils on uplands. In places, they separate the flood plains from the uplands in Brooke and Ohio Counties. Slopes range from 15 to 25 percent.

In a representative profile the surface layer is a very dark grayish-brown silt loam about 7 inches thick. The subsoil is dark brown and extends to a depth of 52 inches or more. It is firm channery silty clay in the upper part and firm channery silty clay loam in the lower part.

Available moisture capacity is high in these soils, and permeability is moderately slow in the subsoil. Natural fertility is moderate to high.

Brookside soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. Grass and legume mixtures grow well on these soils. Steepness of slope, hazard of slipping, high shrink-swell potential, and moderately slow permeability are main concerns when planning homesites or locating roads on these soils.

Representative profile of Brookside silt loam, 15 to 25 percent slopes, in Brooke County, in a pasture, about three-fourths mile up Mingo Run:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; strong, coarse, granular structure; friable; many roots; about 10 percent siltstone and limestone fragments; slightly acid; abrupt, smooth boundary.

B21t—7 to 20 inches, dark-brown (10YR 4/3) channery silty clay; some strong-brown (7.5YR 5/6) streaks; strong, medium, angular blocky structure; firm; common roots; common discontinuous clay films on ped faces; about 15 to 20 percent siltstone and limestone fragments; slightly acid; clear, wavy boundary.

B22t—20 to 32 inches, dark-brown (10YR 4/3) channery silty clay; some light-gray (10YR 7/2) silty lenses; moderate, medium, subangular blocky structure; firm; few roots; common discontinuous clay films on ped faces; about 20 percent siltstone and limestone fragments; neutral; gradual, wavy boundary.

B3t—32 to 52 inches, dark-brown (10YR 4/3) channery silty clay loam and pockets of grayish brown (2.5Y 5/2); weak, medium, subangular blocky structure; firm; common, discontinuous, dark grayish-brown (10YR 4/2) clay films; about 30 percent sandstone and siltstone fragments; fine, mostly weathered, brownish-yellow (10YR 6/6) limy shale tends to dominate the structure below a depth of 48 inches, and clay films are mostly on coarse fragments; neutral.

Depth to bedrock generally is more than 5 feet. The B horizon dominantly is silty clay, but it is silty clay loam or clay in places. It is brown, dark brown, or dark yellowish brown. In places coarse fragments make up as much as 35 percent of the B horizon, but generally coarse fragments make up 15 to 25 percent. Unlimed soils are medium acid or slightly acid in the upper part of the profile and slightly acid or neutral in reaction in the lower part.

Brookside soils in this survey area have slightly thicker and darker colored surface layers than the defined range for the series, but this difference does not alter their usefulness or behavior.

Brookside soils are near moderately well drained Clarksburg soils and well-drained Westmoreland soils. They are better drained than Clarksburg soils, and they lack the fragipan layer characteristic of those soils. They generally are more clayey in the B horizon than Westmoreland soils.

Brookside silt loam, 15 to 25 percent slopes (BrD).—Material originally in the surface layer makes up more than one-fourth of the plow layer of this soil. Included in mapping are small areas of Clarksburg soils, especially in seepy areas. Also included are a few areas of soils that are less steep than this soil, a few areas of steeper soils, and some areas of severely eroded soils.

This Brookside soil has limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is severe in unprotected areas. Keeping tillage to a minimum, growing crops in contour strips, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and tilth. In places diversions are helpful in intercepting runoff from adjacent uplands. Capability unit IVe-1; woodland suitability group 1.

Chagrin Series

The Chagrin series consists of deep, well-drained soils on flood plains along the Ohio River, on islands of the Ohio River, and, to a lesser extent, along other streams in Brooke and Ohio Counties. These soils formed in alluvial material washed from acid and lime-influenced soils on uplands. Slopes range from 0 to 3 percent.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of 34 inches. It is dark yellowish-brown, friable loam in the upper part and dark-brown, friable fine sandy loam in the lower part. The underlying material, to a depth of 52 inches or more, is dark-brown, very friable fine sandy loam.

These soils are subject to flooding. Available moisture capacity is moderate to high, and permeability is moderate to moderately rapid. Natural fertility is high.

Chagrin soils are easily worked and are suited to crops, hay, and pasture. Except where these soils occur on islands, most areas are cleared. Most areas are cropped or are in hay. Areas on the islands are mostly idle or wooded. The hazard of flooding is the main concern when planning homesites or locating roads on these soils.

Representative profile of Chagrin fine sandy loam, in Hancock County, in a cornfield along the Ohio River, about one-fourth mile north of Tomlinson Run:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; moderate, fine, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

B2—8 to 20 inches, dark yellowish-brown (10YR 3/4) loam; weak, fine and medium, subangular blocky structure; friable; many roots; some coatings of dark grayish brown on ped faces and in root holes; medium acid; clear, wavy boundary.

B3—20 to 34 inches, dark-brown (7.5YR 4/4) fine sandy loam; massive to weak, coarse, subangular blocky structure; friable; common roots; some coatings of dark grayish brown on ped faces and in root holes; medium acid; gradual, wavy boundary.

C—34 to 52 inches, dark-brown (7.5YR 4/4) fine sandy loam that contains less fines than that in the B3 horizon; massive; very friable; few roots; slightly acid.

Depth to bedrock generally is greater than 4 feet. The Ap horizon commonly is dark grayish brown or dark brown. The B horizon is fine sandy loam, loam, or silt loam and generally is dark yellowish brown, dark brown, or brown. Unlimed soils are medium acid to neutral in reaction.

Chagrin soils are near well-drained Chavies and Huntington soils, moderately well drained Lindside soils, and poorly drained Dunning soils. They are slightly more clayey in the B horizon than Chavies soils, and they are more frequently flooded. Chagrin soils are more sandy than the Dunning, Huntington, and Lindside soils.

Chagrin fine sandy loam (Cg).—This nearly level soil is subject to flooding, and some low areas flood every year. Included in mapping are soils in lower lying areas that are more sandy than this soil throughout, and are subject to frequent flooding. Also included are soils in higher lying areas that have a darker colored surface layer than this soil. These soils are silty throughout, and they are subject to infrequent or occasional flooding.

This soil is suited to cultivated crops, small grain, hay, and pasture. It can be cropped continuously if the areas are protected by a cover crop. Working the residue from the cover crop into the soil is a practice that helps to improve tilth, fertility, and available moisture capacity. In places crops are occasionally damaged by floodwater. Capability unit IIw-6; woodland suitability group 1.

Chavies Series

The Chavies series consists of deep, well-drained soils. These soils are mainly on ridgelike flood plains along the Ohio River in Brooke and Hancock Counties. They formed in alluvial material washed from acid and lime-influenced soils on uplands. Slopes range from 0 to 5 percent.

In a representative profile the surface layer is a dark grayish-brown, fine sandy loam about 12 inches thick. The next layer, about 5 inches thick, is dark-brown, very friable fine sandy loam. The subsoil extends to a depth of 46 inches. It is dark-brown, slightly firm fine sandy loam in the upper part and dark-brown, firm sandy loam in the lower part. The underlying material, to a depth of 54 inches or more, is dark yellowish-brown, stratified loamy sand, sand, and a small percentage of gravel.

These soils are subject to flooding during periods of extremely high water. Available moisture capacity is low to moderate, and permeability is moderately rapid. Natural fertility is moderate.

Chavies soils are easily worked and are suited to crops, hay, and pasture. Except for the soils on the islands, most areas are cleared and are mainly used for crops and hay. The areas on islands are mostly idle or wooded. The hazard of flooding is the main concern when planning homesites and locating roads on these soils. Septic tank filter fields that are too close to wells can contaminate the water in places.

Representative profile of Chavies fine sandy loam, in Hancock County, in an idle field at Congo Bottom:

Ap—0 to 12 inches, dark grayish-brown (10YR 4/2) fine sandy loam; moderate, fine and medium, granular structure; very friable; many roots; very strongly acid; clear, wavy boundary.

A3—12 to 17 inches, dark-brown (10YR 4/3) fine sandy loam that is slightly coarser than that in the Ap horizon; weak, fine, subangular blocky structure; very friable; many roots; very strongly acid; clear, wavy boundary.

B2t—17 to 29 inches, dark-brown (7.5YR 4/4) fine sandy loam that is slightly more clayey than in the A3 horizon; weak, medium and coarse, subangular blocky structure; friable; slightly firm in place; common roots; many silty faces of dark brown (10YR 4/3); few discontinuous clay films on ped faces; common earthworm burrows; strongly acid; gradual, wavy boundary.

B3—29 to 46 inches, dark-brown (7.5YR 4/4) sandy loam; weak, medium and coarse, subangular blocky structure; friable; firm in place; few roots; few to common silt faces of dark brown (10YR 4/3) on peds; strongly acid; gradual, wavy boundary.

C—46 to 54 inches, dark yellowish-brown (10YR 4/4) stratified loamy sands, sands, and a small percentage of gravel.

Depth to bedrock generally is more than 6 feet. The B horizon generally is fine sandy loam, but in places it is loam or sit loam. It is dark brown, brown, dark yellowish brown, or yellowish brown. Unlimed soils generally are strongly acid, but they range from medium acid to very strongly acid in parts of the profile.

Chavies soils are near well-drained Chagrin and Huntington soils, moderately well drained Lindside soils, and poorly drained Dunning soils. They are slightly more sandy in the B horizon than Chagrin soils, and they flood less frequently. Chavies soils are more sandy and more acid than Huntington soils. They are better drained, more sandy, and more acid than Dunning or Lindside soils.

Chavies fine sandy loam (Ch).—This soil is subject to flooding during periods of extremely high water. Included in mapping are small areas of Lindside soils and small areas of soils that are similar to this soil, but they have a subsoil of sandy clay loam and light clay loam. Also included are small areas of steeper soils along shallow drainageways and escarpments.

This soil is suited to cultivated crops, small grain, hay, and pasture. It can be cropped continuously if these areas are protected by a cover crop. Working the residue of the cover crop into the soil is a practice that helps to improve tilth, fertility, and available moisture capacity. Capability unit IIs-6; woodland suitability group 1.

Clarksburg Series

The Clarksburg series consists of deep, moderately well drained soils on foot slopes. These soils are mainly in Brooke and Ohio Counties. They formed in colluvial material that moved downslope, mainly from Westmoreland soils on uplands. Slopes range from 3 to 25 percent.

In a representative profile the surface layer is dark-brown silt loam about 7 inches thick. The subsoil is 37 inches thick. The upper 15 inches is brown and yellowish-brown silty clay loam that is mottled in the lower part. The lower 22 inches is brown and strong-brown silty clay loam. The underlying material, to a depth of 58 inches, is yellowish-brown, strong-brown, and light brownish-gray channery clay loam. The lower 36 inches is a very firm fragipan layer.

These soils have a seasonal high water table. Available moisture capacity is moderate to high, and permeability is moderately slow in the fragipan layer. Natural fertility is moderate to high.

Clarksburg soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. Steepness of slope, moderately slow permeability, and seasonal high water table are main concerns when planning homesites or locating roads on these soils. The hazard of slipping is also a concern on soils that are moderately steep.

Representative profile of Clarksburg silt loam, 8 to 15 percent slopes, in Ohio County, in a pasture about one-fourth mile east of State Route No. 37, in the head of McGraw Run:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; moderate, medium granular structure; very friable; many roots; about 5 percent siltstone and sandstone fragments; medium acid; clear, wavy boundary.

B21t—7 to 12 inches, brown (7.5YR 5/4) light silty clay loam; moderate, medium, subangular blocky structure; friable; many roots; few discontinuous clay films on ped faces; some dark-brown coatings; about 5 percent siltstone and sandstone fragments; medium acid; clear, wavy boundary.

B22t—12 to 22 inches, yellowish-brown (10YR 5/4) silty clay loam; common, medium, light brownish-gray (10YR 6/2) mottles in lower part; moderate, medium, subangular blocky structure; friable to firm; common roots; common, continuous, brown (7.5YR 5/4) clay films on ped faces; about 5 percent siltstone and sandstone fragments; medium acid; clear, wavy boundary.

Bx1—22 to 32 inches, brown (7.5 YR 5/4) silty clay loam; many, medium mottles of strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2); weak, coarse, subangular blocky and weak platy structure; very firm; few roots; common continuous clay films on ped faces; about 10 percent siltstone and sandstone fragments; strongly acid; clear, wavy boundary.

Bx2—32 to 44 inches, mixed brown (7.5YR 5/4) and strong-brown (7.5YR 5/6) silty clay loam; moderate, coarse, prismatic structure that parts to weak, coarse, subangular blocky; very firm, few roots; common, continuous, gray (10YR 6/1) clay films on prism faces; many coatings of manganese; about 10 percent siltstone and sandstone fragments; strongly acid; clear, wavy boundary.

Cx—44 to 58 inches, mixed yellowish-brown (10YR 5/4), strong-brown (7.5YR 5/6), and light brownish-gray (10YR 6/2), channery, heavy clay loam; massive; very firm; few, discontinuous, gray clay films along cleavage planes; common coatings of manganese; about 25 percent siltstone and sandstone fragments; medium acid.

Depth to bedrock generally is more than 5 feet. Depth to the fragipan ranges from 20 to 30 inches. Depth to low-chroma mottling ranges from 20 to 28 inches. The Ap horizon generally is dark brown or dark grayish brown. Coarse fragments make up 0 to 10 percent of the Ap horizon. The B horizon is silty clay loam or clay loam, or it is channery phases of these textures. It is brown, yellowish brown, or strong brown. Coarse fragments make up 5 to 25 percent of the B horizon. Unlimed soils are strongly acid or medium acid in the upper part of the profile and medium acid or slightly acid in the lower part.

Clarksburg soils are near well-drained Brookside and Westmoreland soils and moderately well drained Guernsey soils. They are less well drained than Brookside and Westmoreland soils, and they have a fragipan that is lacking in those soils. Clarksburg soils are less clayey in the B horizon than Guernsey soils.

Clarksburg silt loam, 3 to 8 percent slopes (CkB).—This soil generally is in small areas and commonly is on alluvial fans. It contains more coarse fragments throughout its profile than the soil described as representative for the series. Seeps are in some areas. Included in mapping are small areas of Lindside soils, especially where this soil is mapped along small streams.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. This soil generally is managed with the adjacent soils on flood plains. If it is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe-14; woodland suitability group 1.

Clarksburg silt loam, 8 to 15 percent slopes (CkC).—This soil is on the longer foot slopes and around heads of streams. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Seeps are common in some areas. Included in mapping are small areas of Brookside and Guernsey soils.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, maintaining shallow drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Diversions are helpful in intercepting runoff from the adjacent uplands. Capability unit IIIe–14; woodland suitability group 1.

Clarksburg silt loam, 15 to 25 percent slopes (CkD).—This soil generally has shorter slopes, contains more coarse fragments, and has a thinner fragipan than the soil described as representative for the series. Included in mapping are small areas of Brookside soils.

This Clarksburg soil has limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is severe in unprotected areas. Keeping tillage to a minimum, growing crops in contour strips, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Diversions are helpful in intercepting runoff from the adjacent uplands. Capability unit IVe–9; woodland suitability group 1.

Cut and Fill Land

Cut and fill land (Cu) consists mostly of mixed soil mamaterial from areas that have been excavated, graded, or filled. The original soil features have been so altered or obscured that identifiable soil profiles or partial profiles make up less than 20 percent of the area. Capability unit, not assigned; woodland suitability group, not assigned.

Dekalb Series

The Dekalb series consists of moderately deep, well-drained soils on broad ridges in Hancock County. They formed in material weathered from acid sandstone. Slopes range from 3 to 30 percent.

In a representative profile the surface layer is dark-brown, channery sandy loam about 7 inches thick. The subsurface layer, about 3 inches thick, is brown, friable, channery light loam. The subsoil, about 16 inches thick, is yellowish-brown, friable, channery light loam in the upper part and yellowish-brown, friable, very channery sandy loam in the lower part. The underlying material is yellowish-brown, friable, very channery sandy loam and extends to bedrock at a depth of 36 inches.

Available moisture capacity is low to moderate in these soils, and permeability is moderately rapid. Natural fertility is low.

Dekalb soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. Special management is needed to reduce water losses and to maintain fertility and good tilth. The limited depth to bedrock and steepness of slope are main concerns when planning homesites and locating roads on these soils.

Representative profile of Dekalb channery sandy loam, 10 to 20 percent slopes, in Hancock County, in an idle field along State Route No. 9/2, about 0.3 mile east of its intersection with State Route No. 9:

Ap—0 to 7 inches, dark-brown (10YR 3/3) channery sandy loam; weak, medium, granular structure; very friable; many roots; about 15 percent sandstone fragments; strongly acid; abrupt, smooth boundary.

A2—7 to 10 inches, brown (10YR 5/3) channery light loam; weak, medium, subangular blocky structure that parts to platy; friable; common roots; some dark-brown coatings; about 20 percent sandstone fragments; strongly acid; clear, wavy boundary.

B2—10 to 18 inches, yellowish-brown (10YR 5/6) channery light loam; weak to moderate, medium, subangular blocky structure; friable; common roots, few, patchy, yellowish-red (5YR 5/6) coatings; about 25 percent coarse fragments; strongly acid; clear, wavy boundary.

B3—18 to 26 inches, yellowish-brown (10YR 5/4) very channery sandy loam that has some colors of yellowish red (5YR 4/6); massive in place, parting to weak, medium, subangular blocky structure; friable; few roots; about 60 percent coarse fragments; strongly acid; gradual, wavy boundary.

C—26 to 36 inches, yellowish-brown (10YR 5/4) very channery sandy loam; single grained; very friable; about 90 percent weathered sandstone that can be cut with a spade.

R—36 inches, sandstone.

Depth to bedrock ranges from 24 to 40 inches. Coarse fragments make up about 15 to 20 percent of the Ap horizon. The B horizon is loam or sandy loam and generally is channery or very channery phases of these textures. It is yellowish brown or brown. Coarse fragments make up 20 to 30 percent of the upper part of the B horizon and as much as 60 percent in the lower part of the B horizon. Unlimed soils are strongly acid or very strongly acid.

Dekalb soils are near well-drained Berks and Gilpin soils and moderately well drained Wharton soils. They are more sandy than these associated soils, and they are better drained and more shallow to bedrock than Wharton soils.

Dekalb channery sandy loam, 3 to 10 percent slopes (DeB).—This soil generally is on broad ridgetops. Its surface layer and subsoil generally are thicker than the soil described as representative for the series, and they contain fewer coarse fragments. Included in mapping are small areas of Berks and Gilpin soils.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion, to reduce water losses, and to maintain fertility and good tilth. Capability unit IIe–10; woodland suitability group 4.

Dekalb channery sandy loam, 10 to 20 percent slopes (DeC).—This soil commonly is on ridgetops and other upper parts of uplands. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Included in mapping are small areas of Berks and Gilpin soils.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion, to reduce water losses, and to maintain fertility and tilth. Capability unit IIIe–10; woodland suitability group 4.

Dekalb channery sandy loam, 20 to 30 percent slopes (DeD).—This soil commonly is in middle areas on uplands. It is slightly coarser textured and less deep to bedrock than the soil described as representative for the series. Included in mapping are small areas of Berks and Gilpin soils.

This Dekalb soil has limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is severe in unprotected areas. Keeping tillage to a minimum, growing crops in contour strips, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion, to reduce water losses, and to maintain fertility and tilth. Capability unit IVe–3; woodland suitability group, north aspect, 3, and south aspect, 4.

Dunning Series

The Dunning series consists of deep, poorly drained soils on flood plains. These soils formed in alluvial material washed from lime-influenced soils on uplands. Slopes generally are less than 3 percent, but a few are as much as 5 percent.

In a representative profile the surface layer is mottled, very dark grayish-brown heavy silt loam about 13 inches thick. The subsoil extends to a depth of 32 inches. It is mottled, gray, friable, light silty clay in the upper part and mottled, gray, firm light silty clay in the lower part. The underlying material, to a depth of 50 inches or more, is mixed gray and reddish-brown, firm silty clay loam.

These soils have a seasonal high water table, and they are subject to flooding. Available moisture capacity is high, and permeability is moderately slow in the subsoil. Natural fertility is high.

Dunning soils are wet most of the winter and in spring. They are limited in their suitability for cultivated crops and deep-rooted legumes. Most areas are cleared and are commonly used for hay and pasture. The seasonal high water table, moderately slow permeability, and the hazard of flooding are major concerns when planning homesites and locating roads on these soils.

Representative profile of Dunning silt loam, in Brooke County, in an idle field along Buffalo Creek, about 2 miles southeast of Bethany:

Ap—0 to 13 inches, very dark grayish-brown (10YR 3/2) heavy silt loam; few, fine mottles of yellowish red (5YR 4/6); moderate, medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

B2g—13 to 20 inches, gray (10YR 5/1) light silty clay; many, medium mottles of of reddish brown (5YR 4/4); moderate, medium and coarse, prismatic structure that parts to moderate, coarse, subangular blocky; friable; common ped faces of dark gray (10YR 4/1); neutral; clear, wavy boundary.

B3g—20 to 32 inches, gray (10YR 5/1) light silty clay; many, medium mottles of reddish brown (5YR 4/4); weak, medium and coarse, prismatic structure; firm; common ped faces of dark gray (10YR 4/1); neutral; gradual, wavy boundary.

Cg—32 to 50 inches, mixed gray (10YR 5/1) and reddish-brown (5YR 4/4) silty clay loam; massive; firm; few ped faces of dark gray (10YR 4/1); few manganese or iron concretions; neutral.

Depth to bedrock generally is more than 4 feet. The Ap horizon ranges from 12 to 16 inches in thickness. It generally is very dark grayish brown or very dark brown. The B horizon is silty clay or silty clay loam. Unlimed soils are slightly acid or neutral.

Dunning soils are near well-drained Chagrin, Chavies, and Huntington soils and moderately well drained Lindside soils. Dunning soils are less well drained than those soils, and they are more clayey in the B horizon. They are less acid than Chavies soils.

Dunning silt loam (Du).—This soil has poor surface drainage. Water stands for long periods in some areas. Included in mapping are small areas of soils that are similar to this Dunning soil, but they are slightly coarser and grayer. Also included are small areas of Lindside soils.

Artificial drainage is needed on this Dunning soil if desirable crops are to be grown. Suitable outlets, however, are lacking in some areas. If this soil is drained, it can be used for cultivated crops, hay, and pasture plants that can tolerate some wetness, but crops are subject to damage from flooding. Delaying tilling of this wet soil until it is reasonably dry and firm helps to prevent compaction and to reduce loss of tilth. Capability unit IIIw–1; woodland suitability group 2.

Ernest Series

The Ernest series consists of deep, moderately well drained soils on foot slopes in Hancock County. These soils formed in colluvial material that moved downslope, mainly from Berks and Gilpin soils on uplands (fig. 3). In places Ernest soils commonly separate the soils on flood plains from the soils on uplands. Slopes range from 3 to 15 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 10 inches thick. The subsoil, about 28 inches thick, is yellowish-brown, friable silt loam in the upper 5 inches, yellowish-brown, friable to firm silty clay loam in the next 6 inches, mottled, brown, firm silty clay loam in the next 5 inches, and mottled yellowish-brown clay loam fragipan in the next 12 inches. The underlying material, to a depth of 60 inches, is a very firm fragipan layer that is mottled light olive-brown clay loam.

These soils have a seasonal high water table. Available moisture capacity is moderate to high, and permeability is moderately slow in the fragipan. Natural fertility is moderate.

Ernest soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. Steepness of slope, moderately slow permeability, and the seasonal high water table are main concerns when planning homesites and locating roads on these soils.

Representative profile of Ernest silt loam, 8 to 15 percent slopes, in Hancock County, in a garden north of State Route No. 18, about three-fourths mile east of State Route No. 8:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; many roots; about 5 percent siltstone fragments; slightly acid (limed); abrupt, smooth boundary.

B1—10 to 15 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; some dark grayish-brown (10YR 4/2) coatings on ped faces and in root holes; about 5 percent siltstone fragments; medium acid; clear, wavy boundary.

B21t—15 to 21 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable to firm; common roots; few, discontinuous, strong-brown (7.5YR 5/6) clay films; about 5 percent siltstone fragments; strongly acid; clear, wavy boundary.

B22t—21 to 26 inches, brown (10YR 5/3) silty clay loam; common, medium mottles of gray (10YR 6/1) and strong brown (7.5YR 5/6); moderate, medium and coarse, subangular blocky structure; firm; few roots; common discontinuous clay films; few pores; few manganese concretions; about 5 percent siltstone fragments; strongly acid; clear, wavy boundary.

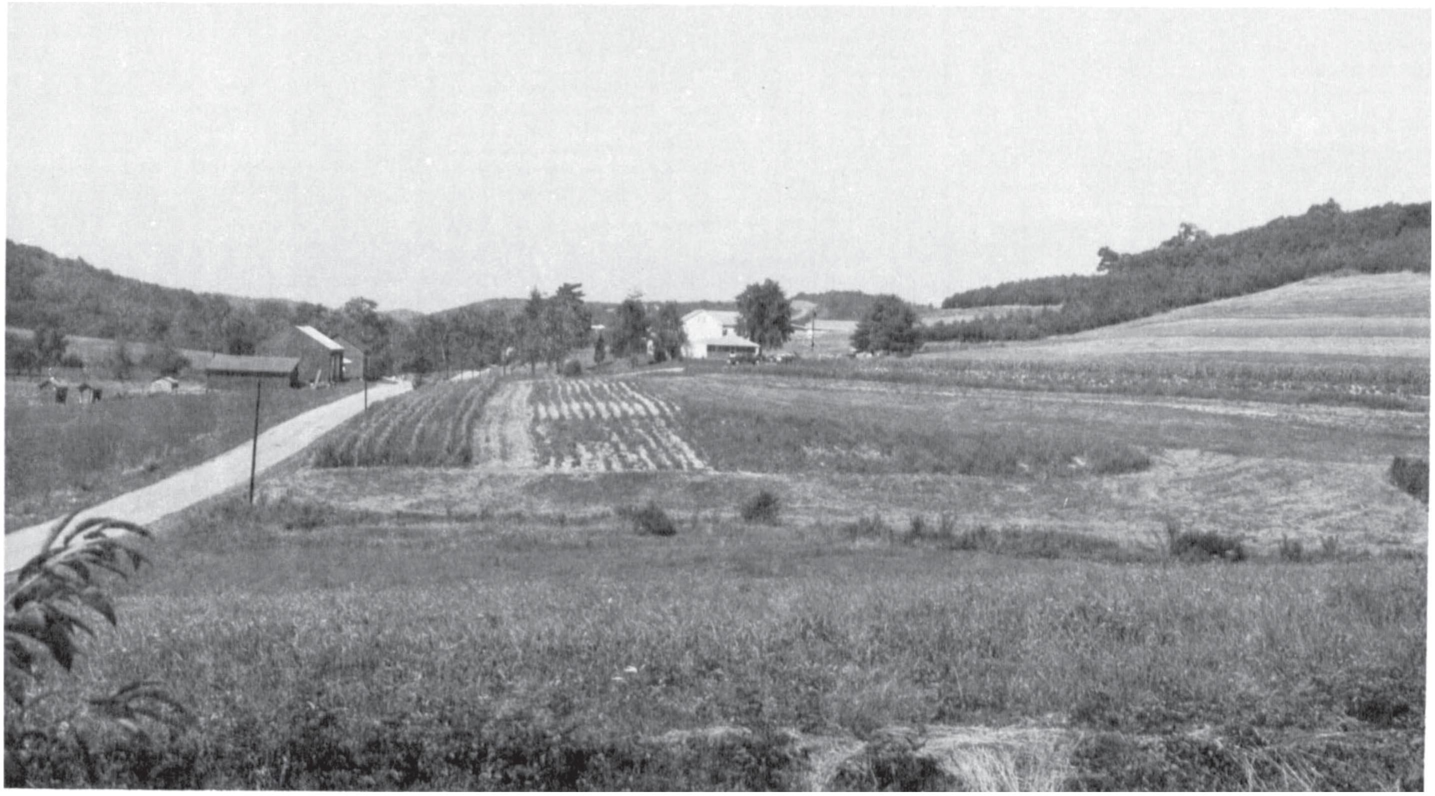

Figure 3.—A typical Ernest landscape in middle of illustration. Berks and Gilpin soils on the uplands, and soils of the Philo and Atkins series on the bottom lands to the left of the farm building.

Bx—26 to 38 inches, yellowish-brown (10YR 5/4) clay loam; common, medium mottles of strong brown (7.5YR 5/6); moderate, coarse, prismatic structure that parts to weak, coarse, subangular blocky and moderate, platy; very firm; few roots along cleavage planes; common, continuous, gray (10YR 6/1) clay films 1 to 2 millimeters thick on prism faces; common, fine manganese concretions; about 10 percent siltstone and fine grained sandstone fragments; very strongly acid; gradual, smooth boundary.

Cx—38 to 60 inches, light olive-brown (2.5Y 5/4) clay loam or silt loam; common to many, medium, strong-brown (7.5YR 5/6) mottles; very weak, coarse, prismatic structure that parts to very weak, subangular blocky and very weak, platy; very firm; few yellowish-brown (10YR 5/4) coatings; many manganese coatings and concretions; about 15 percent siltstone and fine-grained sandstone fragments; strongly acid.

Depth to bedrock generally is more than 5 feet. Depth to the fragipan ranges from 20 to 28 inches. Depth to low-chroma mottling ranges from 16 to 22 inches. The Ap horizon generally is dark grayish brown or dark brown. The B horizon is generally silty clay loam or silt loam, but in places it is clay loam in the Bx horizon. It is yellowish brown, brown, and strong brown, and the Bx horizon is also light olive brown. The content of coarse fragments generally is 5 to 10 percent, but some horizons are nearly free of coarse fragments, and others are as much as 20 percent coarse fragments. Unlimed soils are strongly acid or very strongly acid.

Ernest soils are near well-drained Berks and Gilpin soils. They are less well drained and are deeper than Berks or Gilpin soils, contain fewer coarse fragments than Berks soils, and have a fragipan layer that is not a characteristic of these associated soils.

Ernest silt loam, 3 to 8 percent slopes (ErB).—This soil generally is along alluvial fans, along drainageways, and on long foot slopes. Its fragipan generally is thicker than that in the soil described as representative for the series, and mottling generally is at a shallower depth. Seeps are common in some areas. Included in mapping are small areas of Philo soils along drainageways.

This soil is suited to cultivated crops, small grain, hay, and pasture. It generally is managed with the adjacent soils on flood plains. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe–13; woodland suitability group 1.

Ernest silt loam, 8 to 15 percent slopes (ErC).—This soil is on long foot slopes and around heads of streams. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Seeps are common in some areas. Included in mapping are small areas of Berks and Gilpin soils. Also included are a few areas that have a channery profile and a few areas of soils that are steeper than this soil.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, maintaining shallow drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Diversions are helpful in intercepting runoff from the adjacent uplands. Capability unit IIIe–13; woodland suitability group 1.

Gilpin Series

The Gilpin series consists of moderately deep, well-drained soils on uplands. These soils are mainly in Hancock County and in the northern part of Brooke County. These soils formed in material weathered from interbedded acid shale, siltstone, and sandstone. Slopes range from 3 to 30 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 5 inches thick. The subsurface layer, about 3 inches thick, is pale-brown, very friable silt loam. The subsoil extends to a depth of 23 inches. It is yellowish-brown, friable, channery silt loam in the upper part and yellowish-brown, friable to firm, channery light silty clay loam in the lower part. The underlying material is light yellowish-brown, firm, very channery loam that extends to bedrock at a depth of 32 inches.

Available moisture capacity is moderate to high in these soils, and permeability is moderate. Natural fertility is moderate to low.

Gilpin soils are suited to crops, hay, and pasture. Most areas are cleared. They are used mainly for hay and pasture, but some areas are idle or are becoming wooded. The limited depth to bedrock and steepness of slope are main concerns when planning homesites or locating roads on these soils.

Representative profile of Gilpin silt loam, 10 to 20 percent slopes, in Hancock County, in a pasture just west of State Route No. 8 and about one-half mile south of U.S. Highway 30:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; very friable; many roots; about 10 percent siltstone and fine-grained sandstone fragments; strongly acid; abrupt, wavy boundary.

A2—5 to 8 inches, pale-brown (10YR 6/3) silt loam; very weak, thin, platy structure; very friable; many roots; about 10 percent siltstone and fine-grained sandstone fragments; strongly acid; clear, wavy boundary.

B1—8 to 13 inches, yellowish-brown (10YR 5/4) channery silt loam; weak to moderate, fine, subangular blocky structure; friable; roots common; about 20 percent siltstone and fine-grained sandstone fragments; very strongly acid; clear, wavy boundary.

B2t—13 to 23 inches, yellowish-brown (10YR 5/6) channery light silty clay loam; few ped faces of yellowish brown (10YR 5/4); moderate, fine and medium, subangular blocky structure; friable to firm; few roots; few discontinuous clay films on ped faces in pores and root holes; about 20 percent siltstone and fine-grained sandstone; very strongly acid; gradual, wavy boundary.

C—23 to 32 inches, light yellowish-brown (10YR 6/4) very channery loam; massive; firm; few discontinuous clay films on stone fragments; about 75 percent siltstone and fine-grained sandstone fragments; very strongly acid; gradual, wavy boundary.

R—32 inches, soft siltstone and fine-grained sandstone.

Depth to bedrock ranges from 20 to 36 inches. The Ap horizon is brown, dark brown, or dark grayish brown. In places coarse fragments make up as much as 15 percent of the Ap horizon. The B horizon generally is light silty clay loam, but it is silt loam or heavy loam in places. The material is mostly channery. This horizon is yellowish brown, brown, or strong brown. The B horizon generally is 15 to 25 percent coarse fragments, but in places the coarse fragments make up as much as 40 percent of the lower part of the B horizon. Unlimed soils are strongly acid or very strongly acid.

Gilpin soils are near well-drained Berks, Dekalb, and Upshur, moderately shallow variant, soils and moderately well drained Ernest and Wharton soils. Also, they are near Westmoreland soils in the northern part of Brooke County. Gilpin soils are more shallow to bedrock than the Ernest, Westmoreland, and Wharton soils. They are less sandy than Dekalb soils, less clayey in the B horizon than Wharton soils, and less clayey throughout than Upshur soils. Gilpin soils contain fewer coarse fragments than the Berks or Dekalb soils. They are better drained than the Ernest and Wharton soils, and they lack the fragipan that is characteristic of Ernest soils.

Gilpin silt loam, 3 to 10 percent slopes (GlB).—This soil is on broad ridgetops. It generally is deeper than the soil described as representative for the series, and it contains fewer coarse fragments. Included in mapping are small areas of Berks, Westmoreland, and Wharton soils. Also included are areas of soils that are similar to this Gilpin soil, but they have a thin subsoil of silty clay loam.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe-10; woodland suitability group 1.

Gilpin silt loam, 10 to 20 percent slopes (GlC).—This soil generally is on broad ridgetops and on other upper parts of uplands. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Included in mapping are small areas of Berks and Westmoreland soils.

This Gilpin soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, maintaining shallow drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Diversions help to reduce soil and water losses on long slopes. Capability unit IIIe-10; woodland suitability group 1.

Gilpin silt loam, 10 to 20 percent slopes, severely eroded (GlC3).—This soil generally is on the southern and western exposures of the upper parts of uplands. Erosion has removed most of the original surface layer, and a few shallow gullies or gall spots are present in places. This soil is more eroded, is more shallow to bedrock, and contains more coarse fragments in the surface layer than the soil described as representative for the series. Included in mapping are small areas of Berks soils.

This Gilpin soil has limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is very severe in unprotected areas. Keeping tillage to a minimum, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control further erosion and to maintain fertility and good tilth. Diversions help to reduce soil and water losses on long slopes. Capability unit IVe-3; woodland suitability group 1.

Gilpin silt loam, 20 to 30 percent slopes (GlD).—This soil generally is in middle areas on uplands, above the steeper valley walls, and on narrow ridgetops. It has a thinner subsoil than the soil described as representative for the series, and it generally contains more coarse fragments. Included in mapping are small areas of Berks soils and small areas of soils that have a surface layer of channery loam and channery silt loam.

This Gilpin soil has limited suitability for cultivated crops and is better suited to hay and pasture. Steepness of slope is a severe limitation to many uses. The hazard of erosion is severe in unprotected areas. Keeping tillage to a minimum, growing crops in contour strips, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IVe-3; woodland suitability group, north aspect, 1, and south aspect, 3.

Gilpin silt loam, 20 to 30 percent slopes, severely eroded (GlD3).—This soil is of limited extent and is mainly on southern and western exposures that have been heavily cropped or overgrazed. Erosion has removed most of the original surface layer, and a few shallow gullies or gall spots are present in places. This soil has a thinner subsoil than the soil described as representative for the series, and it generally contains more coarse fragments throughout. Included in mapping are small areas of Berks soils and small areas of soils that have a channery surface layer.

This Gilpin soil is not suited to cultivated crops, but it can be used for pasture. The hazard of erosion is very severe in unprotected areas. Good pasture management, such as rotational grazing, mowing, and proper stocking rates, is needed to help reduce soil and water losses and to maintain or improve fertility. Capability unit VIe-31; woodland suitability group, north aspect, 1, and south aspect, 3.

Guernsey Series

The Guernsey series consists of deep, moderately well drained soils on uplands. These soils are mainly in Brooke and Ohio Counties. They formed in material weathered from interbedded limestone, limy shale and acid shale, siltstone, and sandstone. Slopes range from 3 to 30 percent.

In a representative profile the surface layer is dark-brown silt loam about 7 inches thick. The subsurface layer, about 5 inches thick, is brown, friable silt loam. The subsoil extends to a depth of 34 inches. It is strong-brown, friable to firm silty clay loam in the upper part; mottled, strong-brown, firm, light silty clay in the middle part; and mottled, strong-brown, very firm silty clay in the lower part. The underlying material extends to a depth of 60 inches or more. It is mixed light brownish-gray, yellowish-brown, and strong-brown, very firm silty clay in the upper part and mixed light brownish-gray, dark grayish-brown, and reddish-brown, firm silty clay loam in the lower part.

These soils have a seasonal high water table. Available moisture capacity is high, and permeability is moderately slow or slow in the subsoil. Natural fertility is high.

Guernsey soils are suited to crops, hay, and pasture. Most areas are cleared. They are used mainly for hay and pasture. Steepness of slope, low to moderate shrink-swell potential, seasonal high water table, and moderately slow or slow permeability are the main concerns when planning homesites or locating roads on these soils. The hazard of slipping is a concern in moderately steep areas.

Representative profile of Guernsey silt loam, 10 to 20 percent slopes, about 1½ miles south of West Liberty, Ohio County, along State Route No. 88:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable; many roots; few sandstone fragments; strongly acid; clear, smooth boundary.

A2 or B1—7 to 12 inches, brown (10YR 5/3) silt loam; weak, fine, subangular blocky structure; friable; many roots; few dark-brown (10YR 4/3) coatings on ped faces and in root holes; few sandstone fragments; medium acid; abrupt, wavy boundary.

B21t—12 to 21 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable to firm; common roots; common discontinuous clay films on ped faces; strongly acid; clear, wavy boundary.

B22t—21 to 28 inches, strong-brown (7.5YR 5/6) light silty clay; common, medium mottles of light brownish gray (2.5Y 6/2) and yellowish red (5YR 5/6); moderate, coarse, subangular blocky structure arranged in weak prisms; firm; few roots; common continuous clay films on ped faces; strongly acid; clear, wavy boundary.

B3t—28 to 34 inches, strong-brown (7.5YR 5/6) silty clay; many coarse mottles of light brownish gray (2.5Y 6/2) and yellowish red (5YR 5/6); weak, medium, subangular blocky structure; very firm; few roots; common discontinuous clay films on ped faces; medium acid; gradual, wavy boundary.

C1—34 to 44 inches, mixed light brownish-gray (5Y 6/2), yellowish-brown (10YR 5/4), and strong-brown (7.5YR 5/6) silty clay; massive; very firm; medium acid; gradual, wavy boundary.

C2—44 to 60 inches, mottled, light brownish-gray (2.5Y 6/2), dark grayish-brown (2.5Y 4/2), and reddish-brown (5YR 4/4) silty clay loam; massive; firm; some fragments of coal; common, fine, weathered, soft shale and siltstone, which crush easily between fingers; slightly acid.

Depth to bedrock ranges from 40 to 72 inches. Depth to low-chroma mottling ranges from 15 to 24 inches. The Ap horizon is dark brown, brown, or dark grayish brown. The B horizon is silty clay loam or silty clay. It is brown, yellowish brown, dark yellowish brown, or strong brown. Unlimed soils generally are strongly acid in the upper part of the profile and medium acid or slightly acid in the lower part.

Guernsey soils are near well-drained Brooke and Westmoreland soils. They are deeper and more acid than Brooke soils, generally have a more clayey B horizon than the Westmoreland and Clarksburg soils, and lack the fragipan characteristic of Clarksburg soils.

Guernsey silt loam, 3 to 10 percent slopes (GuB).—This soil generally is on broad ridgetops and saddles. It is slightly deeper and is mottled nearer the surface than the soil described as representative for the series. Seeps are in some areas. Included in mapping are small areas of similar soils that formed in acid material. They have a slightly coarser subsoil than this soil.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe-14; woodland suitability group 1.

Guernsey silt loam, 10 to 20 percent slopes (GuC).—This soil generally is on benches and in coves. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Seeps are in some areas. Included in mapping are small areas of Westmoreland and Clarksburg soils and a few areas that are severely eroded. Also included are small areas of soils that formed in acid material. These soils are similar to this Guernsey soil, but they are slightly coarser textured.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. In places diversions help to reduce soil and water losses on long slopes. Capability unit IIIe-14; woodland suitability group 1.

Guernsey silt loam, 20 to 30 percent slopes (GuD).—This soil generally is on narrow bands around hillsides. It is more shallow to bedrock than the soil described as representative for the series. Seeps are in some areas. Included in mapping are small areas of Westmoreland soils and some soils that contain coal fragments in the lower part of the subsoil.

This Guernsey soil has limited suitability for cultivated crops and is better suited to hay and pasture. Steepness of slope is a severe limitation to most uses. The hazard of erosion is severe in unprotected areas. Keeping tillage to a minimum, growing crops in contour strips, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. In places diversions help to reduce soil and water losses on long slopes. Capability unit IVe-9; woodland suitability group 1.

Guernsey silt loam, 20 to 30 percent slopes, severely eroded (GuD3).—This soil generally is in narrow bands around hillsides. Erosion has removed most of the original surface layer and a few shallow gullies or gall spots are in some areas. This soil is more shallow to bedrock and more eroded than the soil described as representative for the series. Included in mapping are small areas of Westmoreland soils, some soils with coal fragments in the lower part of the subsoil, and some very severely eroded soils.

This Guernsey soil is not suited to cultivated crops, but it can be used for pasture. The hazard of erosion is very severe in unprotected areas. Good pasture management that includes rotational grazing, mowing, and proper stocking rates is needed to help reduce soil and water losses and to maintain and to improve fertility. Capability unit VIe-1; woodland suitability group 1.

Huntington Series

The Huntington series consists of deep, well-drained soils on flood plains. They formed in alluvial material washed from lime-influenced soils on uplands. Slopes range from 0 to 5 percent.

In a representative profile the surface layer is very dark grayish-brown silt loam about 12 inches thick. The subsoil extends to a depth of 42 inches. It is dark grayish-brown, friable silt loam in the upper part and brown, friable silt loam in the lower part. The underlying material, to a depth of 54 inches or more, is stratified silt and fine sand.

These soils are subject to flooding. Available moisture capacity is high, and permeability is moderate. Natural fertility is high.

Huntington soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for crops and hay. The hazard of flooding is the main concern when planning homesites or locating roads on these soils.

Representative profile of Huntington silt loam, about 1½ miles east of Bethany, Brooke County, in a crop field south of Buffalo Creek:

Ap—0 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; very friable; many roots; medium acid; abrupt, smooth boundary.

B2—12 to 24 inches, dark grayish-brown (10YR 4/2) silt loam; very dark grayish-brown (10YR 3/2) ped faces; weak, coarse, prismatic structure; friable; many roots; medium acid; clear, wavy boundary.

B3—24 to 42 inches, brown (10YR 5/3) silt loam; very dark grayish-brown (10YR 3/2) ped faces; weak, coarse, prismatic structure; friable; few roots; slightly acid; gradual, wavy boundary.

C—42 to 54 inches, stratified silt and fine sand.

Depth to bedrock generally is more than 4 feet. The Ap horizon is very dark grayish brown or dark brown. The B horizon is silt loam or light silty clay loam. It is dark grayish brown, dark brown, or dark yellowish brown. Unlimed soils generally are slightly acid, but they range from neutral in reaction to medium acid.

Huntington soils are near well-drained Chagrin and Chavies soils, moderately well drained Lindside soils, and poorly drained Dunning soils. They are less sandy than the Chagrin and Chavies soils, are less acid than Chavies soils, are better drained than the Dunning and Lindside soils, and are less clayey in the B horizon than Dunning soils.

Huntington silt loam (Hu).—This soil is subject to flooding, and some low areas flood every year in places. Included in mapping are small areas of Chagrin soils and small areas of Lindside soils in small depressions. Where this soil is on higher, rarely flooded bottom lands, small areas of soils that have a moderately developed silty profile are also included.

This Huntington soil is suited to cultivated crops, small grain, hay, and pasture. It can be cropped continuously, if the areas are protected by a cover crop. Working the residue from the cover crop into the soil is a practice that helps to improve fertility and tilth. In places crops are subject to damage from flooding. Capability unit IIw-6; woodland suitability group 1.

Lakin Series

The Lakin series consists of deep, excessively drained soils on terraces along the Ohio River mostly in Hancock County. They formed in deep, alluvial and windblown material and are underlain by sand and gravel. Slopes range from 3 to 20 percent.

In a representative profile the surface layer is dark grayish-brown loamy sand about 9 inches thick. The next layer, about 15 inches thick, is dark-brown, friable loamy sand that contains bands and lumps of reddish-brown material. The upper part of the underlying material is yellowish-brown, loose sand that has some evidence of banding. The lower part is brown, friable loamy sand, which extends to sand and gravel at a depth of 50 inches.

Available moisture capacity is low in these soils, and permeability is rapid. Natural fertility is moderate.

Lakin soils are suited to crops, hay, and pasture. Most areas are cleared and are in crops or are idle. These droughty soils need special management to reduce water losses and to maintain fertility and good tilth. Rapid permeability, low available moisture capacity, and a coarse texture are the main concerns when planning homesites or locating roads on these soils. If these soils are used for septic tank filter fields, contamination of nearby wells is a hazard.

Representative profile of Lakin loamy sand, 3 to 10 percent slopes, in Hancock County, about 500 feet west of State Route No. 2 and one-half mile south of Dry Run:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loamy sand; weak, fine, granular structure; very friable; many roots; strongly acid; abrupt, smooth boundary.

C&B—9 to 24 inches, dark-brown (7.5YR 4/4) loamy sand; weak, fine, granular structure; friable in places, very friable when removed; few roots, few reddish-brown (5YR 4/4) bands and lumps, which are slightly higher in clay than the matrix; strongly acid; clear, wavy boundary.

C1—24 to 43 inches, yellowish-brown (10YR 5/4) sand; single grain; loose; some weak evidence of banding; strongly acid; clear, wavy boundary.

C2—43 to 50 inches, brown (7.5YR 4/4) loamy sand that parts to sandy loam with depth; massive; friable; strongly acid; clear, wavy boundary.

IIC3—50 to 56 inches, sand and gravel; medium acid.

Depth to bedrock is more than 6 feet. Depth to gravel generally is more than 4 feet. The C&B horizon is loamy sand or sand. It generally is dark brown, brown, or yellowish brown. Unlimed soils are strongly acid or very strongly acid.

Lakin soils are the only soils mapped on young terraces along the Ohio River.

Lakin loamy sand, 3 to 10 percent slopes (LaB).—This soil has the profile described as representative for the series. Included in mapping are small areas of soils that have a silt loam and gravelly sandy loam profile.

This soil is suited to cultivated crops, small grain, hay, and pasture. In places the growth of crops and short-rooted grasses and legumes, however, is hindered by a lack of water during periods of low rainfall. If this soil is cropped, cultivating on the contour, growing cover crops, using a sequence that includes hay crops, and returning crop residue and cover crops to the soil are practices that help to reduce soil and water losses and to maintain fertility, good tilth, and available moisture capacity. Capability unit IIIs–1; woodland suitability group 4.

Lakin loamy sand, 10 to 20 percent slopes (LaC).—This soil generally is in dunelike areas and on slopes adjacent to uplands. Gravel, where present, generally is at a greater depth than that in the soil described as representative for the series. Included in mapping are small areas of soils that have a silt loam and gravelly sandy loam profile. Also included are some soils that are steeper than this soil.

This soil has limited suitability for cultivated crops, and is better suited to hay and pasture. The growth of cultivated crops and shallow-rooted grasses and legumes is hindered by a lack of water during periods of low rainfall. Keeping tillage to a minimum, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to reduce soil and water losses and to improve or maintain available moisture capacity. Capability unit IVs–1; woodland suitability group 4.

Lindside Series

The Lindside series consists of deep, moderately well drained soils on flood plains. These soils generally are along streams in Brooke and Ohio Counties and along the Ohio River and Kings Creek in Hancock County. They formed in alluvial material washed from lime-influenced soils on uplands. Slopes range from 0 to 3 percent.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil extends to a depth of 44 inches. It is brown, friable silt loam in the upper part and mottled, yellowish-brown, friable light silty clay loam in the lower part. The underlying material, to a depth of 50 inches or more, is mottled, dark-brown, friable silt loam.

These soils have a seasonal high water table and are subject to flooding. Available moisture capacity is high, and permeability is moderately slow in the subsoil. Natural fertility is high.

Lindside soils are suited to crops, hay, and pasture. Most areas are cleared and are used for crops and hay. The hazard of flooding and the seasonal high water table are main concerns when planning homesites and locating roads on these soils.

Representative profile of Lindside silt loam, about one-half mile east of Bethany, Brooke County, in a brushy pasture along Buffalo Creek:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B2—8 to 18 inches, brown (10YR 5/3) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; medium acid; clear, wavy boundary.

B3—18 to 44 inches, yellowish-brown (10YR 5/4) light silty clay loam; many, medium mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6); weak, coarse, prismatic structure that parts to medium and coarse, subangular blocky; friable; few roots; few coatings of light gray (10YR 6/1) along prism faces; few manganese coatings; slightly acid; gradual, wavy boundary.

C—44 to 50 inches, dark-brown (10YR 4/3) silt loam; few, coarse, light brownish-gray (10YR 6/2) mottles and streaks; friable; massive; slightly acid.

Depth to bedrock generally is more than 4 feet. Depth to low-chroma mottling ranges from 14 to 20 inches. The Ap horizon generally is dark brown or dark grayish brown. The B horizon is silt loam or light silty clay loam. It is dark brown, brown, yellowish brown, or dark yellowish brown. Unlimed soils generally are medium acid or slightly acid in the B horizon, but in places the lower part of the B horizon is neutral.

Lindside soils are near well-drained Chagrin, Chavies, and Huntington soils and poorly drained Dunning soils. They are less well drained than the Chagrin, Chavies, and Huntington soils, are less sandy than the Chagrin and Chavies soils, and are less acid than Chavies soils. They are less clayey in the B horizon and are better drained than Dunning soils.

Lindside silt loam (Ld).—This nearly level soil has a seasonal high water table and is subject to flooding. Included in mapping are small areas of Dunning and Huntington soils and small areas that have a fine sandy loam surface layer. Also included are small areas that have a gravelly subsoil and small areas that have a darker colored surface layer and a finer textured profile than this soil.

This soil is suited to cultivated crops, small grain, hay, and pasture. In places small wet areas, however, need artificial drainage if desirable crops are to be grown. This soil can be cropped continuously, but it needs the protection of a cover crop. Crops are subject to damage from flooding in places. Working the residue of cover crops into the soil is a practice that helps to improve tilth and fertility. Capability unit IIw-7; woodland suitability group 1.

Made Land

Made land (Ma) consists of ashes, other industrial wastes, and usable stockpiled materials that generally are around highly industrialized areas. Capability unit, not assigned; woodland suitability group, not assigned.

Monongahela Series

The Monongahela series consists of deep, moderately well drained soils on old high terraces. These soils are mainly along the Ohio River in Brooke and Hancock Counties and along Buffalo Creek in Brooke County. They formed in alluvial material washed from upland soils that are underlain by interbedded acid shale, siltstone, and sandstone. Slopes range from 3 to 15 percent.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is 44 inches thick. It is yellowish-brown silt loam in the upper 13 inches and mottled strong-brown silt loam in the next 16 inches. The lower 15 inches is yellowish-brown, very firm loam.

These soils have a seasonal high water table. Available moisture capacity is high, and permeability is moderately slow in the fragipan. Natural fertility is low.

Monongahela soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and crops. Steepness of slope, seasonal high water table, and moderately slow permeability are the main concerns when planning homesites or locating roads on these soils. Housing developments have replaced farms on some of this acreage.

Representative profile of Monongahela silt loam, 3 to 8 percent slopes, in Brooke County, in Highland Hills Housing Development, about 1½ miles north of Follansbee:

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure that parts to thin platy; very friable; many roots; very strongly acid; abrupt, smooth boundary.

B21t—8 to 17 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable; common roots; few discontinuous clay films on ped faces; very strongly acid; clear, wavy boundary.

B22t—17 to 21 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable to firm; few roots; common discontinuous clay films on ped faces; common, pale-brown (10YR 6/3) silt coatings; few manganese concretions and coatings; very strongly acid; clear, wavy boundary.

Bx1—21 to 37 inches, strong-brown (7.5YR 5/6) silt loam; common, medium mottles of light brownish gray (2.5Y 6/2); moderate, coarse, prismatic structure that parts to medium platy; firm; common, thick, discontinuous clay films of light brownish gray (2.5Y 6/2) along prism faces; few manganese coatings and concretions; strongly acid; gradual, wavy boundary.

Bx2—37 to 52 inches, yellowish-brown (10YR 5/4) loam; common, medium mottles of strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2); massive in places, parting to weak, coarse, prismatic structure; very firm; common, thick, discontinuous clay films of light brownish-gray (2.5Y 6/2) along prism faces; comon manganese coatings; strongly acid.

Depth to bedrock generally is more than 5 feet. Depth to the fragipan ranges from 18 to 28 inches. Depth to low-chroma mottling ranges from 18 to 24 inches. The Ap horizon generally is dark grayish brown, dark brown, or brown. The B horizon is silt loam, light silty clay loam, clay loam, or loam. It is yellowish brown, dark yellowish brown, brown, or strong brown. The profile generally is free of gravel, but where these soils occur near streams, gravel makes up as much as 20 percent of the profile. Unlimed soils are strongly acid or very strongly acid.

Monongahela soils are near Allegheny soils. They are not so well drained as Allegheny soils, which do not have a fragipan.

Monongahela silt loam, 3 to 8 percent slopes (MoB).—This soil generally is on broad terrace flats. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Seeps are in some areas. Included in mapping are small areas of Allegheny soils, small areas of somewhat poorly drained soils that have a fragipan, and areas of soils that are similar to this Monongahela soil, but they are finer textured.

This soil is suited to cultivated crops, small grain, hay, and pasture. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe-13; woodland suitability group 3.

Monongahela silt loam, 8 to 15 percent slopes (MoC).—This soil generally is on the outer edges of terraces and in areas adjacent to shallow drainageways. It has a thinner fragipan than the soil described as representative for the series, and mottling is generally at a greater depth. Seeps are in some areas. Included in mapping are small areas of Allegheny soils and small areas of soils that are steeper than this soil.

This soil is suited to cultivated crops, small grain, hay, and pasture. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, maintaining shallow drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIIe-13; woodland suitability group 3.

Philo Series

The Philo series consists of deep, moderately well drained soils on flood plains. These soils generally are on flood plains along small streams north of Kings Creek in Hancock County. They formed in alluvial material washed from acid soils on uplands. Slopes range from 0 to 3 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil extends to a depth of 27 inches. It is dark yellowish-brown, friable silt loam in the upper part and mottled, dark-brown, friable fine sandy loam in the lower part. It is underlain, to a depth of 52 inches or more, by mottled light brownish-gray, friable fine sandy loam.

These soils have a seasonal high water table and are subject to flooding. In places low areas are flooded every year. Available moisture capacity is high, and permeability is moderate to moderately slow in the subsoil. Natural fertility is moderate.

Philo soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. The hazard of flooding and the seasonal high water table are major concerns when planning homesites or locating roads on these soils.

Representative profile of Philo silt loam, in Hancock County, in an improved pasture west of State Route No. 8, about 2½ miles north of New Manchester:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; very friable; many roots; slightly acid; abrupt, wavy boundary.

B2—6 to 15 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, coarse, granular structure that parts to weak, very fine, subangular blocky; friable; common roots; medium acid; clear, wavy boundary.

B3—15 to 27 inches, dark-brown (10YR 4/3) fine sandy loam; common, fine mottles of strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2); weak, coarse, granular structure; friable; few roots; strongly acid; clear, wavy boundary.

Cg—27 to 52 inches, light brownish-gray (10YR 6/2) fine sandy loam; many coarse mottles of strong brown (7.5YR 5/6); massive; friable; thin discontinuous layers of silty material; strongly acid.

Depth to bedrock generally is more than 4 feet. Depth to low-chroma mottling ranges from 15 to 20 inches. The Ap horizon is dark grayish brown, dark brown, or very dark grayish brown. The B horizon is silt loam, loam, or fine sandy loam. It is yellowish brown, dark yellowish brown, or dark brown. Unlimed soils are strongly acid or very strongly acid.

Philo soils are near Atkins soils, but they are better drained than those soils, and they generally are more sandy in the B horizon.

Philo silt loam (Ph).—This nearly level soil has a seasonal high water table and is subject to flooding. Included in mapping are small areas of Atkins soils, small areas that have a fine sandy loam surface layer, and small areas of well-drained soils that formed in material similar to that of this Philo soil.

This soil is suited to cutlivated crops, small grain, hay, and pasture. In places, however, artificial drainage is needed in small wet areas if deisrable crops are to be grown. This soil can be cropped continuously, but it needs the protection of a cover crop. In places crops are subject to damage from flooding. Working the residue of a cover crop into the soil is a practice that helps to improve tilth and fertility. Capability unit IIw-7; woodland suitabilty group 1.

Strip Mines

Strip mines (Sm) consist of level and unlevel areas of spoil and the high wall that has resulted from surface mining. The spoil is a mixture of soil, rock, and coal fragments. It generally is medium acid. Included in mapping are small areas of Gilpin and Westmoreland soils.

Level areas of this mapping unit support good pastures if they are properly managed. They generally contain too many stones to make the growing of tilled crops practical. The unlevel areas and areas on outer slopes are more suitable for woodland than for other uses. Capability unit, not assigned; woodland suitability group, not assigned.

Upshur Series, Moderately Shallow Variant

The Upshur series, moderately shallow variant, consists of well-drained soils on uplands. These soils are widely scattered throughout Hancock County in small areas on ridgetops. They formed in material weathered from red and olive, limy clay shale. Slopes range from 3 to 15 percent.

In a representative profile the surface layer is reddish-brown silty clay loam about 5 inches thick. The subsoil extends to a depth of 26 inches. It is weak-red, firm, very sticky and very plastic clay in the upper part, and dusky-red, firm, very sticky and very plastic shaly clay in the lower part. The underlying material is dusky-red, firm, very shaly clay that extends to bedrock at a depth of 36 inches.

Available moisture capacity is moderate to high in these soils, and permeability is slow in the subsoil. Natural fertility is moderate to high.

Upshur soils, moderately shallow variant, are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. Some areas are idle or are becoming wooded. These soils are difficult to work, and they puddle if worked when too wet. Grass and legume mixtures grow well. A high shrink-swell potential, limited depth to bedrock, and slow permeability are main concerns when planning homesites or locating roads on these soils. The hazard of slipping is a concern on long slopes.

Representative profile of Upshur silty clay loam, moderately shallow variant, 3 to 8 percent slopes, in Hancock County, at the intersection of State Routes No. 3 and No. 8:

Ap—0 to 5 inches, reddish-brown (5YR 5/3) silty clay loam; strong, medium, granular structure; friable; many roots; strongly acid; abrupt, wavy boundary.

B21t—5 to 16 inches, weak-red (10R 4/3) clay; strong; fine and medium, angular blocky structure; firm, very sticky and very plastic when wet; common roots; common, continuous clay films on ped faces; strongly acid; clear, wavy boundary.

B22t—16 to 26 inches, dusky-red (10R 3/4) shaly clay; moderate, medium, subangular blocky structure, arranged in coarse prisms; firm, very sticky and very plastic when wet; few roots; common, continuous clay films on ped faces; about 20 percent very fine, weathered red shale; strongly acid; gradual, wavy boundary.

C—26 to 36 inches, dusky-red (10R 3/3) very shaly clay; massive; firm, very sticky and very plastic when wet; 75 percent dusky-red (10R 3/3) and olive-brown (2.5Y 4/4) weathered shale; few limy nodules; neutral; gradual, wavy boundary.

R—36 inches, dusky-red (10R 3/3) and olive-brown (2.5Y 4/4) shale.

Depth to bedrock ranges from 2 to 4 feet. The Ap horizon is silty clay loam or silty clay and generally is reddish brown or dark reddish brown. The B horizon is clay or silty clay. It is weak red, dusky red, reddish brown, or dark reddish brown. Unlimed soils are strongly acid or medium acid in the B horizon and slightly acid or neutral in the underlying material.

Upshur, moderately shallow variant, soils are near well-drained Berks and Gilpin soils. They are less acid and are more clayey than Berks or Gilpin soils.

Upshur silty clay loam, moderately shallow variant, 3 to 8 percent slopes (UpB).—This soil generally is on broad ridgetops and knolls. It has the profile described as representative for the series. Included in mapping are small areas of Berks and Gilpin soils, and some areas that are severely eroded.

This Upshur soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIIe-30; woodland suitability group 3.

Upshur silty clay, moderately shallow variant, 8 to 15 percent slopes, severely eroded (UsC3).—This soil generally is in narrow bands around knobs and on benches. Erosion has removed most of the orignal surface layer, and a few shallow gullies or gall spots are present in places. This soil is more eroded and generally is more shallow to bedrock than the soil described as representative for the series. Included in mapping are small areas of Berks and Gilpin soils and small areas of soils that are steeper than this soil.

This Upshur soil has limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is very severe in unprotected areas. Keeping tillage to a minimum, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IVe-30; woodland suitability group 3.

Westmoreland Series

The Westmoreland series consists of deep, well-drained soils on uplands. These soils generally are on ridgetops and hillsides throughout Brooke and Ohio Counties. They formed in material weathered from interbedded limy shale, acid shale, siltstone, and sandstone, and thin beds of limestone. Slopes range from 3 to 55 percent.

In a representative profile the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of 28 inches. It is brown, friable silt loam in the upper part; brown, friable to firm silty clay loam in the middle part; and yellowish-brown, firm, channery silty clay loam in the lower part. The underlying material is yellowish-brown, friable, very channery silty clay loam that extends to bedrock at a depth of 44 inches.

Available moisture capacity is moderate to high in these soils, and permeability is moderate in the subsoil. Natural fertility is moderate to high.

The less sloping Westmoreland soils are suited to crops, hay, and pasture. Most areas are cleared and are used mainly for hay and pasture. Row crops, however, are grown in alternating strips with hay in many areas. Limited depth to bedrock and steepness of slope are main concerns when planning homesites or locating roads on these soils. The hazard of slipping is a concern on soils that are moderately steep, steep, and very steep.

Representative profile of Westmoreland silt loam, 20 to 30 percent slopes, in Brooke County along an abandoned farm lane leading off a gravel road about 1½ miles northeast of State Route No. 88 and Ohio County line:

Ap—0 to 6 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; very friable; many roots; about 10 percent small stone fragments; medium acid; abrupt, smooth boundary.

B1—6 to 9 inches, brown (7.5YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; common roots; about 10 percent siltstone and sandstone fragments; medium acid; clear, wavy boundary.

B21t—9 to 20 inches, brown (7.5YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; friable to firm; slightly sticky and plastic when wet; few roots; common, discontinuous clay films on ped faces and in pores; about 15 percent siltstone and sandstone fragments; medium acid; clear, wavy boundary.

B22t—20 to 28 inches, yellowish-brown (10YR 5/6) channery silty clay loam; weak to moderate, medium, subangular blocky structure; firm; slightly sticky and plastic when wet; few roots; common discontinuous clay films on ped faces and in pores; about 20 percent siltstone and sandstone fragments; medium acid; clear, wavy boundary.

C—28 to 44 inches, yellowish-brown (10YR 5/4) very channery silty clay loam; massive; friable; about 75 percent shale, siltstone and sandstone fragments; medium acid; gradual, wavy boundary.

R—44 inches, shale and siltstone.

Depth to bedrock ranges from 40 to 52 inches. The Ap horizon is brown, dark brown, grayish brown or dark grayish brown. Coarse fragments in the Ap horizon range from 5 to 15 percent. In the southern two-thirds of Ohio County, the Ap horizon contains more coarse fragments than that in other parts of the survey area. The B horizon is silty clay loam, silt loam or heavy loam and is commonly yellowish brown, strong brown, or brown. In places coarse fragments make up as much as 35 percent in parts of the B horizon. Most unlimed soils are medium acid, but they range from strongly acid in the upper part of the profile to slightly acid in the lower part. Less acid soils are in Brooke County and in the northern part of Ohio County, where they are closely associated with Brooke soils.

Westmoreland soils are near well-drained Brooke, Brookside, and Gilpin soils and moderately well drained Clarksburg and Guernsey soils. They are deeper than Brooke and Gilpin soils, are less clayey than Brooke soils, generally are less clayey in the B horizon than Brookside or Guernsey soils, are better drained than Clarksburg or Guernsey soils, and lack the fragipan characteristic of Clarksburg soils.

Westmoreland silt loam, 3 to 10 percent slopes (WeB).—This soil generally is along the crests of broad ridgetops. Its subsoil generally is thicker than that of the soil described as representative for the series. Included in mapping are small areas of Brooke, Guernsey, and Upshur soils and small areas of soils that have a heavy silty clay loam or light silty clay subsoil.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe-11; woodland suitability group 1.

Westmoreland silt loam, 10 to 20 percent slopes (WeC).—This soil generally is on benches and broad ridgetops. Its subsoil is slightly thicker than that of the soil described as representative for the series. Seeps are in some areas. Included in mapping are small areas of Brooke and Upshur soils and small areas of Guernsey soils, especially in coves. Also included are small areas of soils that have a heavy silty clay loam or light silty clay subsoil.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips (fig. 4), using a sequence that includes hay crops, maintaining shallow drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. In places diversions help to reduce soil and water losses on long slopes. Capability unit IIIe-11; woodland suitability group 1.

Westmoreland silt loam, 10 to 20 percent slopes, severely eroded (WeC3).—This soil generally is in small, widely scattered areas on ridgetops and benches. Erosion has removed most of the original surface layer, and a few shallow gullies or gall spots are present in places. This soil is more eroded, more shallow to bedrock, and generally contains more coarse fragments in the surface layer than the soil described as representative for the series. Included in mapping are small areas of Brooke and Upshur soils, mostly on ridgetops.

This soil has limited suitability for cultivated crops and is better suited to hay and pasture. The hazard of erosion is very severe in unprotected areas. Keeping tillage to a minimum, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Diversions help to reduce soil and water losses on long slopes. Capability unit IVe-11; woodland suitability group 1.

Westmoreland silt loam, 20 to 30 percent slopes (WeD).—This soil generally is on benches and ridgetops. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Included in mapping are small areas of Gilpin soils on knobs and

Figure 4.—**Stripcropping on Westmoreland silt loam, 10 to 20 percent slopes.**

Figure 5.—Permanent pasture on Westmoreland silt loam, 20 to 30 percent slopes.

breaks beneath ridgetops. Also included are small areas of Brooke soils and some soils that are severely eroded.

Because of steepness of slope, this soil has only limited suitability to cultivated crops and is better suited to hay and pasture (fig. 5). The hazard of erosion is severe in unprotected areas. Keeping tillage to a minimum, using a sequence that includes hay crops, maintaining natural drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. In places diversions help to reduce soil and water losses on long slopes. Capability unit IVe–11; woodland suitability group, north aspect, 1, and south aspect, 3.

Westmoreland silt loam, 30 to 40 percent slopes (WeE).—This soil generally is in the lower areas on uplands and on narrow ridgetops. The subsoil generally is thinner and contains more coarse fragments than that of the soil described as representative for the series. Included in mapping are small areas of Berks soil, that are mainly along valley walls and narrow ridgetops. Also included are areas of severely eroded soils that are mainly on southern and western exposures.

Because of steepness of slope, this soil is not suited to cultivated crops, but it can be used for pasture. The hazard of erosion is severe in unprotected areas. Good pasture management, such as rotational grazing, mowing, and proper stocking rates, is needed to help reduce soil and water losses and to maintain and improve fertility. Capability unit VIe–1; woodland suitabilty group, north aspect, 1, and south aspect, 3.

Westmoreland silt loam, 40 to 55 percent slopes (WeF).—This soil generally is along wooded walls of valleys. It generally is more shallow to bedrock and contains more coarse fragments in the subsoil than the soil described as representative for the series. A few rock outcrops are present in places. Included in mapping are small areas of Berks soils.

Because of steepness of slope, this Westmoreland soil is not suited to cultivated crops or hay and has only limited suitability as pasture. The hazard of erosion is severe in unprotected areas. Reducing soil and water losses and maintaining pastures on this soil are difficult. This soil is better suited to woodland than to other uses. Capability unit VIIe–1; woodland suitability group, north aspect, 1, and south aspect, 3.

Wharton Series

The Wharton series consists of deep, moderately well drained soils on uplands. These soils are in small areas on broad ridgetops and benches in Hancock County. They formed in material weathered from acid clay shale. Slopes range from 3 to 30 percent.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The next 4 inches is dark-brown, friable silt loam. The subsoil extends to a depth of 34 inches. It is a yellowish-brown, friable to firm silty clay loam in the upper part; mottled, yellowish brown, firm silty clay in the middle part; and mixed grayish-brown and strong-brown, very firm clay in the lower part. The underlying material is mixed grayish-brown and strong-brown, very firm, very shaly silty clay that extends to bedrock at a depth of 40 inches.

These soils have a seasonal high water table. Available moisture capacity is high, and permeability is moderately slow in the subsoil. Natural fertility is low to moderate.

Wharton soils are suited to crops, hay, and pasture. Most areas are cleared. They are used mainly for hay and pasture. Some areas, however, are idle and are becoming brushy. Depth to bedrock, moderately slow permeability, seasonal high water table and steepness of slope are main concerns when planning homesites or locating roads on these soils.

Representative profile of Wharton silt loam, 3 to 10 percent slopes, in Hancock County, in an idle field along State Route No. 3, about one-tenth mile east of State Route No. 8:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; many roots; strongly acid; clear, smooth boundary.

B1 or A3—7 to 11 inches, dark-brown (10YR 4/3) silt loam; weak, very fine, subangular blocky structure; friable; common roots; strongly acid; clear, wavy boundary.

B21t—11 to 18 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium, subangular blocky structure; friable to firm; common roots; few discontinuous clay films on ped faces; strongly acid; clear, wavy boundary.

B22t—18 to 26 inches, yellowish-brown (10YR 5/4) silty clay; common, medium mottles of grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6); moderate, coarse, prismatic structure that parts to coarse, subangular blocky; firm, sticky and plastic when wet; few roots; common continuous clay films along prism faces; very strongly acid; clear, wavy boundary.

B3t—26 to 34 inches, mixed grayish-brown (2.5Y 5/2) and strong-brown (7.5YR 5/6) clay; weak, coarse, prismatic structure; very firm, sticky and plastic when wet; few roots along cleavage planes; few discontinuous clay films on prism faces; very strongly acid; gradual, wavy boundary.

C—34 to 40 inches, mixed grayish-brown (2.5Y 5/2) and strong-brown (7.5YR 5/6) very shaly silty clay; massive; very firm; about 80 percent weathered shale; very strongly acid; gradual, wavy boundary.

R—40 inches, shale.

Depth to bedrock ranges from 40 to 48 inches. Depth to low-chroma mottling ranges from 15 to 24 inches. The Ap horizon is dark grayish brown, grayish brown, or dark brown. The B horizon is silty clay loam, silty clay, or clay. It generally is yellowish brown, dark yellowish brown, or strong brown, but in places it is mixed grayish brown and strong brown in the lower part. The Ap and B horizons are generally free of coarse fragments, but they are as much as 10 percent coarse fragments in some profiles. Unlimed soils are strongly acid or very strongly acid.

Wharton soils are near well-drained Berks, Dekalb, and Gilpin soils. They are deeper, less well drained, contain fewer coarse fragments, and generally are more clayey in the B horizon than the Berks, Dekalb, or Gilpin soils. They are less sandy in the Ap horizon than Dekalb soils.

Wharton silt loam, 3 to 10 percent slopes (WhB).—This soil is on broad ridgetops and flats. It has the profile described as representative for the series. Material originally in the surface layer makes up more than one-fourth of the plow layer. Seeps are common in some areas. Included in mapping are small areas of Berks, Gilpin, and Upshur soils, small areas of less sloping soils, and some soils where bedrock is at a depth of less than 40 inches.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is moderate in unprotected areas. If this soil is cropped, cultivating on the contour, using a sequence that includes hay crops, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. Capability unit IIe-13, woodland suitability group 1.

Wharton silt loam, 10 to 20 percent slopes (WhC).—This soil generally is on benches. It generally contains more coarse fragments than the soil described as representative for the series. Seeps are common in some areas. Included in mapping are small areas of the Berks and Gilpin soils and some soils where bedrock is at a depth of less than 40 inches.

This soil is suited to cultivated crops, small grain, hay, and pasture. The hazard of erosion is severe in unprotected areas. If this soil is cropped, growing crops in contour strips, using a sequence that includes hay crops, maintaining shallow drainageways in sod, and returning crop residue to the soil are practices that help to control erosion and to maintain fertility and good tilth. In places diversions help to reduce soil and water losses. Capability unit IIIe-13; woodland suitability group 1.

Use and Management of the Soils

Most of the soils in Brooke, Hancock, and Ohio Counties are on uplands. They are moderately deep or deep and mostly strongly sloping to very steep. In the northern part of the survey area, most of the soils have low to moderate available water capacity and natural fertility. In the central and southern parts of the counties, available moisture capacity and natural fertility are mostly moderate to high. All except a few of the soils need lime for good growth of crops. The soils, such as Berks and Gilpin soils, in the northern part of the survey area are more acid and less fertile and generally require more lime and more fertilizer than soils, such as Westmoreland soils, in other parts of the Area. Thus, the dominant concerns of management are controlling erosion, improving soil and moisture relationship, and increasing or maintaining fertility and good tilth. In addition, artificial drainage is needed on some of the wet soils, such as Atkins and Dunning soils. For a detailed discussion of use and management of the soils for cropland and pasture, refer to the descriptions of the mapping units in the section "Descriptions of the Soils."

The first part of this section explains how soils are grouped according to their capability and describes briefly the capability units recognized in Brooke, Hancock, and Ohio Counties. Then, estimated acre yields are given for the principal crops under two levels of management. Next, there are discussions of use of the soils as woodland, for wildlife habitat, and in engineering works. Finally, information is given about the use of the soils in town and country planning.

Capability Grouping

Some readers, particularly those who practice large-scale farming, may find it practical to use and manage alike some of the different kinds of soils on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, how suitable soils are for most kinds of farming. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to crops that require special management.

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

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. These levels are discussed in the following paragraphs.

CAPABILITY CLASSES are the broadest grouping and are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, so shallow, or otherwise so limited that they do not produce worthwhile yields of crops, forage, or wood products.

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

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

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example IIe-4 or IIIe-10. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Following is a descriptive outline of the system as recognized in Brooke, Hancock, and Ohio Counties:

Class 1. Soils that have few limitations that restrict their use. (None in Brooke, Hancock, and Ohio Counties.

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

- Subclass IIe: Gently sloping soils that have moderate risk of erosion and that require protection if cultivated.
  - Unit IIe-4.—Deep, well-drained, gently sloping, acid soils on old stream terraces.
  - Unit IIe-10.—Moderately deep, well-drained, gently sloping soils that formed in materials weathered from acid sandstone, interbedded acid shale, siltstone, and sandstone.
  - Unit IIe-11.—Deep, well-drained, gently sloping soils that formed in materials weathered from interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone.
  - Unit IIe-13.—Deep, moderately well drained, gently sloping, acid soils that have a fragipan or clayey layer in their subsoil.
  - Unit IIe-14.—Deep, moderately well drained, gently sloping, lime-influenced soils that have a fragipan or clayey layer in their subsoil.
- Subclass IIw: Soils that have slightly impeded drainage that makes them seasonally wet or are subject to flooding, restricting their use for some crops.
  - Unit IIw-6.—Deep, well-drained soils on flood plains that are occasionally to frequently flooded.
  - Unit IIw-7.—Deep, moderately well drained soils on flood plains that are occasionally to frequently flooded.
- Subclass IIs: Soils that are slightly droughty, which restricts their use for some shallow-rooted crops.
  - Unit IIs-6.—Deep, well-drained, moderately coarse textured and medium-textured soils on flood plains that are infrequently flooded.

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

- Subclass IIIe: Strongly sloping soils that erode easily if not protected.
  - Unit IIIe-4.—Deep, well-drained, strongly sloping, acid soils on old stream terraces.
  - Unit IIIe-10.—Moderately deep, well-drained, strongly sloping soils that formed in materials weathered from acid sandstone, interbedded acid shale, siltstone, and sandstone.
  - Unit IIIe-11.—Deep, well-drained, strongly sloping soils that formed in materials weathered from interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone.
  - Unit IIIe-13.—Deep, moderately well drained, strongly sloping, acid soils that have a fragipan or clayey layer in their subsoil.
  - Unit IIIe-14.—Deep, moderately well drained, strongly sloping, lime-influenced soils that have a fragipan or clayey layer in their subsoil.
  - Unit IIIe-30.—Moderately deep, well-drained, gently sloping, clayey soils that formed in

materials weathered from limy shale or limy shale and limestone.

Unit IIIe–32.—Moderately deep, well-drained, gently sloping, shaly soils that formed in materials weathered from interbedded acid shale, siltstone, and sandstone.

Subclass IIIw: Soils seriously limited by excess water.

Unit IIIw–1.—Deep, poorly drained, nearly level soils on flood plains that are occasionally to frequently flooded.

Subclass IIIs: Soils severely limited by droughtiness.

Unit IIIs–1.—Deep, excessively drained, gently sloping, coarse-textured, acid soils on terraces underlain by gravel.

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

Subclass IVe: Strongly sloping and moderately steep soils that are subject to severe erosion if not protected or that are severely eroded.

Unit IVe–1.—Deep, well-drained, moderately steep soils that formed in colluvium from lime-influenced soils on uplands.

Unit IVe–3.—Moderately deep, well-drained, strongly sloping and moderately steep soils that formed in materials weathered from acid sandstone, interbedded acid shale, siltstone, and sandstone.

Unit IVe–9.—Deep, moderately well drained, moderately steep soils that have a fragipan or clayey layer in their subsoil.

Unit IVe–11.—Deep, well-drained, strongly sloping and moderately steep soils that formed in materials weathered from interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone.

Unit IVe–30.—Moderately deep, well-drained, strongly sloping, clayey soils that formed in materials weathered from limy shale or limy shale and limestone.

Unit IVe–32.—Moderately deep, well-drained, strongly sloping, shaly soils that formed in materials weathered from interbedded acid shale, siltstone, and sandstone.

Subclass IVs: Soils very severely limited by droughtiness.

Unit IVs–1.—Deep, excessively drained, strongly sloping, coarse-textured, acid soils that are underlain by gravel; on terraces.

Class V. Soils that are not likely to erode, but they have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover. (None in Brooke, Hancock, and Ohio Counties.)

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

Subclass VIe: Soils that have a severe hazard of erosion if not protected, or that are severely eroded.

Unit VIe–1.—Deep and moderately deep, well-drained and moderately well drained, moderately steep and steep soils that formed in materials weathered from limy shale and limestone, interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone.

Unit VIe–31.—Moderately deep, well-drained, strongly sloping and moderately steep soils that formed in materials weathered from interbedded acid shale, siltstone, and sandstone.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation, without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife habitat.

Subclass VIIe: Soils subject to severe erosion if not protected, or that are severely eroded.

Unit VIIe–1.—Deep, well-drained, very steep soils that formed in materials weathered from interbedded limy shale, acid shale, siltstone, and sandstone and thin beds of limestone.

Unit VIIe–2.—Moderately deep, well-drained, moderately steep to very steep, shaly soils that formed in materials weathered from interbedded acid shale, siltstone, and sandstone.

Class VIII. Soils and landforms that are unsuitable for the commercial production of crops, for pasture, or for woods. These soils have value for use as wildlife habitat and recreational areas. (None in Brooke, Hancock, and Ohio Counties.)

Estimated yields

The estimated average yields for the principal grain and forage crops and for permanent pasture grown on the soils of Brooke, Hancock, and Ohio Counties are shown in table 2. Yields are based on an average 10-year period for two levels of management and are shown in columns A and B. Yields in any given year may be higher or lower than the average estimates because of weather conditions.

Yields in column A are about what the average farmer obtains for a 10-year period with commonly used practices. Normally, not enough fertilizer and lime is used to get maximum production, adequate drainage is not provided in places, and pastures do not receive adequate attention in places. Where available, known crop yields obtained from farmers or others were used to estimate yields of columns A. Where information was lacking, present yields were estimated, and the properties of the soils were considered. Yields obtained from recent agricultural census reports for Brooke, Hancock, and Ohio Counties were also considered.

Estimated yields listed in columns B are those that can be expected over a 10-year period in which the best available fertilizer and the best management practices are used. They are not the maximum possible yields. Larger applications of fertilizer and more intensive management are likely to result in higher yields than those shown. Also, new techniques in the future are likely to result in higher yields than those shown, but the relative response of the different soils is not likely to change much. Estimated yields provided in columns B were based on results of corn and alfalfa trials made by the West Virginia University Agricultural Experiment Station and on actual experiences of farmers using the best management.

The management needed to obtain yields shown in col-

TABLE 2.—*Estimated average acre yields of principal crops*

[Yields in columns A are those expected under ordinary management; those in columns B, under improved management. Absence of yield indicates crop is not well suited to the soil at the specified level of management. Soils that are severely limited by steepness, stoniness, or very severe erosion are considered not suitable for crops and do not appear in the table]

Soil	Corn		Oats		Clover-grass (hay)		Alfalfa-grass (hay)		Permanent pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Allegheny silt loam, 3 to 8 percent slopes	70	115	45	75	2.0	3.2	2.5	4.2	80	155
Allegheny silt loam, 8 to 15 percent slopes	60	105	42	70	1.7	3.0	2.2	4.0	75	140
Atkins silt loam	----	100	30	55	----	2.7	----	----	65	122
Berks shaly silt loam, 3 to 10 percent slopes	45	75	37	60	1.2	2.7	1.5	3.2	50	100
Berks shaly silt loam, 10 to 20 percent slopes	40	70	35	57	1.2	2.5	1.5	3.0	45	110
Berks shaly silt loam, 10 to 20 percent slopes, severely eroded	----	----	----	----	----	----	----	----	35	90
Berks shaly silt loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	35	90
Brooke silty clay loam, 3 to 10 percent slopes	55	90	40	62	2.0	3.0	2.0	3.7	80	135
Brooke silty clay loam, 10 to 20 percent slopes	50	85	37	60	2.0	3.0	2.5	3.7	75	135
Brooke silty clay loam, 20 to 30 percent slopes	----	----	----	----	----	----	----	----	70	125
Brookside silt loam, 15 to 25 percent slopes	45	80	40	60	1.7	3.0	2.2	4.0	70	145
Chagrin fine sandy loam	80	125	47	75	2.0	3.2	2.5	4.2	100	150
Chavies fine sandy loam	75	120	45	70	2.2	3.2	2.5	4.5	85	160
Clarksburg silt loam, 3 to 8 percent slopes	60	100	45	70	2.0	3.2	2.2	3.5	85	140
Clarksburg silt loam, 8 to 15 percent slopes	55	90	42	65	2.0	3.0	2.2	3.5	80	140
Clarksburg silt loam, 15 to 25 percent slopes	40	75	40	62	1.7	2.7	1.7	3.0	75	135
Dekalb channery sandy loam, 3 to 10 percent slopes	45	80	40	60	1.2	2.7	1.5	3.2	50	125
Dekalb channery sandy loam, 10 to 20 percent slopes	40	75	37	57	1.0	2.5	1.5	3.0	45	115
Dekalb channery sandy loam, 20 to 30 percent slopes	35	70	35	55	1.0	2.2	1.2	3.0	30	100
Dunning silt loam	----	105	37	60	----	3.0	----	----	70	130
Ernest silt loam, 3 to 8 percent slopes	60	95	42	65	2.0	3.0	1.7	3.2	80	140
Ernest silt loam, 8 to 15 percent slopes	55	90	40	62	1.7	3.0	1.7	3.2	75	140
Gilpin silt loam, 3 to 10 percent slopes	55	90	37	62	2.0	2.7	2.0	3.5	75	130
Gilpin silt loam, 10 to 20 percent slopes	50	85	35	60	2.0	2.7	2.0	3.5	75	130
Gilpin silt loam, 10 to 20 percent slopes, severely eroded	45	80	32	55	1.5	2.5	1.7	3.0	65	115
Gilpin silt loam, 20 to 30 percent slopes	45	80	32	55	1.5	2.5	1.0	3.0	65	115
Gilpin silt loam, 20 to 30 percent slopes, severely eroded	----	----	----	----	----	----	----	----	60	95
Guernsey silt loam, 3 to 10 percent slopes	60	105	42	65	2.2	3.2	2.2	3.7	90	160
Guernsey silt loam, 10 to 20 percent slopes	55	95	40	62	2.2	3.2	2.2	3.7	85	160
Guernsey silt loam, 20 to 30 percent slopes	50	90	37	57	2.0	3.0	2.0	3.5	80	145
Guernsey silt loam, 20 to 30 percent slopes, severely eroded	----	----	----	----	----	----	----	----	70	125
Huntington silt loam	85	130	50	80	2.5	3.5	3.0	4.5	90	160
Lakin loamy sand, 3 to 10 percent slopes	40	75	----	----	1.2	2.2	2.0	3.2	70	105
Lakin loamy sand, 10 to 20 percent slopes	35	65	----	----	1.2	2.0	2.0	3.0	70	85
Lindside silt loam	80	125	47	80	2.0	3.2	2.5	4.2	85	160
Monongahela silt loam, 3 to 8 percent slopes	55	90	40	65	1.5	2.7	2.0	3.2	60	130
Monongahela silt loam, 8 to 15 percent slopes	50	85	37	62	1.2	2.7	2.0	3.2	60	130
Philo silt loam	70	120	40	75	1.7	3.2	2.5	4.0	80	150
Upshur silty clay loam, moderately shallow variant, 3 to 8 percent slopes	50	90	37	65	1.5	2.7	2.0	3.7	80	135
Upshur silty clay, moderately shallow variant, 8 to 15 percent slopes, severely eroded	40	75	----	----	1.2	2.5	1.7	3.5	70	120
Westmoreland silt loam, 3 to 10 percent slopes	60	95	40	67	2.0	3.0	2.2	3.7	95	135
Westmoreland silt loam, 10 to 20 percent slopes	55	90	37	65	1.7	3.0	2.2	3.7	95	135
Westmoreland silt loam, 10 to 20 percent slopes, severely eroded	50	80	35	62	1.5	2.7	2.0	3.5	85	120
Westmoreland silt loam, 20 to 30 percent slopes	50	80	35	62	1.5	2.7	2.0	3.5	85	120
Westmoreland silt loam, 30 to 40 percent slopes	----	----	----	----	----	----	----	----	75	105
Wharton silt loam, 3 to 10 percent slopes	50	85	37	62	2.0	3.0	2.0	3.5	90	130
Wharton silt loam, 10 to 20 percent slopes	45	80	35	60	2.0	3.0	2.0	3.5	90	130

[1] The number of days a year 1 cow, horse, or steer, or 7 sheep can graze an acre without injury to pasture.

umns B includes liming to the pH required for the crop, fertilizing according to need as determined by soil tests, using good rotations, and using necessary soil and water conservation practices, including drainage where needed.

Comparisons of yields shown in columns B with those shown in columns A indicate the approximate response to be expected under good management. Crops on deep, well-drained soils that have good moisture-holding capacity generally make the best response. Fairly high yields are indicated in columns A for some soils that have high natural fertility, but relatively little increase in yield is indicated for these soils in columns B because of limitations imposed by heavy texture, slow permeability, and shallowness. The increase in yields under improved management is commonly greater for pasture than for cultivated crops because cultivated crops generally receive more lime and fertilizer and better management practices than pasture.

Use of the Soils as Woodland [2]

Woodland occupies about 93,000 acres, or about one-half of the acreage of the survey area (*4*). Practically all of these wooded areas are privately owned and are in relatively small tracts. About 90 percent of the woodland is made up of oaks, maple, beech, cherry, elm, and other hardwoods. The remaining 10 percent consists of Virginia pine, shortleaf pine, and white pine. Although most of the woodland consists of productive soils, much of the tree cover is made up of poor-quality trees and of species that have low value for wood crops.

The use of this woodland for the production of wood crops has become less important than for other uses, such as wildlife habitat, recreation, and enjoyment of natural beauty. This trend is likely to continue in the future because of the changing pattern of land ownership from farms to rural residential tracts, homesites, and part-time farms of low-intensity use. For a discussion of these or other uses of woodland, refer to the sections "Use of the Soils for Wildlife" and "Use of the Soils in Town and Country Planning."

Regardless of the purposes for which trees are grown, soil properties have strong influences on the kinds of trees that can be grown and how they can best be managed. Differences in soil depth and texture, for example, cause differences in available moisture capacity and thereby influence the rate of tree growth. Other soil features, such as steepness, aspect or direction of slope, and degree of stoniness also affect tree growth and management.

Some moderately steep, steep, and very steep soils have north and south aspects. Soils that have north aspects face in any compass direction from north 45° west clockwise to south 45° east (northerly and easterly directions). Soils that have south aspects face in any compass direction clockwise from south 45° east to north 45° west (southerly and westerly directions).

Soils in the survey area that have similar characteristics that affect the growth and management of trees have been placed into four woodland suitability groups. Some moderately steep, steep, and very steep soils that have both north and south aspects have been placed into two groups because south aspects are drier and less suitable for tree growth than north aspects. This information is provided in table 3 mainly for landowners who want to manage or plant trees for purposes other than for the production of wood crops. The potential of the soils in the survey area for the production of wood crops, however, is also shown in the table by descriptive ratings. These ratings are translated into potential yields of trees at age 50, as shown in the table. Yield information for other species and other more detailed information on limitations of soils used for the production of wood crops can be obtained from local offices of the Soil Conservation Service.

Table 3 also indicates the kinds of trees and shrubs that are generally planted to improve natural beauty, wildlife habitat, or the recreational value of wooded or open areas. In addition, it indicates the species that are suitable for production of Christmas trees and for windbreaks to protect homesites or farmsteads.

White pine, Scotch pine, and Norway spruce are commonly grown for Christmas trees. Soils used for the production of Christmas trees should be nonstony, not subject to flooding, and limited to slopes that are less than 30 percent (B, C, D slope classes). Poorly drained soils are generally not suitable for Christmas trees for commercial purposes.

The species of trees and shrubs suitable for use as windbreaks for homesites and farmsteads are white pine, Scotch pine, Norway spruce, Austrian pine, hemlock, arborvitae, autumn-olive, Amur honeysuckle, forsythia, privet, silky dogwood, red-osier dogwood, and highbush cranberry. Shrubs can be used in combination with conifers.

Hazards or limitations based on potential erosion, plant competition, and seedling mortality are shown in the "Remarks" column in table 3. The hazard of erosion is greatest on steep and very steep soils where roads and trails are constructed. Careful layout of roads and trails, diversion of water, and proper seeding are generally needed to help to control erosion. Seedling mortality is a problem on droughty and very wet soils. Drainage or mounding of wet sites and careful selection of species and grade of planting stock for droughy sites help to overcome the problem of seedling mortality. Plant competition is very severe on fertile soils. In places grasses, weeds, or brush tend to crowd out planted trees. Severe plant competition necessitates the chemical or mechanical control of grasses and weeds in the preparation of planting sites. It also indicates the need to prepare for release of planted trees from invading hardwood brush.

Use of the Soils for Wildlife [3]

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

[2] By ROSS H. MELLINGER, woodland conservationist, Soil Conservation Service, and JOHN L. GORMAN, soil scientist, Soil Conservation Service.

[3] WILLIAM J. MELVIN, field biologist, Soil Conservation Service, assisted in the preparation of this section.

of water. These elements, in turn, are generally related to the kinds of soil.

Wildlife is not abundant in this survey area. The most common species are the cottontail rabbit, squirrel, grouse, mourning dove, deer, woodchuck, and raccoon.

Tomlinson Run Lake in Hancock County, Castleman Run Lake in Brooke County, and Bear Rocks Lakes in Ohio County provide warm water for fishing in the Area. They also provide seasonal fishing for trout.

Habitat for wildlife normally can be created or improved by planting suitable vegetation, by properly managing the existing plant cover, by fostering the natural establishment of desirable plants, or by using a combination of these measures (*1*).

This section rates the soils of Brooke, Hancock, and Ohio Counties according to their suitability for eight elements of wildlife habitat and for three classes of wildlife. Then, it explains the ratings and describes the elements and the classes of wildlife.

The suitability ratings in this section can be used as an aid in—

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

Habitat elements and classes of wildlife

Table 4 lists the soils in the counties and rates their suitability numerically for eight elements of wildlife habitat and for three classes, or groups, of wildlife. The ratings used are *well suited*, *suited*, *poorly suited*, and *unsuited*. The land types Cut and fill land (Cu), Made land (Ma), and Strip mines (Sm) are not listed or rated in the table because they are highly variable in their properties, and onsite investigation must be made to determine their suitability for wildlife habitat.

A rating of *well-suited* means that habitat is generally easily created, improved, or maintained. Soil limitations are negligible in habitat management, and satisfactory results are well assured.

A rating of *suited* means that habitat generally can be created, improved, or maintained, but the soils have moderate limitations that affect the creation, improvement, or maintenance of the habitat. A moderate intensity of management and fairly frequent attention are needed to assure satisfactory results.

A rating of *poorly suited* means that habitat can generally be created, improved, or maintained, but there are rather severe soil limitations. Habitat management can be difficult and expensive and can require intensive effort. Satisfactory results are questionable.

A rating of *unsuited* means that it is impractical to create, improve, or maintain habitat because of the very severe soil limitations. Unsatisfactory results are probable.

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

Each soil is rated in table 4 according to its suitability for various kinds of plants and other elements that make up wildlife habitat.

Grain and seed crops consist of seed-producing annuals, such as corn, sorghum, wheat, millet, soybeans, and other plants commonly grown for grain or seed. The major soil properties that affect this habitat element are effective rooting depth, available moisture capacity, natural drainage, slope, surface stoniness, hazard of flooding, and texture of the surface layer and subsoil.

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

Wild herbaceous upland plants are native or introduced perennial grasses and weeds that generally are established naturally. They include Indiangrass, goldenrod, wild ryegrass, oatgrass, pokeweed, strawberries, lespedeza, beggarweed, ragweed, and dandelion. They provide food and cover principally to wildlife that frequent upland areas. The major soil properties that affect this habitat element are effective rooting depth, available moisture capacity, natural drainage, surface stoniness, hazard of flooding or ponding, and texture of the surface layer and subsoil.

Hardwood woody plants are nonconiferous trees, shrubs, and woody vines that produce nuts or other fruits, buds, catkins, twigs, or foliage that wildlife eat. They are generally established naturally, but are planted in places. Among the native kinds are oak, cherry, maple, poplar, dogwood, persimmon, sumac, sassafras, hazelnut, black walnut, hickory, sweetgum, grape, and briers. The major soil properties that affect this habitat element are effective rooting depth, available moisture capacity, natural drainage, and surface stoniness or rockiness.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, and multiflora rose are some of the shrubs that generally are available and can be planted on soils that are rated well suited. Hardwoods that are not available commercially can commonly be transplanted successfully.

Coniferous woody plants are cone-bearing evergreen trees and shrubs that are used by wildlife primarily as cover, though they also provide browse and seeds or fruitlike cones. Among these are Virginia pine, white pine, and redcedar. Generally, the plants are established naturally in areas where cover of weeds and sod is thin, but they can also be planted. The major soil properties that affect this habitat element are effective rooting depth, available moisture capacity, natural drainage, surface stoniness, or rockiness, and texture of the surface layer and subsoil. Well-suited soils are those on which plants grow slowly and delay closing the canopy. It is important that branches be maintained close to the ground so that food and cover are readily available to rabbits, pheasant,

TABLE 3.—*Suitability of*

[The land types Cut and fill land (Cu), Made

Woodland suitability group, brief description of soils, and map symbols	Potential productivity for wood crops
Group 1: Deep and moderately deep, well drained and moderately well drained, nearly level to very steep soils that have high to moderate available moisture capacity. (Includes soils on stream bottoms that are subject to flooding.) AhB, AhC, BrD, Cg, Ch, CkB, CkC, CkD, ErB, ErC, GlB, GlC, GlC3, GlD, GlD3, GuB, GuC, GuD, GuD3, Hu, Ld, Ph, WeB, WeC, WeC3, WeD, WeE, WeF, WhB, WhC. Units GlD, GlD3, WeD, WeE, and WeF, north aspects only. For south aspects of these units, see Group 3.	Very good to excellent for oaks, yellow-poplar, and other hardwoods. Yield is about 14,000 to 19,000 board feet per acre for oaks and about 24,000 to 32,000 board feet per acre for yellow-poplar.
Group 2: Deep, poorly drained, nearly level soils on bottom lands that are subject to flooding. Available moisture capacity is high. At, Du.	Excellent for pin oaks and other wetland species. Estimated yield is about 14,000 board feet per acre.
Group 3: Moderately deep and deep, well drained and moderately well drained, gently sloping to very steep soils that have low to high available moisture capacity. BeB, BeC, BeC3, BeD, BeE3, BkF, BoB, BoC, BoD, DeD, GlD, GlD3, MoB, MoC, UpB, UsC3, WeD, WeE, WeF. Units BeD, BeE3, BkF, and DeD, north aspects only. For south aspects of these units, see Group 4. Units GlD, GlD3, WeD, WeE, and WeF, south aspects only. For north aspects of these units, see Group 1.	Good for oaks, yellow-poplar, and other upland hardwoods. Yield is about 18,000 board feet per acre for yellow-poplar and about 10,000 board feet per acre for oaks.
Group 4: Moderately deep and deep, droughty, gently sloping to very steep, shaly and sandy soils that mostly have low available moisture capacity. BeD, BeE3, BkF, DeB, DeC, DeD, LaB, LaC. Units BeD, BeE3, BkF, and DeD, south aspects only. For north aspects of these units, see Group 3.	Fair for oaks and other upland hardwoods. Yield is about 6,000 board feet per acre for oaks.

and other small animals. If the trees quickly form a dense canopy that shuts out the light, the lower branches die.

On soils poorly suited to coniferous wildlife habitat, widely spaced conifers may quickly, but only temporarily, produce the desired growth. Maintaining these plants is difficult because the soils are well suited to hardwood plants. Unless the stand is carefully managed, hardwoods invade and commonly overtop the conifers.

Wetland food and cover plants are wild, herbaceous, annual and perennial plants that grow on moist to wet sites, excluding submerged or floating aquatics. They produce food and cover extensively used mainly by wetland wildlife. They include smartweed, wild millet, sedges, reeds, rushes, wild rice, and cattails. The major soil properties that affect this habitat element are natural drainage, surface stoniness, frequency of flooding or ponding, slope, and texture of the surface layer and subsoil.

Shallow-water developments are impoundments or excavations that provide areas of shallow water, generally not more than 5 feet deep, near food and cover for wetland wildlife. Examples of such developments are shallow dugouts, level ditches, blasted potholes, and devices that keep the water 6 to 24 inches deep in marshes. The major soil properties that affect this habitat element are depth to bedrock, natural drainage, slope, hazard of flooding, and surface stoniness.

Excavated ponds are dugout areas that generally receive their water from a permanently high water table, rather than from runoff. They provide water for many kinds of wildlife, particularly migratory or overwintering waterfowl. The major soil properties that affect this habitat element are depth to bedrock, natural drainage, surface stoniness, slope, and hazard of flooding.

Farm ponds of the impounded type are not considered as habitat elements, but they can be important for recreational activities, including fishing. They can also be a source of water for wildlife. If stocked with fish, such impoundments need to be at least 6 feet deep throughout a large part of the area.

In table 4 the soils are rated according to their suitability for three classes of wildlife in the counties: open-land, woodland, and wetland.

Open-land wildlife consists of quail, meadowlarks, field sparrows, doves, cottontail rabbits, red foxes, and woodchucks. These birds and mammals normally make their home in areas of cropland, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, and shrubs.

Woodland wildlife consists of birds and mammals that prefer woodland. Among these are ruffed grouse, woodcock, thrushes, vireos, scarlet tanagers, gray and red squirrels, gray fox, white-tailed deer, raccoon, and wild turkey. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants.

Wetland wildlife consists of birds and mammals that normally make their home in wet areas, such as ponds, marshes, and swamps. Among these are ducks, geese, herons, shore birds, mink, beaver, and muskrat.

Each rating under "Kinds of wildlife" in table 4 is based on the ratings listed for the habitat elements in the first part of the table. For open-land wildlife the rating is based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. The rating for woodland wildlife is based on the ratings listed for grasses and legumes, wild herbaceous *the soils for woodland*

land (Ma), and Strip mines (Sm) are not listed]

Species suitable for planting		Remarks
Trees	Shrubs	
Black walnut (on well-drained soils only), white ash, sugar maple, black locust, sycamore, silver maple, shagbark hickory, hardy pecan, willow, cottonwood, white pine, Scotch pine, Norway spruce, Austrian pine, hemlock.	Autumn-olive, flowering dogwood, Amur honeysuckle, flowering crabapple, forsythia, firethorn, highbush cranberry, privet, shrub lespedeza, hazelnut, redbud.	Severe plant competition from annual weeds and grasses; controls needed before and after planting. Severe hazard of erosion where slopes are more than 30 percent.
Pin oak, red maple, silver maple, sweetgum, willow, arborvitae, white pine.	Silky dogwood, red-osier dogwood, blackhaw.	Severe plant competition from grasses and sedges; controls needed before and after planting. Planting needs to be on mounds or ridges to reduce seedling mortality. Water table at or near the surface in winter.
White pine, Scotch pine, Austrian pine, Norway spruce, hemlock, European or Japanese larch, white ash, sugar maple, red maple, silver maple, shagbark hickory, hardy pecan, sourwood, black locust.	Flowering dogwood, flowering crabapple, hawthorn, European mountain-ash, redbud, serviceberry, autumn-olive, bayberry, highbush cranberry, firethorn, forsythia, hazelnut, Amur honeysuckle, shrub lespedeza, privet, blackhaw.	Moderate to severe plant competition from brush and grasses; controls needed for sod and generally needed for brush after planting. Severe hazard of erosion where slopes are more than 30 percent.
White pine, Scotch pine, Virginia pine, pitch pine, Table Mountain pine, shortleaf pine.	Autumn-olive, European mountain-ash, bayberry, hazelnut, shrub lespedeza, privet, blackhaw.	Moderate plant competition from brush. In places old field sites need control of brush after planting. Moderate hazard of erosion where slopes are more than 30 percent. Seedling mortality is generally severe.

upland plants, hardwood woody plants, and coniferous woody plants. For wetland wildlife the rating is based on ratings shown for wetland food and cover plants, shallow water developments, and excavated ponds.

Engineering Uses of the Soils [4]

In this section two systems of soil classification used by engineers are explained, soil properties important in engineering are estimated for the soils in the three counties, and the soils are interpreted according to their use in engineering. Also given are enginering test data for selected soils.

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. The properties most important to the engineer are permeability, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, and reaction (pH). Depth to water table, depth to bedrock, and relief are also important.

It is not intended that the material in this survey will eliminate the need for onsite sampling and testing of sites for design and construction of specific engineering works and uses. The information given in this section is for the named soil to a depth of 4 to 5 feet or to bedrock if it is at a lesser depth. It does not apply, therefore, to greater depths or necessarily to inclusions that may occur within a delineation shown on the detailed soil map. The information in this section should be used mainly in planning more detailed field investigations to determine the conditions of the soil material at the proposed site.

The information in this survey can be used to:

1. Make soil and land use studies that will aid in selecting and developing sites for industry, business, residences, and recreation.
2. Make preliminary estimates of the engineering properties of soils that help in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables, and in planning detailed investigations at the selected locations.
4. Locate probable sources of topsoil and roadfill.
5. Correlate performance of engineering structures with soil mapping units to develop information for overall planning that will be useful in designing and maintaining engineering structures.
6. Determine the suitability of soil mapping units for cross-county movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports and aerial photographs to make maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

[4] WILLIAM T. JAMES, JR., civil engineer, Soil Conservation Service, assisted in the preparation of this section.

TABLE 4.—*Suitability of the soils for elements of wildlife habitat and for kinds of wildlife*

[Soils rated 1 are well suited; 2, suited; 3, poorly suited; and 4, unsuited. Interpretations were not made for the land types Cut and fill land (Cu), Made land (Ma), and Strip mines (Sm)]

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow-water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Allegheny: AhB, AhC	2	1	1	1	3	3–4	4	4	1	1	4
Atkins: At	3	2	2	1	2	2	2–3	3	2	1	2
Berks:											
BeB, BeC	2	2	2	2	2	4	4	4	2	2	4
BeC3, BeD	3	2–3	2	2	2	4	4	4	2	2	4
BeE3, BkF	4	4	2	2	2	4	4	4	3–4	3	4
Brooke:											
BoB, BoC	2	1	1	1	3	4	4	4	1	1	4
BoD	3	2	1	1	3	4	4	4	2	1	4
Brookside: BrD	3	2	1	2	3	4	4	4	2	1	4
Chagrin: Cg	1	1	1	1	3	4	4	4	1	1	4
Chavies: Ch	1	1	1	1	3	4	4	4	1	1	4
Clarksburg:											
CkB, CkC	2	1	1	1	3	4	4	2–3	1	1	4
CkD	3	2	1	1	3	4	4	4	2	2	4
Dekalb:											
DeB, DeC	2	2	2	2	2	4	4	4	2	2	4
DeD	3	2	2	2	2	4	4	4	2	2	4
Dunning: Du	3	2	2	1	2	2	2–3	3	2	1	2
Ernest: ErB, ErC	2	1	1	1	3	4	4	2–3	1	1	4
Gilpin:											
GlB, GlC	2	1	1	1	3	4	4	4	1–2	1–2	4
GlC3, GlD	3	2	1	1	3	4	4	4	2	2	4
GlD3	4	3	1	1	3	4	4	4	3	2	4
Guernsey:											
GuB, GuC	2	1	1	1	3	4	4	2–3	1	1	4
GuD	3	2	1	1	3	4	4	4	2	2	4
GuD3	4	3	1	1	3	4	4	4	3	2	4
Huntington: Hu	1	1	1	1	3	4	4	4	1	1	4
Lakin: LaB, LaC	3	3	3	3	1	4	4	4	3	3	4
Lindside: Ld	2	1	1	1	3	3	3	3	1	1	3
Monongahela: MoB, MoC	2	1	1	1	3	4	3	3	1	1	4
Philo: Ph	2	1	1	1	3	3	3	3	1	1	3
Upshur, moderately shallow variant:											
UpB	2	1	1	1	3	4	4	2–3	1	1	4
UsC3	3	2	1	1	3	4	4	4	2	1	4
Westmoreland:											
WeB, WeC	2	1	1	1	3	4	4	3	1–2	1	4
WeC3, WeD	3	2	1	1	3	4	4	4	2	2	4
WeE, WeF	4	3–4	1	1	3	4	4	4	3	2	4
Wharton: WhB, WhC	2	1	1	1	3	4	4	4	1	1	4

Some of the terms used by soil scientists may have a different meaning to the engineer. Many of these terms as used by the soil scientist will be defined in the Glossary at the back of this survey.

Much of the information in this section is given in tables 5, 6, and 7, but additional information useful to engineers can be found in other sections of this soil survey, particularly in the section "Descriptions of the Soils."

Engineering classification systems

Two systems of classifying soils are in general use among engineers. They are the Unified system used by the Soil Conservation Service engineers, Department of Defense, and others, and the AASHO system adopted by the American Association of State Highway Officials. Table 5 gives the estimated classification for the soil series in Brooke, Hancock, and Ohio Counties for each system, and table 7 gives the test data for selected soils.

The Unified soils classification system (*10*) identifies soil material as coarse grained, fine grained, or highly organic. The coarse-grained materials are sand (S) and gravel (G) and are divided into four groups, each according to the amount of fine material they contain. Fine-grained materials are silt (M) and clay (C) and are divided into six groups according to their liquid limit and plasticity. L and H represent low and high plasticity, respectively. Symbols are used in combinations of two, such as ML, which indicates a low plastic silt, and CL, a low plastic clay. Sometimes they are shown as ML–CL, indicating soils on the borderline between two classes.

The American Association of State Highway Officials (AASHO) system (*2*) of soil classification is the system commonly used by highway engineers. In this system, soil materials that have about the same general load-carrying capacity are grouped together, resulting in seven major groups ranging from A–1 through A–7. In the test data given in table 7, the major groups in which the soils are placed have been subdivided into subgroups and given an index number that shows values for road subgrade within each group. Group index numbers range from 0 for the best material to 20 for the poorest.

Soil properties significant to engineering

Estimated in table 5, generally by layers, are soil properties that are important to engineering, engineering and textural classifications, soil material, and percentages of soil material passing sieves of three sizes. The data in table 5 are based on the results of soil tests shown in table 7 and on data obtained from similar soils in nearby Marshall County.

Depth to seasonal high water table and to bedrock are indicated in table 5. Soils that have a high water table are limited in their use for highways and other construction. Depth to bedrock greatly affects design, construction, and maintenance of structures.

The column "Depth from Surface" indicates the depth and thickness of the layers for whch the estimates were made. The layers reported in table 5 are fewer and generally thicker than those in the detailed profiles described in the section "Description of the Soils."

Listed for the layers in table 5 are the USDA textural classification, the Unified and AASHO engineering classifications, and the estimated percentages of material that pass Nos. 4, 10, and 200 sieves. The amount of material passing a No. 200 sieve determines whether soil material is coarse grained or fine grained.

In table 5 the permeability of the major layers is estimated and is indicated by a numerical range in inches per hour. Permeability is the rate at which air and water move downward through a saturated soil.

The available moisture capacity, expressed as a range in inches per inch of soil depth, is the approximate amount of water that plants are able to remove from a soil that is wet to field capacity.

Soil reaction is given as a range in pH values, which indicate the degree of acidity or alkalinity of the soil material. In table 5 the values are based on several field checks, but in some places the values are above or below that shown. Because the surface horizons are influenced by liming, ranges are not shown for these horizons.

The shrink-swell potential indicates the volume change to be expected of the soil material with change in moisture content. It is expressed as low, moderate, or high. Soil material that is nonsticky and has low plasticity, such as the ML or A–4, has a low shink-swell potential. Sticky and plastic clay that cracks when dry, such as CH or A–7, has a high shrink-swell potential.

Engineering interpretations of soils

The soils of Brooke, Hancock, and Ohio Counties are rated in table 6 according to their suitability as a source of topsoil and road fill, suitability for winter grading, and susceptibility to frost action and to hillside slippage. Also listed in the table are soil features that affect the location of highways and the construction and maintenance of farm ponds, drainage systems, diversions and waterways, and pipelines.

The suitability of the soil as a source of sand and gravel is not shown, though the Lakin soils are a good source of sand and their substratum is a good source of gravel.

The soils are rated *good*, *fair*, and *poor* as a source of topsoil and road fill. Soils rated *good* as a source of topsoil are naturally fertile, are moderately permeable, have moderate to high moisture-holding capacities, are easily vegetated, and are not easily eroded. Soils rated *fair* and *poor* have less favorable physical properties. Considered in rating soils as a source of material for road fill are shrink-swell potential, compactibility, erodibility, and depth to bedrock.

The suitability of soils for winter grading is greatly affected by shrink-swell potential and depth to water table. Soils that have a high shrink-swell potential, such as Brooke and Upshur soils, are poorly suited to winter grading, and those that have a seasonal high water table, such as Dunning soils, are unsuitable for winter grading.

A rating of *low*, *moderate*, or *high* is given each soil according to its susceptibility to frost action. The ratings are based on the texture and natural drainage of the soil. The higher the silt content of a soil, the more susceptible it is to damaging frost action because it is more likely to heave as a result of freezing and thawing.

Hillside slippage is associated with ground water that acts as a hydraulic jack and lubricant along seepage paths between sloping layers of soil, soil and bedrock contacts, boundaries of different geologic materials, and defective rock conditions. Construction slides, such as

TABLE 5.—*Estimated soil properties*

[Absence of data indicates that the soil is too variable to be rated

Soil series and map symbols	Depth to— Seasonal high water table	Depth to— Bedrock	Depth from surface	Classification: USDA texture	Classification: Unified	Classification: AASHO
	Feet	*Feet*	*Inches*			
Allegheny: AhB, AhC	>3	>5	0–13	Silt loam	ML, CL–ML	A–4
			13–39	Clay loam	ML, CL–ML	A–4, A–6
			39–60	Fine sandy loam	ML, SM, SC	A–2, A–4
Atkins: At	0	>4	0–8	Silt loam	ML	A–4
			8–52	Silt loam	ML, CL, SM	A–4, A–6
Berks: BeB, BeC, BeC3, BeD, BeE3, BkF	>3	2–3	0–8	Shaly silt loam	SM, SC, GC, ML, GM	A–2, A–4, A–6
			8–17	Shaly silt loam	SM, SC, GC, GM	A–2, A–4
			17–30	Very shaly silt loam	GM, SM	A–2
			30	Shale and siltstone.		
Brooke: BoB, BoC, BoD	>3	2–3	0–6	Silty clay loam	CL, MH	A–6
			6–19	Clay	CH, MH	A–6, A–7
			19–36	Silty clay	CL, CH, MH	A–6, A–7
			36	Limestone.		
Brookside: BrD	>3	>5	0–7	Silt loam	ML, CL	A–4, A–6
			7–32	Channery silty clay	CH, MH	A–6, A–7
			32–52	Channery silty clay loam	CL, CH, MH	A–6, A–7
Chagrin: Cg	>3	>4	0–34	Fine sandy loam, loam	ML, SM	A–4
			34–52	Fine sandy loam	ML, SM	A–4
Chavies: Ch	>3	>6	0–17	Fine sandy loam	SM, ML	A–2, A–4
			17–46	Fine sandy loam, sandy loam	SM, ML	A–4
			46–54	Loamy sand, sand	SM	A–2, A–4
Clarksburg: CkB, CkC, CkD	1½–2	>5	0–7	Silt loam	CL, ML	A–4, A–6, A–7
			7–22	Silty clay loam	CL	A–6, A–7
			22–44	Silty clay loam (fragipan)	CL	A–6
			44–58	Channery clay loam (fragipan).	CL, ML–CL, SM	A–4, A–6
Cut and fill land: Cu. Too variable to be rated.						
Dekalb: DeB, DeC, DeD	>4	2–3	0–10	Channery sandy loam, channery loam.	SM	A–2, A–4
			10–18	Channery loam	SM	A–2, A–4
			18–36	Very channery sandy loam	SM, GM	A–2, A–4
			36	Sandstone.		
Dunning: Du	0	>4	0–13	Silt loam	ML, CL	A–4, A–6
			13–32	Silty clay	CL, MH	A–6, A–7
			32–50	Silty clay loam	CL	A–6
Ernest: ErB, ErC	1½–2	>5	0–15	Silt loam	CL, ML	A–6, A–4
			15–26	Silty clay loam	CL	A–6, A–7
			26–60	Clay loam (fragipan)	CL	A–6, A–7
Gilpin: GlB, GlC, GlC3, GlD, GlD3	>3	2–3	0–8	Silt loam	CL–ML, SM	A–4
			8–23	Channery silt loam, channery silty clay loam.	SC, ML, CL, SM	A–4, A–6
			23–32	Very channery loam	SM, CL–ML	A–4
			32	Siltstone and fine-grained sandstone.		

significant to engineering

or that no estimate was made. The symbol > means more than]

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
			Inches per hour	*Inches per inch of soil*	*pH*	
95–100	90–100	65–85	0. 63–6. 3	0. 12–0. 18	----------------	Low.
85–100	80–100	70–100	0. 63–2. 0	0. 12–0. 18	4. 5–5. 5	Moderate.
65–100	60–100	25–100	0. 63–6. 3	0. 08–0. 15	4. 5–5. 5	Low.
90–100	90–100	75–90	0. 63–2. 0	0. 18–0. 21	----------------	Low.
90–100	85–100	45–85	0. 2–0. 63	0. 12–0. 18	4. 5–5. 5	Low.
45–70	40–70	30–60	0. 63–6. 3	0. 05–0. 12	----------------	Low
40–70	30–55	20–45	2. 0–6. 3	0. 03–0. 08	4. 5–5. 5	Low.
30–60	25–50	15–35	2. 0–6. 3	0. 03–0. 05	4. 5–5. 5	Low.
90–100	85–100	80–100	0. 2–2. 0	0. 18–0. 24	----------------	Moderate.
80–100	75–100	65–95	0. 06–0. 2	0. 12–0. 15	6. 1–7. 3	High.
75–100	70–100	60–90	0. 06–0. 2	0. 15–0. 18	6. 1–7. 3	High.
90–100	85–100	75–100	0. 63–2. 0	0. 18–0. 24	----------------	Moderate.
80–100	75–100	70–95	0. 2–0. 63	0. 15–0. 18	5. 6–7. 3	High.
70–95	65–95	60–80	0. 2–0. 63	0. 15–0. 18	6. 1–7. 3	Moderate.
90–100	90–100	45–75	0. 63–6. 3	0. 08–0. 15	5. 6–7. 3	Low.
90–100	85–100	40–55	2. 0–6. 3	0. 08–0. 12	5. 6–7. 3	Low.
90–100	85–100	30–60	2. 0–6. 3	0. 08–0. 12	----------------	Low.
85–100	85–100	36–60	2. 0–6. 3	0. 05–0. 12	4. 5–6. 0	Low.
60–95	55–90	25–45	2. 0–6. 3	0. 05–0. 08	5. 1–6. 0	Low.
85–100	80–100	75–90	2. 0–6. 3	0. 15–0. 21	----------------	Low.
85–100	85–100	65–85	0. 63–2. 0	0. 12–0. 15	5. 1–6. 0	Moderate.
80–100	80–100	55–90	0. 2–0. 63	0. 08–0. 12	5. 6–6. 5	Moderate.
70–95	65–95	45–80	0. 2–0. 63	0. 08–0. 12	5. 6–6. 5	Moderate.
60–80	55–70	20–45	2. 0–6. 3	0. 08–0. 15	----------------	Low.
50–80	45–70	20–45	2. 0–6. 3	0. 08–0. 12	4. 5–5. 5	Low.
40–75	40–70	15–40	2. 0–6. 3	0. 05–0. 08	4. 5–5. 5	Low.
90–100	90–100	70–90	2. 0–6. 3	0. 18–0. 21	----------------	Low.
90–100	90–100	80–95	0. 2–0. 63	0. 12–0. 18	6. 1–7. 3	Moderate.
90–100	85–100	75–90	0. 2–0. 63	0. 12–0. 15	6. 1–7. 3	Moderate.
85–100	85–95	70–90	0. 63–6. 3	0. 15–0. 18	----------------	Low.
85–100	85–100	65–90	0. 63–2. 0	0. 12–0. 15	4. 5–5. 5	Moderate.
85–100	75–100	55–90	0. 2–0. 63	0. 08–0. 12	4. 5–5. 5	Moderate.
80–95	70–85	45–65	0. 63–2. 0	0. 12–0. 18	----------------	Low.
90–100	75–95	40–85	0. 63–2. 0	0. 08–0. 15	4. 5–5. 5	Moderate.
85–100	70–100	40–70	0. 63–2. 0	0. 05–0. 08	4. 5–5. 5	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to— Seasonal high water table	Bedrock	Depth from surface	Classification: USDA texture	Unified	AASHO
Guernsey: GuB, GuC, GuD, GuD3	1½–2	3–6	0–12	Silt loam	ML	A–4
			12–28	Silty clay loam, silty clay	ML, CL	A–4, A–6, A–7
			28–60	Silty clay, silty clay loam	CL, MH	A–6, A–7
Huntington: Hu	>3	>4	0–42	Silt loam	ML, CL	A–4, A–6
			42–54	Stratified silt and fine sand	SM	A–2, A–4
Lakin: LaB, LaC	>5	>6	0–9	Loamy sand	SM	A–2
			9–50	Loamy sand, sand	SM, SP–SM	A–2, A–3
Lindside: Ld	1–2	>4	0–18	Silt loam	ML	A–4
			18–50	Silty clay loam, silt loam	CL, ML	A–4, A–6
Made land: Ma. Too variable to be rated.						
Monongahela: MoB, MoC	1½–2	>5	0–8	Silt loam	ML	A–4
			8–21	Silt loam	ML, CL	A–4, A–6
			21–52	Silt loam, loam (fragipan)	ML, CL, SM	A–4
Philo: Ph	1–2	>4	0–15	Silt loam	ML	A–4
			15–52	Fine sandy loam	SM, ML	A–4
Strip mines: Sm. Too variable to be rated.						
Upshur, moderately shallow variant: UpB, UsC3.	>4	2–4	0–5	Silty clay loam, silty clay	CL, MH	A–4, A–6
			5–36	Shaly clay, very shaly clay (soft weathered shale).	CH, MH	A–6, A–7
			36	Shale.		
Westmoreland: WeB, WeC, WeC3, WeD, WeE, WeF.	>4	3–4	0–9	Silt loam	CL, ML	A–4, A–6
			9–28	Silty clay loam, channery silty clay loam.	CL	A–6, A–7
			28–44	Very channery silty clay loam	CL, SM, SC, GM	A–2, A–4, A–6
			44	Shale and siltstone.		
Wharton: WhB, WhC	1½–2	3–4	0–11	Silt loam	ML, CL	A–4, A–6
			11–26	Silty clay loam, silty clay	CL, MH	A–6, A–7
			26–34	Clay	CL, MH, CH	A–6, A–7
			34–40	Very shaly silty clay (soft weathered shale).	CL, MH	A–6
			40	Shale.		

highway slides, result from the interception of old existing slides, rapid drainage and drawdown of existing water tables, removal of lateral support from unstable slopes, overloading of weak soils or of sloping unstable foundations, and recharging of ground water seep paths beyond their capacities. Slides in farming areas occur along seepage planes between contrasting soil layers or soil and bedrock contacts in topographic coves or sags in bedrock surface or stratigraphy. The soils subject to slippage are clayey, and their bedrock is dominantly clay shale and pervious interbeds of fractured sandstone, limestone, and coal that feed ground water to the seep plane. The ratings for hillside slippage are based primarily on the clay content of the soil, knowledge of the underlying bedrock, and the slope of the soil. The ratings are general in nature. A rating of low susceptibility for hillside slippage does not mean that slippage cannot occur. Some areas mapped as one kind of soil frequently contain spots of different kinds of soil that could not be separated at the scale of mapping. Onsite determination by geologists and engineers is needed for more precise predictions at construction sites.

Some features that affect highway location are the hazard of flooding, shrink-swell potential, compactibility, hazard of slippage, depth to bedrock, and height of the water table.

Most ponds in these counties are of the impoundment type. Soil features need to be favorable for both the reservoir areas and the embankments. The soil material needs to compact well and become almost impermeable to water. Soil features affecting the use of soils for farm ponds are sealing potential of the soil material, layers *significant to engineering*—Continued

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
90–100	85–100	75–90	0.63–2.0	0.18–0.21	----------------	Low.
90–100	85–100	75–95	0.2–0.63	0.12–0.15	5.1–6.0	Moderate.
85–100	80–95	80–90	0.06–0.20	0.08–0.12	5.6–6.5	Moderate.
90–100	85–100	80–95	0.63–2.0	0.18–0.24	5.6–7.3	Low.
80–95	60–80	20–45	2.0–6.3	0.12–0.15	6.1–7.3	Low.
95–100	95–100	15–30	>6.3	0.03–0.08	----------------	Low.
95–100	95–100	10–30	>6.3	0.03–0.08	4.5–5.5	Low.
90–100	90–100	70–85	0.63–2.0	0.18–0.24	5.1–6.0	Low.
90–100	90–100	75–90	0.2–0.63	0.15–0.21	5.6–7.3	Low.
90–100	85–100	70–90	0.63–2.0	0.18–0.21	----------------	Low.
90–100	80–100	60–85	0.63–2.0	0.15–0.18	4.5–5.5	Low.
80–100	75–95	45–80	0.2–0.63	0.08–0.12	4.5–5.5	Low.
90–100	90–100	70–80	2.0–6.3	0.15–0.18	----------------	Low.
70–100	70–100	40–65	0.2–2.0	0.12–0.15	4.5–5.5	Low.
95–100	90–100	80–95	0.2–0.63	0.12–0.18	----------------	Moderate.
90–100	80–100	65–100	0.06–0.2	0.12–0.15	5.1–6.5	High.
85–100	80–95	65–85	0.63–6.3	0.15–0.18	----------------	Low.
75–100	70–95	60–85	0.63–2.0	0.12–0.15	5.1–6.0	Moderate.
60–90	50–85	30–85	0.63–2.0	0.08–0.12	5.6–6.5	Low.
95–100	90–100	75–90	0.63–2.0	0.18–0.21	----------------	Low.
95–100	95–100	80–95	0.63–2.0	0.15–0.18	4.5–5.5	Moderate.
90–100	90–100	70–90	0.2–0.63	0.08–0.12	4.5–5.5	Moderate to high.
80–95	70–90	55–80	0.2–0.63	0.08–0.12	4.5–5.5	Moderate.

of sand, depth to bedrock, stability, permeability, and susceptibility to seepage, slippage, and flooding. Soils that are sandy or underlain by sand and gravel, and those that are shallow to bedrock, are generally not suited or poorly suited to farm ponds.

Soil features that affect drainage for crops and pasture are permeability, high water table, and availability of outlets. The moderately well drained soils generally need only spot drainage for farm use, but the somewhat poorly drained and poorly drained soils commonly need surface and subsurface drainage.

Diversions and waterways are needed on some of the soils in the survey area. They help to divert water from long slopes or to divert water from level cropland at the base of slopes. Soil features that affect the use of diversions and waterways are slope, depth to bedrock, height of water table, flooding, erodibility, and availability of suitable outlets. Soil features that affect the construction and maintenance of pipelines are the hazard of slippage, depth to bedrock, depth to a fluctuation of water table, and the hazard of flooding.

Engineering test data

To help evaluate the soils for engineering purposes, samples were taken from soils of the Allegheny series, which are dominant on stream terraces; the Clarksburg and Ernest series, which are the major series of soils that formed in colluvium on foot slopes; and the Gilpin and Westmoreland series, which are two of the major series of soils on uplands. They were tested in accordance with the standard procedures of the American Association of State Highway Officials (AASHO). The results of these

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—		Suitability for winter grading	Susceptibility to—		Soil features affecting—
	Topsoil	Road fill		Frost action	Hillside slippage	Highway location
Allegheny: AhB, AhC	Fair to good.	Fair to good.	Fair to good.	Moderate	Low	All features favorable
Atkins: At	Fair	Fair	Unsuitable	High	Low	Hazard of flooding; seasonal high water table at or near surface.
Berks: BeB, BeC, BeC3, BeD, BeE3, BkF.	Fair to poor.	Fair to good.	Fair	Moderate	Low	Bedrock at depth of 2 to 3 feet; slope.
Brooke: BoB, BoC, BoD	Fair to poor.	Poor	Poor	Moderate	High	Bedrock at depth of 2 to 3 feet; high shrink-swell potential; hazard of slipping; slope.
Brookside: BrD	Fair	Fair to poor.	Poor	Moderate	Moderate	High shrink-swell potential; hazard of slipping; slope.
Chagrin: Cg	Fair to good.	Fair	Fair to poor.	Moderate	Low	Hazard of flooding
Chavies: Ch	Fair to good.	Fair to good.	Fair to good.	Moderate	Low	Hazard of infrequent flooding.
Clarksburg: CkB, CkC, CkD	Fair	Fair to poor.	Poor	Moderate	Moderate	Seasonal high water table at depth of 1½ to 2 feet; seepage above pan; slope; hazard of slipping.
Cut and fill land: Cu. No interpretations made						
Dekalb: DeB, DeC, DeD	Poor	Good	Good	Low	Low	Bedrock at depth of 2 to 3 feet; slope.
Dunning: Du	Fair	Poor	Unsuitable	High	Low	Hazard of flooding; seasonal high water table at or near surface.
Ernest: ErB, ErC	Fair	Fair to poor.	Poor	Moderate	Low	Seasonal high water table at depth of 1½ to 2 feet; seepage above pan.
Gilpin: GlB, GlC, GlC3, GlD, GlD3.	Fair to good.	Fair	Fair	Moderate	Low to moderate.	Bedrock at depth of 2 to 3 feet; slope.

engineering properties of the soils

Soil features affecting—Continued					
Ponds		Drainage for crops and pasture	Diversions and waterways	Construction and maintenance of pipelines
Reservoir area	Embankments			
Pervious substratum	Fair stability; pervious material in substratum.	Not needed	All features favorable	All features favorable.
Hazard of flooding	Fair stability; hazard of flooding; erodible.	Hazard of flooding; moderately slow permeability; seasonal high water table at or near surface; outlet problems.	Seasonal high water table at or near surface; hazard of flooding.	Seasonal high water table at or near surface; hazard of flooding.
Pervious substratum; bedrock at depth of 2 to 3 feet; slope.	Fair stability; pervious material in substratum; subject to piping.	Not needed	Bedrock at depth of 2 to 3 feet; erodible.	Bedrock at depth of 2 to 3 feet.
Low seepage losses; hazard of slipping; bedrock at depth of 2 to 3 feet.	Poor stability; hazard of slipping.	Not needed	Erodible	Plastic clay; hazard of slipping; bedrock at depth of 2 to 3 feet.
Low seepage losses; hazard of slipping.	Fair stability; hazard of slipping.	Not needed	Erodible	Plastic silty clay; hazard of slipping.
Pervious substratum; hazard of flooding.	Fair stability; pervious material in substratum; hazard of flooding.	Not needed	Erodible	Hazard of flooding.
Pervious substratum; hazard of infrequent flooding.	Fair stability; pervious material in substratum; hazard of infrequent flooding.	Not needed	Not generally needed	Hazard of infrequent flooding.
Low seepage losses	Fair stability	Moderately slow permeability in pan; seasonal high water table at depth of 1½ to 2 feet.	Seasonal high water table at depth of 1½ to 2 feet; erodible.	Seasonal high water table at depth of 1½ to 2 feet.
Pervious substratum; bedrock at depth of 2 to 3 feet.	Pervious material in substratum.	Not needed	Bedrock at depth of 2 to 3 feet.	Bedrock at depth of 2 to 3 feet.
Hazard of flooding	Poor stability; hazard of flooding; erodible.	Hazard of flooding; moderately slow permeability; seasonal high water table at or near surface; outlet problems.	Seasonal high water table at or near surface; hazard of flooding.	Seasonal high water table at or near surface; hazard of flooding.
Low seepage losses	Fair to poor stability	Moderately slow permeability in pan; seasonal high water table at depth of 1½ to 2 feet.	Erodible	Seasonal high water table at depth of 1½ to 2 feet.
Pervious substratum; bedrock at depth of 2 to 3 feet.	Fair stability; subject to piping.	Not needed	Bedrock at depth of 2 to 3 feet.	Bedrock at depth of 2 to 3 feet.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—		Suitability for winter grading	Susceptibility to—		Soil features affecting—
	Topsoil	Road fill		Frost action	Hillside slippage	Highway location
Guernsey: GuB, GuC, GuD, GuD3	Fair	Fair to poor.	Poor	High	Moderate	Seasonal high water table at depth of 1½ to 2 feet; hazard of slipping.
Huntington: Hu	Good	Fair	Fair	Moderate	Low	Hazard of flooding.
Lakin: LaB, LaC	Poor	Fair to good.	Good	Low	Low	All features favorable.
Lindside: Ld	Good	Fair	Poor	Moderate	Low	Hazard of flooding; seasonal high water table at depth of 1 to 2 feet.
Made land: Ma. No interpretations made.						
Monongahela: MoB, MoC	Fair to good.	Fair	Poor	Moderate	Low	Seasonal high water table at depth of 1½ to 2 feet; seepage above pan.
Philo: Ph	Good	Fair	Poor	Moderate to high.	Low	Hazard of flooding; seasonal high water table at depth of 1 to 2 feet.
Strip mines: Sm. No interpretations made.						
Upshur, moderately shallow variant: UpB, UsC3.	Fair to poor.	Poor	Poor	Moderate to high.	High	Bedrock at depth of 2 to 4 feet; high shrink-swell potential; hazard of slipping.
Westmoreland: WeB, WeC, WeC3, WeD, WeE, WeF.	Fair to good.	Fair	Fair	Moderate	Moderate	Bedrock at depth of 3 to 4 feet; hazard of slipping; slope.
Wharton: WhB, WhC	Fair	Fair to poor.	Poor	High	Moderate	Seasonal high water table at depth of 1½ to 2 feet; bedrock at depth of 3 to 4 feet; hazard of slipping.

engineering properties of the soils—Continued

Soil features affecting—Continued				
Ponds		Drainage for crops and pasture	Diversions and waterways	Construction and maintenance of pipelines
Reservoir area	Embankments			
Low seepage losses; hazard of slipping.	Poor stability; erodible; hazard of slipping.	Slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Seasonal high water table at depth of 1½ to 2 feet; erodible.	Seasonal high water table at depth of 1½ to 2 feet; hazard of slipping.
Pervious substratum; hazard of flooding.	Fair stability; hazard of flooding; subject to piping.	Not needed	Not generally needed	Hazard of flooding.
Pervious materials	Poor stability; pervious materials.	Not needed	Rapid permeability; erodible.	All features favorable.
Pervious substratum; hazard of flooding.	Fair stability; hazard of flooding; subject to piping.	Hazard of flooding; seasonal high water table at depth of 1 to 2 feet; moderately slow permeability.	Seasonal high water table at depth of 1 to 2 feet; hazard of flooding.	Seasonal high water table at depth of 1 to 2 feet; hazard of flooding.
Pervious substratum	Fair stability; seepage above pan.	Moderately slow permeability in pan; seasonal high water table at depth of 1½ to 2 feet; spot drainage helpful.	Seasonal high water table at depth of 1½ to 2 feet; erodible.	Seasonal high water table at depth of 1½ to 2 feet.
Pervious substratum; hazard of flooding.	Fair stability; hazard of flooding; erodible; subject to piping.	Hazard of flooding; seasonal high water table at depth of 1 to 2 feet.	Seasonal high water table at depth of 1 to 2 feet; hazard of flooding.	Seasonal high water table at depth of 1 to 2 feet; hazard of flooding.
Low seepage losses; hazard of slipping.	Poor stability; erodible	Not needed	Erodible	Plastic clay; hazard of slipping; bedrock at depth of 2 to 4 feet.
Pervious substratum; bedrock at depth of 3 to 4 feet; hazard of slipping.	Fair stability; erodible	Not needed	Erodible	Bedrock at depth of 3 to 4 feet; hazard of slipping.
Low seepage losses; bedrock at depth of 3 to 4 feet; hazard of slipping.	Poor stability; erodible; hazard of slipping.	Moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Erodible	Seasonal high water table at depth of 1½ to 2 feet; bedrock at depth of 3 to 4 feet; hazard of slipping.

TABLE 7.—*Engineering*

[Samples taken from 10 soil profiles. Tests performed by West Virginia University, in cooperation with the Bureau of Public Roads, in

Soil name and location	Parent material	West Virginia University laboratory number	Depth	Moisture density [1]	
				Maximum dry density	Optimum moisture
			Inches	*Lb. per cu. ft.*	*Percent*
Allegheny silt loam:					
¾ mile northeast of State Route No. 2 along State Route No. 66/5, Hancock County. (Modal)	Alluvium (stream terrace).	15-7-1	0-10	105	18
		15-7-2	20-35	108	19
		15-7-3	39-60	109	17
Behind Lawrenceville Fire Department building, Hancock County. (Coarse subsoil)	Alluvium (stream terrace).	15-8-1	14-29	109	16
		15-8-2	36-60	107	17
¼ mile east of State Route No. 2, south of Highland Hills housing development, Follansbee, Brooke County. (Gravelly substratum)	Alluvium (stream terrace).	5-1-2	40-60	116	13
Clarksburg silt loam:					
¼ mile east of State Route No. 37 in head of McGraw Run, Ohio County. (Modal)	Colluvium.	35-1-1	0-7	93	25
		35-1-2	22-32	109	18
		35-1-3	44-58	118	14
Ernest silt loam:					
North of State Route No. 18 and about ¾ mile east of State Route No. 8, Hancock County. (Modal)	Colluvium.	15-2-1	0-10	104	20
		15-2-2	26-38	106	20
		15-2-3	38-60	110	17
¼ mile south of State Route No. 9/2 and ¼ mile east of State Route No. 9 Hancock County. (Silty, low coarse fragments)	Colluvium.	15-1-1	23-37	103	21
		15-1-2	37-66	109	17
Gilpin silt loam:					
West of State Route No. 8 and ½ mile south of U.S. Highway No. 30, Hancock County. (Modal)	Shale, siltstone, sandstone.	15-6-1	0-5	111	15
		15-6-2	13-23	115	15
		15-6-3	23-32	117	12
South of State Route No. 38 and about ¾ mile east of State Route No. 8, Hancock County. (Silty subsoil)	Shale, siltstone, sandstone.	15-4-1	9-19	108	19
		15-4-2	24-32	119	14
Westmoreland silt loam:					
East of State Route 11/1 and about 1¼ miles northeast of State Route No. 88 and Ohio County line, Brooke County. (Modal)	Shale, siltstone, sandstone, limestone.	5-2-1	0-6	104	19
		5-2-2	9-20	103	19
		5-2-3	28-44	108	17
¾ mile north of Cross Creek along State Route No. 7/3, Brooke County. (Coarse substratum)	Shale, siltstone, sandstone, limestone.	5-3-1	7-17	106	20
		5-3-2	28-40	118	14

[1] Based on the moisture-density relations of soils using a 5.5-pound rammer and 12-inch drop, AASHO Designation T 99-61, Method C (*2*).

[2] Mechanical analyses according to the AASHO Designation: T 88-57 (*2*). Results by this procedure may differ somewhat from results 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

test data

accordance with standard procedures of the American Association of State Highway Officials (AASHO) (*2*)]

Mechanical analysis [2]								Liquid limit	Plasticity index	Classification	
Percentage passing sieve [3]—				Percentage smaller than—						AASHO [4]	Unified
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.				
								Percent			
100	100	97	82	75	46	19	9	30	6	A-4(8)	CL-ML
100	100	100	97	87	57	33	28	31	8	A-4(8)	CL-ML
100	100	100	97	87	50	24	19	26	4	A-4(8)	CL-ML
100	100	100	97	79	33	16	12	28	7	A-4(8)	CL-ML
100	100	100	98	88	44	19	14	25	2	A-4(8)	ML
69	63	48	25	24	21	17	15	29	11	A-2-6(0)	SC
98	96	90	80	74	55	25	15	45	11	A-7-5(10)	ML
97	95	89	79	75	64	34	25	37	15	A-6(10)	CL
97	93	81	53	50	43	27	19	23	8	A-4(4)	CL
97	93	85	78	72	53	25	15	40	16	A-6(10)	CL-ML
99	94	87	80	74	59	39	30	44	23	A-7-6(14)	CL
88	81	69	60	55	45	29	21	34	16	A-6(8)	CL
100	100	98	91	85	67	40	31	39	20	A-6(12)	CL
100	100	97	88	82	61	31	24	38	25	A-6(14)	CL
84	75	69	45	39	31	15	9	25	2	A-4(2)	SM
95	90	84	56	50	36	22	15	25	4	A-4(4)	CL-ML
100	100	97	45	36	26	17	11	23	3	A-4(2)	SM
96	93	90	85	80	61	35	27	35	12	A-6(9)	CL-ML
92	80	72	63	55	39	26	18	32	7	A-4(6)	CL-ML
88	83	78	71	69	57	25	15	35	11	A-6(7)	CL-ML
96	93	89	84	79	67	39	30	39	16	A-6(10)	CL-ML
89	77	71	64	61	52	34	24	34	14	A-6(8)	CL
88	84	75	70	68	57	32	23	37	19	A-6(11)	CL
67	56	46	38	36	29	17	11	31	11	A-6(1)	SC

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for naming textural classes for soils.

[3] Based on total material. Laboratory test data corrected for amount of sample larger than 3 inches discarded in field sampling.

[4] Soils are subdivided as to their suitability for road subgrades with (0) being best suited. As the index number becomes larger, the material is less suited.

tests and the classification of each sample according to both the AASHO and Unified systems are given in table 7.

Moisture density, the relation of moisture content and the density to which a soil material is compacted, is given in table 7. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, the density decreases with increase in moisture. The highest dry density obtained in the compaction test is termed *maximum dry density*. Moisture-density data are important in earthwork, for, as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

The liquid limit and plasticity index given in table 7 indicate the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a semisolid to a plastic state. The *liquid limit* is the moisture content at which the material passes from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Use of the Soils in Town and Country Planning

Industry and housing occupy most of the soils on bottom lands and terraces along the Ohio River. In addition, suburban developments are spreading to the adjacent soils on uplands (fig. 6).

The remaining undeveloped areas along the Ohio River are in high demand by industry. Thus, planners of most future recreational and community developments will have to consider use of soils in other areas. Most soils in the three counties have properties that limit, in some way, their suitability for these uses. The estimated degree and kinds of soil limitations for several major components of town and country planning are given in table 8. The information given in this table is for the named soil to a depth of 4 to 5 feet or to bedrock if it is at a lesser depth, and it does not apply, therefore, to greater depths or necessarily to inclusions of other soils which in places occur within a delineation on the detailed soil map.

The soils are rated according to three degrees of limitations; namely, *slight*, *moderate*, or *severe*. Soils rated *slight* have few, if any, limitations for the interpreted use. Those with a *moderate* rating have one or more properties that limit their use, but the limitation can generally be overcome by correct planning, careful design, and good management. Soils rated *severe* have one or more properties that seriously limit their use. A soil that has severe limitations increases the probability of failure and adds to the cost of design, construction, and maintenance of recreational and community developments. In table 8, if the rating is *moderate* or *severe*, the main limiting property or properties are given. Among these properties are depth to bedrock, permeability, depth to water table, the hazard of flooding, the hazard of slippage, and texture.

The importance of a soil property may be different for one use than it is for another. For example, a deep,

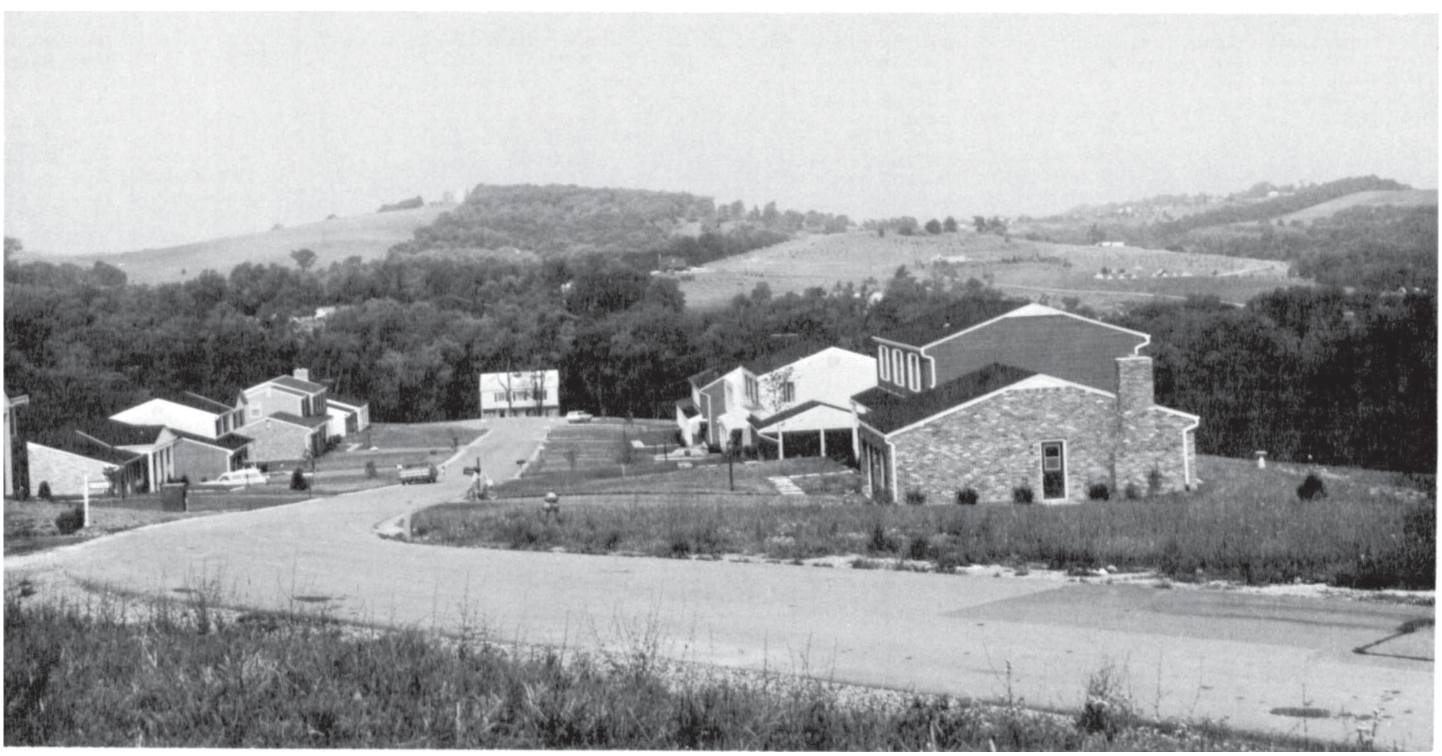

***Figure 6.*—Housing development on Westmoreland silt loam, 10 to 20 percent slopes.**

coarse-textured soil is generally suited to use for sewage effluent disposal fields, but it is poorly suited to use for sewage lagoons and impoundments. Flooding is generally less restrictive for picnic areas and other related uses than for homesites. The hazard of flooding for a particular mapping unit may vary considerably from place to place along streams. The history of flooding at a proposed site should be carefully studied before buildings or other facilities are planned. A soil having properties that cause severe limitations for a given use may also have properties that are less restrictive, but they need to be considered in planning its use. The ratings in table 8 do not eliminate the need for careful onsite investigations.

Discussed in the following paragraphs are the soil properties considered in rating the limitations to each of the uses of town and country planning given in table 8.

Low Building Sites.—These buildings are three stories or less and have a basement 8 feet below the surface. The main soil properties considered in rating limitations to use of the soils as sites for low buildings are slope, depth to seasonal water table, depth to bedrock, shrink-swell potential, and the hazards of flooding and slippage. A method of sewage disposal is not considered. If basements are not planned, the depth to bedrock is of less importance.

Lawns and Landscaping.—Among the soil properties that determine whether a lawn can be established and maintained are depth to bedrock, texture, slope, droughtiness, depth to water table, hazard of flooding, and the content of coarse fragments. Soil properties need to be such that a good lawn can be easily established and maintained with only additions of lime and fertilizer.

Sewage Effluent Disposal Fields.—The suitability of a soil for disposing effluent from septic tanks depends mainly on depth to bedrock, depth to seasonal water table, permeability, hazard of flooding, and slope. Disposing of effluent from septic tanks is difficult if the soils are slowly permeable, have a seasonally high water table, have slopes of more than 8 percent, or are subject to flooding. In table 8 the soils that have slight limitation are generally well suited to filter fields. Soils that have a rating of moderate are less well suited and commonly need larger filter fields than soils that have slight limitation. Soils that have a severe rating may be unsuitable, and onsite investigation is needed before a disposal field is planned. Filter fields on soils underlain by pervious materials may contaminate nearby wells.

Impoundments and Sewage Lagoons.—Impoundments are generally more than one-half acre in size and are used for swimming, fishing, ice skating, and similar kinds of recreation. Sewage lagoons are shallow ponds built to dispose of sewage through oxidation. They may be practical in some areas where septic tanks or a central sewage system is not feasible or practical. Among the soil properties that affect the degree of limitation are slope, depth to bedrock, permeability, and the hazard of flooding. Soils that are sandy or underlain by sand and gravel and soils that are shallow to bedrock have severe limitations to use as impoundments and sewage lagoons.

Picnic Areas.—These areas are intensively used for park-type picnics. Soil properties that affect use for picnic areas are surface texture, slope, depth to seasonal water table, and the hazard of flooding.

Playgrounds.—These areas are generally small and are used for football, baseball, and other athletic field events. Because nearly level areas are needed, considerable grading and land shaping are generally required. Soils that have a clayey, gravelly, or channery surface layer are unsuitable for play areas. Soil depth, slope, depth to water table, and the hazard of flooding are other soil properties that affect the suitability of soils for playgrounds.

Streets and low-cost roads.—These streets and roads are hard-surfaced, similar to town or township roads, and do not include paved highways.. Among the soil properties that affect the degree of limitations are depth to bedrock, slope, depth to seasonal water table, traffic-supporting capacity, and the hazard of flooding. Tables 5 and 6 in the section "Engineering Uses of the Soils" provide additional soil information that will be useful to those planning streets and low-cost roads. Table 5 shows the shrink-swell potential for the soils in the three counties. Table 6 shows the suitability of the soils for road fill, the limitations that affect the location of highways, and the susceptibility to frost action.

Paths and trails.—These areas are used for local and cross-county footpaths and trails for bridle paths. They will be used as they occur in nature, and little or no soil will be moved. The main soil properties that affect an area for these uses are depth to water table, surface texture, slope, and the hazard of flooding.

Camp areas.—Tent and trailer sites need to be large enough to provide privacy and to include level pads, picnic tables, fireplaces, and parking spaces. Limitations are generally less severe for tent sites than for trailer sites. Soil properties to consider when selecting campsites are slope, depth to water table, texture of the surface layer, and the hazard of flooding.

Formation and Classification of Soils

The origin, development, and classification of the soils in Brooke, Hancock, and Ohio Counties are discussed in this section. The five factors of soil formation are listed and their influence on the soils are discussed. The soils are classified into broad groups, and a description of each group is given. Table 9 shows the relationship between the present and the former soil classification system.

Factors of Soil Formation

The soils of Brooke, Hancock, and Ohio Counties have resulted from the interaction of five major factors of soil formation: parent material, time, climate, plant and animal life, and relief (*3*). Each factor modifies the effectiveness of the other factors. Influenced by these factors, the two main processes of soil formation are the accumulation of parent materials and the differentiation of horizons in the profile (*8*). Horizons are faint to distinct, depending on the gains, losses, and alterations that have taken place. Parent material, relief, and time are responsible for producing differences among the soils in the survey area. Climate and plant and animal life generally show their influences throughout broad areas and are relatively uniform throughout the three counties.

TABLE 8.—*Estimated degree and kinds of limitations*

[A rating of slight indicates few, if any, limitations; moderate indicates the limitations may be overcome with correct planning and

Soil series and map symbols	Sites for buildings of three stories or less	Lawns and landscaping	Sewage effluent disposal fields	Impoundments and sewage lagoons
Allegheny:				
AhB	Slight	Slight	Moderate: slope	Severe: pervious substratum.
AhC	Moderate: slope	Moderate: slope	Moderate: slope	Severe: pervious substratum; slope.
Atkins: At	Severe: hazard of flooding; seasonal high water table at or near the surface.	Severe: hazard of flooding; seasonal high water table at or near the surface.	Severe: moderately slow permeability; hazard of flooding; seasonal high water table at or near the surface.	Severe: pervious substratum; hazard of flooding.
Berks:				
BeB	Severe: bedrock at depth of 2 to 3 feet.	Moderate: coarse fragments; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.
BeC, BeC3	Severe: bedrock at depth of 2 to 3 feet.	Moderate: coarse fragments; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet; slope.
BeD, BeE3, BkF	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope	Severe: bedrock at depth of 2 to 3 feet; slope.	Severe: bedrock at depth of 2 to 3 feet; slope.
Brooke:				
BoB	Severe:[1] bedrock at depth of 2 to 3 feet; high shrink-swell potential.	Moderate: clayey surface layer; bedrock at depth of 2 to 3 feet.	Severe: slow permeability; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.
BoC	Severe: bedrock at depth of 2 to 3 feet; high shrink-swell potential.	Moderate: clayey surface layer; bedrock at depth of 2 to 3 feet; slope.	Severe: slow permeability; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet; slope.
BoD	Severe: slope; bedrock at depth of 2 to 3 feet; hazard of slipping; high shrink-swell potential.	Severe: slope	Severe: slow permeability; bedrock at depth of 2 to 3 feet; slope.	Severe: bedrock at depth of 2 to 3 feet; slope.
Brookside: BrD	Severe: slope; hazard of slipping.	Severe: slope	Severe: moderately slow permeability; slope.	Severe: slope
Chagrin: Cg	Severe: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.	Severe: pervious substratum; hazard of flooding.
Chavies: Ch	Severe: hazard of flooding.	Slight	Moderate: hazard of flooding.	Severe: pervious substratum.

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careful design; severe indicates limitations that increase the probability of failure and add to the cost of installation and maintenance]

Picnic areas	Playgrounds	Streets and low-cost roads	Paths and trails	Camp areas for tents and small trailers
Slight	Moderate: slope	Moderate: fair traffic-supporting capacity.	Slight	Slight.
Moderate: slope	Severe: slope	Moderate: fair traffic-supporting capacity; slope.	Slight	Moderate: slope.
Severe: seasonal high water table at or near the surface.	Severe: seasonal high water table at or near the surface; hazard of flooding.	Severe: hazard of flooding; seasonal high water table at or near the surface.	Severe: seasonal high water table at or near the surface.	Severe: seasonal high water table at or near the surface; hazard of flooding.
Slight	Moderate: bedrock at depth of 2 to 3 feet; coarse fragments; slope.	Moderate: bedrock at depth of 2 to 3 feet; fair traffic-supporting capacity; slope.	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope	Slight	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope. Severe where slopes are more than 30 percent.	Severe: slope.
Moderate: clayey surface layer.	Severe: clayey surface layer.	Severe: poor traffic-supporting capacity.	Moderate: clayey surface layer.	Moderate: clayey surface layer.
Moderate: clayey surface layer; slope.	Severe: clayey surface layer.	Severe: poor traffic-supporting capacity; slope.	Moderate: clayey surface layer.	Moderate: clayey surface layer; slope.
Severe: slope	Severe: clayey surface layer; slope.	Severe: poor traffic-supporting capacity; slope.	Moderate: clayey surface layer; slope.	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Moderate: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.
Slight	Slight	Slight	Slight	Moderate: hazard of flooding.

TABLE 8.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Sites for buildings of three stories or less	Lawns and landscaping	Sewage effluent disposal fields	Impoundments and sewage lagoons
Clarksburg:				
CkB	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderate shrink-swell potential; seeps.	Moderate: seasonal high water table at depth of 1½ to 2 feet; seeps.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Moderate: slope.
CkC	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderate shrink-swell potential; seeps.	Moderate: slope; seasonal high water table at depth of 1½ to 2 feet; seeps.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Severe: slope.
CkD	Severe: slope; hazard of slipping.	Severe: slope.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet; slope.	Severe: slope.
Cut and fill land: Cu. No interpretations made.				
Dekalb:				
DeB	Severe: bedrock at depth of 2 to 3 feet.	Moderate: droughty; coarse fragments; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.	Severe: permeable materials; bedrock at depth of 2 to 3 feet.
DeC	Severe: bedrock at depth of 2 to 3 feet.	Moderate: slope; coarse fragments; droughty; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.	Severe: permeable materials; bedrock at depth of 2 to 3 feet; slope.
DeD	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet; slope.	Severe: permeable materials; bedrock at depth of 2 to 3 feet; slope.
Dunning: Du	Severe: hazard of flooding; seasonal high water table at or near the surface.	Severe: hazard of flooding; seasonal high water table at or near the surface.	Severe: moderately slow permeability; hazard of flooding; seasonal high water table at or near the surface.	Severe: sandy layers in places; hazard of flooding.
Ernest:				
ErB	Moderate: seasonal high water table at depth of 1½ to 2 feet; seeps; moderate shrink-swell potential.	Moderate: seasonal high water table at depth of 1½ to 2 feet; seeps.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Moderate: slope.
ErC	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope; seeps; moderate shrink-swell potential.	Moderate: slope; seasonal high water table at depth of 1½ to 2 feet; seeps.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Severe: slope.
Gilpin:				
GlB	Severe: bedrock at depth of 2 to 3 feet.	Moderate: coarse fragments; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.
GlC, GlC3	Severe: bedrock at depth of 2 to 3 feet.	Moderate: slope; coarse fragments; bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet.	Severe: bedrock at depth of 2 to 3 feet; slope.
GlD, GlD3	Severe: slope; bedrock at depth of 2 to 3 feet.	Severe: slope.	Severe: bedrock at depth of 2 to 3 feet; slope.	Severe: bedrock at depth of 2 to 3 feet; slope.

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Picnic areas	Playgrounds	Streets and low-cost roads	Paths and trails	Camp areas for tents and small trailers
Moderate: seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope; moderately slow permeability in pan.	Moderate: seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.	Severe: slope; seeps	Moderate: seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity; slope.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Slight	Moderate: bedrock at depth of 2 to 3 feet; slope; coarse fragments.	Moderate: bedrock at depth of 2 to 3 feet; slope.	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope	Slight	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Severe: seasonal high water table at or near the surface.	Severe: seasonal high water table at or near the surface; hazard of flooding.	Severe: seasonal high water table at or near the surface; hazard of flooding.	Severe: seasonal high water table at or near the surface.	Severe: seasonal high water table at or near the surface; hazard of flooding.
Moderate: seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope; moderately slow permeability in pan.	Moderate: seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.	Severe: slope	Moderate: seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity; slope.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.
Slight	Moderate: bedrock at depth of 2 to 3 feet; slope; coarse fragments.	Moderate: bedrock at depth of 2 to 3 feet; fair traffic-supporting capacity; slope.	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope	Slight	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.

TABLE 8.—*Estimated degree and kinds of limitation*

Soil series and map symbols	Sites for buildings of three stories or less	Lawns and landscaping	Sewage effluent disposal fields	Impoundments and sewage lagoons
Guernsey:				
GuB	Moderate: seasonal high water table at depth of 1½ to 2 feet; seeps; bedrock at depth of 3½ to 6 feet; moderate shrink-swell potential.	Moderate: seasonal high water table at depth of 1½ to 2 feet; seeps.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Moderate: slope.
GuC	Moderate: seasonal high water table at depth of 1½ to 2 feet; seeps; slope; bedrock at depth of 3½ to 6 feet; moderate shrink-swell potential.	Moderate: slope; seasonal high water table at depth of 1½ to 2 feet; seeps.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Severe: slope.
GuD, GuD3	Severe: slope; hazard of slipping.	Severe: slope.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet; slope.	Severe: slope.
Huntington: Hu	Severe: hazard of flooding.	Moderate: hazard of flooding.	Moderate: hazard of flooding.	Severe: pervious substratum; hazard of flooding.
Lakin:				
LaB	Slight.	Moderate: droughty.	Moderate: slope.	Severe: pervious substratum.
LaC	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: pervious substratum; slope.
Lindside: Ld	Severe: hazard of flooding; seasonal high water table at depth of 1 to 2 feet.	Moderate: hazard of flooding; seasonal high water table at depth of 1 to 2 feet.	Severe: moderately slow permeability; seasonal high water table at depth of 1 to 2 feet; hazard of flooding.	Severe: sandy layers in places; hazard of flooding.
Made land: Ma. No interpretations made.				
Monongahela:				
MoB	Moderate: seasonal high water table at depth of 1½ to 2 feet; seeps.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: moderately slow permeability in pan; seasonal high water table at depth of 1½ to 2 feet.	Moderate: sandy layers in places; slope.
MoC	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope; seeps.	Moderate: slope; seep spots in places; seasonal high water table at depth of 1½ to 2 feet.	Severe: moderately slow permeability in pan; seasonal high water table at depth of 1½ to 2 feet.	Severe: slope.
Philo: Ph	Severe: hazard of flooding; seasonal high water table at depth of 1 to 2 feet.	Moderate: hazard of flooding.	Severe: hazard of flooding; seasonal high water table at depth of 1 to 2 feet.	Severe: pervious substratum; hazard of flooding.
Strip mines: Sm. No interpretations made.				

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Picnic areas	Playgrounds	Streets and low-cost roads	Paths and trails	Camp areas for tents and small trailers
Moderate: seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope; moderately slow permeability.	Moderate: seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity; slope.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.	Severe: slope	Severe: slope	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope	Severe: slope.
Moderate: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.	Slight	Severe: hazard of flooding.
Moderate: droughty; sandy surface layer.	Moderate: droughty; slope.	Slight	Moderate: droughty; sandy surface layer.	Moderate: droughty; sandy surface layer.
Moderate: droughty; sandy surface layer; slope.	Severe: slope	Moderate: slope	Moderate: droughty; sandy surface layer.	Moderate: droughty; sandy surface layer; slope.
Moderate: seasonal high water table at depth of 1 to 2 feet; hazard of flooding.	Moderate: seasonal high water table at depth of 1 to 2 feet; hazard of flooding.	Severe: hazard of flooding.	Slight	Severe: hazard of flooding.
Moderate: seasonal high water table at depth of 1½ to 2 feet.	Moderate: seasonal high water table at depth of 1½ to 2 feet; moderately slow permeability in pan; slope.	Moderate: seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.	Severe: slope	Moderate: seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity; slope.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.
Moderate: seasonal high water table at depth of 1 to 2 feet; slope.	Moderate: hazard of flooding; seasonal high water table at depth of 1 to 2 feet.	Severe: hazard of flooding.	Moderate: seasonal high water table at depth of 1 to 2 feet.	Severe: seasonal high water table at depth of 1 to 2 feet; hazard of flooding.

TABLE 8.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Sites for buildings of three stories or less	Lawns and landscaping	Sewage effluent disposal fields	Impoundments and sewage lagoons
Upshur, moderately shallow variant:				
UpB	Severe: bedrock at depth of 2 to 4 feet; high shrink-swell potential.	Moderate: clayey surface layer; bedrock at depth of 2 to 4 feet.	Severe: slow permeability.	Severe: bedrock at depth of 2 to 4 feet.
UsC3	Severe: bedrock at depth of 2 to 4 feet; high shrink-swell potential.	Severe: clayey surface layer; bedrock at depth of 2 to 4 feet.	Severe: slow permeability	Severe: bedrock at depth of 2 to 4 feet; slope.
Westmoreland:				
WeB	Moderate: bedrock at depth of 3 to 4 feet; moderate shrink-swell potential.	Moderate: bedrock at depth of 3 to 4 feet.	Severe: bedrock at depth of 3 to 4 feet.	Moderate: bedrock at depth of 3 to 4 feet; slope.
WeC, WeC3	Moderate: bedrock at depth of 3 to 4 feet; moderate shrink-swell potential; slope.	Moderate: slope; bedrock at depth of 3 to 4 feet.	Severe: bedrock at depth of 3 to 4 feet.	Severe: slope
WeD, WeE, WeF	Severe: slope; hazard of slipping; bedrock at depth of 3 to 4 feet.	Severe: slope	Severe: bedrock at depth of 3 to 4 feet; slope.	Severe: slope
Wharton:				
WhB	Moderate: seasonal high water table at depth of 1½ to 2 feet; bedrock at depth of 3 to 4 feet; moderate shrink-swell potential.	Moderate: seasonal high water table at depth of 1½ to 2 feet.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Moderate: bedrock at depth of 3 to 4 feet; slope.
WhC	Moderate: bedrock at depth of 3 to 4 feet; slope.	Moderate: slope; seasonal high water table at depth of 1½ to 2 feet.	Severe: moderately slow permeability; seasonal high water table at depth of 1½ to 2 feet.	Severe: slope

[1] Moderate for buildings without basements or if rippable to depth of 3 feet.

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Picnic areas	Playgrounds	Streets and low-cost roads	Paths and trails	Camp areas for tents and small trailers
Moderate: clayey surface layer.	Severe: clayey surface layer.	Severe: poor traffic-supporting capacity.	Moderate: clayey surface layer.	Moderate: clayey surface layer.
Severe: clayey surface layer.	Severe: clayey surface layer.	Severe: poor traffic-supporting capacity.	Severe: clayey surface layer.	Severe: clayey surface layer.
Slight	Moderate: slope	Moderate: bedrock at depth of 3 to 4 feet; fair traffic-supporting capacity; slope.	Slight	Slight.
Moderate: slope	Severe: slope	Severe: slope	Slight	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Moderate: slope. Severe where slopes are more than 30 percent.	Severe: slope.
Moderate: seasonal high water table at depth of 1½ to 2 feet.	Moderate: slope; seasonal high water table at depth of 1½ to 2 feet; moderately slow permeability.	Moderate: slope; seasonal high water table at depth of 1½ to 2 feet; fair traffic-supporting capacity.	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet.
Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.	Severe: slope	Severe: slope	Slight	Moderate: seasonal high water table at depth of 1½ to 2 feet; slope.

TABLE 9.—*Soil series classified by higher categories*

Series	Family	Subgroup	Order	Great soil group, 1938 classification
Allegheny	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils intergrading to Gray-Brown Podzolic soils.
Atkins	Fine-loamy, mixed, acid, mesic	Typic Fluvaquents	Entisols	Low-Humic Gley soils.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Brooke	Fine, mixed, mesic	Mollic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Brookside [1]	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Chagrin	Fine-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial soils.
Chavies	Coarse-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Alluvial soils intergrading to Gray-Brown Podzolic soils.
Clarksburg	Fine-loamy, mixed, mesic	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils.
Dekalb	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Dunning	Fine, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols	Humic Gley soils.
Ernest	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols	Red-Yellow Podzolic soils intergrading to Gray-Brown Podzolic soils.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils intergrading to Gray-Brown Podzolic soils.
Guernsey	Fine, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Huntington	Fine-silty, mixed, mesic	Fluventic Hapludolls	Mollisols	Alluvial soils.
Lakin	Mixed, mesic	Alfic Udipsamments	Entisols	Regisols intergrading to Gray-Brown Podzolic soils.
Lindside	Fine-silty, mixed, mesic	Fluvaquentic Eutrochrepts	Inceptisols	Alluvial soils.
Monongahela	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols	Red-Yellow Podzolic soils intergrading to Gray-Brown Podzolic soils.
Philo	Coarse-loamy, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols	Alluvial soils.
Upshur, moderately shallow variant.	Fine, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Westmoreland	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Wharton	Clayey, mixed, mesic	Aquic Hapludults	Ultisols	Red-Yellow Podzolic soils intergrading to Gray-Brown Podzolic soils.

[1] Brookside soils are taxadjuncts to the Brookside series because they have a thicker and darker surface layer than currently is permitted in the range for the series.

Parent material and time

The character of the parent material strongly influences the time required for soil formation and the nature of the soil produced. The soils of this survey area formed in residual, colluvial, and alluvial materials.

Most soils formed in residual materials. These materials are mainly from interbedded limy shale, acid shale, siltstone, sandstone, limestone, and a few thin beds of limy red shale. In Ohio County and in the southern part of Brooke County, the parent material is mostly of the Dunkard and Monongahela geologic series. Most of the soils, such as the Westmoreland soil, that formed in these materials show an influence from the limy shale and limestone. They are relatively high in content of carbonates, are medium textured to moderately fine textured, and have a moderately developed profile. Such soils as Berks and Gilpin soils are the most common in Hancock County. They formed mostly in material weathered from acid rocks of the Conemaugh and Allegheny geologic series. Berks soils are medium textured, are low in content of carbonates, and have a weakly developed profile. Gilpin soils show a slightly stronger influence from acid shale than Berks soils and are medium textured to moderately fine textured, are moderate to low in content of carbonates, and have a moderately developed profile.

In terms of years, the residual materials are the oldest parent material in the survey area. The soil-forming factors, however, have been retarded in their action by clayey material, by resistant rock material, and by the steepness of slopes. Thus, some of the soils that formed in these materials have a less well developed profile than some of the soils that formed in younger materials. The Westmoreland, Berks, and Gilpin soils are the dominant soils that formed in residual materials.

Colluvial materials are along the foot slopes, around stream heads, and on a few benches throughout the survey area. These materials moved downslope from acid and lime-influenced residual soils. The Brookside and Clarksburg soils formed on foot slopes below Westmoreland soils. They are moderate to high in content of carbonates and have a moderately developed profile. Ernest soils are more acid and are on foot slopes below the Berks and Gilpin soils. They have a moderately developed profile. The Clarksburg and Ernest soils also have a well-developed fragipan in the lower part of the subsoil.

Glaciers did not cover any of this survey area, but they influenced the older alluvial materials.

The material on terraces along the Ohio River was deposited as glacial outwash south of the ice sheet. This material is sandy and is generally underlain by gravel at a depth of more than 4 feet. It is presumed to be of Wisconsin glacier age (*12*), and in some areas it appears to have been worked by wind action. Lakin soils are on these terraces. They are deep, rapidly permeable, coarse-textured soils that have a very weakly developed profile. Allegheny and Monongahela soils are on terraces along Kings, Cross, Buffalo, and Wheeling Creeks and are also presumed to be of the Wisconsin glacier age. They formed, however, in finer materials and have a moderately developed profile.

The material on terraces high above the Ohio River was probably deposited during Nebraskan or Kansan time. This material was apparently washed from soils formed in materials weathered from acid shale, siltstone, and sandstone. The soil-forming processes have had considerable time to act on this material. Many additions, losses, and alterations have taken place. The resulting soils, such as Allegheny and Monongahela soils, are strongly leached and have moderately to strongly developed profiles. Monongahela soils also have a well-developed fragipan.

Alluvial deposits on flood plains are the youngest parent materials in this survey area. These materials washed from mainly acid and lime-influenced residual soils. Among the resulting soils, the Atkins, Chavies, and Philo soils are low in content of carbonates, and the Chagrin, Huntington, and Lindside soils are moderate to high in content of carbonates. Most of these soils are physically well suited to soil formation, but the soil-forming processes have had such a short time to work that the soils have relatively weak profile development. Chavies soils are on alluvial land-forms above all but very infrequent overflow. They have a weakly expressed horizon of clay accumulation. The other soils on flood plains are subject to flooding and receive sediment more frequently. They lack horizons of clay accumulation, but they have a weak or moderate structure and a B horizon that commonly shows developed colors.

Climate

Brooke, Hancock, and Ohio Counties have a warm, humid, temperate climate that is generally uniform throughout the three counties. Climate, therefore, is not responsible for any major differences in the soil, but it favors the development of horizons in the soil profile. Most of the extensive soils in the survey area are moderate to low in content of organic matter, are fairly well leached of bases in the upper part of their solum, and have moderately developed profiles.

A detailed description of the climate in the three counties is given in the section "General Nature of the Area."

Plant and animal life

Plants and animals aid in soil formation by adding organic matter to the soil and transferring plant nutrients from one horizon to another (*9*).

The survey area was originally covered by mixed hardwoods. Rainfall, warm temperatures, and small animal life, however, stimulated the decomposition of fallen leaves and stems, so that only shallow layers of organic matter have accumulated. Decomposition of these plant remains caused the formation of organic acids that aided the leaching processes. Thus, if not limed, the present surface layer of most soils in the three counties is acid.

Relief

Relief affects soil formation through its controlling effect on the amount of water moving through the soil, the amount of runoff, and erosion.

Gently to strongly sloping soils on old terraces and residual materials have had large amounts of water move through them. This condition favors the formation of deep soils that have a moderately developed to well-developed profile, such as Allegheny, Guernsey, Monongahela, Wharton, and Westmoreland soils. The kinds of parent material have had a controlling effect on the depth of the Gilpin soils. It is likely one of the controlling factors on depth and development of the profile in the Berks soils on these slopes.

In this survey area relief is favorable for formation of soils on flood plains and on most young terraces, and formation is progressing at a fairly rapid rate. Soils that formed in alluvium are weakly developed, mainly because too little time has elapsed since the material was deposited. The profile of the Lakin soils is weakly developed, partly because of their sandy parent material.

On steep hillsides soil material is commonly washed away almost as rapidly as it forms. Westmoreland soils on hillsides are extensive in Brooke and Ohio Counties, and Berks soils are extensive in Hancock County. It is likely that these soils will remain less deep to bedrock than soils on more gentle slopes.

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 relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and to 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 used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and later revised (*6*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. It is under continual study (*5*, *8*). Therefore, readers interested in developments of the current system should search the latest literature available. In table 9, the soil series of Brooke, Hancock, and Ohio Counties are placed in some categories of the current system, and also in great soil groups of the 1938 classification.

ORDERS. Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soils orders are those that tend to give broad climatic groupings of soils. The exceptions to this are the Entisols, Histosols, and, to some extent, Inceptisols, which occur in many different climates. Five soil orders are represented in Brooke, Hancock, and Ohio Counties. They are Ultisols, Alfisols, Mollisols, Inceptisols, and Entisols.

Ultisols have the most strongly developed horizons of all the soils in the survey area. They are characterized as having a B horizon of clay accumulation, bright colors in the B horizon, moderate structure, and relatively low base saturation. The Allegheny, Gilpin, and Monongahela soils are the Ultisols in these three counties.

Alfisols are less weathered and generally have a slightly less strongly developed horizon than the Ultisols. They also have a B horizon of clay accumulation, but they have higher base saturation and generally have slightly duller colors than the Ultisols. The Clarksburg and Guernsey soils are the Alfisols in the three counties.

Mollisols are high in content of organic matter in the surface and subsurface horizons, have high base saturation, and may or may not have a B horizon of clay accumulation. In this survey area, the Huntington and Dunning soils are representative of this order. They do not have a horizon of clay accumulation.

Inceptisols have not progressed far enough to have a horizon of clay accumulation. They show some evidence of development, however, including weak structure and alterations resulting in a B horizon with slightly brighter colors than those of the surface layer or the substratum layer. The Berks and Dekalb soils are representative of the Inceptisols.

Entisols are recent soils. They lack a horizon of clay accumulation, have either a weak structure or are massive or single grained, and are only slightly altered from the materials in which they are developing. Lakin soils are representative of the Entisols. The most apparent evidences of soil development in Lakin soils are the thin bands and lumps of B horizon occurring in the C horizon matrix.

SUBORDERS. Each order is divided into suborders, primarily on the basis of those soil characteristics that produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUPS. Suborders are separated into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with the growth of roots or the movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 9, because it is the last word in the name of the subgroup.

SUBGROUPS. Great groups are subdivided into subgroups. one representing the central, or typic, segment of a group, and others, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILIES. Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name.

General Nature of the Area

This section provides general information about Brooke, Hancock, and Ohio Counties. It briefly describes the early history and development of the Area, present farming and land use, relief and drainage, and the geology and climate.

Early Settlement and Development

Settlers began to move into the Area in the middle 1700's. Early settlements were at the present locations of Wellsburg and Wheeling (*12*). The early settlers found the soil well suited to grain, such as wheat, corn, and rye. Growing these crops was the main farming enterprise for the first 50 years following 1772. After this time, the production of grain declined, and sheep were introduced. Wool and wool products were exchanged in southern markets for sugar, molasses, cotton, and fruit. The raising of sheep flourished until about 1880, when dairying and the growing of fruit and truck crops began. For additional information on farming in the survey area, see "Present Farming and Land Use."

The value of the Ohio River as a carrier of trade was early recognized. The towns on its banks became important commercial points on the western frontier. Wellsburg and Wheeling were large shipping and boat-building centers. National Road was constructed in the early 1800's. It connected Wheeling to Cumberland, Maryland, and to other points to the east. Through-coaches and freight wagons traveled this road heavily until the Baltimore and Ohio Railroad was completed in the mid-1800's. Later, other roads were constructed that linked the Area with other points to the east.

The three counties are now served by the Norfolk and Western, the Baltimore and Ohio, and the Penn Central Railroads; by a commercial airport; by U.S. Highways Nos. 22, 250, and 40; and by Interstate Highway No. 70. Heavily traveled are State Routes Nos. 2, 8, 27, 67, and 88. Many other roads serve the residents of the Area.

Iron, coal, pottery, glass, brick, and clay industries were important to the growth of the Area. In the mid-1880's, Wheeling was referred to as the nail city and, at that time, was the greatest iron nail center of the world. One of the world's largest white ware potteries in the early 1900's was in Newell, Hancock County. The brick and clay industry was important to the town of New Cumberland. The iron and coal industries are now prominent in the Area, and the pottery, glass, brick, and clay industries are of less importance.

Wheeling is the county seat of Ohio County and the largest city in the survey area. According to the Bureau of Census, it had a population of 53,400 in 1960 and a population of 48,188 in 1970, or a decrease of 9.8 percent. Weirton, the steel center and second largest city in the survey area, had a population of 28,200 in 1960 and a population of 27,131 in 1970, or a decrease of 3.8 percent. Wellsburg, the county seat of Brooke County, and New Cumberland, the county seat of Hancock County, also show declines in population from 1960 to 1970.

Present Farming and Land Use

The land in farms in the three counties is declining, according to data prepared by the U.S. Bureau of Census. About 38.3 percent of the land area, or 68,172 acres, was in farms in 1964, compared with 31.3 percent, or 55,344 acres, in 1969. The number of farms decreased from 531 in 1964 to 362 in 1969. In 1969 the average size of the farms was 152.9 acres.

Harvested cropland in the survey area decreased from 18,287 acres in 1964 to 13,178 acres in 1969. Woodland, including pastured woodland, decreased from 17,792 acres in 1964 to 14,435 acres in 1969. All other land in farms decreased from 24,359 acres in 1964 to 14,655 acres in 1969. All other land includes pasture land other than pastured cropland and pastured woodland, rangeland, and land in house lots, barn lots, ponds, roads, and wasteland.

The principal field crops are corn, oats, wheat, barley, alfalfa, alfalfa and grass mixtures, and clover and grass mixtures. These are commonly grown in alternating strips on many farms.

Crops harvested in 1969 included 1,057 acres of corn for grain and 373 acres of corn for silage, 220 acres of wheat, 1,243 acres of other small grains, and 8,988 acres of hay.

Most farm income is from livestock and livestock products. Dairying is the most important farm enterprise. In 1964, 102 dairies in the Area sold 22,533,456 pounds of whole milk. Ohio County had 83 of the dairies reported. In 1969 the number of dairies was less than in 1964. Beef cattle, poultry, and their products are produced for sale on some farms.

Vegetable sales in the Area for 1964 were $27,366. Apples that were harvested amounted to 5,818,194 pounds in 1964 and 4,148,262 pounds in 1969. Most vegetables and orchard fruits are produced in Hancock County.

Many farmers supplement their income by working in industry.

Relief and Drainage

The three-county area is characterized by hills and narrow valleys. The hills rise rather abruptly above the floors of the valleys, but the rise above the walls of the valleys is more gradual to the moderately wide hilltops. Slopes are generally very steep to steep along the walls of the valleys and moderately steep to gently sloping above the steeper part of the valley walls and along the hilltops.

The overall relief is slightly more rugged in the southern part of Ohio County than in other parts of the survey area. The highest point in the survey area is 1,440 feet. It is near the Pennsylvania line and south of U.S. Highway No. 40 in Ohio County. The lowest point is 618 feet, which is the normal pool level of the Ohio River at Wheeling. The total relief is thus 822 feet.

All drainage flows into the Ohio River. Most of the survey area is drained by Wheeling, Little Wheeling, Middle Wheeling, and Short Creeks in Ohio County; Short, Buffalo, Cross, and Harmon Creeks in Brooke County; and Kings Creek and Hardin and Tomlinson Runs in Hancock County.

A system of locks and dams on the Ohio River maintains a water level that facilitates the movement of boats and barges.

Geology

Most of the exposed rocks in the three counties consist of interbedded brown and gray sandstone, siltstone, limy and acid gray shale, limestone, coal, and a few thin beds of limy red shale. These rocks are a part of the Dunkard, Monongahela, Conemaugh, and Allegheny geologic series (*12, 13*).

In the Dunkard and Monongahela series, limestone and gray shale beds are dominant. Also, most of the commercial coals are in the Monongahela series. Brown and gray acid sandstone, siltstone, and gray shale beds are dominant in the Conemaugh and Allegheny series, but a few thin beds of limestone and limy red shale are in some areas.

The soils formed in material weathered from young rocks in the southern part of the survey area and in material weathered from older rocks on the northern part. In Ohio County the dominant rocks are of the Dunkard series. In Brooke County, rocks of the Dunkard and Monongahela series are dominant and in about equal amounts, and there is a lesser amount of Conemaugh rocks in the northern part of the county. In Hancock County, Conemaugh rocks are dominant, and some of the streams cut through rock beds of the Allegheny series.

Climate [5]

The climate of this general Area is humid and continental. It is characterized by marked seasonal differences in temperature, a wide yearly range in temperature, and adequate, evenly distributed precipitation. This general area is influenced by cold, dry air masses from the northern part of North America and by warm, humid, maritime, tropical air masses from the Gulf of Mexico. It is directly in the path of the large-scale cyclonic storms or low-pressure areas that travel northeastward up the Ohio Valley. These storms, most frequent during the colder half of the year, cause large day-to-day changes in temperature and bring frequent changes in weather. Thaws and freezes are common in winter. About three cold waves with subzero temperatures occur each year. Snow normally averages about 40 inches and generally begins in November and falls as late as April. It makes up about 30 percent of the precipitation in winter.

The climate is favorable for the growth of most farm crops common to the area. The principal farming indus-

[5] By ROBERT O. WEEDFALL, climatologist for West Virginia, National Weather Service, U.S. Department of Commerce.

tries are fruit, vegetable, and livestock. The length of the growing season averages about 140 days. The average date of the last occurrence of 32° F. in spring is about May 16, and the first occurrence in fall is about October 5. Temperatures of 90° or above occur on an average of 19 days per year, but the dry summer of 1953 had almost twice this number (*11*). Table 10 gives the probabilities of last freezing temperatures in spring and first in fall.

TABLE 10.—*Probabilities of last freezing temperature in spring and first in fall*

[Data are from an 18-year record kept at the Weirton climate station (elevation 1,040 feet)]

Probability	Dates for given probability at temperature of—				
	16° or lower	20° or lower	24° or lower	28° or lower	32° or lower
Spring:					
1 year in 10 later than	March 29	April 7	April 16	April 28	May 18
1 year in 4 later than	March 21	March 30	April 10	April 22	May 8
1 year in 2 later than	March 11	March 21	April 3	April 16	April 28
3 years in 4 later than	March 2	March 12	March 27	April 9	April 18
9 years in 10 later than	February 21	March 4	March 20	April 4	April 9
Fall:					
1 year in 10 earlier than	November 17	November 16	October 27	October 23	October 8
1 year in 4 earlier than	November 25	November 21	November 3	October 29	October 15
1 year in 2 earlier than	December 4	November 27	November 11	November 5	October 23
3 years in 4 earlier than	December 12	December 4	November 19	November 12	October 30
9 years in 10 earlier than	December 20	December 9	November 27	November 18	November 6

Seven months of the year, April through October, have sunshine more than 50 percent of the possible time, and the period of June through September has sunshine about 65 percent of the possible time. The 5 months that have less daylight hours have sunshine only about 40 percent of the possible time.

Although precipitation is rather evenly distributed throughout the year, the total is somewhat greater and more intense in summer. Outbreaks of cool air from Canada bring relief from warm humid spells, but they frequently produce heavy thunderstorms, which are most common in June and July. Violent winds or hail and intense rainfall sometimes accompany the more severe thunderstorms. Because of these heavy intense rainfalls the smaller streams and creeks overflow their banks and cause local flooding. Fall is generally the driest season and the time when the smaller streams run dry. Table 11 gives data on temperature and precipitation for Brooke, Hancock, and Ohio Counties.

Windstorms or high winds associated with some of the

TABLE 11.—*Temperature and precipitation data*

[Data from Weirton climate station, Hancock County (elevation 1,040 feet)]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have about 4 days with— Maximum temperature equal to or higher than—	Two years in 10 will have about 4 days with— Minimum temperature equal to or lower than—	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Average number of days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
	° F.	° F.	° F.	° F.	Inches	Inches	Inches		Inches
January	39	23	56	3	3.01	1.4	5.3	7	3.5
February	42	24	59	5	2.72	1.5	4.3	7	3.0
March	50	30	70	15	3.69	2.2	6.6	3	3.5
April	64	41	79	25	3.83	2.3	5.8	(1)	1.3
May	74	49	85	36	3.67	2.0	5.8	0	0
June	82	58	90	45	3.85	2.2	6.5	0	0
July	85	62	92	52	4.30	1.9	7.3	0	0
August	84	61	91	48	3.38	1.0	5.6	0	0
September	78	54	89	40	2.69	.9	5.7	0	0
October	68	44	80	30	2.43	.8	4.9	0	0
November	53	34	70	19	2.73	1.5	4.3	1	3.0
December	41	25	58	6	2.27	1.0	4.9	6	2.7
Year	63	42	(2) 95	(3) −3	38.57	30.5	48.0	24	2.9

[1] Less than half a day. [2] Average annual maximum. [3] Average annual minimum.

more violent thunderstorms and with strong frontal passages or small squall lines cause some property damage in places, particularly at and near the higher elevations on hilltops. Although occasional windstorms occur, the most violent type of storm, the tornado, has never been observed in Brooke or Hancock Counties, and only once in Ohio County. This storm was on April 16, 1880, near Wheeling. Winds from the west-southwest are most frequent throughout the year. Wind velocities are highest during the colder months and are generally lowest from May through October.

The average relative humidity ranges from 75 to 87 percent at 7 a.m., which is indicative of the maximum daily value. The highest values, above 80 percent, occur in summer and early in fall and are the result of fog in the valleys in early morning. The average relative humidity varies from 68 percent at 1 p.m. in winter to about 50 percent in summer. Even lower values occur in summer during the heat of the afternoon on days without rain. Although the humidity is likely to be low during hot spells, uncomfortably warm, humid afternoons occur on a few days every summer, particularly at the lower elevations near the Ohio River.

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Glossary

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

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

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.

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

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

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

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

Coarse-textured soil. Sand and loamy sand.

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

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

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Fine-textured soils. *Moderately fine textured:* clay loam, sandy clay loam, silty clay loam; *Fine-textured:* sandy clay, silty clay, and clay. Roughly, soil that contains 35 percent or more of clay.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard 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. The 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.

Gall spot. A very severely eroded spot or area in which the subsoil is exposed.

Gravelly soil material. From 15 to 50 percent of material, by volume, consists of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

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

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

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

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

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

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

Medium-textured soil. Soil of very fine sandy loam, loam, silt loam, or silt texture.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

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

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

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

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	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Residual material. Unconsolidated, partly weathered mineral material that accumulated over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

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

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.

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

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, to serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

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

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

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

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

Upland. Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

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

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. The suitability of the soils for use as cropland as discussed in the soil descriptions. The capability grouping is discussed on pages 26 to 28. Other information is given in tables as follows:

Acreage and extent, table 1, page 7.
Estimated yields, table 2, page 29.
Engineering uses of the soils, table 5, page 36; and table 6, page 40.

Map symbol	Mapping unit	Page	Capability unit Symbol	Woodland suitability group Number
AhB	Allegheny silt loam, 3 to 8 percent slopes	8	IIe-4	1
AhC	Allegheny silt loam, 8 to 15 percent slopes	8	IIIe-4	1
At	Atkins silt loam	9	IIIw-1	2
BeB	Berks shaly silt loam, 3 to 10 percent slopes	9	IIIe-32	3
BeC	Berks shaly silt loam, 10 to 20 percent slopes	9	IVe-32	3
BeC3	Berks shaly silt loam, 10 to 20 percent slopes, severely eroded	10	VIe-31	3
BeD	Berks shaly silt loam, 20 to 30 percent slopes	10	VIe-31	3,4
BeE3	Berks shaly silt loam, 20 to 40 percent slopes, severely eroded	10	VIIe-2	3,4
BkF	Berks soils, 30 to 65 percent slopes	10	VIIe-2	3,4
BoB	Brooke silty clay loam, 3 to 10 percent slopes	11	IIIe-30	3
BoC	Brooke silty clay loam, 10 to 20 percent slopes	11	IVe-30	3
BoD	Brooke silty clay loam, 20 to 30 percent slopes	11	VIe-1	3
BrD	Brookside silt loam, 15 to 25 percent slopes	11	IVe-1	1
Cg	Chagrin fine sandy loam	12	IIw-6	1
Ch	Chavies fine sandy loam	13	IIs-6	1
CkB	Clarksburg silt loam, 3 to 8 percent slopes	13	IIe-14	1
CkC	Clarksburg silt loam, 8 to 15 percent slopes	13	IIIe-14	1
CkD	Clarksburg silt loam, 15 to 25 percent slopes	14	IVe-9	1
Cu	Cut and fill land	14	------	------
DeB	Dekalb channery sandy loam, 3 to 10 percent slopes	14	IIe-10	4
DeC	Dekalb channery sandy loam, 10 to 20 percent slopes	14	IIIe-10	4
DeD	Dekalb channery sandy loam, 20 to 30 percent slopes	14	IVe-3	3,4
Du	Dunning silt loam	15	IIIw-1	2
ErB	Ernest silt loam, 3 to 8 percent slopes	16	IIe-13	1
ErC	Ernest silt loam, 8 to 15 percent slopes	16	IIIe-13	1
GlB	Gilpin silt loam, 3 to 10 percent slopes	17	IIe-10	1
GlC	Gilpin silt loam, 10 to 20 percent slopes	17	IIIe-10	1
GlC3	Gilpin silt loam, 10 to 20 percent slopes, severely eroded	17	IVe-3	1
GlD	Gilpin silt loam, 20 to 30 percent slopes	17	IVe-3	1,3
GlD3	Gilpin silt loam, 20 to 30 percent slopes, severely eroded	18	VIe-31	1,3
GuB	Guernsey silt loam, 3 to 10 percent slopes	18	IIe-14	1
GuC	Guernsey silt loam, 10 to 20 percent slopes	18	IIIe-14	1
GuD	Guernsey silt loam, 20 to 30 percent slopes	19	IVe-9	1
GuD3	Guernsey silt loam, 20 to 30 percent slopes, severely eroded	19	VIe-1	1
Hu	Huntington silt loam	19	IIw-6	1
LaB	Lakin loamy sand, 3 to 10 percent slopes	20	IIIs-1	4
LaC	Lakin loamy sand, 10 to 20 percent slopes	20	IVs-1	4
Ld	Lindside silt loam	20	IIw-7	1
Ma	Made land	21	------	------
MoB	Monongahela silt loam, 3 to 8 percent slopes	21	IIe-13	3
MoC	Monongahela silt loam, 8 to 15 percent slopes	21	IIIe-13	3
Ph	Philo silt loam	22	IIw-7	1
Sm	Strip mines	22	------	------
UpB	Upshur silty clay loam, moderately shallow variant, 3 to 8 percent slopes	23	IIIe-30	3
UsC3	Upshur silty clay, moderately shallow variant, 8 to 15 percent slopes, severely eroded	23	IVe-30	3
WeB	Westmoreland silt loam, 3 to 10 percent slopes	23	IIe-11	1
WeC	Westmoreland silt loam, 10 to 20 percent slopes	23	IIIe-11	1
WeC3	Westmoreland silt loam, 10 to 20 percent slopes, severely eroded	24	IVe-11	1
WeD	Westmoreland silt loam, 20 to 30 percent slopes	24	IVe-11	1,3
WeE	Westmoreland silt loam, 30 to 40 percent slopes	25	VIe-1	1,3
WeF	Westmoreland silt loam, 40 to 55 percent slopes	25	VIIe-1	1,3
WhB	Wharton silt loam, 3 to 10 percent slopes	26	IIe-13	1
WhC	Wharton silt loam, 10 to 20 percent slopes	26	IIIe-13	1

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