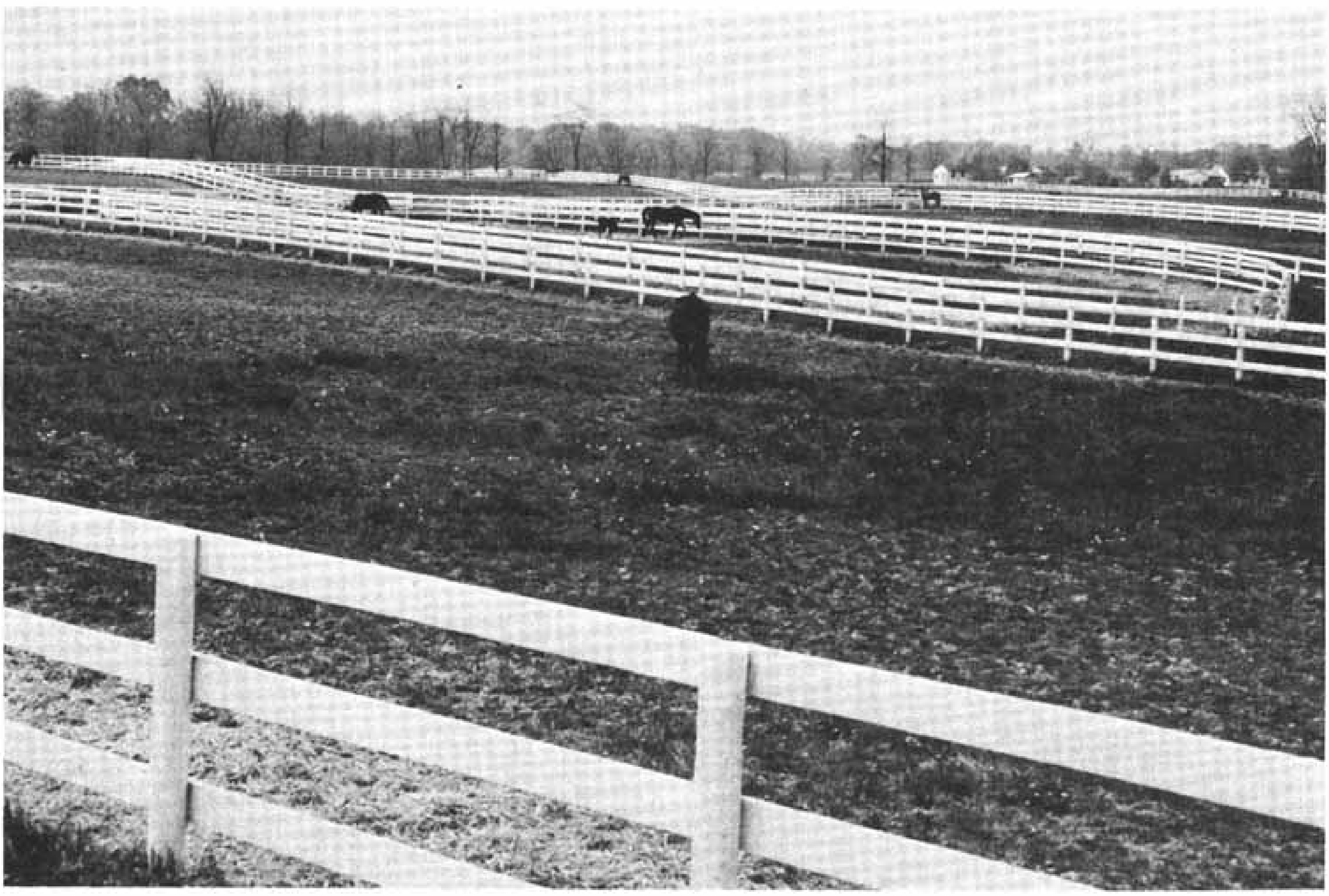
SOIL SURVEY OF

Warren County, Ohio



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Ohio Department of Natural Resources
Division of Lands and Soil
and the
Ohio Agricultural Research and Development Center

Issued March 1973

Major fieldwork for this soil survey was done in the period 1957–63. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1963. This survey was made cooperatively by the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Warren County 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, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, pasture, 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 Warren County are shown on the 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 woodland groups.

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

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

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

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

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

Newcomers in Warren County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information in the section "Additional Facts about Warren County."

Cover: **Horse farm on Rossmoyne silt loam, 2 to 6 percent slopes.**

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SOIL SURVEY OF WARREN COUNTY, OHIO

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE OHIO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF LANDS AND SOIL, AND THE OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER

WARREN COUNTY is in the southwestern part of Ohio (fig. 1). It occupies approximately 261,120 acres, or 408 square miles, and is roughly rectangular in shape. The county is made up of 11 townships.

The population of Warren County in 1960 was approximately 65,711 (*15*).[1] Lebanon, the county seat, is the largest community in the county. It is near the center of the county. Lebanon had a population of 5,993 in 1960.

Large areas of deep, nearly level or gently sloping soils make Warren County well suited to farming. Corn, wheat, soybeans, and hay are the principal crops. Grain crops are used mainly as feed for livestock.

Warren County is directly south of the metropolitan area of Dayton, Ohio, and north of the larger metropolitan area of Cincinnati, Ohio. For this reason, community development is occurring in some parts of the county, but farming still is the dominant land use.

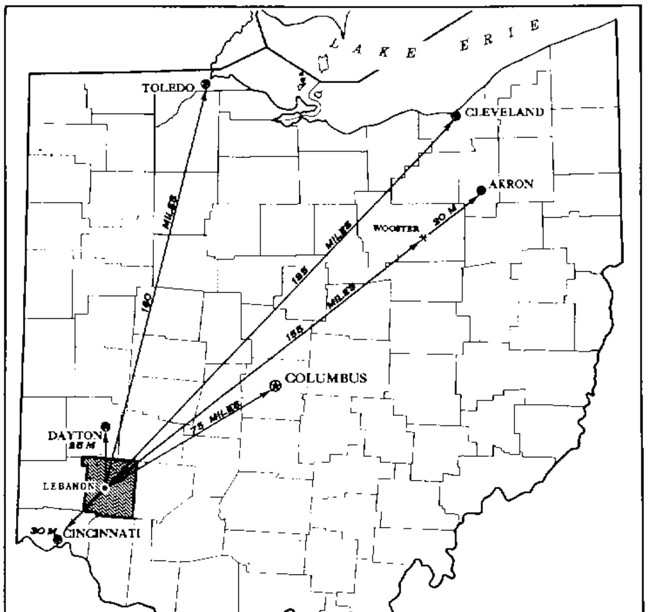

Figure 1.—**Location of Warren County in Ohio.**

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Warren County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, 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. 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 (*13*).

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. Cincinnati and Clermont, 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 soils.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. 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, Fox loam, 0 to 2 percent slopes, is one of several phases within the Fox 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,

[1] Italic numbers in parentheses refer to Literature Cited, page 113.

and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared using the aerial photographs for the base map.

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 other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Warren County: Soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the name of the dominant soil in a single series, for example, Eden complex; or the names of the dominant soils in two or more series, joined by a hyphen, for example, Fox-Casco complex, 12 to 18 percent slopes, moderately eroded.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and," for example, Rodman and Casco gravelly loams, 18 to 25 percent slopes, moderately eroded.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be 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. Cut and fill land is a land type in Warren County.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then the soil scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Warren County. A soil association is a landscape that has a distinctive 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.

The soil associations in Warren County join associations in other counties that have the same or similar kind of landscapes but do not necessarily have the same dominant soils or the same proportion of dominant soils.

The six soil associations in Warren County are described in the following pages.

1. Clermont-Avonburg Association

Poorly drained and somewhat poorly drained, nearly level to gently sloping soils that formed in loess and Illinoian-age glacial till

This soil association is in scattered areas that are mainly in the southern and east-central parts of the county. The nearly level soils in most of the association are broken in places by slight rises. V-shaped drainageways dissect the soils and hinder cultivation in some places.

This association makes up about 14 percent of the county. About 48 percent of this is Clermont soils, 42 percent is Avonburg soils, and the remaining 10 percent is other soils.

The Clermont and Avonburg soils formed partly in loess and partly in the underlying clay loam glacial till of Illinoian age. Clermont soils are nearly level and poorly drained and occupy broad areas. Avonburg soils are somewhat poorly drained and lie on slight rises.

Other soils are the poorly drained Blanchester soils in low areas and along drainageways, the moderately well drained Rossmoyne soils on scattered low knolls, and the dark-colored, very poorly drained Patton soils in low level areas. The Patton soils are in one area along State Route 350 in the eastern part of the county.

Wetness is the major limitation to use of the soils in this association. These soils dry out slowly in spring even if drained. Drainage is difficult on these soils because permeability is slow or very slow, and the soils are level to gently sloping. A combination of surface ditches and bedding is normally used for drainage. Land smoothing is used to some extent. The soils in this association are suited to farming if they are adequately drained and otherwise managed well. Most of the acreage is used for crops, mainly corn and soybeans. The major soils are very strongly acid or extremely acid unless limed. Only a small area is used for community development in this association, partly because the soils are seasonally wet for long periods in winter and spring. The Rossmoyne soils have the fewest limitations for building sites.

2. Rossmoyne-Hickory-Fairmount Association

Moderately well drained and well drained, gently sloping to steep soils that formed in silt-capped glacial till and in residual material.

This soil association occupies much of the southeastern and east-central parts of the county. The soils are gently sloping to steep and are in the steepest parts of the county. The major soils occupy side slopes around streams and drainageways that flow into the Little Miami River and Todd Fork of the Little Miami River. All of this association is highly dissected, for the streams are deeply entrenched.

This association makes up about 28 percent of the county. About 55 percent of this is Rossmoyne soils, 19 percent is Hickory soils, 13 percent is Fairmount soils, and the remaining 13 percent is other soils.

The moderately well drained Rossmoyne soils are dominant. They occupy the uppermost slopes, which range to as much as 12 percent. The Rossmoyne soils formed in silt-capped glacial till of Illinoian age. In the subsoil they have a dense compact layer that restricts movement of water and growth of plant roots.

Hickory soils formed in glacial till of Illinoian age that, in some places, is thin over residual shale and limestone. The Hickory soils are well drained. They generally are steeper than the Rossmoyne soils. Much of the acreage of Hickory soils is mapped in complexes with Fairmount soils where the glacial till is thin over calcareous shale and limestone.

The Fairmount soils are shallow and well drained. They formed in material weathered from interbedded shale and limestone. Most areas of steep Fairmount soils have limestone flagstones on the surface.

Among the other soils in this association are the well-drained Crider and Cincinnati soils on the uplands and the well-drained Parke and Rainsboro soils on terraces along some of the larger streams. The Crider soils are only in the eastern part of the county in one area called Spring Hill. Smaller areas of other soils occur along the streams.

Steepness is the dominant limitation to the use of the soils in this association. Corn and soybeans are commonly grown on the less sloping soils, and pasture and woodland are dominant on the steeper soils. Much of the woodland in the county is in this association. Erosion and gullying are serious hazards throughout.

The dissected terrain offers numerous scenic views for homesites, but there is little community development in this association. Soil limitations to community development are steep slopes and bedrock at a shallow depth on the side slopes.

3. Russell-Miamian-Xenia-Wynn Association

Well drained and moderately well drained, nearly level to sloping soils on the Wisconsin-age glacial till plain

This soil association occupies a large continuous area in most of the northern and western parts of the county. Much of the association consists of undulating to rolling uplands that are commonly cut by numerous V-shaped valleys.

This association makes up about 36 percent of the county. About 40 percent of this is Russell and Miamian soils, 19 percent is Xenia soils, 12 percent is Wynn soils and the remaining 29 percent is other soils.

The Russell, Miamian, and Xenia soils formed partly in loess and partly in the underlying calcareous loam glacial till of Wisconsin age. The Wynn soils formed in loess and glacial till that overlie limestone bedrock at a depth of 20 to 40 inches. Russell and Miamian soils are mapped together in complexes. They are well drained. Xenia soils are moderately well drained, and Wynn soils are well drained.

Among other soils are the well drained, steep Hennepin soils on the sides of stream valleys and the dark-colored, moderately well drained, gently sloping Dana soils. Small areas of well-drained Alford soils and somewhat poorly-drained Iva soils occur near the place where Caesar Creek flows into the Little Miami River.

The erosion hazard is the major limitation to farming in this association. Common practices used to control erosion are stripcropping, contour farming, and the use of grassed waterways. The nearly level soils of the association have few limitations for farming. If practices for controlling erosion are used where needed, most of the soils are well suited to farm crops. Some of the steeper soils are wooded or are used for pasture.

Because bedrock is near the surface, the Wynn soils are limited for use as sites for buildings with basements and for other community development. Although most of this association is used for farming, community development is taking place to some extent, particularly in the western part of the county adjacent to Butler County and around Lebanon. Some areas of this association can be developed for hiking and nature trails or other recreational facilities.

4. Fincastle-Brookston Association

Somewhat poorly drained and very poorly drained, nearly level or gently sloping soils on the Wisconsin-age glacial till plain

This soil association is in areas scattered over the county from near Mason and Kings Mills in the southwestern part to north and east of Waynesville and Harveysburg in the northeastern part. The soils in these scattered areas are nearly level or gently sloping.

This association makes up about 9 percent of the county. About 60 percent of this is Fincastle soils, 35 percent is Brookston soils, and the remaining 5 percent is other soils.

The Fincastle and Brookston soils formed in silt-capped glacial till of Wisconsin age. Fincastle soils are somewhat poorly drained, nearly level or gently sloping, and lighter colored and slightly higher in elevation than Brookston. Brookston soils are very poorly drained and lie in the low, nearly level or depressional areas. Either Fincastle or

Brookston soils are dominant in some areas of this association, and Fincastle soils in other areas.

Other soils are the somewhat poorly drained Reesville, the very poorly drained Ragsdale, and the moderately well drained Xenia soils.

A seasonally high water table and excessive wetness are the major limitations to the use of the soils for farming. The soils are well suited to commonly grown farm crops, but drainage is needed for optimum crop growth. Corn and soybeans are the main crops. The erosion hazard is only slight.

Seasonal wetness and poor natural drainage are limitations for many nonfarm uses. Basements and foundations in the dominant soils are likely to be wet unless drainage is provided. In the low areas, drainage outlets are difficult to establish. The Xenia soils have the fewest limitations for building sites.

5. Genesee-Fox Association

Well-drained, nearly level soils on flood plains and nearly level to moderately steep soils on Wisconsin-age glacial outwash terraces

The largest part of this soil association occupies an area that roughly parallels the Little Miami River and its major tributaries. The other part is in the northwestern part of the county along the Miami River and Clear Creek. Both areas consist mainly of nearly level soils on bottom lands that are broken in places by nearly level to gently sloping soils on stream terraces. A few areas of steeper soils are between terrace levels. The major soils in the association are well drained.

This association makes up about 10 percent of the county. About 30 percent of this is Genesee soils, 30 percent is Fox soils, and the remaining 40 percent is other soils.

The nearly level Genesee soils formed in loamy alluvium and occupy the bottom lands. The Fox soils formed in 24 to 42 inches of loamy material that overlies calcareous sand and gravel. They are mainly nearly level to gently sloping on terraces and more sloping on terrace breaks. Fox soils are dominant in the northwestern part of the county along the Miami River.

Other soils are Ross, Algiers, Eel, Shoals, and Sloan soils on bottom lands and Williamsburg, Warsaw, Rainsboro, and Parke soils on the terraces. All of the soils on bottom lands are subject to flooding.

Use of the Genesee and the lower Fox soils are limited mainly by flooding. Use of the Fox soils is also limited by droughtiness during dry periods and by an erosion hazard on the steeper slopes. All of the soils are well suited to crops, and the major soils are suited to irrigation. Corn and soybeans are the major crops in this association.

Nursery crops are grown to some extent on the Williamsburg soils. In some places on Genesee soils, johnsongrass is a serious weed pest. Community development has occurred to some extent, particularly in the northwestern part of Warren County. Flooding is a hazard in low-lying areas of Fox soils in this association. The Fox and Warsaw soils are a potential source of sand and gravel for commercial use.

6. Patton-Henshaw Association

Very poorly drained and somewhat poorly drained, nearly level soils that formed in lacustrine sediments in formerly ponded areas

This soil association occupies three areas in Warren County. Two of these areas are located in the eastern part of Massie and Washington Townships. The largest area is long and narrow and is along the Butler County line in the western part of Warren County.

This association makes up about 3 percent of the county. About 80 percent of this is Patton soils, 10 percent is Henshaw soils, and the remaining 10 percent is other soils.

The dominant soils, Patton and Henshaw, formed in silty and clayey materials deposited in old glacial lakes. They lie on a plain that, in places, is interspersed with small rises and is dissected by small drainageways.

The Patton soils are very poorly drained, dark colored, and nearly level to slightly depressional. The Henshaw soils are lighter colored and somewhat poorly drained. They are nearly level and occupy the low rises.

Among other soils are the Kings and Uniontown. The Kings soils are very poorly drained and occupy depressions in Shakers Swamp in the western part of the county. The better drained Uniontown soils are on slightly higher knolls.

Use of the soils in this association is limited mainly by wetness. Most areas of Patton and Henshaw soils are adequately drained, and this association is one of the most productive for farming in the county. The soils are used intensively for cash grains, and corn and soybeans are the main crops. The association is used little for community development, partly because the soils are so wet.

Use and Management of the Soils

This section discusses the use and management of the soils in Warren County for farming, woodland, wildlife, and engineering. Also discussed are selected nonfarm uses. In the part of this section on farming, there are estimated yields of principal crops grown on the various soils in the county. The part on wildlife gives information about the suitability of the soils for elements of wildlife and the use of the soils for various kinds of wildlife. The engineering part of this section gives test data for selected soils and estimates of engineering properties for all of the soils. It also gives interpretations of properties for selected engineering uses. The part on planning land use gives estimated degrees of limitations and the kinds of limitations of the soils for selected nonfarm uses.

Pasture Management

Most of the pasture in the county is on soils that are susceptible to erosion. These soils generally are eroded, low in natural fertility, and have poor tilth. Some pastures are on soils that have drainage needs. Soils that require drainage for optimum growth of row crops also require drainage for optimum growth of most pasture plants.

Erosion control is particularly important because many of the soils used for pasture are already eroded. Control of erosion is particularly important during seeding. Mulch seeding or use of a nurse crop helps to prevent further erosion.

Drainage must be as well established for pastures as for row crops.

Lime and fertilizer needs should be determined by soil tests. Adequate amounts of these amendments should be supplied to meet the requirements of the pasture plants grown and the needs of the farmer.

Soil compaction, caused by grazing when the soils are wet, slows the growth of pasture plants. Harvesting methods other than grazing, such as for hay, silage, or soilage, help to increase the growth of pasture plants and reduces soil compaction. Tilling when the moisture content is optimum also helps to reduce soil compaction.

The ability of a pasture to produce and to provide surface protection of the soils is influenced by the number of livestock, the length of time the livestock graze, the season they graze, and the availability of water. Practices of good management are: (1) Stocking at proper rates so as to maintain key forage species; (2) rotating pasture; (3) deferring grazing; (4) grazing at the proper season according to species; and (5) supplying ample water and salt at strategic locations.

Capability Grouping

Capability grouping shows in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are 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 rice, cranberries, horticultural crops, or other crops requiring special management.

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

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

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I. Soils have few limitations that restrict their use.
- Class II. Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III. Soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV. Soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V. Soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat. (No class V soils in Warren County.)
- Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.
- Class VIII. Soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes. (No class VIII soils in Warren County.)

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 interfers with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soils is limited mainly because it is shallow, droughty, or stony; and *c*, used in some parts of the United States but not in Warren County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, 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-1. 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 two foregoing paragraphs, and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

Described in the following pages are the capability units in Warren County. The soils in any one unit are similar in the kind of management they require, and in their response to that management. The descriptions of the capability units give the soil characteristics that affect the choice of crops, productivity, and management in that unit. In some units, one or two soils may differ slightly from the rest of the soils in the unit. These soils that differ are included because they have a small acreage that does not justify a separate capability unit description, or because they are similar in many important properties to the other soils in the unit. By including soils that differ slightly, the number of capability units in this soil survey are kept to a practical minimum. The exceptions are noted because they affect use and management.

The ratings of low, medium, or high available moisture capacity refers to the normal rooting depth of corn, soybeans, or other commonly grown field crops. Depth of root zone refers to the depth of soil to a root restricting layer, such as a fragipan, dense clay, compact till, or bedrock.

Although these descriptions point out soil features that limit the use of the soils for crops or pasture, no specific recommendations for overcoming these limitations are given. Many methods are suitable for controlling erosion or of obtaining adequate drainage on any given field of any kind of soil. For specific information regarding erosion control, drainage, or other management practices, the farmer should request the information from the nearest office of the Soil Conservation Service or the Ohio Cooperative Extension Service.

The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series appear in the unit.

The individual soils in each capability unit can be determined by consulting the "Guide to Mapping Units" at the back of this survey. Cut and fill land, Gravel pits, Muck, and Riverwash have not been assigned a capability unit.

The following general, or basic, management practices are needed on practically all of the soils in the county.

Levels of management.—Two levels of management, improved and optimum, are defined for use in this soil survey in the subsection "Estimated Yields," which follows this subsection. The table of estimated crop yields gives yields under both levels of management. The capability unit descriptions on the following pages stress optimum management. The use of optimum management results in optimum crop growth on practically all of the soils.

Maintenance of adequate fertility.—Because many of the soils in the county, particularly those that are light colored, such as the Cincinnati, Clermont, and Kendallville, are naturally acid and low in content of plant nutrients, additions of lime and fertilizer are needed. Such additions should be based on the results of soil tests, on the need of the crop, and on the level of crop growth desired. For assistance in determining the kinds and amounts of fertilizer to apply, the farmer should consult the Ohio Cooperative Extension Service. Maintaining the organic content of the soils helps to insure good soil structure and tilth.

Utilization of crop residues.—In many of the soils in the county, for example, the Clermont and Henshaw, the organic-matter content is below optimum level. To offset this deficiency, all crop residues should be incorporated into the soil. If soybeans or other crops that supply small amounts of residues are grown, the cropping system should provide cover or sod crops.

Drainage.—In this county wetness is a hazard on about 40 percent of the acreage suitable for cultivated crops. Needed on the somewhat poorly drained, poorly drained, and very poorly drained soils are land smoothing (fig. 2), tile, surface drains, or a combination of these. The moderately well drained soils generally need few or no drainage practices. If they are drained, most of the soils on which use is limited by wetness are suited to general farm crops.

***Figure 2.*—Land smoothing on Clermont silt loam.**

Control of erosion.—In the county erosion is a hazard on gently sloping to very steep soils. This amounts to about 58 percent of the acreage suitable for cultivation. Erosion control practices commonly used in the county are constructing diversion terraces and waterways, contour stripcropping, contour tillage, minimum tillage, utilizing crop residues, and planting close-growing crops.

Cropping systems.—Cropping systems can be defined as the growing of crops under needed management practices. These systems include the use of rotations that contain grasses and legumes, and the use of sequences that give the desired benefits without the use of such crops. A satisfactory cropping system meets the needs of the soil for improvement or maintenance of good physical condition, protects the soil during critical periods when erosion usually occurs, aids in the control of weeds, insects, and diseases, and fulfills the farmer's desire for good crop growth.

In sloping areas as the frequency of row crops in the cropping system increases, so does the need for establishing conservation measures. It is impossible to list all of the possible cropping systems suitable for any particular soil. For example, by using contour stripcropping on a sloping soil, a rotation of a year of a row crop, a year of a small grain, and 2 years of meadow may be satisfactory. Because of excessive erosion, the row crop would not be satisfactory in the cropping system unless contour strips were established.

Field crops commonly grown in the county include corn, soybeans, and small grains, such as wheat and oats. The pasture and hay plants commonly grown are alfalfa, alsike clover, ladino clover, red clover, timothy, orchardgrass, and bromegrass. Specialty crops include cigar leaf tobacco, sweet corn, strawberries, squash, and trees for landscaping. The kinds of crops named are not exclusive, but they do show the kind of crops that are adapted to the soils in the county.

For specific information regarding erosion control, recommended crop varieties, drainage, or other management practices, the reader should consult technicians at the nearest office of the Soil Conservation Service or the Ohio Cooperative Extension Service.

CAPABILITY UNIT I-1

This capability unit consists of medium-textured soils that are nearly level and well drained or moderately well drained. These soils are in the Ockley, Miamian, Russell, Williamsburg, and Xenia series. All the soils have a deep or moderately deep root zone and moderate or moderately slow permeability. They have a high or medium available moisture capacity and a high capacity for storing and releasing plant nutrients. The root zone is strongly acid to mildly alkaline. The most acid part of these soils is in the upper 2 feet.

These soils have no soil features that limit use for field crops or pasture. Where management is improved or optimum, there is little or no erosion hazard. All of the soils are subject to surface crusting, but good soil structure can be maintained by using crops that supply large amounts of crop residues and by using minimum tillage.

These soils are suited to all of the field crops and to the hay and pasture plants commonly grown in the county. They also are suited to the specialty crops adapted to the climate. Row crops can be grown year after year if management is optimum. If management is less than optimum, loss of good soil structure and poorer crop growth are likely. These soils are suited to irrigation.

CAPABILITY UNIT I-2

This capability unit consists of dark-colored, medium-textured Dana and Wea soils that are nearly level and moderately well drained or well drained. They have a deep root zone, moderate or moderately slow permeability, a high available moisture capacity, and a high capacity for storing and releasing plant nutrients. Their root zone is medium acid to neutral. These soils have a moderately high organic-matter content.

These soils have no soil features that limit use for field crops or pasture. If management is improved or optimum, the erosion hazard is slight or none. Tilth is generally good in the surface layer, and the soils resist crusting. These soils have a higher organic-matter content than nearby lighter colored soils, and they are less susceptible to surface crusting. Soil structure can be maintained by using crops that supply large amounts of crop residues.

These soils are suited to all of the field crops and to the hay and pasture plants commonly grown in the county. They also are suited to the specialty crops adapted to the climate. These soils can be used year after year for row crops if management is good. Organic-matter content and crop growth generally decrease if management is less than optimum. The soils in this unit are suited to irrigation.

CAPABILITY UNIT IIe-1

This capability unit consists of medium-textured and moderately coarse textured soils that are mostly gently sloping and are well drained or moderately well drained. These soils are in the Alford, Birkbeck, Cincinnati, Crider, Dana, Hickory, Kendallville, Miamian, Ockley, Parke, Princeton, Russell, Uniontown, Williamsburg, and Xenia series. They have a deep or moderately deep root zone and moderate or moderately slow permeability. They have a medium or high available moisture capacity and a moderate to high capacity for storing and releasing plant nutrients. The root zone of the soils in this unit generally ranges from very strongly acid to slightly acid, but in some places, part of the root zone is neutral. The lime required for the soils is extremely variable. Surface runoff is medium to rapid, and the hazard of erosion is moderate in cultivated areas. Some of the soils are already moderately eroded. All of the soils are susceptible to surface crusting, but Dana and Princeton soils are less susceptible than the others. The moderately eroded soils puddle and clod more easily than the uneroded soils.

The soils in this unit are suited to all of the field crops and to the hay and pasture plants that are commonly grown in the county. They are also suited to commonly grown specialty crops. These soils can be cultivated year after year on slopes of up to 4 percent if management is optimum. Erosion losses are generally excessive where soils on slopes of more than 4 percent are continually cultivated. A thick plant cover in hay meadows and pastures helps to control erosion.

CAPABILITY UNIT IIe-2

This capability unit consists of medium-textured Plattville and Wynn soils that are well drained and mostly gently sloping. Limestone or limestone and shale bedrock is at a depth of 20 to 40 inches. These soils have a moderately deep root zone, slow or moderately slow permeability, a medium to low available moisture capacity, and a moderate capacity for storing and releasing plant nutrients. Their root zone is mostly medium acid to neutral.

The erosion hazard is moderate, partly because surface runoff is medium to rapid. These soils are especially droughty where limestone is only 20 to 30 inches below the surface. The Wynn soils are susceptible to surface crusting. In some places they are moderately eroded and require more careful management than uneroded areas. The Plattville soils have a higher organic-matter content than Wynn soils and are less susceptible to crusting.

All of the soils generally are suited to the field or pasture crops commonly grown in Warren county. They are suited to continuous row crops on slopes up to 4 percent if management is optimum. If soils having slopes of more than 4 percent are cultivated continuously, excessive erosion losses are likely. A thick plant cover in pastures and hay meadows helps to control erosion.

CAPABILITY UNIT IIe-3

This capability unit consists of medium-textured Rainsboro and Rossmoyne soils that are gently sloping and moderately well drained. These soils have a fragipan, a moderately deep root zone, moderately slow permeability, and a medium available moisture capacity. The root zone and available moisture capacity are limited by the fragipan. These soils hve a moderate capacity for storing and releasing plant nutrients. They are strongly acid in the root zone.

The erosion hazard is moderate, partly because surface runoff is medium to rapid. All the soils are subject to surface crusting. If plowed when wet, the moderacly eroded Rossmoyne soil is likely to be more cloddy than the other soils. All of the soils with slopes of up to 4 percent are suited to continuous row crops if management is optimum. Where soils having slopes of more than 4 percent are continuously cultivated, erosion losses are likely to be excessive. The soils in this unit are suited to all of the field crops and to hay and pasture plants commonly grown in the county. They are not well suited to specialty crops. A thick plant cover in pastures and hayfields helps to control erosion.

CAPABILITY UNIT IIe-4

This capability group consists of medium-textured Fox and Warsaw soils that are gently sloping and well drained. These soils have calcareous sand and gravel within 24 to 42 inches of the surface. They have a moderately deep root zone, moderate permeability, a medium to low available moisture capacity, and a moderate capacity for storing and releasing plant nutrients. Above the calcareous sand and gravel, these soils are medium acid to slightly acid. The Warsaw soils have a higher organic-matter content than the Fox soils. The erosion hazard is moderate on all of these soils. They have medium to rapid surface runoff, and tend to be droughty where the sand and gravel are within 30 inches of the surface. Surface crusting is not likely.

These soils are suited to all of the field crops, to hay and pasture plants, and to the specialty crops commonly grown in the county. They warm up and dry out early in spring. They are well suited to irrigation if erosion is controlled. If high value crops are to be grown, irrigation should be considered. These soils are suited to cultivation year after year on slopes of up to 4 percent if management is optimum. The loam surface layer of these soils is easily worked, and it maintains its structure if crop residues are fully utilized. If these soils are not irrigated, pastures are poor in summer. A thick plant cover in pastures and hayfields helps to control erosion.

CAPABILITY UNIT IIw-1

This capability unit consists of somewhat poorly drained Algiers and Shoals soils. These soils occupy low-lying parts of the flood plain and are subject to flooding, particularly during winter and spring. The water table is high during winter and spring, and the surface is ponded for short periods in the lowest areas. Even in areas not flooded, these soils stay wet until late in the spring unless they are drained. The root zone of these soils is deep when the water table is low. They have a high available moisture capacity and generally a high capacity for holding and releasing plant nutrients. These soils are neutral in reaction. The Algiers soils are moderately slowly permeable, and the Shoals soils are moderately permeable. Tile lines and surface drains are effective in these soils if adequate outlets can be established. Good outlets are difficult to establish in some areas because the soils are low in the landscape.

Seasonal wetness is the major limitation to use of these soils. Maintenance of good soil structure is a problem because these soils are commonly worked when too wet. These soils compact and soil structure deteriorates if they are worked or pasture is grazed when the soils are wet. This makes the soils more difficult to till and makes pastures less productive.

These soils can be cultivated year after year if management is improved or optimum. The erosion hazard is slight or none where management is less than optimum, but optimum crop growth cannot be obtained for a long period. Flooding during winter and spring limits the choice of crops largely to summer crops. If these soils are adequately drained, they are suited to most of the commonly grown field crops and hay or pasture plants that can tolerate some wetness and flooding. They are poorly suited to specialty crops. In some local areas, flooding is so frequent that protective cover, either trees or grass, is needed continuously.

CAPABILITY UNIT IIw-2

This capability unit consists of nearly level, moderately well drained or well drained soils that are medium textured, moderately coarse textured, and coarse textured. These soils occupy bottom lands that are subject to flooding. The soils in this unit are in the Abscota, Eel, Genesee, Lanier, and Ross series. They have a moderately deep or deep root zone, moderate or rapid permeability, and generally a medium or high available moisture capacity. The Abscota and Lanier soils have a low to very low available moisture capacity. The Abscota, Lanier, and Ross soils have a higher organic-matter content than the other soils.

The soils in this unit are subject to periodic flooding that restricts use and the choice of crops to be grown. Flooding generally occurs during winter or spring. Areas of these soils are less likely to be flooded in the Miami Conservancy District than elsewhere. Deterioration of soil structure is seldom a concern on these sandy or loamy soils. The Lanier and Abscota soils are more droughty than the other soils in this unit. All of the soils are suited to irrigation.

These soils are suited to most of the commonly grown field crops and hay or pasture plants in the county. They are also suited to summer specialty crops, particularly if irrigated. Soils in this unit can be cultivated year after year if management is optimum. In some local areas, flooding is so frequent that the soils should be continuously in a protective cover of trees or grass.

CAPABILITY UNIT IIw-3

This capability unit consists of both medium-textured and moderately fine textured soils that are nearly level and poorly or very poorly drained. These soils are in the Blanchester, Brookston, Patton, and Ragsdale series. They have a seasonally high water table, a deep rooting zone when the water table is low, moderately slow to slow permeability, a high available moisture capacity, and a high or very high capacity for storing and releasing plant nutrients. The Blanchester soils are very acid in the root zone, but the other soils are neutral.

The hazard of wetness is moderate on these soils. They are highly susceptible to compaction if they are worked, or if cattle are grazed, when the soils are wet. Tile lines and surface ditches are effective if adequate outlets can be established.

These soils can be cultivated year after year if management is improved or optimum. They are suited to most of the commonly grown field crops and to hay and pasture plants that tolerate wet soils. They are also suited to sweet corn, tomatoes, and other specialty crops.

CAPABILITY UNIT IIw-4

This capability unit consists of somewhat poorly drained soils that are nearly level or gently sloping. These soils are in the Fincastle, Henshaw, Iva, and Reesville series. They are silty because they formed, at least partly, in silt deposited by wind or water. All of the soils have a seasonally high water table. They have a deep rooting zone in summer, moderately slow or slow permeability, a medium to high available moisture capacity, and a moderate capacity for storing and releasing plant nutrients.

These soils are moderately wet seasonally. Tile lines or surface drains help to reduce excess wetness. On the gently sloping Fincastle and Henshaw soils, the erosion hazard is moderate. Maintaining good structure in the surface layer is a concern on these silty soils. The soils in this unit generally are low in organic-matter content and are susceptible to surface crusting.

These soils can be used for row crops year after year if management is optimum. They are suited to the commonly grown field crops and to hay and pasture plants that tolerate some wetness. The soils in this unit dry slowly in spring, and planting dates may be delayed in areas not drained.

CAPABILITY UNIT IIw-5

This capability unit consists of nearly level, moderately well drained Rainsboro and Rossmoyne soils. These soils have a moderately deep root zone, moderately slow permeability, and a medium available moisture capacity. A fragipan occurs in the subsoil. The capacity for storing and releasing plant nutrients is moderate. The soils in this unit are strongly acid in the root zone.

These soils are moderately wet seasonally, but they require only random drainage. Surface runoff is slow. In some places, shallow surface drainage ditches effectively dispose of excess surface water. Maintenance of good soil structure is a concern on these silty soils.

These soils can be cultivated year after year if management is improved or optimum, but crop growth is likely to be less than optimum if management is only improved. Soils in this unit are suited to field crops and to hay and pasture plants commonly grown in the county. They are not well suited to specialty crops.

CAPABILITY UNIT IIs-1

This capability unit consists of well-drained Fox and Warsaw soils that overlie calcareous sand and gravel at a depth of 24 to 42 inches. The root zone of these soils is moderately deep over the calcareous sand and gravel. Permeability is moderate, the available moisture capacity is medium to low, and the capacity for storing and releasing plant nutrients is moderate. The loam surface layer is only slightly susceptible to surface crusting. The root zone is medium acid to slightly acid.

These soils are moderately susceptible to drought. By using all crop residues effectively, the moisture-holding capacity is increased. Surface runoff is slow, and there is little or no erosion hazard.

The soils in this unit are suited to continuous use for row crops if management is optimum. They also are suited to adapted specialty crops. These soils dry out and warm up early in spring. They are also well suited to irrigation, and irrigation should be considered if specialty crops are to be grown. Pasture and hay plants grow well on these soils in spring and early in summer without irrigation.

CAPABILITY UNIT IIIe-1

This capability unit consists of well-drained soils in the Cincinnati, Hickory, Kendallville, Miamian, Russell, Parke, Princeton, and Williamsburg series. Some of these soils are severely eroded and gently sloping, and some are sloping and uneroded or moderately eroded. All the soils have a deep or moderately deep root zone, moderate or moderately slow permeability, a medium or high available moisture capacity, and a moderate to high capacity for storing and releasing plant nutrients. The root zone of these soils is very strongly acid to neutral or mildly alkaline. Most of the soils have a silt loam surface layer, but the Princeton soil has a fine sandy loam surface layer.

The soils in this unit are very susceptible to erosion if they are used for cultivated crops. Where the soils are frequently cultivated, maintenance of fertility, of good soil structure, and of organic-matter content are concerns. The soils that have a silt loam surface texture are subject to crusting. The severely eroded Miamian soil is more droughty than the other soils, and it generally has calcareous till close to the surface or exposed in some areas.

Soils in this unit are suited to all of the field crops and to hay and pasture plants that are commonly grown in the county. These soils are not well suited to specialty crops unless management is very intensive. They are suited to frequent cultivation if management is optimum. Planting grasses and legumes helps to maintain favorable soil structure and to control erosion. A thick plant cover on pasture and hayland is effective in controlling erosion.

CAPABILITY UNIT IIIe-2

Fox loam, 6 to 12 percent slopes, moderately eroded, is the only soil in the capability unit. This soil is well drained. Its root zone is 24 to 42 inches thick over sand and gravel. Permeability is moderate, the available moisture capacity is medium to low, and the capacity for storing and releasing plant nutrients is moderate.

On this soil the drought hazard is moderate, and the erosion hazard is severe. This soil can be cultivated frequently if erosion is controlled and fertility and organic-matter content are maintained at a high level. Grasses and legumes help to control erosion.

The soil in this unit is well suited to field crops and to hay and pasture plants commonly grown in the county. It is better suited to small grains than to row crops. It is not well suited to specialty crops, because the erosion hazard is severe. In summer the forage of pastures is poor because this soil is droughty.

CAPABILITY UNIT IIIe-3

This capability unit consists of well-drained Eden and Wynn soils that are 20 to 40 inches thick over limestone and shale bedrock. These soils have slow or moderately slow permeability, a medium or low available moisture capacity, and a moderate capacity for storing and releasing plant nutrients. These soils are neutral or medium acid in the root zone. In many places the Eden soils have flagstones in the plow layer.

The erosion hazard is severe in cultivated areas. If these soils are frequently cultivated, maintaining fertility, good soil structure, and organic-matter content are problems.

The soils in this unit are suited to all field crops commonly grown in the county. These soils can be cultivated frequently if management is optimum, but erosion is difficult to control in areas where row crops are grown frequently. Grasses, legumes, and other close-growing crops help to control erosion.

These soils are well suited to pasture or hay crops. Except when pasture is reseeded, erosion is only a slight hazard if a thick plant cover is maintained.

CAPABILITY UNIT IIIe-4

This capability unit consists of light-colored, moderately well drained, sloping and gently sloping Rossmoyne soils. These soils have a fragipan, but their root zone is moderately deep. Permeability is moderately slow, the available moisture capacity is medium, and the capacity for storing and releasing plant nutrients is moderate. The root zone is strongly acid.

The soils in this unit have rapid surface runoff. The gently sloping soil is severely eroded, and erosion is a severe hazard on all of the soils if they are cultivated frequently. In frequently cultivated areas, it is difficult to maintain fertility, good soil structure, and organic-matter content.

These soils are suited to all field crops commonly grown in the county. The severely eroded soil in this unit is not well suited to frequent cultivation, but it is suited to cultivation in cropping sequences that include pasture or sod crops much of the time. Pasture or sod crops help to control erosion.

These soils are well suited to pasture or hay crops. There is little hazard of erosion except when pasture is reseeded, if a thick plant cover is maintained.

CAPABILITY UNIT IIIw-1

This unit consists of dark-colored, very poorly drained soils that are nearly level or depressional and have a silty clay loam surface layer. One of these soils is in the Sloan series and the other is a thick surface variant from the Kings series. The Sloan soil is on flood plains, and the thick surface variant occupies a lacustrine area locally called Shaker Swamp.

The hazard of wetness is severe on both of these soils. The Sloan soil is subject to occasional flooding. The Kings variant tends to be mucky in a few areas, but it is not an organic soil. Although both of these soils have a high water table during wet periods, their root zone is deep when the water table is low. These soils have moderately slow to slow permeability, high to very high available moisture capacity, and a very high capacity for storing and releasing plant nutrients.

If these soils are drained, they are well suited to corn. Open ditches and tile are effective in removing excess water. Outlets for tile commonly are not available, because these soils are in low areas.

Corn is well suited to these soils, but small grain tends to lodge because nitrogen and water are excessive. Hay and pasture plants that tolerate wet soils grow well if drainage keeps the water table below the root zone. In some areas the Sloan soil is flooded so often that it should be kept in either trees or grass.

CAPABILITY UNIT IIIw-2

In this capability unit are soils of the uplands that are somewhat poorly drained and nearly level to gently sloping. These soils formed in glacial material of Illinoian age. They are members of the Avonburg series. The root zone is moderately deep. Permeability is slow, and the available moisture capacity is medium. These soils have a moderate capacity for storing and releasing plant nutrients. The root zone is very strongly acid. A fragipan is in the subsoil.

Use of these soils is severely limited by wetness. The gently sloping Avonburg soil is moderately susceptible to erosion. Maintenance of good structure in the surface layer is required for all soils in this unit. The water table is high during wet periods, and the soils dry out slowly in spring unless they are drained. Plowing and planting are commonly delayed in wet years. Bedding and surface ditches have reduced excessive wetness in some areas. The soils can be drained by tile, but this drainage is slow.

In drained areas that are protected from erosion, the soils are suited to most commonly grown field crops and to hay and pasture plants that tolerate wet soils. Row crops can be grown year after year on slopes up to 4 percent if optimum management is used.

CAPABILITY UNIT IIIw-3

Clermont silt loam is the only soil in this capability unit. This nearly level, poorly drained soil has a moderately deep, very strongly acid to extremely acid rooting zone. Permeability is very slow, and the available moisture capacity is medium. This soil has a moderate capacity for storing and releasing plant nutrients. It is in the southern and eastern parts of the county, where it formed in an area glaciated in Illinoian age. This soil is locally called crawdad land, buckshot land, or buttermilk soil.

A severe wetness limitation makes farming difficult. The silt loam surface layer has weak structure and is low in organic-matter content. Additions of organic matter help to improve the structure of the surface layer. The water table is high during wet periods, and the soil dries out slowly in spring. Water movement in the soil is slow. Slow drying and surface ponding delay spring plowing and planting in wet years. Bedding and surface ditches reduce wetness in many areas (fig. 3). Tile drains do not work well, but land smoothing is beneficial in most places.

This soil is used mostly for general farm crops and pasture. Wooded areas remain wooded because they generally are a long distance from drainage outlets. Hay and pasture plants that tolerate wet soils are well suited. This soil compacts readily if pastures are grazed when wet.

***Figure 3.*—Improving surface drainage on Clermont silt loam.**

CAPABILITY UNIT IIIs-1

Casco loam, 2 to 6 percent slopes, moderately eroded, is the only soil in this unit. This soil is shallow to sand and gravel. It occupies terraces and kames. It has a shallow root zone, moderate permeability, a low available moisture capacity, and a low capacity for storing and releasing plant nutrients. The soil is slightly acid to neutral, and the underlying sand and gravel are calcareous.

Droughtiness is the major limitation to the use of this soil. Erosion is a hazard where the soil is cultivated. This soil is suited to irrigation, but frequent irrigations are required because the available moisture capacity is low. This soil most commonly occupies short slopes where it is difficult to manage apart from adjacent soils. In most places the short slopes prohibit use of most erosion control practices, but a thick cover of grasses or legumes is an effective control.

This soil is suited to most of the field crops and to the hay or pasture plants commonly grown in the county. Because the soil is droughty in summer, grain crops and hay or pasture plants are better adapted to this soil than row crops. Pasture plants grow slowly in summer unless the soil is irrigated.

CAPABILITY UNIT IVe-1

The soils in this capability unit are sloping or moderately steep and well drained or moderately well drained. They are members of the Casco, Fox, Hennepin, Hickory, Miamian, and Rossmoyne series. Erosion has been severe on the sloping soils and moderate on the moderately steep soils. The root zone is moderately deep in most places. Permeability is moderate to moderately slow, and the available moisture capacity is medium or low. These soils have a moderate capacity for storing and releasing of plant nutrients.

A very severe erosion hazard is the major limitation to use of these soils for farming. Slope and past erosion make it difficult to till these soils without excessive erosion losses. The severely eroded soils are more droughty than the uneroded ones. Because they are droughty, the severely eroded soils are better suited to spring crops than to crops that mature late in summer.

These soils can be cultivated occasionally if erosion is controlled. The severely eroded soils are well suited to pasture and hay crops, particularly those that tolerate hot, dry summers. A thick plant cover in pastures and meadows helps to control erosion.

CAPABILITY UNIT IVe-2

This capability unit consists of well-drained, gently sloping to sloping soils in the Eden and Wynn series. The root zone of these soils is 20 to 40 inches deep over limestone and shale bedrock. Permeability is slow or moderately slow. The available moisture capacity is medium to low, and the capacity for the storing and releasing of plant nutrients is moderate.

In cultivated areas the erosion hazard is very severe, but these soils can be cultivated occasionally if erosion is controlled. Because of past erosion, these soils generally are difficult to till. They are more droughty than uneroded soils and are better suited to crops that grow in spring than to crops that mature late in summer. They are well suited to pasture and hay crops, particularly those that tolerate hot, dry summers. In pastures and meadows, a thick plant cover helps to control erosion.

CAPABILITY UNIT VIe-1

This capability unit consists of well-drained soils that are moderately steep, steep, or very steep. These soils are in the Casco, Eden, Fairmount, Hennepin, Hickory, Miamian, and Rodman series. Most of these soils are moderately eroded, but some are severely eroded. Except for the dark-colored Fairmount and Rodman soils, they are all light colored. The Fairmount and Eden soils have a shallow root zone in most places, and a low to very low available moisture capacity, but the other soils have a moderately deep to shallow root zone and a medium to low available moisture capacity. Permeability is moderate to moderately slow in most of the soils, but Rodman soils have rapid permeability. The severely eroded soils in this unit are calcareous at the surface, and the others are calcareous near the surface.

A severe erosion hazard is the major limitation to use. These soils are too steep or too eroded for cultivation, but pasture and hay crops can be grown. Seedings are generally difficult to establish on the severely eroded soils because of their high content of lime. Erosion control is difficult on the steeper soils unless a thick plant cover is maintained. The steeper soils are better suited to pasture than to hay.

CAPABILITY UNIT VIIe-1

This capability unit consists of well-drained soils that are steep to very steep. These soils are in the Casco, Eden, Fairmount, Hickory, and Rodman series. All of these soils are moderately eroded. Their root zone is either shallow or moderately deep, and they have a very low to medium available moisture capacity. The Rodman, Casco, and Fairmount soils are especially droughty.

Steep to very steep slopes are the major limitation to the use of these soils. Surface runoff is very rapid, and there is a very severe erosion hazard in areas where plant cover is thin or absent. These soils are suited to permanent pasture or to trees for watershed protection. Pastures are generally difficult to maintain in good condition because equipment operation is hazardous on the steep slopes.

Estimated Yields

Table 1 shows, for each soil in the county, the estimated average acre yield of principal crops that can be expected over a period of years when two levels of management, optimum and improved, are used. These levels of management are defined as follows:

In optimum management—

1. The content of water in the soil is optimum for crop growth. Practices are used to increase water intake and the moisture-holding capacity of the soil. If water is excessive, its content is reduced by appropriate drainage practices. Irrigation is not included within optimum management as defined here.
2. Appropriate erosion control practices are used where they are needed.
3. Appropriate tillage practices that are adapted to the soil and the crop to be grown are used. Among these practices are plowing, seedbed preparation, and control of weeds and insects.
4. The fertility and pH of the soil are at an optimum level. Trace elements are applied as needed.

5. All operations are performed at the right time, which is the time when they contribute most toward efficient production.
6. Adapted high-yielding crop varieties are used.

Improved management is management in which one or more of the basic practices of optimum management are not followed or are applied inadequately.

The yields under columns A reflect generally prevailing or improved management. Those in columns B reflect optimum management. The estimated yields under optimum management can be obtained by good farm operators if they apply the best information now available.

The estimated yields in table 1 are not static values but are designed to indicate the productive ability of the soil. The yield is influenced by soil characteristics and indicates how desirable these characteristics may be for crop production. Consequently, a relative position for any soil is evident when the yield of a soil is compared with that of the other soils in the county. The yield may change as research improves technology, but the relative position of a soil in relation to the other soils is not likely to change.

The estimates in table 1 are based primarily on interviews with farmers, observations, and field trials of the county agricultural extension agent and district conservationists of the Soil Conservation Service. Also used are experimental results of the Ohio Agricultural Research and Development Center and direct observations by members of the soil survey field party. The estimates on different kinds of soil are the average yields through a period of years and under two broadly defined levels of management.

These yield figures may not apply directly to any specific field in any particular year. The reason for this is that soils vary from place to place, and management practices differ from farm to farm. Also, the weather varies from year to year. The estimates are intended only as a general guide to the relative productivity of the soils and as an indication of how crops respond to improved management on the different soils.

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*

[Figures in columns A indicate yields under improved management; figures in columns B indicate yields under optimum management. Absence of figures indicate crop is not suited to the soil specified or is not commonly grown on it. No estimates were made for Cut and fill land, Gravel pits, and Riverwash]

Soil	Corn		Wheat		Soybeans		Alfalfa and grass hay	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Abscota sand, calcareous variant	50	70	20	35	15	25	1. 5	3. 5
Alford silt loam, till substratum, 1 to 4 percent slopes	70	105	30	40	25	35	2. 5	4. 0
Algiers silt loam	75	120	25	40	25	40	2. 5	4. 5
Avonburg silt loam, 0 to 2 percent slopes	55	100	20	40	20	35	2. 0	3. 0
Avonburg silt loam, 2 to 6 percent slopes	55	95	20	35	20	30	2. 0	3. 0
Avonburg silt loam, 2 to 6 percent slopes, moderately eroded	45	85	15	25	15	25	2. 0	3. 0
Birkbeck silt loam, 1 to 4 percent slopes	75	110	30	45	25	40	2. 5	4. 5
Blanchester silt loam	65	105	20	45	25	40	2. 0	4. 5
Brookston silty clay loam	85	120	30	45	30	45	3. 5	5. 0
Casco loam, 2 to 6 percent slopes, moderately eroded	50	75	20	30	15	20	2. 0	3. 5
Casco loam, 6 to 12 percent slopes, moderately eroded	45	70	20	30	15	20	1. 5	3. 5
Casco-Rodman complex, 12 to 18 percent slopes, moderately eroded	------	------	------	------	------	------	1. 5	2. 5
Cincinnati silt loam, 2 to 6 percent slopes	60	100	25	35	25	30	2. 5	4. 0
Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded	55	90	25	35	20	30	2. 5	4. 0
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	50	85	25	30	15	25	2. 0	3. 5
Clermont silt loam	50	95	20	30	20	30	1. 5	3. 0
Crider silt loam, 2 to 6 percent slopes	70	105	25	40	25	35	2. 5	4. 5
Dana silt loam, 0 to 2 percent slopes	75	120	30	45	25	40	3. 0	4. 5
Dana silt loam, 2 to 6 percent slopes	75	115	30	45	25	40	3. 0	4. 5
Eden complex, 2 to 6 percent slopes, moderately eroded	60	85	20	35	20	30	2. 0	4. 0
Eden complex, 6 to 12 percent slopes, moderately eroded	60	75	20	30	20	30	1. 5	3. 0
Eden complex, 12 to 18 percent slopes, moderately eroded	55	70	20	25	15	25	1. 0	2. 5
Eden complex, 18 to 25 percent slopes, moderately eroded	------	------	------	------	------	------	1. 0	2. 5
Eden complex, 25 to 35 percent slopes, moderately eroded	------	------	------	------	------	------	1. 0	2. 5
Eel loam	75	110	25	40	25	40	3. 0	4. 5
Fairmount-Eden flaggy silty clay loams, 12 to 25 percent slopes, moderately eroded	------	------	------	------	------	------	2. 0	3. 5
Fairmount-Eden flaggy silty clay loams, 25 to 50 percent slopes, moderately eroded	------	------	------	------	------	------	1. 5	2. 5
Fincastle silt loam, 0 to 2 percent slopes	70	105	25	40	25	40	2. 5	4. 0
Fincastle silt loam, 2 to 6 percent slopes	70	105	25	40	25	40	2. 5	4. 0
Fox loam, 0 to 2 percent slopes	65	90	25	40	20	30	3. 0	4. 5
Fox loam, 2 to 6 percent slopes	65	90	25	40	20	30	3. 0	4. 5
Fox loam, 2 to 6 percent slopes, moderately eroded	60	85	25	40	15	25	3. 0	4. 5
Fox loam, 6 to 12 percent slopes, moderately eroded	50	75	20	35	15	25	2. 5	4. 0
Fox-Casco complex, 12 to 18 percent slopes, moderately eroded	45	70	20	30	10	25	2. 0	3. 5

TABLE 1.—*Estimated average yields per acre of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Soybeans		Alfalfa and grass hay	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Genesee fine sandy loam	80	115	30	40	25	40	3.0	5.0
Genesee loam	80	115	30	40	30	45	3.0	5.0
Hennepin silt loam, 25 to 35 percent slopes	----	----	----	----	----	----	2.0	3.5
Hennepin silt loam, 25 to 35 percent slopes, moderately eroded	----	----	----	----	----	----	1.5	2.5
Hennepin-Miamian silt loams, 18 to 25 percent slopes	----	----	----	----	----	----	2.0	3.5
Hennepin-Miamian silt loams, 18 to 25 percent slopes, moderately eroded	----	----	----	----	----	----	1.5	3.0
Hennepin-Miamian complex, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	1.0	1.5
Henshaw silt loam, 1 to 4 percent slopes	70	105	25	40	25	40	2.0	4.0
Hickory silt loam, 2 to 6 percent slopes, moderately eroded	50	85	25	40	20	30	2.5	4.0
Hickory silt loam, 6 to 12 percent slopes, moderately eroded	45	70	20	35	15	25	2.5	4.0
Hickory silt loam, 12 to 18 percent slopes, moderately eroded	35	60	20	30	10	20	2.0	3.5
Hickory clay loam, 6 to 12 percent slopes, severely eroded	35	60	20	30	10	20	2.0	3.5
Hickory clay loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	1.0	3.0
Hickory-Fairmount complex, 18 to 25 percent slopes, moderately eroded	----	----	----	----	----	----	----	3.0
Hickory-Fairmount complex, 25 to 50 percent slopes, moderately eroded	----	----	----	----	----	----	----	2.5
Iva silt loam, till substratum, 0 to 2 percent slopes	65	110	25	45	25	40	2.5	4.5
Kendallville loam, 2 to 6 percent slopes	60	95	25	40	20	30	2.5	4.0
Kendallville loam, 6 to 12 percent slopes, moderately eroded	50	85	25	35	20	30	2.5	4.0
Kings silty clay loam, thick surface variant	80	120	25	45	30	40	3.0	5.0
Lanier sandy loam	60	75	20	35	15	25	2.0	3.5
Miamian clay loam, 2 to 6 percent slopes, severely eroded	40	70	15	30	15	20	1.5	3.0
Miamian clay loam, 6 to 12 percent slopes, severely eroded	40	55	15	25	10	20	1.5	2.5
Miamian-Hennepin silt loams, 12 to 18 percent slopes, moderately eroded	40	55	15	20	10	20	1.5	2.5
Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded	50	85	25	40	20	25	2.5	4.0
Muck	80	120	----	----	----	----	----	----
Ockley silt loam, 0 to 2 percent slopes	75	110	30	40	25	40	3.0	5.0
Ockley silt loam, 2 to 6 percent slopes	70	105	30	40	20	35	3.0	5.0
Ockley silt loam, 2 to 6 percent slopes, moderately eroded	60	100	30	40	20	35	2.5	4.5
Parke silt loam, 2 to 6 percent slopes	65	105	30	45	20	35	3.0	4.5
Parke silt loam, 6 to 18 percent slopes, moderately eroded	60	85	25	35	20	30	2.5	4.0
Patton silt loam, silted	85	120	30	45	30	45	3.0	5.0
Patton silty clay loam	85	120	30	45	30	45	3.0	5.0
Plattville silt loam, 1 to 6 percent slopes	60	95	25	40	20	30	2.5	4.0
Princeton fine sandy loam, 2 to 6 percent slopes	50	95	25	40	25	35	2.5	4.5
Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded	45	85	25	40	20	30	2.5	4.5
Ragsdale silty clay loam	85	120	35	50	30	45	3.0	5.0
Rainsboro silt loam, 0 to 2 percent slopes	60	100	25	40	20	30	2.5	4.0
Rainsboro silt loam, 2 to 6 percent slopes	60	100	25	40	20	30	2.5	4.0
Reesville silt loam	75	110	30	40	25	40	2.5	4.5
Rodman and Casco gravelly loams, 18 to 25 percent slopes, moderately eroded	----	----	----	----	----	----	1.0	2.5
Ross loam	85	120	30	40	30	40	3.5	5.0
Rossmoyne silt loam, 0 to 2 percent slopes	65	100	25	40	25	35	2.5	4.0
Rossmoyne silt loam, 2 to 6 percent slopes	65	95	25	40	25	35	2.5	4.0
Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded	60	95	25	40	20	30	2.0	4.0
Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded	55	85	20	35	15	25	2.0	4.0
Rossmoyne silty clay loam, 2 to 6 percent slopes, severely eroded	50	80	20	30	15	25	2.0	3.5
Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded	40	70	15	25	10	20	1.5	3.0
Russell-Miamian silt loams, 0 to 2 percent slopes	70	105	30	45	25	40	2.5	4.5
Russell-Miamian silt loams, 2 to 6 percent slopes	70	100	30	40	25	35	2.5	4.5
Russell-Miamian silt loams, 2 to 6 percent slopes, moderately eroded	60	95	30	40	25	30	2.5	4.5
Shoals silt loam	75	100	25	40	30	40	2.5	4.5
Sloan silty clay loam	75	110	30	45	30	45	2.0	5.0
Uniontown silt loam, 1 to 6 percent slopes	70	105	30	40	25	40	2.0	5.0
Warsaw loam, 0 to 2 percent slopes	75	110	30	40	25	40	3.5	5.0
Warsaw loam, 2 to 6 percent slopes	75	110	30	40	25	40	3.5	5.0
Wea silt loam, 0 to 2 percent slopes	80	120	30	50	30	45	3.5	5.0
Williamsburg silt loam, 0 to 2 percent slopes	65	100	25	40	25	35	2.0	4.0
Williamsburg silt loam, 2 to 6 percent slopes	65	100	25	40	25	35	2.0	4.0
Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded	55	85	20	35	20	30	2.0	3.5
Wynn silt loam, 2 to 6 percent slopes	60	95	25	40	20	35	2.5	4.0
Wynn silt loam, 2 to 6 percent slopes, moderately eroded	55	95	20	35	20	30	2.5	3.5
Wynn silt loam, 6 to 12 percent slopes, moderately eroded	45	85	25	35	15	25	2.0	3.5
Wynn silt loam, 6 to 12 percent slopes, severely eroded	30	65	15	25	10	20	1.0	2.5
Xenia silt loam, 0 to 2 percent slopes	75	105	30	45	25	35	2.5	4.5
Xenia silt loam, 2 to 6 percent slopes	70	100	30	45	25	35	2.5	4.5
Xenia silt loam, 2 to 6 percent slopes, moderately eroded	60	95	25	40	20	30	2.0	4.0

Woodland

When the early settlers arrived in what is now Warren County, the area was almost completely covered by a forest of mixed hardwoods. Woodland now covers less than 10 percent of the land area. It occurs as scattered woodlots that average 20 acres in size and are mostly on steep soils that border the streams of the county. In other areas trees grow in scattered tracts on wet upland areas and in scattered areas of the flood plain.

Most of the potential farmland and some marginal areas were cleared for farming. Farming, however, was abandoned on the poorest soils, and they reverted to woodland.

Through the years timber apparently was harvested selectively, for the best trees were cut. Not enough trees of low potential were removed. The present stand generally is of poor quality.

Sawmills and wood-using plants do not operate in the county. Occasional loads of sawlogs are cut and hauled to semiportable saws in adjoining counties. A small amount of hardwood pulpwood is marketed in Middletown, in adjacent Butler County.

Many of the soils in the county have a good potential for producing trees. Table 2 indicates the comparative productivity ratings for all of the soils in the county. This table also rates the soil-related hazards and limitations to woodland management. The following paragraphs briefly discuss the headings in table 2.

Woodland group, soil series, and map symbols.—In the first column of table 2, each soil group is identified by a symbol that has three numbers and letters. The first is an Arabic number that denotes productivity class. Highest productivity is denoted by 1, next highest by 2, and so on to the poorest productivity class, which is denoted by 4.

The next part of the symbol is a small letter that represents a dominant soil characteristic that is associated with problems affecting the management of woodland on soils of the group. The letter *o* denotes no significant limitation; *c*, clayey texture in the surface layer; *d*, limited depth; *f*, fragmental soils that have a high content of coarse fragments; *r*, relief or slope, and *w*, wetness.

The last Arabic number in the symbol indicates subdivisions within each subclass and identifies groups of soils that are capable of producing similar kinds of woodcrops, that need similar management to produce these crops where the existing vegetation is similar, and that have about the same potential productivity. An example is the 1 in the symbol 2w1.

Also in the first column are the soil series and the map symbols of the soils that have been placed in the woodland groups.

Species.—The most important tree species that occur on the soils of each group are listed in table 2.

Slope.—Slope is shown as a range in percent. Also, on some soils the site index, annual growth, and preferred species vary from one area to another because of aspect. This information is given in table 2 for soils in those woodland groups to which it applies. Aspect, or the compass direction in which a slope faces, is listed as north and east, south and west, and neutral. The north and east quadrant is the most favorable for tree production on the steeper soils. Neutral aspects are those between the cool, moist north and east aspects and the hotter, drier south and west aspects.

Potential productivity.—The data on potential productivity are under the subheadings "Site index" and "Annual growth."

Site index.—This is a number that is the height, in feet, that a particular tree species will attain on a soil at 50 years of age. For most commercial species in Ohio, site index curves based on published research are available (*10*, *5*, *6*), and they span the ages of approximately 30 to 80 years. These curves were used to determine site index from measurements in the field.

Annual growth.—This is given in board feet per acre. Yield data are given for upland oaks (*10*), yellow-poplar (*8*), and white pine (*4*). The yields for upland oaks and white pine are based on an 80-year rotation, and yields for yellow-poplar on a 50-year rotation.

Preferred species.—Under this heading are listed, for the soils in each woodland group, the trees that should be favored in existing stands and the trees that are preferred for planting. For those woodland groups in which the choice of species is affected by direction of slope, the preferred species are listed separately by aspect.

In table 2 are listed the hazards and limitations that affect management of the soils in each woodland group. As shown in the table, each woodland group has, in varying degree, limitations that influence its management. These are expressed in the relative terms, slight, moderate, or severe. The relative term expresses the degree of limitation, as explained in the following paragraphs.

Erosion hazard.—This term refers to the susceptibility of a soil to water erosion after the cover has been removed or the soil has been disturbed.

Ratings are based on differences in soil characteristics that affect surface runoff and erosion. These differences are related to tons of soil loss per acre per unit of rainfall for a slope of specified length and percentage.

Where the erosion hazard is *slight*, no significant problems exist. Where it is *moderate*, some attention must be given to preventing erosion. Woodland management has moderate restrictions of methods and timing. Where erosion hazard is *severe*, intensive treatment, specialized equipment, careful methods, and discretion in the timing of operations all must be used.

Equipment limitation.—Use of woodland equipment may be limited by soil texture, contrasting soil horizons, steep slopes, wetness, rockiness, or stoniness.

Where the limitation is *slight*, the kind of equipment and the time of year that this equipment can be used are not significantly restricted. Where the limitation is *moderate*, use of equipment is moderately restricted by one or more of the soil properties mentioned. Where the limitation is *severe*, special equipment may be needed to overcome the restrictions of one or more of the soil properties mentioned.

Seedling mortality.—This term refers to degree of mortality that is expected among naturally occurring or planted tree seedlings as influenced by kinds of soils or topographic conditions, assuming that plant competition is not a limiting factor. Among the soil characteristics that contribute to seedling mortality are internal drainage, rooting depth, texture of the surface layer, and aspect.

Where seedling mortality is *slight*, 0 to 25 percent of the seedlings is expected to die. Where it is *moderate*, 25 to 50 percent is expected to die. Some replanting may be necessary. Where seedling mortality is *severe*, more than 50 percent of the seedlings is expected to die. Seedlings may have to be planted for 2 or 3 years early in the life of a new stand or special measures have to be taken to insure adequate survival of seedlings.

Plant competition.—This term refers to the rate of invasion by unwanted trees, shrubs, and vines when openings are made in the canopy. Broad-leaved trees and conifers are rated separately in table 2.

Plant competition is *slight* if it does not prevent adequate natural regeneration and early growth, or does not interfere with the normal development of planted seedlings. It is *moderate* if it delays natural or artificial regeneration and slows the growth of seedlings, but does not prevent the eventual development of a fully stocked, normal stand. Competition is *severe* if natural or artificial restocking is prevented unless the site is intensively prepared and maintenance practices such as weeding are intensive.

Windthrow hazard.—This term is used as an evaluation of soil characteristics that control the development of tree roots to permit them to anchor the trees firmly in the ground so that they resist winds of high velocity.

Windthrow hazard is *slight* where no significant loss of trees is expected from blow down. It is *moderate* if root development is adequate for stability except for periods of excessive wetness and during periods of greatest wind velocity, when some trees may blow down. Windthrow hazard is *severe* where many trees are expected to be blown down in wet periods and when wind velocity is high. When windthrow hazard is severe, the woodland should be thinned and trees cut only under the supervision of a professional forester.

Wildlife

Wildlife is an important natural resource of Warren County. The species most common in the county are cottontail rabbit, fox squirrel, gray squirrel, woodchuck, white-tailed deer, ring-necked pheasant, bobwhite quail, muskrat, raccoon, gray and red foxes, and many songbirds and other nongame birds. Most of the soils in the county are suitable for use as habitats for some kind of wildlife.

The welfare of any kind of wildlife depends on the presence and adequate distribution of food plants, shelter plants, and water. The absence, inadequacy, or inaccessibility of any one of these habitat elements, results in the absence or scarcity of the species. The kinds of wildlife that live in a given area, and the numbers of each kind, are closely related to land use, the kinds and patterns of vegetation, and the kinds and distribution of water. Most managed wildlife habitats are created or improved by planting suitable vegetation, by manipulating existing vegetation, by inducing natural establishment of desired plants, or by combinations of such measures. The influence that a soil will have on the growth and characteristics of plants can be inferred from a knowledge of the soil properties. Wetland habitats also may be related to soils. Interested persons should contact the local game protector, county agricultural extension agent, or a representative of the Soil Conservation Service for specific information about managing areas for wildlife.

The information in this subsection may be used to aid in—

1. Broad planning for wildlife use in parks, wildlife refuges, nature study areas, and other recreational developments.
2. Selecting the better soil sites so that specific kinds of wildlife habitat elements can be created, improved, or maintained.
3. Determining the relative degree of management required for the habitat elements.
4. Eliminating sites on which it is difficult or not feasible to manage for specific kinds of wildlife.
5. Determining areas suitable for acquisition for use as wildlife habitat.

Table 3 lists the soils in the county and rates their suitability for eight elements of wildlife habitat and for three classes, or groups, of wildlife. The numbers 1, 2, 3, and 4 are used as ratings, and each number indicates relative suitability. A rating of 1 denotes well suited; 2, denotes suited; 3, poorly suited; and 4, not suited. Soils that are well suited have few limitations. Those that are suited have moderate limitations, and those that are poorly suited have severe limitations. Not considered in the ratings are present land use, the location of a soil in relation to other soils, and the mobility of wildlife. *All of the soils are rated on the basis of their natural drainage class. Artificial drainage can change the ratings indicated on table 3.* Only a few drained areas of poorly drained or very poorly drained soils are used for development of wildlife habitat. A more detailed explanation of this rating system is discussed by Allan, Garland, and Dugan (*1*).

Elements of wildlife habitat

The elements of wildlife habitat for which each soil in the county is rated are described in the following paragraphs.

Grain and seed crops consist of such seed-producing annuals as corn, dwarf sorghum, wheat, barley, oats, and rye.

Grasses and legumes are established by planting. Among these plants are Kentucky bluegrass, tall fescue, smooth brome, timothy, redtop, orchardgrass, switchgrass, reed canarygrass, red and alsike clovers, birdsfoot trefoil, and alfalfa.

Wild herbaceous upland plants are perennial grasses and weeds that generally are established naturally. They include foxtail, milkweed, thistle, daisy, goldenrod, ragweed, smartweed, strawberry, nightshade, and dandelion.

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 may be planted. Among the native hardwood plants are oak, beech, cherry, maple, hickory, poplar, aspen, walnut, dogwood, hawthorn, roses, and briers.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Some of the shrubs that generally are available and can be planted on suitable soils are autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, viburnums, and dogwood. Hardwoods that are not available commercially can commonly be transplanted successfully.

TABLE 2.—*Woodland groups*

Woodland group, soils, and map symbols	Species	Slope		Potential productivity		Preferred species
		Range	Aspect	Site index	Annual growth [1]	In existing stands
		Percent		*Feet*	*Board feet per acre*	
Group 1o1:						
Alford (AfB).	Upland oaks	0–12	All	85+	300	Red oak, white oak, black oak, yellow-poplar, white pine, black walnut, sugar maple, white ash.
Birkbeck (BbB).	Yellow-poplar	0–12	All	95+	450	
Eel (Ee).	Sugar maple	0–12	All	85+		
Genesee (Gd, Gn).						
Iva (IvA).						
Ockley (OcA, OcB, OcB2).						
Plattville (PlB).						
Princeton (PrB).						
Ross (Rn).						
Wea (WeA).						
Williamsburg (WlA, WlB, WlC2).						
Xenia (XeA, XeB, XeB2).						
Group 2o1:						
Abscota (AbA).	Upland oaks	0–18	All	75–85	246	Yellow-poplar, black walnut, red oak, white oak.
Cincinnati (CnB, CnB2, CnC2).						
Crider (CrB).						
Dana (DaA, DaB).						
Fox (FlA, FlB, FlB2, FlC2).						
Hickory (HrB2, HrC2).						
Kendallville (KeB, KeC2).						
Lanier (Lg).						
Miamian (MmB3, MmC3).						
Miamian-Russell (MrC2).						
Parke (PaB, PaD2).						
Princeton (PrC2).						
Rainsboro (RbA, RbB).						
Rossmoyne (RpA, RpB, RpB2, RpC2).						
Russell-Miamian (RvA, RvB, RvB2).						
Uniontown (UnB).						
Warsaw (WaA, WaB).						
Wynn (WyB, WyB2, WyC2).						
Group 2r1:						
Hennepin (HeF, HeF2).	Upland oaks	12–35	Neutral	75–85	246	Yellow-poplar, black walnut, red oak, white oak.
Hennepin-Miamian (HmE, HmE2).						
Hickory (HrD2).						
Miamian-Hennepin (MnD2).	Upland oaks	12–35	North and east	81–92		Yellow-poplar, black walnut, red oak, white oak.
	Upland oaks	12–35	South and west	71–80		White oak, Virginia pine, red oak
Group 2w1:						
Algiers (Ag).	Upland oaks	0–2	All	75–85	246	Red oak, black oak, yellow-poplar, white ash, sugar maple, black walnut, red maple.
Blanchester (Bc).	Yellow-poplar	0–2	All	85–95	396	
Brookston (Br).	White pine	0–2	All	85–95	1,000+	
Clermont (Co).						
Patton (Pb, Pc).						
Ragsdale (Ra).						
Shoals (Sh).						
Sloan (So).						

See footnote at end of table

and factors in management

Preferred species—Continued	Hazards and limitations affecting management					
				Plant competition for—		
For planting	Erosion hazard	Equipment limitation	Seedling mortality	Conifers	Hardwoods	Windthrow hazard
White pine, black walnut, yellow-poplar, white ash, Norway spruce.	Slight	Slight	Slight	Severe	Moderate	Slight.
White pine, black walnut, yellow-poplar.	Slight	Slight	Slight	Severe	Moderate	Slight.
White pine, black walnut, yellow-poplar.	Slight	Moderate	Slight	Severe	Moderate	Slight.
White pine, black walnut, yellow-poplar. Virginia pine, white pine.						
White pine, yellow-poplar.	Slight	Severe	Severe	Severe	Severe	Severe.

TABLE 2.—*Woodland groups*

Woodland group, soils, and map symbols	Species	Slope		Potential productivity		Preferred species
		Range	Aspect	Site index	Annual growth [1]	In existing stands
		Percent		*Feet*	*Board feet per acre*	
Group 2w2: Avonburg (AvA, AvB, AvB2). Fincastle (FhA, FhB). Henshaw (HoB). Reesville (Re).	Upland oaks	0–6	All	75–85	246	Red oak, black oak, yellow-poplar, white ash, sugar maple, black walnut, red maple.
	Yellow-poplar	0–6	All	85–95	396	
	White pine	0–6	All	85–95	1,000+	
Group 3o1: Hickory (HsC3). Rossmoyne (RsB3, RsC3). Wynn (WyC3).	Upland oaks	2–12	All	65–75	176	Red oak, white oak, yellow-poplar, black walnut.
	Yellow-poplar	2–12	All	75–85	288	
	White pine	2–12	All	75–85	990	
Group 3r1: Hennepin-Miamian (HnD3). Hickory (HsD3).	Upland oaks	12–18	Neutral	65–75	176	Red oak, white oak, yellow-poplar, black walnut.
	Upland oaks	12–18	North and east	70–81	--------	Red oak, white oak, yellow-poplar, black walnut.
	Upland oaks	12–18	South and west	61–71	--------	White oak, chestnut oak, red oak.
Group 3f1: Casco (CcB2, CcC2). Casco-Rodman (CdD2). Fox-Casco (FoD2).	Upland oaks	2–18	All	65–75	176	Red oak, white oak, black oak, yellow-poplar, black walnut.
Group 3c1: Eden (EdB2, EdC2, EdD2, EdE2).	Upland oaks	2–25	All	65–75	176	Red oak, white oak, black oak, yellow-poplar, black walnut.
Group 3w1: Kings (Kg).	Upland oaks	0–2	All	65–75	176	Red oak, white oak, black oak, yellow-poplar, black walnut, red maple.
Group 4f1: Rodman and Casco (RkE2).	Upland oaks	18–25	All	55–65	104	Red oak, white oak, chestnut oak.
Group 4d1: Eden (EdF2). Fairmount-Eden (FaE2, FaF2). Hickory-Fairmount (HtE2, HtF2).	Upland oaks	18–35	All	55–65	104	White oak, chestnut oak, shortleaf pine, Virginia pine.

[1] Dashes indicate annual growth was not calculated.

and factors in management—Continued

Preferred species—Continued	Hazards and limitations affecting management					
For planting	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition for— Conifers	Plant competition for— Hardwoods	Windthrow hazard
White pine, yellow-poplar.	Moderate	Moderate	Moderate	Severe	Severe	Moderate.
White pine, yellow-poplar, Virginia pine.	Slight	Slight	Slight	Moderate	Slight	Slight.
White pine, yellow-poplar, Virginia pine.	Moderate	Moderate	Slight	Moderate	Slight	Slight.
White pine, yellow-poplar, Virginia pine.						
White pine, Virginia pine.						
White pine, Virginia pine, yellow-poplar.	Slight	Slight	Moderate	Moderate	Slight	Slight.
White pine, yellow-poplar Virginia pine.	Slight to moderate.	Moderate to severe.	Slight	Moderate	Slight	Slight.
White pine, yellow-poplar	Slight	Moderate	Slight	Moderate	Slight	Slight.
White pine, Virginia pine	Moderate	Moderate	Moderate	Slight	Slight	Slight.
Eastern redcedar, shortleaf pine, Virginia pine.	Severe	Severe	Severe	Slight	Slight	Moderate.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*

[Suitability was not determined for Cut and fill land, Gravel pits, and Riverwash. A rating of 1 denotes well suited; 2, suited; 3, poorly suited; and 4, not suited]

Soil series and map symbols	Habitat elements								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	Ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Abscota: AbA	1	1	1	1	3	4	4	4	1	1	4
Alford: AfB	1	1	1	1	3	4	4	4	1	1	4
Algiers: Ag	4	3	3	1	1	1	1	1	3	1	1
Avonburg:											
AvA	2	2	1	1	3	2	2	2	1	2	2
AvB, AvB2	2	2	1	1	3	3	4	4	1	2	4
Birkbeck: BbB	1	1	1	1	3	3	4	3	1	1	4
Blanchester: Bc	4	3	3	1	1	1	1	1	3	1	1
Brookston: Br	4	3	3	1	1	1	1	1	3	1	1
Casco:											
CcB2	2	2	1	2	1	4	4	4	2	2	4
CcC2	3	2	1	3	1	4	4	4	2	2	4
Casco-Rodman complex:											
CdD2	3	3	2	3	1	4	4	4	3	3	4
Cincinnati:											
CnB, CnB2	1	1	1	1	3	4	4	4	1	1	4
CnC2	1	1	1	1	3	4	4	4	1	1	4
Clermont: Co	3	2	2	1	2	1	1	1	2	2	1
Crider: CrB	1	1	1	1	3	4	4	4	1	1	4
Dana:											
DaA	1	1	1	1	3	3	3	3	1	2	3
DaB	1	1	1	1	3	4	4	4	1	1	4
Eden complexes:											
EdB2	2	1	1	1	2	4	4	4	1	1	4
EdC2	2	1	1	1	3	4	4	4	1	1	4
EdD2, EdE2, EdF2	4	4	1	1	3	4	4	4	3	2	4
Eel: Ee	1	1	1	1	3	4	3	3	1	1	4
Fairmount-Eden complexes:											
FaE2, FaF2	4	4	3	2	2	4	4	4	4	3	4
Fincastle:											
FhA	2	2	1	1	3	2	2	2	1	2	2
FhB	2	2	1	1	3	3	3	3	1	2	3
Fox:											
FlA	2	1	1	1	3	4	4	4	1	1	4
FlB, FlB2	2	1	1	1	3	4	4	4	1	1	4
FlC2	2	1	1	1	3	4	4	4	1	1	4
Fox-Casco complex: FoD2	3	2	2	2	2	4	4	4	2	2	4
Genesee: Gd, Gn	1	1	1	1	3	4	4	4	1	1	4
Hennepin: HeF, HeF2	4	2	1	1	3	4	4	4	2	2	4
Hennepin-Miamian complexes:											
HmE, HmE2, HnD3	4	2	1	1	3	4	4	4	2	2	4

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Habitat elements: 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	Ponds	Kinds of wildlife: Openland wildlife	Woodland wildlife	Wetland wildlife
Henshaw: HoB	2	2	1	1	3	3	3	3	1	2	3
Hickory:											
HrB2	2	1	1	1	3	4	4	4	1	1	4
HrC2, HsC3	2	1	1	1	3	4	4	4	1	1	4
HrD2, HsD3	3	2	1	1	3	4	4	4	2	2	4
Hickory-Fairmount complexes: HtE2, HtF2	3	2	1	1	3	4	4	4	2	2	4
Iva: IvA	2	2	1	1	3	2	2	2	1	2	2
Kendallville:											
KeB	1	1	1	1	3	4	4	4	1	1	4
KeC2	2	2	2	1	3	4	4	4	2	2	4
Kings: Kg	4	3	3	1	1	1	1	1	3	1	1
Lanier: Lg	3	2	2	1	3	4	4	4	2	2	4
Miamian: MmB3, MmC3	2	2	2	1	3	4	4	4	2	2	4
Miamian-Hennepin complex: MnD2	2	2	2	1	3	4	4	4	2	2	4
Miamian-Russell complex: MrC2	3	2	2	1	3	4	4	4	3	2	4
Muck: Mu	4	4	4	4	4	2	1	1	4	4	2
Ockley:											
OcA	1	1	1	1	3	4	4	4	1	1	4
OcB, OcB2	1	1	1	1	3	4	4	4	1	1	4
Parke:											
PaB	1	1	1	1	3	4	4	4	1	1	4
PaD2	1	1	1	1	3	4	4	4	1	1	4
Patton: Pb, Pc	4	3	3	1	1	1	1	1	3	1	1
Plattville: PlB	2	1	1	1	3	4	4	4	1	1	4
Princeton:											
PrB	1	1	2	1	3	4	4	4	1	1	4
PrC2	2	1	1	1	3	4	4	4	1	1	4
Ragsdale: Ra	4	3	3	1	1	1	1	1	3	1	1
Rainsboro:											
RbA	1	1	1	1	3	3	3	3	1	2	3
RbB	2	1	1	1	3	4	4	4	1	2	4
Reesville: Re	2	2	1	1	3	2	2	2	1	2	2
Rodman and Casco: RkE2	4	4	3	3	1	4	4	4	4	3	4
Ross: Rn	1	1	1	1	3	4	4	4	1	1	4
Rossmoyne:											
RpA	1	1	1	1	3	3	3	3	1	2	3
RpB, RpB2, RsB3	1	1	1	1	3	4	4	4	1	2	4
RpC2, RsC3	2	1	1	1	3	4	4	4	1	2	4
Russell-Miamian complexes:											
RvA	1	1	1	1	3	4	4	4	1	1	4
RvB, RvB2	1	1	1	1	3	4	4	4	1	1	4

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Habitat elements								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	Ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Shoals: Sh	2	2	1	1	3	2	2	3	1	2	2
Sloan: So	4	3	3	1	1	2	2	4	3	1	3
Uniontown: UnB	1	1	1	1	3	3	4	3	1	1	3
Warsaw:											
WaA	2	1	1	1	3	4	4	4	1	1	4
WaB	2	1	1	1	3	4	4	4	1	1	4
Wea: WeA	1	1	1	1	3	4	4	4	1	1	4
Williamsburg:											
WlA, WlB	1	1	1	1	3	4	4	4	1	1	4
WlC2	2	1	1	1	3	4	4	4	2	1	4
Wynn:											
WyB, WyB2	2	1	1	1	3	4	4	4	1	1	4
WyC2, WyC3	2	1	1	1	3	4	4	4	1	1	4
Xenia:											
XeA	1	1	1	1	3	3	3	3	1	1	3
XeB, XeB2	1	1	1	1	3	4	4	4	1	1	4

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. Among them are Norway spruce, white pine, arborvitae, redcedar, and juniper. Generally, the plants are established naturally in areas where the cover of weeds and sod is thin. The soils that are well suited as coniferous wildlife habitat are those that cause plants to grow slowly and delay closure of the canopy. It is important that branches be maintained close to the ground so that food and cover are readily available to rabbits, pheasants, and other small animals. If the trees quickly form a dense canopy that shuts out the sunlight, the lower branches die.

On soils that are poorly suited as coniferous wildlife habitat, widely spaced plants may quickly, though temporarily, show the desired growth characteristics. Establishment or maintenance of wildlife habitat, however, is difficult because these soils are well suited to competing hardwoods. 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. They include smartweed, wild millet, rush, bulrush, spikerush, sedges, burreed, wildrice, buttonbush, rice cutgrass, and cattail.

Shallow water developments are impoundments or excavations that provide areas of shallow water near food and cover used by wetland wildlife. Examples are shallow dugouts, level ditches, blasted potholes, and devices that keep the water 6 to 24 inches deep in marshes.

Ponds are dug-out areas of water, or a combination of these areas and impoundments behind low dikes, in which the water is at a depth suitable for producing fish or wildlife. If fish are produced, part of the pond should be at least 6 feet deep.

Kinds of wildlife

The three kinds of wildlife for which table 3 rates the suitability of the soils in the county as wildlife habitat are described in the following paragraphs.

Openland wildlife are pheasants, 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 are woodcocks, thrushes, vireos, scarlet tanagers, woodpeckers, gray squirrels, fox squirrels, gray foxes, white-tailed deer, raccoons, and opossums. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants.

Wetland wildlife are ducks, geese, rails, herons, shore birds, mink, and muskrats. These birds and mammals normally make their home in wet areas, such as ponds, marshes, and swamps.

Each rating under "Kinds of wildlife" in table 3 is based on the ratings listed for the habitat elements in the first part of the table. For openland wildlife the rating is based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood plants, and coniferous woody plants. The rating for woodland wildlife is based on the ratings listed for all the elements except grain and seed crops. For wetland wildlife the rating is based on the ratings shown for wetland food and cover plants, shallow water developments, and ponds.

Engineering Uses of the Soils [2]

Engineers are especially interested in soil properties because they affect the construction and maintenance of roads, airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the properties most important to the engineer are permeability to water, compaction characteristics, drainage, shrink-swell characteristics, grain size and distribution, plasticity, and reaction. Other important soil properties are depth to water table, depth to bedrock, and topography.

Information in this survey can be used as a guide to—

1. Make soil and land use studies that will aid in selecting and developing small industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils 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 highway, airport, pipeline, and cable locations, and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other construction materials.
5. Correlate performance of engineering structures with soil mapping units to develop data for a general plan to be used in designing and maintaining certain engineering practices and structures.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, 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.

The engineering interpretations in tables 4, 5, and 6 are useful when used with the soil map for identification of soil areas. It should be emphasized, however, that these interpretations may not eliminate the need for sampling and testing at the site of specific engineering works that involve heavy loads and excavations deeper than the depth of layers reported.

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

The normal depth of observation of soils during a soil survey is 60 inches or to bedrock if it occurs within a 60-inch depth. Information in this section pertains to these depths and to the named kinds of soil listed. Mapping units may contain included areas of contrasting or dissimilar soils. If these included areas are named kinds of soil, they are rated in the tables in this section.

Engineering classification systems

Two engineering classification systems are used in this soil survey. One is the system adopted by the American Association of State Highway Officials (AASHO) (*2, 9*). In this system soil materials are classified in seven principal groups. The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A-7, consisting of clay soils that have low strength when wet. Within each group the relative engineering value of the material is indicated by a group index number, ranging from 0 for the best material in the soil group to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol in the column headed "AASHO" of table 4.

Some engineers prefer to use the Unified Soil Classification System (*17*). Soil materials are classified on the basis of particle size distribution, liquid limit, and plasticity index, in this system. Soil materials are identified as fine grained (six classes), coarse grained (eight classes), or highly organic soils (one class). This system can be used in making an approximate classification of soils in the field.

Table 4 shows laboratory determined classifications for soils tested in the county. Table 5 shows the estimated engineering classifications for all of the soils in the county.

Engineering test data

Samples of three soil profiles in Warren County were tested according to standard AASHO procedures to help evaluate the soils for engineering purposes. Table 4 shows the results of these tests. The three soils sampled are extensive soils in the county. Test data for some of the same soils that occur in Warren County are in the published soil surveys for Clinton County and Preble County, Ohio.

Moisture density.—In the moisture-density or compaction test, a sampe of soil material is compacted several times using the same compactive effort, but each time at a higher content of moisture. The dry density, or unit weight, of the compacted material increases until the optimum moisture content is reached. After that, the dry density decreases as the moisture content increases. The highest dry density obtained in the compaction test is termed maximum dry density. Soil in earthwork is most stable if it is compacted to about the maximum dry density when it is at the optimum moisture content.

Mechanical analyses.—The mechanical analyses were made by combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method should not be used in naming USDA textural classes.

Liquid limit and plasticity index.—The tests for liquid limit and plasticity index measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the soil material changes from a semisolid to a plastic state. As the moisture is further increased, the soil material changes from a plastic state 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 soil 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 the soil material is in a plastic condition. Some silty and sandy soils are nonplastic. They do not become plastic at any moisture content.

[2] LLOYD E. GILLOGLY, construction engineer, Soil Conservation Service, Columbus, Ohio, assisted in preparing this section.

Classification.—Two engineering classifications are shown. One is the system approved by the AASHO and the other is the Unified system. The modified AASHO classification used by the Ohio Department of Highways Testing Laboratory is also shown. The AASHO and Unified systems are briefly defined under the heading "Engineering Classification Systems."

Engineering properties of soils

Table 5 lists the soil series and map symbols of the soils in Warren County. This table shows estimated engineering properties of the soils and USDA texture classification. Additional information about the soils is given in the section "Descriptions of the Soils." Geology is referred to in the sections "Formation and Classification of the Soils" and "Additional Facts About Warren County."

The estimated engineering properties in table 5 are based on soil texture, soil structure, porosity, permeability, and test data on the same kinds of soil in other counties. Depth to bedrock is not given in table 5, because it does not generally occur within the upper 5 feet of any of the soils except Eden, Fairmount, Plattville, and Wynn. It is at a depth of 1½ to 3½ feet in the Eden, Plattville, and Wynn soils and at a depth of less than 2 feet in the Fairmount soils. The following paragraphs briefly describe the columns shown on table 5.

Seasonally high water table.—Depth to the seasonal high water table refers to the shallowest depth at which the soil is saturated in winter and early in spring because of a perched or other ground water table. If less precipitation than normal falls during wet periods, the water table may be considerably deeper. Soil conditions immediately after heavy precipitation are not considered. In all soils, particularly in sloping soils on uplands, the depth to the water table is generally greater late in spring, in summer, and in fall than indicated in this column.

Depth from surface.—The depths for each soil correspond to significant changes in texture in the typical profile described for each soil series. The estimated data given are for the typical soil in each series. Soils in the same series that differ from the typical soil can have properties that vary slightly from those shown.

Percentage passing sieve.—Under this heading the columns show estimated particle size according to standard-sized sieves.

USDA texture.—The textures indicated correspond to the textures given in the technical description of the soil described in the section "Descriptions of the Soils."

Engineering classification.—The estimated classifications are based on actual test data from this county and other survey areas and are described in "Engineering Classification Systems."

Range in permeability.—Permeability values are estimates of the range in rates of downward water movement through the major soil horizons when they are saturated, but when water drains freely because the horizons are above a true water table. These values are estimates based on soil texture, soil structure, porosity, permeability, and

TABLE 4.—

[Tests performed by the State of Ohio Department of Highways in accordance with

Soil name and location	Parent material	Ohio report No.	Depth	Moisture density [1]	
				Maximum dry density	Optimum moisture
			Inches	*Pounds per cubic foot*	*Percent*
Clermont silt loam: Harlan Township: 3 miles west-northwest of Blanchester (Clinton County).	Windblown silt (loess) over Illinoian till.	SO-38035	0–8	104	18
		38036	17–32	106	18
		38037	53–103	113	16
		38038	103–115		
Fincastle silt loam: Turtle Creek Township: NE¼SW¼ sec. 24.	Windblown silt (loess) over glacial till (Wisconsin).	56443	0–9	103	19
		56444	9–37	104	18
		56445	37–60	121	13
Russell silt loam: Turtle Creek Township: SW¼SW¼ sec. 24.	Windblown silt (loess) over glacial till (Wisconsin).	56440	0–13		
		56441	13–32		
		56442	32–60		

[1] Based on AASHO Designation: T 99–57, Method A (*2*).

[2] Mechanical analysis according to 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 than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

infiltration tests. On any given soil, infiltration through the surface layer varies considerably and depends on land use and management and initial moisture content.

Range in available moisture capacity.—The available moisture capacity is 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. Available moisture capacity is a measure of the maximum amount of moisture a particular soil can store for use by plants. The estimated values listed are based on the difference in percentage moisture retained at 1/3 atmosphere and 15 atmospheres of tension for medium- and fine-textured soils. For sandy soils, the estimated values are based on the difference between 1/10 atmosphere and 15 atmospheres of tension. The available moisture capacity in compact glacial till and fragipans is rated at a lower figure than normal for the given textures. This is a result of increased bulk densities in these layers that greatly reduces the penetration of plant roots. Thus, some of the moisture stored is not available to plant roots.

Reaction.—The pH ranges given in this column represent a summary of the many field pH determinations taken during the survey on each of the soils in the county. See "Reaction" in the Glossary for definition.

Shrink-swell potential.—The estimated shrink-swell potential is an indication of the volume change to be expected for soil material with changes in moisture content. The soil materials rated high have serious limitations for engineering uses, since the increase in volume when the dry soil is wetted is generally accompanied by a loss in bearing capacity.

Corrosion potential.—The corrosion potential indicated for uncoated steel is based on soil texture, soil drainage, and total acidity. Electrical resistivity is *not* considered in this rating. The corrosion potential for concrete is based on soil texture and pH values. The rating given is for average concrete. The ratings do not apply to concrete mixed specifically for corrosion resistance.

Engineering interpretations of soils

Table 6 lists all of the soil series in Warren county and the map symbols of each series. It interprets selected characteristics of the soils for various engineering uses. The interpretations shown in table 6 are based on actual and estimated soil test data in tables 4 and 5 and on field experience. The following paragraphs briefly describe the columns shown in table 6.

Suitability for winter grading.—Because of wetness, plasticity, or susceptibility of freezing, many of the soils are not adapted to grading during part of the winter. Such soils are rated poor, and more suitable soils are rated fair or good.

Susceptibility to frost action.—Silty and fine sandy soils that are wet most of the winter are the ones that are most susceptible to frost action. Such soils are rated high, and less susceptible soils are rated low or moderate.

Engineering test data

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

Mechanical analysis [2]						Liquid limit	Plasticity index	Classification		Ohio [4]
Percentage passing sieve—					Percentage smaller than 0.005 mm.			AASHO	Unified [3]	
¾-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						
						Percent				
----------	----------	100	95	87	29	39	9	A–4(8)	ML	A–4b
----------	----------	100	97	91	47	38	15	A–6(10)	ML–CL	A–6a
[5] 81	81	79	75	67	37	33	11	A–6(7)	ML–CL	A–6a
----------	100	99	95	87	48	38	20	A–6(12)	CL	A–6b
----------	----------	100	98	95	30	[6] NP	NP	A–4(8)	ML	A–4b
----------	----------	100	99	95	37	38	15	A–6(10)	ML–CL	A–6a
[7] 91	80	73	65	55	26	27	8	A–4(4)	CL	A–4a
----------	----------	100	98	94	32	NP	NP	A–4(8)	ML	A–4b
----------	100	96	91	79	38	39	16	A–6(10)	CL	A–6b
[7] 96	87	81	75	63	29	28	9	A–4(6)	CL	A–4a

[3] SCS and BPR (Bureau of Public Roads) have agreed to consider that all soils having plasticity indexes within 2 points of A-line are to be given a borderline classification. An example of a borderline classification obtained by this use is ML–CL.

[4] Based on "Classification of Soils", Ohio State Testing Laboratory, O.D.H. February 1, 1955.

[5] Percentage passing 1½-inch sieve is 100.

[6] NP=Nonplastic.

[7] Percentage passing 1-inch sieve is 100.

TABLE 5.—*Estimated*

[Properties were not determined for Cut

Soil series and map symbols	Depth to seasonally high water table	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)
	Feet	*Inches*	*Percent*				
Abscota, calcareous variant: AbA	[3] 3	0-12		90–100	80–100	40–70	5–35
		12–42		90–100	75–90	40–70	0–15
		42–60		25–70	20–35	15–30	0–15
Alford: AfB	>3	0–12		100	100	95–100	90–100
		12–53		100	100	95–100	85–95
		53–95		100	80–95	75–95	50–70
		95–120		100	80–90	75–85	50–70
Algiers: Ag	[3]0–1	0–24		85–100	80–95	80–95	55–75
		24–60		90–100	80–90	75–85	70–90
Avonburg: AvA, AvB, AvB2	0–1	0–14		100	100	95–100	85–100
		14–24		100	100	95–100	85–100
		24–69		100	90–100	90–100	80–90
		69–104	2–10	90–100	80–90	80–90	55–70
Birkbeck: BbB	2–3	0–10		100	100	95–100	85–100
		10–36		100	100	95–100	90–100
		36–45		100	90–100	85–95	80–90
		45–60		100	85–100	80–95	65–80
Blanchester: Bc	0	0–8		95–100	90–100	85–100	80–100
		8–50		100	100	90–100	90–100
		50–98	2–10	80–100	75–100	70–100	50–75
		98–110	2–10	80–100	80–100	70–90	60–70
Brookston: Br	0–1	0–12		100	100	90–100	85–95
		12–40		100	90–100	90–100	80–95
		40–60	0–5	80–100	75–95	75–90	65–75
Casco: CcB2, CcC2, CdD2 For Rodman part of CdD2, see Rodman series.	>3	0–11		90–100	90–100	80–90	45–70
		11–18		90–100	85–95	75–90	65–75
		18–60	5–10	50–80	40–75	25–50	4–25
Cincinnati: CnB, CnB2, CnC2	>3	0–16		100	100	90–100	80–90
		16–36		95–100	90–100	90–100	85–90
		36–95	0–5	90–100	85–100	75–95	70–90
Clermont: Co	0–1	0–17		100	100	90–100	85–100
		17–43		100	100	90–100	90–100
		43–110	0–5	95–100	85–100	80–90	60–85

See footnotes at end of table.

properties

and fill land, Gravel pits, and Riverwash]

Classification			Permeability	Available moisture capacity [1]	Reaction [2]	Shrink-swell potential	Corrosion potential	
USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Sand	SW-SM, SM	A-1, A-2, A-3	2.0-6.3	0.06-0.10	7.4-8.4	Low		Low.
Sand	SP, SW, SM	A-1, A-2	6.3-12.0	0.04-0.08	7.4-8.4	Low	Low	Low.
Sand and gravel	GW, SW, GM, SM	A-1, A-2	6.3-12.0+	0.04	7.4-8.4	Low	Low	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.19-0.24	5.1-6.0	Low		Moderate to high.
Silty clay loam	CL, ML-CL	A-4, A-6	0.63-2.0	0.19-0.21	4.6-6.0	Low	Moderate	Moderate to high.
Clay loam	CL, ML-CL	A-6	0.2-0.63	0.08-0.12	6.6-7.3	Low	Moderate	Low.
Clay loam	CL	A-6	0.2-0.63	0.06-0.10	7.4-8.4	Low	Moderate	Low.
Silt loam	ML, CL	A-4, A-6	0.63-2.0	0.18-0.23	6.6-7.3	Low	High	Low.
Silty clay loam	CL, ML-CL	A-6	0.2-0.63	0.18-0.21	6.6-7.3	Moderate	High	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.18-0.22	4.6-5.6	Low		High.
Silty clay loam	CL, ML-CL	A-6, A-7	0.2-2.0	0.16-0.19	4.6-5.0	Moderate	High	High.
Silty clay loam to clay.	CL, ML-CL	A-6, A-7	<0.2	0.06-0.10	4.6-5.0	Low	High	High.
Clay loam	CL	A-6	<0.2	0.06-0.10	6.1-7.3	Low	High	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.19-0.24	6.1-7.3	Low		Low.
Silty clay loam	CL, ML-CL	A-6	0.63-2.0	0.15-0.20	6.1-7.3	Moderate	Moderate to high.	Low.
Silt loam	CL, ML-CL	A-6	0.63-2.0	0.14-0.18	6.6-8.0	Low	Moderate to high.	Low.
Silt loam	ML-CL, CL	A-6	0.2-0.63	0.06-0.10	7.4-8.4	Low	Moderate to high.	Low.
Silt loam	ML, ML-CL	A-4, A-6	0.63-2.0	0.18-0.20	4.6-5.5	Moderate		Moderate to high.
Silty clay loam	CH, MH	A-7	0.2-0.63	0.15-0.18	4.6-5.5	High	High	Moderate to high.
Clay loam	CH, ML-CL	A-7	<0.2	0.15-0.20	5.6-6.5	High	High	Moderate to low
Clay loam	CL, ML-CL	A-6, A-7	<0.2	0.06-0.10	7.4-8.4	Moderate	High	Low.
Silty clay loam	ML-CL, MH	A-7	0.63-2.0	0.18-0.23	6.1-7.3	Moderate to high.		Low.
Silty clay loam and clay loam.	CL, MH-CH	A-7	0.63-2.0	0.15-0.18	6.1-7.3	High	High	Low.
Loam	CL, ML-CL	A-4, A-6	0.2-0.63	0.10-0.14	7.4-8.4	Low	High	Low.
Loam	ML, SM	A-4	0.63-2.0	0.14-0.18	6.1-7.3	Low		Low.
Clay loam	CL, SC	A-6	0.63-2.0	0.15-0.19	6.1-7.3	Moderate	Low	Low.
Gravelly sandy loam to sand and gravel.	GW, SW, GM, SM	A-1, A-2	6.3-12.0+	<0.04	7.4-8.4	Low	Low	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.16-0.20	4.5-5.5	Low		High.
Silty clay loam	ML, CL	A-6	0.63-2.0	0.14-0.18	4.6-5.5	Moderate	Moderate	High.
Loam or clay loam	ML, CL	A-4, A-6	0.2-0.63	0.08-0.12	4.6-7.3	Low to moderate.	Moderate	High to moderate.
Silt loam to light silty clay loam.	ML, ML-CL	A-4, A-6	0.2-0.63	0.18-0.22	4.1-5.0	Low		High.
Silty clay loam	CL, ML-CL	A-6	<0.063	0.08-0.15	4.1-5.0	Moderate	High	High.
Clay loam	CL, ML-CL	A-4, A-6	<0.063	0.06-0.10	4.6-7.3	Moderate	High	High. [4]

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonally high water table	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)
	Feet	*Inches*	*Percent*				
Crider: CrB	>3	0–12	----	100	100	90–100	90–100
		12–42	----	100	95–100	95–100	90–100
		42–77	0–5	100	95–100	90–100	90–100
		77–85	----	----	----	----	----
Dana: DaA, DaB	2–3	0–16	----	100	100	95–100	90–100
		16–28	----	100	100	95–100	90–100
		28–45	----	100	90–100	80–95	60–75
		45–60	0–5	85–95	75–85	65–75	55–65
Eden: EdB2, EdC2, EdD2, EdE2, EdF2	3	0–10	----	100	100	80–95	70–100
		10–24	10	100	80–100	75–95	60–75
		24–30	----	----	----	----	----
Eel: Ee	[3] 2–3	0–45	----	90–100	85–95	85–95	70–90
		45–60	0–5	70–90	50–80	45–75	15–70
Fairmount: FaE2, FaF2. For Eden part of FaE2 and FaF2, see Eden series.	>3	0–9	20–30	90–100	80–100	75–95	70–90
		9–17	20–30	90–100	85–100	80–100	80–100
		17–50	----	----	----	----	----
Fincastle: FhA, FhB	0–1	0–12	----	100	95–100	90–100	90–100
		12–37	----	100	90–100	90–100	90–100
		37–60	0–5	90–100	75–90	60–80	55–75
Fox: FlA, FlB, FlB2, FlC2, FoD2. For Casco part of FoD2, see Casco series.	>3	0–9	----	85–100	85–100	65–100	60–80
		9–30	----	80–100	65–95	55–95	45–90
		30–60	0–5	25–60	20–35	5–15	0–15
Genesee: Gd, Gn	[3] >3	0–60	----	85–100	80–90	80–90	40–60
Hennepin: HeF, HeF2, HmE, HmE2, HnD3. For Miamian part of HmE, HmE2, and HnD3, see Miamian series.	>3	0–8	----	100	90–100	80–90	75–100
		8–60	2–10	80–95	75–90	60–80	55–75
Henshaw: HoB	0–1	0–16	----	100	100	90–100	85–100
		16–45	----	100	100	90–100	85–100
		45–50	----	100	100	90–100	80–100
Hickory: HrB2, HrC2, HrD2, HsC3, HsD3, HtE2, HtF2. For Fairmount part of HtE2 and HtF2, see Fairmount series.	>3	0–7	----	85–100	80–100	75–100	65–100
		7–36	----	85–100	80–100	70–85	55–70
		36–60	2–5	85–100	80–95	70–90	60–70

See footnotes at end of table.

properties—Continued

Classification			Permeability	Available moisture capacity [1]	Reaction [2]	Shrink-swell potential	Corrosion potential	
USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	ML, CL	A-4	0. 63-2. 0	0. 16-0. 20	5. 6-6. 5	Low		Moderate.
Silty clay loam	ML, CH	A-6, A-7	0. 63-2. 0	0. 14-0. 18	5. 1-6. 0	Moderate to high.	Moderate	Moderate.
Clay to sandy clay loam.	CL, CH	A-6, A-7	0. 63-2. 0	0. 12-0. 16	5. 1-6. 0	Moderate to high.	Moderate	Moderate.
Limestone bedrock.								
Silt loam	ML, ML-CL	A-4	0. 63-2. 0	0. 17-0. 23	6. 1-7. 3	Low		Low.
Silty clay loam	CL, ML-CL	A-6	0. 63-2. 0	0. 15-0. 18	6. 1-7. 3	Moderate	High	Low.
Clay loam	CL, ML-CL	A-6	0. 63-2. 0	0. 15-0. 18	6. 1-7. 3	Moderate	High	Low.
Loam	CL, ML-CL	A-4	0. 2-0. 63	0. 06-0. 10	7. 4-8. 4	Low	Moderate	Low.
Silt loam to silty clay loam.	CL, ML-CL	A-6, A-7	0. 2-0. 63	0. 14-0. 18	6. 6-7. 3	High		Low.
Clay	CH, ML-CL	A-7	0. 63-0. 2	0. 12-0. 15	6. 6-7. 8	High	High	Low.
Clay shale and interbedded limestone.								
Loam	ML, CL	A-4, A-6	0. 63-2. 0	0. 15-0. 22	6. 6-7. 3	Low	Moderate to high.	Low.
Sandy loam to stratified loamy sand and gravel.	ML, SM	A-2, A-4	2. 0-6. 3	0. 08-0. 12	6. 6-7. 8	Low	High	Low.
Silty clay loam to silty clay.	CH, ML-CL	A-6, A-7	0. 63-2. 0	0. 18-0. 24	6. 6-7. 3	High		Low.
Silty clay or clay	CH	A-7	0. 2-0. 63	0. 14-0. 18	6. 6-7. 8	High	High	Low.
Interbedded shale and limestone.								
Silt loam	ML, ML-CL	A-4	0. 63-2. 0	0. 16-0. 22	5. 1-6. 0	Low		Moderate.
Silty clay loam	ML, CL	A-6	0. 2-0. 63	0. 14-0. 18	5. 1-6. 6	Moderate	High	Moderate.
Loam	ML-CL, CL	A-4	0. 2-0. 63	0. 10-0. 16	7. 4-8. 4	Low	High	Low.
Loam	ML, ML-CL	A-4	0. 63-2. 0	0. 14-0. 18	5. 6-7. 3	Low		Moderate.
Sandy clay loam and clay.	CL, ML, SC	A-6, A-7	0. 63-2. 0	0. 14-0. 18	6. 1-7. 8	Moderate	Moderate	Low.
Sand and gravel	GW, GM, SW, SM	A-1	6. 3-12. 0+	0. 02-0. 04	7. 4-8. 4	Low	Low	Low.
Loam	ML, CL, SM	A-4, A-6	0. 63-2. 0	0. 18-0. 24	6. 6-7. 3	Low	Low to moderate.	Low.
Silt loam to silty clay loam.	ML, CL	A-4, A-6	0. 63-2. 0	0. 16-0. 20	6. 6-8. 4	Moderate		Low.
Loam or clay loam.	CL, ML-CL	A-4	0. 2-0. 63	0. 08-0. 14	7. 4-8. 4	Moderate to low.	Low to moderate.	Low.
Silt loam	ML, ML-CL	A-4	0. 63-2. 0	0. 18-0. 24	4. 5-6. 5	Low		Moderate.
Silty clay loam	CL, CH	A-6, A-7	0. 2-0. 63	0. 14-0. 18	4. 5-6. 5	Moderate	High	Moderate.
Silty clay loam	CL	A-6	0. 2-0. 63	0. 14-0. 18	7. 4-7. 8	Low to moderate.	High	Low.
Silt loam	ML, ML-CL	A-4	0. 63-2. 0	0. 18-0. 24	5. 1-5. 5	Low		Moderate.
Silty clay loam or clay loam.	CL	A-6	0. 63-2. 0	0. 15-0. 20	4. 6-5. 5	Moderate	Moderate	High.
Clay loam	ML, CL	A-4, A-6	0. 2-0. 63	0. 10-0. 14	6. 6-7. 8	Low to moderate.	Moderate	Low.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonally high water table	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—			
				No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)
	Feet	*Inches*	*Percent*				
Iva: IvA	0–1½	0–18	0–10	100	100	95–100	90–100
		18–58	----	100	100	95–100	90–100
		58–120	1–5	90–100	85–100	80–90	70–85
Kendallville: KeB, KeC2	>3	0–11	----	90–100	85–100	65–80	55–65
		11–25	----	85–100	80–90	70–80	45–70
		25–60	2–10	90–100	80–90	75–85	55–75
Kings, thick surface variant: Kg	0	0–20	----	100	100	100	90–100
		20–60	----	100	100	90–100	90–100
Lanier: Lg	[3] >3	0–10	----	90–100	75–90	50–75	30–40
		10–24	5–20	55–75	25–50	20–40	10–25
		24–50	5–50	50–80	20–50	20–45	20–30
Miamian: MmB3, MmC3, MnD2, MrC2. For Hennepin part of MnD2, see Hennepin series. For Russell part of MrC2, see Russell series.	>3	0–8	----	90–100	90–100	90–100	65–90
		8–24	----	90–100	90–100	80–95	70–90
		24–60	2–10	80–95	70–90	50–65	50–65
Muck: Mu	0–1	0–60	----	----	----	----	----
		60–70	----	90–100	80–100	80–100	80–100
Ockley: OcA, OcB, OcB2	>3	0–13	----	90–100	90–100	90–100	75–90
		13–36	----	100	90–100	85–100	80–90
		36–54	----	85–100	80–100	75–90	45–75
		54–70	2–5	30–60	20–30	15–25	0–15
Parke: PaB, PaD2	>3	0–14	----	100	90–100	90–100	85–100
		14–32	----	100	90–100	90–100	85–100
		32–76	----	90–100	85–100	80–90	60–75
		76–108	----	70–85	45–60	35–50	30–45
Patton: Pb, Pc	0–1	0–8	0–5	100	100	95–100	80–100
		8–64	----	100	100	95–100	85–100
		64–70	----	100	80–95	70–90	40–65
Plattville: PlB	>3	0–12	----	90–100	90–100	80–90	70–90
		12–27	----	90–100	90–100	80–90	65–90
		27–35	----	----	----	----	----
Princeton: PrB, PrC2	>3	0–16	----	100	100	50–75	35–55
		16–32	----	100	100	60–75	40–55
		32–60	----	100	100	40–65	20–35

See footnotes at end of table.

properties—Continued

Classification			Permeability	Available moisture capacity [1]	Reaction [2]	Shrink-swell potential	Corrosion potential	
USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.15-0.20	4.6-6.0	Low		Moderate to high.
Silty clay loam	CL	A-6	0.2-0.63	0.15-0.18	4.6-6.0	Moderate	High	Moderate to high.
Silty clay to clay loam.	CL, ML-CL	A-6, A-4	0.2-0.63	0.10-0.15	6.1-7.8	Moderate	High	Low.
Loam	ML, CL	A-4, A-6	0.63-2.0	0.18-0.22	5.6-6.1	Low		Moderate.
Clay loam or sandy clay loam.	CL, SC	A-4, A-6	0.63-2.0	0.14-0.18	5.1-6.5	Moderate to low.	Moderate	Moderate.
Clay loam to loam	ML, CL	A-4, A-6	0.2-0.63	0.12-0.16	6.1-8.4	Low to moderate.	Moderate	Low.
Silty clay loam	CL, ML-CL	A-6, A-7	0.63-2.0	0.18-0.24	6.6-7.3	Moderate to high.	High	Low.
Silty clay	CH	A-7	<0.2	0.12-0.16	6.6-7.3	High	High	Low.
Sandy loam	SM	A-2, A-4	2.0-6.3+	0.08-0.12	7.4-8.4	Low		Low.
Very gravelly sandy loam.	SM, GM, GW, SW	A-2, A-1	6.3-12.0+	<0.04	7.4-8.4	Low	Low	Low.
Sand and gravel	GW, SW, GM, SM	A-1, A-2	6.3-12.0+	<0.04	7.4-8.4	Low	Low	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.18-0.24	5.1-6.0	Low		Moderate.
Silty clay loam or clay loam.	CL	A-6, A-7	0.63-2.0	0.16-0.20	5.1-6.5	Moderate	Moderate	Moderate.
Loam	CL, ML-CL	A-4	0.2-0.63	0.10-0.14	7.4-8.4	Low	Low	Low.
Muck	Pt		0.63-2.0	>0.25	6.6-7.3	Variable	High	Low.
Marl	CH, CL	A-7, A-6	<0.2	0.10-0.15	7.4-8.4	Variable	High	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.18-0.24	5.6-6.5	Low		Moderate.
Silty clay loam	CL, ML-CL	A-6	0.63-2.0	0.16-0.19	5.6-6.5	Moderate	Moderate	Moderate.
Clay loam to sandy clay loam.	CL, SC	A-6	0.63-2.0	0.16-0.19	5.6-7.3	Moderate	Moderate	Moderate to low.
Sand and gravel	GW, GM, SM, SW	A-1	2.0-6.3+	<0.04	7.4-8.4	Low	Low	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.18-0.24	4.1-5.0	Low		High.
Silty clay loam	CL, ML-CL	A-6	0.63-2.0	0.16-0.20	4.1-5.0	Moderate	Moderate	High.
Clay loam	CL, ML-CL	A-6	0.63-2.0	0.14-0.18	4.1-5.0	Moderate	Moderate	High.
Sandy loam to sandy clay loam.	SM, SC	A-2, A-4	0.63-2.0	0.12-0.16	4.6-5.0	Low	Low	High.
Silt loam or silty clay loam.	CL, ML-CL	A-6	0.2-0.63	0.19-0.22	6.6-7.3	Moderate		Low.
Silty clay loam	CH, CL	A-6, A-7	0.20-0.63	0.16-0.20	6.6-7.3	High	High	Low.
Loam or sandy loam.	SM, ML	A-4, A-6	0.20-2.0	0.14-0.18	6.6-7.3	Low to moderate.	High	Low.
Silt loam	ML, ML-CL	A-4	0.63-2.0	0.17-0.22	5.6-6.5	Low		Moderate.
Silty clay loam	CL, ML-CL	A-6, A-7	0.2-2.0	0.15-0.18	6.6-7.3	Moderate	Moderate	Low.
Interbedded limestone and shale.								
Fine sandy loam to sandy loam.	SM, ML	A-4	0.63-2.0	0.10-0.16	4.5-5.5	Low		Moderate to high.
Sandy clay loam	SC, CL	A-6	0.63-2.0	0.12-0.15	5.1-6.0	Low	Low	Moderate.
Sandy loam to loamy sand.	SM	A-2	2.0-6.3	0.05-0.08	5.6-7.8	Low	Low	Moderate to low.

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TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonally high water table	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—			
				No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)
	Feet	*Inches*	*Percent*				
Ragsdale: Ra	0–1	0–12		100	90–100	90–100	90–100
		12–44		100	90–100	90–100	90–100
		44–60		100	90–100	85–100	80–95
Rainsboro: RbA, RbB	1½–3	0–12		100	90–100	90–100	85–95
		12–36		100	90–100	90–100	85–100
		36–60		85–100	80–100	70–90	60–75
		60–120	2–5	90–100	75–100	60–75	35–55
Reesville: Re	½–1½	0–12		100	90–100	90–100	85–100
		12–42		100	90–100	90–100	90–100
		42–60		100	90–100	80–95	65–95
Rodman: RkE2. For Casco part of RkE2, see Casco series.	>3	0–13	0–5	70–90	55–75	45–65	30–40
		13–20	5–10	50–75	30–50	30–45	20–35
		20–50	5–10	30–50	20–30	15–25	0–15
Ross: Rn	[3] >3	0–60		90–100	90–100	80–90	65–90
Rossmoyne: RpA, RpB, RpB2, RpC2, RsB3, RsC3.	2–3	0–13		90–100	90–100	90–100	85–100
		13–27		100	95–100	90–100	85–100
		27–39		95–100	90–100	85–100	75–100
		39–92	0–5	90–100	85–95	80–90	70–80
Russell: RvA, RvB, RvB2. For Miamian part of RvA, RvB, and RvB2, see Miamian series.	>3	0–7		100	90–100	90–100	85–95
		7–38		100	90–100	90–100	85–100
		38–60	0–5	90–100	90–100	80–90	60–80
Shoals: Sh	[3] ½–1½	0–60		90–100	90–100	80–95	65–90
Sloan: So	[3] 0–1	0–60		100	100	80–95	70–95
Uniontown: UnB	1½–3	0–10		100	95–100	90–100	85–95
		10–30		100	95–100	90–100	85–95
		30–60		90–100	95–100	85–95	70–85
Warsaw: WaA, WaB	>3	0–14		90–100	90–100	55–75	60–80
		14–36		80–100	75–90	60–85	45–80
		36–60	5–15	25–60	20–35	15–25	0–15
Wea: WeA	>3	0–14		90–100	90–100	85–100	75–95
		14–40		90–100	90–100	85–100	75–100
		40–45		80–100	80–100	65–85	40–55
		45–60	0–5	30–60	20–30	5–25	0–15

See footnotes at end of table.

properties—Continued

Classification			Permea-bility	Available moisture capacity [1]	Reaction [2]	Shrink-swell potential	Corrosion potential	
USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silty clay loam	CL, ML–CL	A–6	0.63–2.0	0.18–0.24	6.6–7.3	Low to moderate.		Low.
Silty clay loam	CL, CH	A–6, A–7	0.2–0.63	0.15–0.20	6.6–7.3	Moderate to high.	High	Low.
Silt loam	ML, CL	A–4, A–6	0.2–0.63	0.14–0.17	6.6–7.8	Low	High	Low.
Silt loam	ML, ML–CL	A–4	0.63–2.0	0.18–0.23	5.1–6.5	Low		Moderate.
Silty clay loam	CL, ML–CL	A–6, A–7	0.63–2.0	0.18–0.21	5.1–6.0	Moderate	High	Moderate.
Clay loam	CL, ML–CL	A–6	0.2–0.63	0.08–0.14	5.1–6.0	Low	High	Moderate.
Clay loam and sandy clay loam.	SM, ML	A–4	0.63–2.0	0.14–0.18	5.1–7.3	Low	High	Moderate to low.
Silt loam	ML, ML–CL	A–4	0.63–2.0	0.17–0.24	6.0–6.6	Low		Low.
Silty clay loam	CL, ML–CL	A–6, A–7	0.2–0.63	0.15–0.19	6.1–6.6	Moderate to high.	High	Low.
Silt loam to loam.	ML, CL	A–4, A–6	0.2–0.63	0.15–0.18	7.4–8.4	Low to moderate.	High	Low.
Gravelly sandy loam.	SM	A–2, A–4	>6.3	0.10–0.14	7.4–8.4	Low		Low.
Very gravelly sandy loam.	GM, SM	A–1, A–2	>6.3	<0.04	7.4–8.4	Low	Low	Low.
Sand and gravel	GW, GM, SW, SM	A–1	>6.3	<0.04	7.4–8.4	Low	Low	Low.
Loam	ML	A–4	0.63–2.0	0.16–0.22	6.6–7.3	Low	Low	Low.
Silt loam	ML, ML–CL	A–4	0.63–2.0	0.18–0.22	4.5–5.5	Low		High.
Silty clay loam	CL, ML–CL	A–6	0.63–2.0	0.16–0.20	4.5–5.5	Moderate	High	High.
Silty clay loam	CL, ML–CL	A–6	0.2–0.63	0.06–0.10	4.5–5.5	Low	High	High.
Silty clay loam to clay loam.	CL, ML–CL	A–6	0.2–0.63	0.06–0.10	4.5–7.4	Low	High	High to moderate.
Silt loam	ML, ML–CL	A–4	0.63–2.0	0.16–0.22	5.6–6.5	Low		Moderate.
Silty clay loam	CL, ML–CL	A–6	0.2–2.0	0.15–0.18	5.1–6.0	Moderate	Moderate	Moderate.
Clay loam	CL, ML–CL	A–4, A–6	0.2–0.63	0.14–0.17	6.6–7.8	Low	Low	Low.
Silt loam	ML, ML–CL	A–4	0.2–2.0	0.16–0.20	6.6–7.3	Low	High	Low.
Silty clay loam	CL, ML–CL	A–6	0.2–0.63	0.17–0.22	6.6–7.3	Moderate	High	Low.
Silt loam	ML, ML–CL	A–4	0.63–2.0	0.18–0.24	5.6–6.5	Low		Moderate.
Silty clay loam	CL, ML–CL	A–6	0.63–2.0	0.16–0.20	5.6–6.5	Moderate	Moderate	Moderate to low.
Silt loam to silty clay loam.	ML, CL	A–4, A–6	0.2–0.63	0.16–0.20	6.6–7.4	Moderate	Moderate	Low.
Loam	ML, ML–CL	A–4, A–6	0.63–2.0	0.16–0.22	5.6–6.5	Low		Moderate.
Clay loam	CL, ML, SC	A–6, A–7	0.63–2.0	0.14–0.18	5.6–6.5	Moderate	Moderate	Moderate.
Stratified sand and gravel.	GM, GW, SM, SW	A–1, A–2	>6.3	<0.04	7.4–8.4	Low	Low	Low.
Silt loam	ML, ML–CL	A–4	0.63–2.0	0.18–0.22	5.6–7.3	Low		Moderate to low.
Silty clay loam	CL, ML–CL	A–6, A–7	0.63–2.0	0.16–0.20	5.1–6.6	Moderate	Moderate	Moderate to low.
Sandy clay loam	CL, SC	A–6	0.63–2.0	0.16–0.20	5.6–7.3	Moderate	Moderate	Moderate to low.
Sand and gravel	GW, GM, SW, SM	A–1	>6.3	<0.04	7.4–8.4	Low	Low	Low.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonally high water table	Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)
	Feet	*Inches*	*Percent*				
Williamsburg: WIA, WIB, WIC2	>3	0–12		100	90–100	80–95	70–90
		12–24		100	90–100	85–100	75–100
		24–70		90–100	90–100	80–95	65–80
		70–100		80–100	80–90	65–85	40–55
Wynn: WyB, WyB2, WyC2, WyC3	>3	0–8		100	90–100	85–95	75–95
		8–28		100	90–100	80–100	75–100
		28–32	0–5	100	90–100	85–100	85–100
		32–40					
Xenia: XeA, XeB, XeB2	1½–3	0–15		100	90–100	90–100	90–100
		15–45		100	90–100	90–100	85–95
		45–60	0–5	90–100	85–95	75–85	50–60

[1] Lower than normal A.M.C. is indicated for fragipans, dense till, and dense clay layers as these conditions limit root penetration. Therefore, less moisture is available to plant roots in these layers.
[2] Surface layer may have a higher pH than indicated, due to liming.

TABLE 6.—*Engineering*

[No interpretations were made for Cut and

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill: Solum	Road fill: Substratum	Soil features affecting— Highway location [1]
Abscota, calcareous variant: AbA.	Good	Low	Poor: sandy material.	Good for sand and gravel.	Good	Good	Subject to flooding.
Alford: AfB	Fair: silty material but well drained.	Low to moderate.	Good	Not suited	Poor: high silt content.	Fair: clay loam material.	Erodible on cut slopes; well-drained silty material.
Algiers: Ag	Poor: subject to flooding; seasonal high water table.	High	Good: subject to flooding.	Not suited	Poor: subject to flooding; wet material difficult to compact.	Poor	Seasonal high water table; subject to flooding and ponding.

See footnotes at end of table.

properties—Continued

Classification			Permeability	Available moisture capacity [1]	Reaction [2]	Shrink-swell potential	Corrosion potential	
USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	ML, ML–CL	A–4	0. 63–2. 0	0. 18–0. 24	5. 1–6. 1	Low		Moderate.
Silty clay loam	CL, ML–CL	A–6	0. 63–2. 0	0. 16–0. 18	4. 5–6. 0	Moderate	Moderate	Moderate to high.
Clay loam	CL, ML–CL	A–6	0. 63–2. 0	0. 16–0. 18	4. 5–6. 0	Moderate	Moderate	Moderate to high.
Sandy clay loam	SC, CL	A–6	0. 63–2. 0	0. 14–0. 16	6. 6–7. 8	Low	Low	Low.
Silt loam	ML, ML–CL	A–4	0. 63–2. 0	0. 18–0. 24	5. 6–6. 5	Low		Moderate.
Silty clay loam	CL, ML–CL	A–6, A–7	0. 63–2. 0	0. 16–0. 19	5. 6–6. 5	Moderate	High	Moderate.
Clay	CH, ML–CL	A–7	0. 2–0. 63	0. 14–0. 20	7. 4–8. 4	Moderate to high.	High	Low.
Limestone and shale.								
Silt loam	ML, ML–CL	A–4	0. 63–2. 0	0. 18–0. 24	5. 1–6. 0	Low		Moderate.
Silty clay loam	CL, ML–CL	A–6	0. 2–0. 63	0. 14–0. 18	5. 1–6. 0	Moderate	Moderate	Moderate.
Loam	CL, ML–CL	A–4, A–6	0. 2–0. 63	0. 12–0. 15	6. 1–7. 8	Low	Moderate	Low.

[3] Subject to flooding. During periods of high water, the water table is higher than indicated.
[4] High in upper 70 inches, low below.

interpretations of the soils

fill land, Gravel pits, and Riverwash]

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [3]				
Sandy; well-drained; subject to flooding; trench walls are unstable.	Pervious material; moderately rapid to rapid permeability.	Sandy material subject to piping; generally good stability; permeable material; slight compressibility.	Well drained	Low available moisture capacity.	Nearly level; sandy; droughty in summer.	Subject to flooding; droughty in summer.
Thick soil; well-drained silty material.	Moderate seepage to a depth of 4 feet; low seepage below a depth of 5 feet.	Fair stability; fair compaction; moderate to slow permeability; fair resistance to piping; medium compressibility.	Well drained	High available moisture capacity; moderate permeability to a depth of 4 feet.	Moderately erodible; well drained.	Moderately erodible; well drained.
Subject to flooding.	Possible seepage if excavated below 5 feet; subject to flooding; seasonal high water table.	Fair to poor stability and compaction; slow permeability; poor to fair resistance to piping.	Subject to flooding; moderately slow permeability.	Somewhat poorly drained; seasonal high water table; subject to flooding.	Nearly level; subject to flooding.	Nearly level; seasonal high water table; subject to flooding.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Suscepti-bility to frost action	Suitability as source of— Topsoil	Sand and gravel	Road fill: Solum	Road fill: Substratum	Soil features affecting— Highway location [1]
Avonburg: AvA, AvB, AvB2.	Poor: seasonal high water table.	High	Good	Not suited	Fair to poor: seasonal high water table; medium to high compressibility.	Fair to poor	Seasonal high water table; seepage along fragipan.
Birkbeck: BbB	Poor: high silt content; moderately well drained.	Moderate	Good	Not suited	Fair to poor: high silt content.	Fair to poor: silt loam till below depth of 4 feet.	Gently sloping slopes are moderately erodible on cuts and fills.
Blanchester: Bc	Poor: wet sticky material; poorly drained.	High	Fair: thin over moderately fine textured material.	Not suited	Poor: high shrink-swell potential; dries slowly; high compressibility.	Poor: clay loam till.	Nearly level; seasonal high water table; slowly permeable; poorly drained; subject to ponding.
Brookston: Br	Poor: very poorly drained; moderately fine textured material.	High	Fair: moderately fine textured topsoil.	Not suited	Poor: plastic material; high shrink-swell potential.	Fair to poor: medium to high compressibility.	Seasonal high water table; very poorly drained; subject to ponding.
Casco: CcB2, CcC2, CdD2. For Rodman part of CdD2, see Rodman series.	Good	Low	Fair: limited suitable topsoil available.	Good for sand and gravel below 2 feet; stratified, well graded, and calcareous.	Fair: medium compressibility.	Good: sandy and gravelly material.	Well drained; cut slopes are gravelly and droughty.
Cincinnati: CnB, CnB2, CnC2.	Fair: well drained, but fragipan causes some seasonal wetness.	Moderate to low.	Good	Not suited	Fair: medium to high compressibility.	Fair: medium to high compressibility.	Moderately slow permeability; well drained; some seepage on fragipan.
Clermont: Co	Poor: poorly drained, moderately fine textured material.	High	Fair: low organic-matter content.	Not suited	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Seasonal high water table; nearly level; poor natural drainage; very slow permeability.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds: Reservoir area	Farm ponds: Embankment [3]	Agricultural drainage	Irrigation	Terraces or diversions	Waterways
Seasonal high water table; seepage on fragipan.	Slowly permeable; low seepage losses.	Fair stability and compaction; medium compressibility; fair resistance to piping; slow permeability.	Slowly permeable; seasonal high water table.	Somewhat poorly drained; seasonal high water table; slowly permeable.	Highly erodible; seasonal high water table; seepage on fragipan.	Subject to seepage on fragipan; seasonal high water table.
Moderately well drained; seasonally wet for short periods.	Slow rate of seepage in substratum; moderately permeable to depth of about 4 feet.	Fair compaction; fair stability; slow to moderate permeability; medium compressibility; fair resistance to piping.	Moderately well drained.	High available moisture capacity; moderate permeability to depth of about 4 feet.	Moderately erodible.	Moderately erodible.
Poorly drained; seasonal high water table.	Slow rate of seepage; seasonal high water table.	Fair to poor stability; fair to poor compaction; slow permeability; high compressibility; good resistance to piping.	Slowly permeable; subject to ponding; poorly drained.	High available moisture capacity; nearly level to depressional areas; seasonal high water table; slowly permeable.	Poorly drained; nearly level to depressional areas; seasonally wet.	Poorly drained; nearly level to depressional areas; seasonally wet.
Very poorly drained; seasonal high water table.	Low seepage losses; moderately slow permeability; seasonal high water table.	Fair to poor stability and compaction; slow permeability; medium to high compressibility; good resistance to piping.	Moderate permeability to depth of 40 inches; seasonal high water table; very poorly drained.	Very poorly drained; seasonal high water table; high available moisture capacity.	Nearly level; very poorly drained.	Nearly level; very poorly drained.
Well-drained sandy and gravelly material.	Excessive seepage losses in substratum.	Pervious substratum; good stability and compaction if mixed; variable resistance to piping; low compressibility if mixed.	Well drained	Low available moisture capacity; rapid infiltration.	Slightly erodible; droughty material in cuts.	Slightly erodible; cut channels are sandy and gravelly and droughty.
Well drained	Slow rate of seepage.	Fair stability; fair compaction; slowly permeable; medium compressibility; fair resistance to piping.	Well drained	Medium available moisture capacity; moderately erodible.	Moderately erodible on slopes; well drained.	Moderately erodible on slopes; well drained; some seepage on fragipan.
Poorly drained; seasonal high water table.	Very slowly permeable; seasonal high water table.	Fair to poor stability and compaction; slow permeability; medium compressibility; fair resistance to piping.	Very slow permeability; poorly drained.	Poorly drained; seasonally wet; very slowly permeable.	Nearly level; seasonally wet.	Nearly level; seasonally wet.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location [1]
					Solum	Substratum	
Crider: CrB	Fair: well drained, but moderately fine textured material.	Low to moderate.	Good	Not suited for sand or gravel; possible source of limestone.	Fair to poor: medium to high compressibility.	Not suited: limestone.	Well drained; limestone below depth of 4 to 5 feet.
Dana: DaA, DaB	Poor: seasonally wet, moderately fine textured material.	Moderate to high.	Good	Not suited	Fair: medium to high compressibility.	Fair: medium to high compressibility.	Moderately well drained; moderately slow permeability.
Eden: EdB2, EdC2, EdD2, EdE2, EdF2.	Fair to poor: well drained, but moderately fine to fine textured material.	Moderate	Poor: thin to clay.	Not suited for sand or gravel.	Poor: moderately fine to fine textured material.	Not suited: moderately deep to limestone and shale.	Limited depth to limestone and shale; clayey material; well drained; some steep slopes.
Eel: Ee	Poor: seasonally wet; subject to flooding.	Moderate	Good	Poor for sand, locally fair in substratum; poor for gravel.	Fair to poor: medium to high compressibility.	Poor to good: stratified silts, sands, and gravel.	Subject to flooding: seasonal high water table for short periods; moderate permeability.
Fairmount: FaE2, FaF2. For Eden part of FaE2, and FaF2, see Eden series.	Poor: steep slopes; clayey material.	Moderate to low.	Poor: high clay content.	Not suitable	Poor: high compressibility.	Poor to unsuited: interbedded limestone and shale.	Limited depth to limestone and shale; steep slopes; clayey material; subject to slips.
Fincastle: FhA, FhB	Poor: seasonal high water table; moderately fine textured material.	High	Good	Not suitable	Fair to poor: moderate shrink-swell potential; medium to high compressibility.	Fair: fair stability and compaction.	Seasonal high water table; moderately slow permeability.
Fox: FlA, FlB, FlB2, FlC2, FoD2. For Casco part of FoD2, see Casco series.	Fair: well drained, but moderately fine to fine textured; substratum well suited to winter grading.	Low	Fair: limited quantity available.	Good for gravel and sand below depth of 1½ to 3½ feet; stratified; well graded; calcareous.	Fair to poor: variable stability and compaction.	Good: sand and gravel.	Cut slopes are droughty; well drained; stable substratum.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [3]				
Limestone bedrock at depth below 4 to 5 feet; well drained.	Possibility of excessive seepage in underlying limestone.	Poor stability and compaction; slow permeability; medium to high compressibility; good resistance to piping.	Well drained	High available moisture capacity; gently sloping and moderately erodible.	Gently sloping and moderately erodible.	Gently sloping and moderately erodible.
Moderately well drained; moderately fine textured material.	Slow rate of seepage.	Fair stability; fair compaction; slow permeability; medium compressibility; fair resistance to piping.	Moderately slow permeability in till substratum; moderately well drained.	High available moisture capacity; good infiltration.	Moderately well drained; moderately erodible.	Moderately well drained; moderately erodible.
Moderately deep to limestone and shale; well drained; some steep slopes.	Moderately deep to limestone and shale bedrock.	Limited material available; fair to poor stability and compaction; slow permeability; high compressibility.	Well drained	Well drained; moderately deep to rock; low available moisture capacity; some steep slopes.	Moderately deep to rock; some steep slopes; highly erodible.	Moderately deep to rock; highly erodible material.
Subject to flooding; seasonal high water table for short periods; trench walls are unstable.	Subject to flooding; permeable material in substratum.	Fair stability; fair compaction; moderate permeability; medium to high compressibility; possibility of piping.	Seasonal high water table for short periods; moderately permeable; subject to flooding.	High available moisture capacity; subject to flooding; nearly level.	Subject to flooding; nearly level.	Subject to flooding; nearly level.
Steep slopes; shallow to limestone and shale.	Steep slopes; shallow to limestone and shale.	Limited material available; fair to poor stability and compaction; high compressibility; slow permeability; good resistance to piping.	Steep; well drained.	Steep slopes; erosion hazard; shallow to shale and limestone.	Shallow to limestone and shale; steep slopes.	Shallow to limestone and shale; steep slopes.
Seasonal high water table.	Low seepage losses; seasonal high water table.	Fair stability; fair compaction; slow permeability; medium to high compressibility; possibility of piping.	Somewhat poorly drained; moderately slow permeability.	Seasonal high water table; moderately slow permeability; medium to high available moisture capacity.	Nearly level to gently sloping; moderately erodible.	Nearly level to gently sloping; moderately erodible; subject to seepage.
Well drained; sandy and gravelly below depth of 1½ to 3½ feet.	Pervious material in substratum; high seepage losses.	Pervious material in substratum; variable stability and compaction; slow permeability; variable compressibility; good resistance to piping.	Well drained	Medium to low available moisture capacity; good infiltration; moderate permeability.	Cut channels are droughty; gravelly material at depth of 20 inches in some places.	Cut channels are droughty; moderately erodible.

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TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Suscepti-bility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location [1]
					Solum	Substratum	
Genesee: Gd, Gn	Fair to good: subject to flooding.	Low to moderate.	Good	Poor: locally fair for sand in substratum.	Fair to poor: medium compressibility.	Fair to poor: medium compressibility.	Good natural drainage; subject to flooding; nearly level.
Hennepin: HeF, HeF2, HmE, HmE2, HnD3. For the Miamian part of HmE, HmE2, and HnD3, see Miamian series.	Fair to poor: well drained, but subject to frost action.	Moderate	Poor: thin.	Not suitable	Fair to poor: medium compressibility.	Fair: medium compressibility.	Steep slopes; cut slopes are droughty; well drained.
Henshaw: HoB	Poor: seasonally wet and slow to dry.	High	Good to depth of about 12 to 16 inches.	Not suitable	Poor: soft silty material; highly compressible.	Poor: soft silty material; highly compressible.	Somewhat poorly drained; soft and unstable when wet; seasonal high water table; moderately slow permeability.
Hickory: HrB2, HrC2, HrD2, HsC3, HsD3, HtE2, HtF2. For Fairmount part of HtE2 and HtF2, see Fairmount series.	Fair to poor: well drained, but moderately fine textured.	Low to moderate.	Fair: limited quantity.	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Some steep slopes; well drained.
Iva: IvA	Poor: seasonally high water table; material dries slowly.	High	Good to depth of of about 18 inches.	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Nearly level: seasonal high water table; moderately slow permeability; somewhat poorly drained; soft and compressible when wet.
Kendallville: KeB, KeC2.	Fair: well drained, but dries slowly during winter.	Low to moderate.	Fair: limited quantity.	Not suitable	Fair: medium compressibility.	Fair: medium compressibility.	Cut slopes are droughty; well drained.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [3]				
Subject to flooding; ditch walls are unstable.	Possible seepage; subject to flooding.	Fair to poor stability and compaction; moderate permeability; medium compressibility; subject to piping.	Well drained	Subject to flooding; high available moisture capacity; good infiltration.	Subject to flooding; nearly level.	Subject to flooding; nearly level.
Shallow to calcareous glacial till; well drained; steep slopes.	Low seepage losses; steep slopes.	Fair stability and compaction; slow permeability; medium compressibility; fair resistance to piping.	Well drained	Steep slopes; very low available moisture capacity.	Channels cut into calcareous till material; droughty; steep slopes.	Droughty; steep slopes.
Seasonal high water table; somewhat poorly drained; trench walls are unstable.	Low seepage losses; seasonal high water table.	Fair stability and compaction; slow permeability; medium to high compressibility; fair resistance to piping.	Moderately slow permeability; seasonal high water table; somewhat poorly drained.	Somewhat poorly drained; seasonal high water table; high available moisture capacity.	Somewhat poorly drained; seasonally wet; moderately erodible.	Somewhat poorly drained; seasonally wet; moderately erodible.
Well drained; some steep slopes.	Low seepage losses; some steep slopes.	Fair stability and compaction; slow permeability; medium to high compressibility; fair resistance to piping.	Well drained	Medium infiltration rate; some steep slopes; medium available moisture capacity.	Some steep slopes; moderately erodible.	Some steep slopes; moderately erodible.
Somewhat poorly drained; ditch walls are unstable.	Slow rate of seepage.	Fair stability and compaction; slow permeability; medium to high compressibility; fair resistance to piping.	Seasonal high water table; moderately slow permeability; nearly level.	Seasonal high water table; moderately slow permeability; high available moisture capacity.	Seasonal high water table; moderately erodible.	Seasonal high water table; moderately erodible.
Well drained	Generally slow rate of seepage; some gravelly seams may occur in upper 2 feet.	Fair stability; fair compaction; medium compressibility; slow permeability; good resistance to piping.	Well drained; moderate permeability in uppermost 2 to 3 feet.	Medium available moisture capacity; good intake rate; moderate permeability in upper 2 to 3 feet.	Cut channels are droughty; moderately erodible.	Moderately erodible; cut channels are droughty.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location [1]
					Solum	Substratum	
Kings, thick surface variant: Kg.	Poor: high water table; very poorly drained.	High	Poor: moderately fine textured material.	Not suitable	Poor: soft and compressible.	Poor: soft and compressible.	Very poorly drained; high water table; soft and unstable when wet.
Lanier: Lg	Good: subject to flooding	Low	Fair: limited quantity.	Generally poor; high fine content and limited quantity; locally fair to good for both sand and gravel.	Good	Good	Subject to flooding; well drained.
Miamian: MmB3, MmC3, MnD2, MrC2. For Hennepin part of MnD2, see Hennepin series. For Russell part of MrC2, see Russell series.	Poor: well drained, but generally sticky during winter; moderately fine to fine textured material.	Moderate	Fair: limited quantity.	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Some moderately steep slopes; well drained; moderately slow permeability.
Muck: Mu	Poor: wet organic material.	High	Poor: organic material.	Not suitable	Not suitable for road fill; soft and unstable; subject to subsidence when drained; high water table.	Not suitable for road fill; soft and unstable; subject to subsidence when drained; high water table.	Organic soil; subject to subsidence if drained; high water table; slowly permeable substratum; soft when wet.
Ockley: OcA, OcB, OcB2.	Fair: well drained, but moderately fine textured; good at depth below about 50 inches.	Low to moderate.	Good	Good for gravel and sand below depth of about 4 feet; well graded; stratified; calcareous.	Fair: medium compressibility.	Good: low compressibility.	Well drained; stable.
Parke: PaB, PaD2	Fair: well drained but sticky during winter.	Low to moderate.	Good	Fair in a few areas below depths of 6 to 8 feet.	Fair: medium compressibility.	Good: medium compressibility.	Well drained; some moderately steep slopes.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [3]				
Very poorly drained; high water table.	High water table; low seepage rate.	Fair to poor stability; fair to poor compaction; slow permeability; high compressibility; good resistance to piping.	High water table; slowly permeable; very poorly drained.	Very poorly drained; slowly permeable; high available moisture capacity.	Very poorly drained; nearly level.	Very poorly drained; nearly level.
Subject to flooding; well drained; sandy and gravelly; trench walls are unstable.	Subject to flooding; permeable material; high seepage losses.	Good stability; good compaction; pervious material; slight compressibility; variable resistance to piping.	Well drained; subject to flooding.	Low available moisture capacity; subject to flooding	Nearly level; subject to flooding.	Nearly level; subject to flooding; droughty in summer.
Well drained	Low seepage losses.	Fair stability and compaction; slow permeability; medium compressibility; good resistance to piping.	Well drained	Medium available moisture capacity; moderately slow permeability.	Well drained; moderately erodible.	Well drained; moderately erodible.
High water table; soft unstable organic material.	Organic soil; high water table; slowly permeable substratum.	Organic soil; not suited.	Organic material; high water table; danger of subsidence if drained.	High water table; rapid intake rate; very high available moisture capacity.	Nearly level; high water table.	Nearly level; high water table.
Stable; well drained; sand and gravel below depth of 4 feet.	Excessive rate of seepage in substratum.	Fair stability; good compaction; slow permeability; medium compressibility; good resistance to piping.	Well drained	High available moisture capacity; moderately permeable; good intake rate.	Well drained; moderately erodible.	Well drained; moderately erodible.
Well drained	Excessive seepage losses.	Fair to good stability and compaction; slow permeability; medium compressibility; good resistance to piping.	Well drained	High available moisture capacity and intake rate; moderate permeability.	Well drained; moderately erodible.	Well drained; moderately erodible.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Suscepti-bility to frost action	Suitability as source of—				Soil features affecting—
			Topsoil	Sand and gravel	Road fill		Highway location [1]
					Solum	Substratum	
Patton: Pb, Pc	Poor: very poorly drained; silty material.	High	Good	Not suitable	Poor: wet silty material; difficult to compact.	Poor: wet silty material; difficult to compact.	Moderately slow permeability; soft when wet; seasonal high water table; very poorly drained; local flooding and ponding.
Plattville: PlB	Poor: generally wet and sticky during winter.	Moderate	Good	Not suitable; locally may be a source of limestone.	Poor: medium to high compressibility.	Not suitable: limestone bedrock.	Moderate depth to bedrock; moderately well drained.
Princeton: PrB, PrC2.	Good	Low	Fair to good.	Fair source of sand below a depth of 4 feet.	Good	Good	Well drained; cut slopes are droughty.
Ragsdale: Ra	Poor: seasonal high water table; wet and sticky in winter.	High	Good	Not suitable	Poor: high compressibility.	Poor: high compressibility.	Seasonal high water table; moderately slow permeability; soft and unstable when wet; very poorly drained.
Rainsboro: RbA, RbB.	Poor: generally wet and sticky during winter.	Moderate to high.	Good	Not suitable	Fair to poor: medium to high compressibility.	Fair to good: medium to low compressibility.	Seepage on cut slopes along fragipan; moderately well drained.
Reesville: Re	Poor: seasonally high water table; somewhat poorly drained.	High	Good	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Seasonal high water table; soft and unstable when wet; somewhat poorly drained; moderately slow permeability.
Rodman: RkE2. For Casco part of RkE2, see Casco series.	Good	Low	Poor: gravelly and thin material.	Good for gravel and sand; stratified; well graded; calcareous.	Good	Good	Well drained; steep slopes; shallow to sand and gravel; cut slopes are droughty.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [3]				
Very poorly drained; seasonal high water table; soft when wet; local flooding; trench walls are unstable.	Low seepage losses; moderately slow permeability; seasonal high water table; nearly level; local flooding.	Fair to poor stability; slow permeability; fair to poor compaction; fair resistance to piping.	Moderately slow permeability; nearly level; seasonal high water table; very poorly drained.	Very poorly drained; high available moisture capacity.	Nearly level; very poorly drained.	Nearly level; very poorly drained.
Limestone bedrock at depth of 1½ to 3½ feet.	Fractured bedrock at depth of 1½ to 3½ feet; possible high seepage losses.	Fair stability; fair compaction; slow permeability; medium to high compressibility; fair resistance to piping.	Moderately well to well drained.	Medium available moisture capacity; good intake rate.	Moderate depth to limestone; moderately erodible.	Moderate depth to limestone; moderately erodible.
Well drained; ditch walls are unstable; strongly acid in upper 2 to 3 feet.	High seepage losses.	Moderately permeable material; fair stability; fair to good compaction; slight compressibility; fair to poor resistance to piping.	Well drained____	Good intake rate; low available moisture capacity.	Moderately erodible on slopes; well drained.	Moderately erodible on slopes; well drained.
Very poorly drained; soft and compressible when wet; seasonal high water table.	Low seepage losses; seasonal high water table.	Fair to poor stability and compaction; slow permeability; high compressibility; good resistance to piping.	Seasonal high water table; moderately slow permeability; very poorly drained.	Seasonal high water table; moderately slow permeability; very poorly drained.	Seasonal high water table; nearly level.	Seasonal high water table; nearly level.
Moderately well drained; fragipan; seepage on top of pan; strongly acid in upper 3 feet.	Excessive rate of seepage in substratum.	Fair stability; fair compaction; medium to high compressibility; fair resistance to piping.	Moderately slow permeability; seasonal high water table; fragipan.	Medium available moisture capacity; moderately slow permeability; fragipan.	Moderately well drained; moderately erodible.	Moderately well drained; moderately erodible.
Somewhat poorly drained; seasonal high water table; soft and compressible when wet.	Slow rate of seepage; seasonal high water table.	Fair stability and compaction; slow permeability; medium to high compressibility; fair resistance to piping.	Seasonal high water table; somewhat poorly drained; moderately slow permeability.	Seasonal high water table; somewhat poorly drained; high available moisture capacity.	Nearly level; somewhat poorly drained; seasonal high water table.	Nearly level; somewhat poorly drained; seasonal high water table.
Well-drained, sandy and gravelly material; ditch walls are unstable.	Excessive seepage losses; steep slopes.	Pervious gravelly material; good stability.	Well drained____	Very low available moisture capacity; shallow to gravel and sand.	Very low available moisture capacity; droughty; steep slopes.	Droughty; steep slopes.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Suscepti-bility to frost action	Suitability as source of— Topsoil	Suitability as source of— Sand and gravel	Suitability as source of— Road fill: Solum	Suitability as source of— Road fill: Substratum	Soil features affecting— Highway location [1]
Ross: Rn	Poor: subject to flooding.	Moderate	Good	Locally fair for sand; not suitable for gravel.	Fair: medium compressibility.	Fair: stratified silty material.	Subject to flooding; well drained.
Rossmoyne: RpA, RpB, RpB2, RpC2, RsB3, RsC3.	Poor: wet and sticky in winter.	Moderate	Good	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Moderately slow permeability; seepage on fragipan; moderately well drained.
Russell: RvA, RvB RvB2. For Miamian part of RvA, RvB, and RvB2, see Miamian series.	Poor: wet and sticky in winter.	Moderate	Fair to good: limited suitable topsoil.	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Well drained; moderately slow permeability.
Shoals: Sh	Poor: subject to flooding; seasonal high water table.	High	Good to depth of 2 feet or more.	Not suitable	Fair to poor: wet silty material.	Fair to poor: wet silty material.	Subject to flooding; seasonal high water table; soft and compressible when wet; somewhat poorly drained.
Sloan: So	Poor: subject to flooding; seasonal high water table.	High	Fair: moderately fine textured topsoil.	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressiblity.	Subject to flooding; seasonal high water table; soft and compressible when wet; very poorly drained.
Uniontown: UnB	Poor: wet and sticky in winter.	Moderate	Fair to good: limited quantity.	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Unstable when wet; seasonal high water table; moderately slow permeability; moderately well drained.

See footnotes at end of table.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [3]				
Subject to flooding; ditch walls are unstable.	Subject to flooding; permeable substratum.	Fair to poor stability and compaction; medium compressibility; poor resistance to piping; moderate permeability.	Well drained	Moderately permeable; high available moisture capacity; subject to flooding.	Subject to flooding; nearly level.	Subject to flooding; nearly level.
Moderately well drained; seasonally wet for short periods.	Moderately slow permeability.	Fair stability and compaction; slow permeability; medium compressibility; fair resistance to piping.	Moderately slowly permeable; fragipan.	Medium available moisture capacity; moderately slow permeability.	Moderately well drained; moderately erodible.	Moderately well drained; moderately erodible.
Well drained	Slow rate of seepage.	Fair stability; fair compaction; medium to high compressibility; slow permeability; good resistance to piping.	Well drained	Moderately slow permeability; high available moisture capacity.	Well drained; moderately erodible.	Well drained; moderately erodible.
Subject to flooding; ditch walls are unstable; seasonal high water table.	Permeable layers in substratum; subject to flooding; seasonal high water table.	Fair to poor stability and compaction; slow to moderate permeability; susceptible to piping.	Seasonal high water table; moderately slowly permeable; subject to flooding.	Subject to flooding; seasonal high water table; high available moisture capacity.	Nearly level; subject to flooding.	Nearly level; subject to flooding; somewhat poorly drained.
Subject to flooding; ditch walls are unstable; seasonal high water table.	Permeable layers in substratum; subject to flooding.	Fair stability; fair to good compaction; slow permeability; medium to high compressibility; fair resistance to piping.	Subject to flooding; seasonal high water table; moderately slow permeability.	Subject to flooding; very poorly drained; high available moisture capacity.	Nearly level; subject to flooding.	Nearly level; subject to flooding; very poorly drained.
Moderately well drained.	Low seepage losses.	Fair stability and compaction; slow permeability; medium to high compressibility; fair resistance to piping.	Moderately slow permeability; seasonal high water table.	High available moisture capacity; seasonal high water table; moderately slow permeability.	Moderately well drained; moderately erodible.	Moderately well drained; moderately erodible.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of— Topsoil	Suitability as source of— Sand and gravel	Road fill: Solum	Road fill: Substratum	Soil features affecting— Highway location [1]
Warsaw: WaA, WaB.	Fair in upper 20 to 40 inches; good below 20 to 40 inches.	Low	Good	Good below depth of 1½ to 3½ feet; well graded; stratified; calcareous sand and gravel.	Fair: medium compressibility.	Good: low compressibility.	Well drained; cut slopes are droughty.
Wea: WeA	Fair in upper 40 inches; moderately fine textured material; good in substratum.	Low	Good	Good for sand and gravel below depth of 48 inches; well graded; stratified; calcareous.	Fair: medium compressibility.	Good: medium compressibility.	Well drained; cut slopes are droughty.
Williamsburg: WlA, WlB, WlC2.	Fair: well drained but sticky in winter.	Low to moderate.	Good	Not suitable	Fair: medium compressibility.	Fair: medium compressibility.	Well drained; moderately permeable.
Wynn: WyB, WyB2, WyC2, WyC3.	Fair: well drained but sticky in winter.	Moderate	Fair: limited quantity.	Not suitable	Fair to poor: medium to high compressibility.	Not suitable: limestone and shale.	20 to 40 inches to limestone and shale; well drained.
Xenia: XeA, XeB, XeB2.	Poor: wet and sticky in winter	Moderate to high.	Good	Not suitable	Fair to poor: medium to high compressibility.	Fair to poor: medium to high compressibility.	Seasonal high water table for short periods; moderately slow permeability.

[1] Frost action, shrink-swell potential, and suitability for winter grading are rated separately on tables 5 and 6.
[2] See table 5 for estimated properties.

interpretations of the soils—Continued

Soil features affecting—Continued						
Pipeline construction and maintenance [2]	Farm ponds		Agricultural drainage	Irrigation	Terraces or diversions	Waterways
	Reservoir area	Embankment [3]				
Well drained sandy and gravelly substratum.	Excessive seepage losses in substratum.	Pervious substratum; fair stability and compaction; medium compressibility; good resistance to piping.	Well drained.	Medium available moisture capacity; good intake rate.	Cut channels are gravelly and droughty; slightly erodible.	Cut channels are gravelly and droughty; slightly erodible.
Well drained; sandy and gravelly substratum.	Excessive seepage losses in substratum.	Pervious substratum; fair stability and compaction; medium compressibility; good resistance to piping.	Well drained.	High available moisture capacity; moderate permeability.	Nearly level; well drained.	Nearly level; well drained.
Well drained.	Moderate to excessive seepage losses.	Fair stability and compaction; medium compressibility; slow permeability; fair resistance to piping.	Well drained.	High available moisture capacity; moderate permeability.	Well drained; slightly erodible.	Well drained; slightly erodible.
Well drained; 20 to 40 inches to limestone and shale.	20 to 40 inches to limestone and shale.	Fair stability and compaction; slow permeability; medium to high compressibility; good resistance to piping.	Moderately slow permeability; limestone and shale at depth of 20 to 40 inches.	Medium available moisture capacity; moderately slow permeability; limestone and shale at depth of 20 to 40 inches.	Limestone and shale at depth of 20 to 40 inches; moderately erodible.	Limestone and shale at depth of 20 to 40 inches; moderately erodible.
Moderately well drained; seasonal high water table for short periods.	Low seepage losses.	Fair stability and compaction; slow permeability; medium to high compressibility; good resistance to piping.	Moderately slowly permeable; seasonal high water table for short periods.	Medium to high available moisture capacity; seasonal high water table for short periods; moderately slow permeability.	Moderately well drained; moderately erodible.	Moderately well drained; moderately erodible.

[3] Permeability rated for soil in embankment and properly compacted. Ratings also apply to low dikes and levees.

Suitability as source of topsoil, sand and gravel, and road fill.—The thickness, texture, and natural fertility of the surface layer determine the suitability of a soil for use as topsoil, or topdressing for road banks and embankments to promote the growth of plants. Only the surface layer of the soil is considered in this rating, except as noted otherwise.

Information is given about the soils as a possible source of sand and gravel used for construction purposes. If a soil is rated good it should not be assumed that all areas of that soil can be used for commercial development for sand or gravel.

Well-graded, coarse-grained material or mixtures of clay and coarse-grained material are desirable for road fill, but plastic clayey soils, poorly graded silty soils, and organic soils are low in stability and are not desirable for road fill. The ratings for road fill refer to the upper 2 to 3 feet (solum) and the underlying substratum.

Highway locations.—Soil features that affect highway location include shallowness to rock, high water table, steep slopes, slippage, and flood hazard.

Pipeline construction and maintenance.—Soil features that affect pipelines are depth to hard bedrock, soil stability, and natural drainage. Corrosion potential is rated in table 5.

Farm ponds.—Under "Reservoir area" consideration is given primarily to the sealing potential of the reservoir. Shallowness to bedrock and the susceptibility to overflow on flood plains are also noted. Under "Embankment", the soils are rated according to the stability and permeability of the materials if used in the construction of pond embankments. The permeability noted in this column is for the soil material when compacted at optimum moisture. The information in this column is also pertinent for low dikes and levees.

Agricultural drainage.—The soil features are described relative to natural drainage of the soils, their inplace permeability, and the presence of a seasonal high water table.

Irrigation.—The moisture-holding capacity of the soils, drainage, permeability, water table, infiltration, and topography are features that affect irrigation.

Terraces or diversions.—Slope erodibility are the main features that affect suitability of soils for terraces and diversions. Other soil features considered are depth to rock and presence of a seasonal high water table. Nearly level soils need no terracing, and steep soils are not well adapted to terracing. Highly erodible soils require special care in the construction of diversions.

Waterways.—Slope and erodibility of the soils are the main features considered. Depth to rock and high water table are also important.

Town and Country Planning

Warren County is south of the large metropolitan area of Dayton, Ohio, and northeast of the even larger metropolitan area of Cincinnati, Ohio. The rapid expansion of Dayton and Cincinnati will greatly affect land use in Warren County. Because of this expansion, competition for use of the land is increasing. Farming now is the dominant land use in Warren County, but there is already a mixing of farm and nonfarm uses in the townships close to Dayton, Cincinnati, and Middletown, Ohio. Farming areas throughout the county are reduced as residential, industrial, transportation, and recreational facilities are developed.

The expansion of nonfarm uses of land may remove many acres from farm use in a short period. Freeways and superhighways may displace up to about 50 acres of farmland per mile. A shopping center may replace 50 to 100 acres.

Community planners and industrial users of land generally look for soil areas that are least costly to develop. Table 7 provides information about soil properties and their effects on selected uses. This information is useful in town and country planning.

Comparisons can be made between the soils in the county for any planning problem. Other useful information for planning is on the soil maps and in other parts of this soil survey. Table 7 gives the estimated degrees and kinds of limitation of soils for specified land uses. Through the use of this information, suitable alternatives can be determined and used as a basis for long-range planning and zoning. Because extensive manipulation of a soil alters some of its natural properties, the ratings for some uses no longer apply in areas where cutting and filling has been extensive.

Any one soil property may impose a degree of limitation for a specified land use, but for another land use this same soil property may be more or less limiting. For this reason, the estimated degree of limitation for each soil and specified land use is given as slight, moderate, and severe. A rating of *slight* indicates that the soil has no important limitation for the specified use. A rating of *moderate* shows that the soil has some limitations for the specified use. Moderate limitations need to be recognized, but they can be overcome or corrected. A rating of *severe* indicates that the soil has limitations for the intended use that are difficult and costly to overcome. A rating of severe does not mean that the soil cannot be used for the specified use. It does mean that hazards are greater and that costs of overcoming the limitations will be higher than on soils having limitations rated slight or moderate.

The column heads in table 7 are described in the following paragraphs.

Farming.—Farming is rated in table 7 to aid land-use planners when they are considering alternative uses of the land. Some soils are more suitable for farming than for many nonfarm uses. The soils have been rated according to their limitations if used for cultivated crops. In rating these limitations, pasture and specialty crops have not been considered. The effects of slope, erosion, wetness, and droughtiness, and other limiting properties have been estimated.

Sewage effluent disposal.—Soil properties important to the installation and operation of septic tank disposal fields include permeability, depth to bedrock, slope, natural drainage, depth to the water table, and the hazard of flooding. Flooding and a seasonally high water table prevent the proper functioning of a disposal field for varying periods of time. Limitations of all soils subject to flooding have been rated severe. Limitations for many of the soils in the county have been rated severe because they have moderately slow or slower permeability. Some soils that have severe limitations to use for disposing of sewage are better suited to this use than others that have a severe rating. This is because in the better suited soils the least permeable layer is at a greater depth and the zone of absorption is thicker. For example, the Russell, Miamian, and Uniontown soils are of this kind. A septic tank should be installed in these soils only as a temporary solution. In soils that have rapid permeability, septic tank disposal fields are likely to pollute the underground water supply and the nearby wells and springs.

Sewage lagoons.—Sewage lagoons are shallow ponds built to dispose of sewage through oxidation. They may be needed in an area where septic tanks or a central sewage system is not practical. Among the features that determine the degree of limitations are the hazard of flooding, slope, depth to bedrock, and permeability.

Homesite locations.—These locations are for homes of three stories or less that have a basement, but the ratings also apply to sites for small industrial, commercial, and institutional buildings of the same size or smaller.

Most of the acreage taken from farming is being converted to new residential developments. These developments generally surround present urban areas. In addition, individual houses or small groups of houses are being built throughout the county.

Soil properties and some related site characteristics that are used in rating limitations for homesite locations are depth to bedrock, slope, natural drainage, flood hazard, and surface stoniness or rockiness. The method of sewage disposal is not considered in the rating.

Soils subject to flooding have severe limitations for homesites. Flooding may be infrequent, but it is costly and damaging when it does occur. Homes on naturally wet soils may have wet basements if adequate drainage is not provided. The Avonburg, Patton, Brookston, and Clermont soils are of this kind. In many areas in the county, well-developed systems of tile and open-ditch drains have been installed for farm uses. In these areas excavations for buildings disrupt the established drainage system, and the soils then revert to their natural condition of wetness.

Some soils, such as the Patton or Ragsdale, have a high silt content. These soils are not so favorable for supporting structural foundations as are the Fox, Ockley, and other of the coarser textured soils. Soils that have high shrink-swell properties are likely to heave and to crack foundations unless special precautions are taken. Also, high shrink-swell properties affect the alignment of sidewalks, patios, floors, and rock walls. This effect can be lessened by using a subgrade, or layers of sandy or gravelly material, directly below the structure. The soils are rated for shrink-swell potential in table 5.

Excavating basements and installing underground utility lines are difficult and expensive in soils that are shallow to bedrock. Sloping soils are susceptible to erosion, and excavation and leveling may be difficult on them.

Lawns, landscaping, and golf fairways.—Some soils in the county are suitable sources of topsoil, as indicated in table 5. During construction, the upper foot of natural surface soil can be scalped and pushed aside into a stockpile. This material can be distributed over the area after grading has been completed, for it provides a good root zone for lawn plants, flowers, shrubs, and trees. In areas developed for streets, the natural surface soil can be scalped in a like manner and used to improve adjacent areas where it is needed most.

Among the soil properties that determine whether a good lawn or golf fairway (fig. 4, page 66) can be established are natural drainage, slope, depth to bedrock, texture of the surface soil, stoniness and rockiness, and the hazard of flooding.

Streets and parking lots.—This column rates limitations to use of soils for streets and parking lots in subdivisions. The ratings apply to streets and parking lots not subject to heavy traffic continuously. Soil characteristics that affect this use include drainage, slope, depth to bedrock, the hazard of flooding, and stoniness or rockiness. Tables 4 and 5 in the section "Engineering Uses of the Soils" give other information about the soils that is important for streets and parking lots. The degree of slope planned for the sides of cuts and fills depends on the erodibility of the soil and its capacity to support close-growing vegetation.

Recreation.—Recreation is becoming increasingly important in Warren County. All the soils in the county are suitable for one or more kinds of recreational development. Soils on flood plains are suitable for some kinds of recreation because they generally occur in long, winding areas along streams and adjacent scenic hills. Use of these soils for homes, highways, and most other nonfarm uses is severely limited by flooding. In addition, construction in these areas may hold back the natural flow of floodwater. Among the kinds of recreational facilities that can be developed on flood plains are extensive parks and play areas. Also suitable in some areas are intensive play areas, such as ball diamonds, picnic areas, and tennis courts, that are not used during normal periods of flooding and are not subject to costly damage by floodwater. An onsite evaluation and consideration of possible flooding damage can help prevent or reduce losses caused by flooding.

Athletic fields.—These fairly small tracks are used for baseball, football, tennis, volleyball, badminton, and other sports. Because the areas must be level or nearly level, considerable shaping may be needed. Consequently, the limitation is moderate or severe for soils that have slopes of more than 2 percent. Also important to athletic fields is the texture of the surface layer. Natural drainage and permeability are soil properties that influence the kind and amount of drainage needed for athletic fields.

Parks and play areas.—These areas can be located on many kinds of soils. Areas consisting of several different soils may provide a variety of wildlife and natural vegetation. Considered in rating the soils for picnicking, hiking, nature study, and similar uses are range of slope, texture of the surface soil, natural drainage, stoniness, and hazard of flooding. Paths in picnic and play areas should be constructed and maintained in a way that helps control erosion.

Campsites.—Campsites for tents should be located in areas where the landscape is attractive, the trafficability is good, and the production of grasses and trees is medium or high. Soils in which the natural drainage is good have less serious limitations than wetter soils. Soil limitations are severe on soils along streams where flooding is a hazard to life and property. Slopes generally have more severe limitations for trailer campsites than for tent campsites. Soils that are firm when moist and nonsticky when wet are most desirable. The soils most suitable for campsites are those having a surface layer of loam, silt loam, sandy loam, or fine sandy loam.

TABLE 7.—*Estimated degree and kinds of*

[No determinations were made for Cut and

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location (3 stories or less)[1]	Lawns, landscaping, golf fairways
Abscota, calcareous variant: AbA.	Moderate: droughty.	Severe:[2] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Alford: AfB	Slight	Moderate: moderately slow permeability below a depth of 4 feet.	Moderate: moderate permeability to a depth of 4 feet.	Slight	Slight
Algiers: Ag	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Avonburg:					
AvA	Moderate: somewhat poorly drained.	Severe: slow permeability.	Slight	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
AvB, AvB2	Moderate: somewhat poorly drained.	Severe: slow permeability.	Moderate: slope	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Birkbeck: BbB	Slight	Severe: moderately slow permeability.	Moderate: moderate permeability to a depth of 4 feet.	Slight	Slight
Blanchester: Bc	Slight	Severe: slow permeability; poorly drained.	Slight	Severe: poorly drained.	Severe: poorly drained.
Brookston: Br	Slight	Severe: very poorly drained; moderately slow permeability.	Slight	Severe: very poorly drained.	Severe: very poorly drained.
Casco:					
CcB2	Moderate: erosion hazard.	Slight[2]	Severe:[2] pervious substratum.	Slight	Severe: droughty
CcC2	Severe: erosion hazard.	Moderate:[2] slope	Severe:[2] pervious substratum; slope.	Moderate: slope	Severe: droughty
CdD2	Severe: slope and erosion hazard.	Severe:[2] slope	Severe:[2] pervious substratum; slope.	Severe: slope	Severe: droughty; slope.
Cincinnati:					
CnB, CnB2	Slight	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight

See footnotes at end of table.

limitations of soils for specified land uses

fill land, Gravel pits, Muck, and Riverwash]

Streets and parking lots	Recreation: Athletic fields (intensive use)	Recreation: Parks and play areas	Recreation: Campsites: Tents	Recreation: Campsites: Trailers	Sanitary land fill (trench type)	Cemeteries
Severe: subject to flooding.	Severe: subject to flooding; sand texture.	Severe: subject to flooding; sand texture.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Slight	Slight.
Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Moderate: somewhat poorly drained.	Severe: slow permeability.	Moderate: somewhat poorly drained.	Severe: slow permeability.	Severe: slow permeability.	Moderate: somewhat poorly drained; moderately fine texture.	Severe: slow permeability.
Moderate: somewhat poorly drained.	Severe: slow permeability.	Moderate: somewhat poorly drained.	Severe: slow permeability.	Severe: slow permeability.	Moderate: somewhat poorly drained; moderately fine texture.	Severe: slow permeability.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Slight	Slight.
Severe: poorly drained.	Severe: poorly drained; slow permeability.	Severe: poorly drained.	Severe: poorly drained; slow permeability.	Severe: poorly drained; slow permeability.	Severe: poorly drained; subject to ponding.	Severe: poorly drained; slow permeability.
Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained; subject to ponding.	Severe: very poorly drained.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe:[2] pervious substratum.	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Severe:[2] pervious substratum.	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe:[2] slope; pervious substratum.	Severe: slope.
Moderate: slope.	Moderate: slope; moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: slope; moderately slow permeability.	Moderate: moderately fine texture.	Slight.

TABLE 7.—*Estimated degree and kinds of*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location (3 stories or less)[1]	Lawns, landscaping, golf fairways
Cincinnati—Continued					
CnC2	Moderate: erosion hazard.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope
Clermont: Co	Moderate: poorly drained.	Severe: very slow permeability; poorly drained.	Slight	Severe: poorly drained.	Severe: poorly drained.
Crider: CrB	Slight	Slight	Moderate: moderate permeability.	Slight	Slight
Dana:					
DaA	Slight	Severe: moderately slow permeability.	Slight	Slight	Slight
DaB	Slight	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight
Eden: EdB2, EdC2, EdD2, EdE2, EdF2.	Generally severe: 1½ to 3½ feet to rock; slope; moderate for EdB2.	Severe: 1½ to 3½ feet to rock; slope; slow permeability.	Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3½ feet to rock; slope.
Eel: Ee	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Fairmount: FaE2, FaF2. For Eden part of FaE2 and FaF2, see Eden series.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.
Fincastle:					
FhA	Slight	Severe: somewhat poorly drained; moderately slow permeability.	Slight	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
FhB	Slight	Severe: somewhat poorly drained; moderately slow permeability.	Moderate: slope	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.

See footnotes at end of table.

limitations of soils for specified land uses—Continued

Streets and parking lots	Recreation: Athletic fields (intensive use)	Recreation: Parks and play areas	Recreation: Campsites: Tents	Recreation: Campsites: Trailers	Sanitary land fill (trench type)	Cemeteries
Severe: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope; moderately fine texture; bedrock at a depth of 5 to 8 feet.	Moderate: slope.
Severe: poorly drained.	Severe: poorly drained; very slow permeability.	Severe: poorly drained.	Severe: poorly drained; very slow permeability.	Severe: poorly drained; very slow permeability.	Severe: poorly drained; subject to ponding.	Severe: poorly drained; very slow permeability.
Moderate: slope.	Moderate: slope.	Slight.	Slight.	Moderate: slope.	Moderate: moderately fine texture.	Slight.
Slight.	Moderate: moderately slow permeability.	Slight.	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Moderate: slope.	Moderate: slope; moderately slow permeability.	Slight.	Moderate: moderately slow permeability.	Moderate: slope; moderately slow permeability.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3½ feet to rock; slope.	Severe: 1½ to 3 feet to rock; slope.
Severe: subject to flooding.	Slight to severe:[3] subject to flooding.	Slight to severe:[3] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.	Severe: steep slopes and limited depth to bedrock.
Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately fine texture.	Severe: somewhat poorly drained.
Moderate: somewhat poorly drained; slope.	Moderate: somewhat poorly drained; slope; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately slow permeability; slope.	Moderate: somewhat poorly drained; moderately fine texture.	Severe: somewhat poorly drained.

TABLE 7.—*Estimated degree and kinds of*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location (3 stories or less)[1]	Lawns, landscaping, golf fairways
Fox:[4]					
FlA	Slight	Slight [2]	Severe: pervious substratum.	Slight	Slight
FlB, FlB2	Slight	Slight [2]	Severe: pervious substratum.	Slight	Slight
FlC2	Moderate: slope and erosion hazard.	Moderate:[2] slope.	Severe: pervious substratum; slope.	Moderate: slope	Moderate: slope; droughtiness.
FoD2	Severe: slope and erosion hazard.	Severe:[2] slope	Severe: pervious substratum; slope.	Severe: slope	Severe: slope; droughtiness.
Genesee: Gd, Gn	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Hennepin: HeF, HeF2, HmE, HmE2, HnD3.	Severe: slope and erosion hazard.	Severe: slope; moderately slow permeability.	Severe: slope	Severe: slope	Severe: slope
Henshaw: HoB	Slight	Severe: moderately slow permeability.	Slight	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Hickory:					
HrB2	Slight	Severe: moderately slow permeability.	Moderate: slope.	Slight	Sl ght
HrC2	Moderate: slope and erosion hazard.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope
HsC3	Severe: erosion hazard.	Severe: moderately slow permeability.	Severe: slope	Severe: slope	Severe: slope
HrD2, HsD3, HtE2, HtF2. For Fairmount part of HtE2 and HtF2, see Fairmount series.	Severe: erosion hazard.	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope
Iva: IvA	Slight	Severe: moderately slow permeability.	Slight	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.

See footnotes at end of table.

limitations of soils for specified land uses—Continued

Streets and parking lots	Recreation: Athletic fields (intensive use)	Recreation: Parks and play areas	Recreation: Campsites: Tents	Recreation: Campsites: Trailers	Sanitary land fill (trench type)	Cemeteries
Slight	Slight	Slight	Slight	Slight	Severe:[2] pervious substratum.	Slight.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe:[2] pervious substratum.	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Severe:[2] pervious substratum.	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe:[2] slope; pervious substratum.	Severe: slope.
Severe: subject to flooding.	Slight to severe:[3] subject to flooding.	Slight to severe:[3] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: somewhat poorly drained; slope.	Moderate: somewhat poorly drained; moderately slow permeability; slope.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately slow permeability; slope.	Moderate: somewhat poorly drained; moderately fine texture.	Severe: somewhat poorly drained.
Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope; moderately fine textured.	Moderate: slope; moderately slow permeability.
Severe: slope	Severe: slope	Severe: erosion	Severe: erosion	Severe: slope	Moderate: slope; moderately fine texture.	Moderate: slope; moderately slow permeability.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately fine texture.	Severe: somewhat poorly drained.

TABLE 7.—*Estimated degree and kinds of*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location (3 stories or less)[1]	Lawns, landscaping, golf fairways
Kendallville:					
KeB	Slight	Severe: moderately slow permeability.	Moderate: moderate permeability in upper 2 feet; slope.	Slight	Slight
KeC2	Moderate: slope and erosion hazard.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope
Kings, thick surface variant: Kg.	Moderate: excessive wetness.	Severe: very poorly drained; slow permeability.	Slight	Severe: very poorly drained.	Severe: very poorly drained.
Lanier: Lg	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Miamian:					
MmB3	Moderate: erosion hazard.	Severe: moderately slow permeability.	Moderate: slope	Slight	Moderate: erosion.
MmC3	Severe: slope and erosion hazard.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Severe: erosion
MnD2	Severe: slope and erosion hazard.	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope	Severe: slope
MrC2	Moderate: erosion hazard.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope
Ockley:					
OcA	Slight	Slight [2]	Severe:[2] pervious substratum.	Slight	Slight
OcB, OcB2	Slight	Slight [2]	Severe:[2] pervious substratum.	Slight	Slight
Parke:					
PaB	Slight	Slight	Moderate: moderately permeable; slope.	Slight	Slight
PaD2	Moderate: slope and erosion hazard.	Severe: slope	Severe: slope	Severe: slope	Severe: slope

See footnotes at end of table.

limitations of soils for specified land uses—Continued

Streets and parking lots	Recreation: Athletic fields (intensive use)	Recreation: Parks and play areas	Recreation: Campsites: Tents	Recreation: Campsites: Trailers	Sanitary land fill (trench type)	Cemeteries
Moderate: slope.	Moderate: slope; moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.
Severe: very poorly drained.	Severe: very poorly drained; slow permeability.	Severe: very poorly drained.	Severe: very poorly drained; slow permeability.	Severe: very poorly drained; slow permeability.	Severe: very poorly drained.	Severe: very poorly drained; slow permeability.
Severe: subject to flooding	Severe: subject to flooding.	Severe:[3] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight to moderate: erosion.	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Moderate to severe: erosion.	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.
Slight	Slight	Slight	Slight	Slight	Severe: pervious substratum.	Slight.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe: pervious substratum.	Slight.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Moderate: moderately fine texture.	Slight.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 7.—*Estimated degree and kinds of*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location (3 stories or less) [1]	Lawns, landscaping, golf fairways
Patton: Pb, Pc	Slight	Severe: very poorly drained; moderately slow permeability.	Slight	Severe: very poorly drained.	Severe: very poorly drained.
Plattville: PlB	Slight	Severe: moderately slow permeability; moderately deep to rock.	Severe: moderately deep to rock.	Severe: moderately deep to rock.	Moderate: moderately deep to rock.
Princeton:					
PrB	Slight	Slight [2]	Severe: [3] pervious substratum.	Slight	Slight
PrC2	Moderate: erosion hazard.	Moderate: slope	Severe: [2] pervious substratum.	Moderate: slope	Moderate: slope
Ragsdale: Ra	Slight	Severe: very poorly drained; moderately slow permeability.	Slight	Severe: very poorly drained.	Severe: very poorly drained.
Rainsboro:					
RbA	Slight	Severe: moderately slow permeability.	Moderate: moderately pervious substratum.	Slight	Slight
RbB	Slight	Severe: moderately slow permeability.	Moderate: moderately pervious substratum; slope.	Slight	Slight
Reesville: Re	Slight	Severe: moderately slow permeability; somewhat poorly drained.	Slight	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Rodman: RkE2	Severe: slope and erosion hazard.	Severe: [2] slope	Severe: slope; pervious soil.	Severe: slope	Severe: slope
Ross: Rn	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.

See footnotes at end of table.

limitations of soils for specified land uses—Continued

Streets and parking lots	Recreation				Sanitary land fill (trench type)	Cemeteries
	Athletic fields (intensive use)	Parks and play areas	Campsites			
			Tents	Trailers		
Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained; subject to ponding.	Severe: very poorly drained.
Severe: moderately deep to rock.	Severe: moderately deep to rock.	Moderate: moderately deep to rock.	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Severe: moderately deep to to rock.	Severe: moderately deep to rock.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe: pervious substratum.	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Severe: pervious substratum.	Moderate: slope.
Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.	Severe: very poorly drained.
Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; pervious soil.	Severe: slope.
Severe: subject to flooding.	Slight to severe:[8] subject to flooding.	Slight to severe:[3] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.

TABLE 7.—*Estimated degree and kinds of*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location (3 stories or less) [1]	Lawns, landscaping, golf fairways
Rossmoyne: RpA	Slight	Severe: moderately slow permeability.	Slight	Slight	Slight
RpB, RpB2	Slight	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight
RpC2	Moderate: erosion hazard.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope
RsB3	Moderate: erosion hazard.	Severe: moderately slow permeability.	Moderate: slope	Slight	Moderate: erosion.
RsC3	Severe: slope and erosion.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Severe: erosion
Russell: RvA	Slight	Severe: moderately slow permeability.	Slight	Slight	Slight
RvB, RvB2	Slight	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight
Shoals: Sh	Slight	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Sloan: So	Moderate: very poorly drained.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Uniontown: UnB	Slight	Severe: moderately slow permeability.	Moderate: moderately permeable above 4 feet.	Slight	Slight
Warsaw: WaA	Slight	Slight [2]	Severe: [2] pervious substratum.	Slight	Slight
WaB	Slight	Slight [2]	Severe: [2] pervious substratum.	Slight	Slight

See footnotes at end of table.

limitations of soils for specified land uses—Continued

Streets and parking lots	Recreation: Athletic fields (intensive use)	Recreation: Parks and play areas	Recreation: Campsites: Tents	Recreation: Campsites: Trailers	Sanitary land fill (trench type)	Cemeteries
Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; slope.	Severe: slope	Moderate: moderately fine texture; slope.	Moderate: moderately slow permeability; slope.
Moderate: slope.	Moderate: moderately slow permeability; slope.	Moderate: erosion.	Moderate: moderately slow permeability; erosion.	Moderate: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: moderately slow permeability.
Severe: slope	Severe: slope	Severe: erosion	Moderate: moderately slow permeability; slope; erosion.	Severe: slope	Moderate: moderately fine texture; slope.	Moderate: moderately slow permeability; slope.
Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.
Moderate: slope.	Moderate: moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability.	Moderate: slope.	Slight	Moderate: moderately slow permeability.
Severe: subject to flooding.	Moderate to severe:[3] subject to flooding.	Moderate:[3] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Severe: subject to flooding.	Severe: subject to flooding.	Severe: very poorly drained; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Moderate: slope.	Moderate: slope; moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: slope; moderately slow permeability.	Moderate: moderately fine texture.	Slight.
Slight	Slight	Slight	Slight	Slight	Severe:[2] pervious substratum.	Slight.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe:[2] pervious substratum.	Slight.

TABLE 7.—*Estimated degree and kinds of*

Soil series and map symbols	Farming (cultivated crops only)	Sewage effluent disposal (onsite)	Sewage lagoons	Homesite location (3 stories or less) [1]	Lawns, landscaping, golf fairways
Wea: WeA	Slight	Slight [2]	Severe: pervious substratum.	Slight	Slight
Williamsburg:					
WlA	Slight	Moderate: [2] moderately permeable.	Severe: pervious substratum.	Slight	Slight
WlB	Slight	Moderate: [2] moderately permeable.	Severe: pervious substratum.	Slight	Slight
WlC2	Moderate: erosion hazard.	Moderate: [2] moderately permeable; slope.	Severe: pervious substratum; slope.	Moderate: slope	Moderate: slope
Wynn:					
WyB, WyB2	Slight	Severe: [2] limited depth to limestone.	Severe: [2] limited depth to limestone.	Severe: [2] limited depth to limestone.	Moderate: limited depth to limestone.
WyC2	Moderate: erosion hazard.	Severe: [2] limited depth to limestone.	Severe: [2] limited depth to limestone.	Severe: [2] limited depth to limestone.	Moderate: limited depth to limestone; slope.
WyC3	Severe: erosion	Severe: [2] limited depth to limestone.	Severe: [2] limited depth to limestone.	Severe: [2] limited depth to limestone.	Severe: limited depth to limestone; erosion.
Xenia:					
XeA	Slight	Severe: moderately slow permeability.	Slight	Slight	Slight
XeB, XeB2	Slight	Severe: moderately slow permeability.	Moderate: slope	Slight	Slight

[1] The rating given in this column also applies to small industrial, institutional, and commercial locations.
[2] Possibility of underground water contamination.

limitations of soils for specified land uses—Continued

Streets and parking lots	Recreation: Athletic fields (intensive use)	Recreation: Parks and play areas	Recreation: Campsites: Tents	Recreation: Campsites: Trailers	Sanitary land fill (trench type)	Cemeteries
Slight	Slight	Slight	Slight	Slight	Severe:[2] pervious substratum.	Slight.
Slight	Slight	Slight	Slight	Slight	Severe: pervious substratum.	Slight.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe: pervious substratum.	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Severe: pervious substratum.	Moderate: slope.
Severe: limited depth to limestone.	Severe: limited depth to limestone.	Moderate: limited depth to limestone.	Slight	Moderate: slope.	Severe: limited depth to limestone.	Severe: limited depth to limestone.
Severe: limited depth to limestone; slope.	Severe: limited depth to limestone; slope.	Moderate: limited depth to limestone.	Moderate: slope.	Severe: slope	Severe: limited depth to limestone.	Severe: limited depth to limestone.
Severe: limited depth to limestone; slope.	Severe: limited depth to limestone; slope.	Moderate: limited depth to limestone.	Moderate: slope.	Severe: slope	Severe: limited depth to limestone.	Severe: limited depth to limestone.
Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight.
Slight	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Moderate: moderately slow permeability; slope.	Slight	Slight.

[3] Rating is dependent upon local flooding conditions.
[4] Locally, low areas of Fox are subject to flooding.

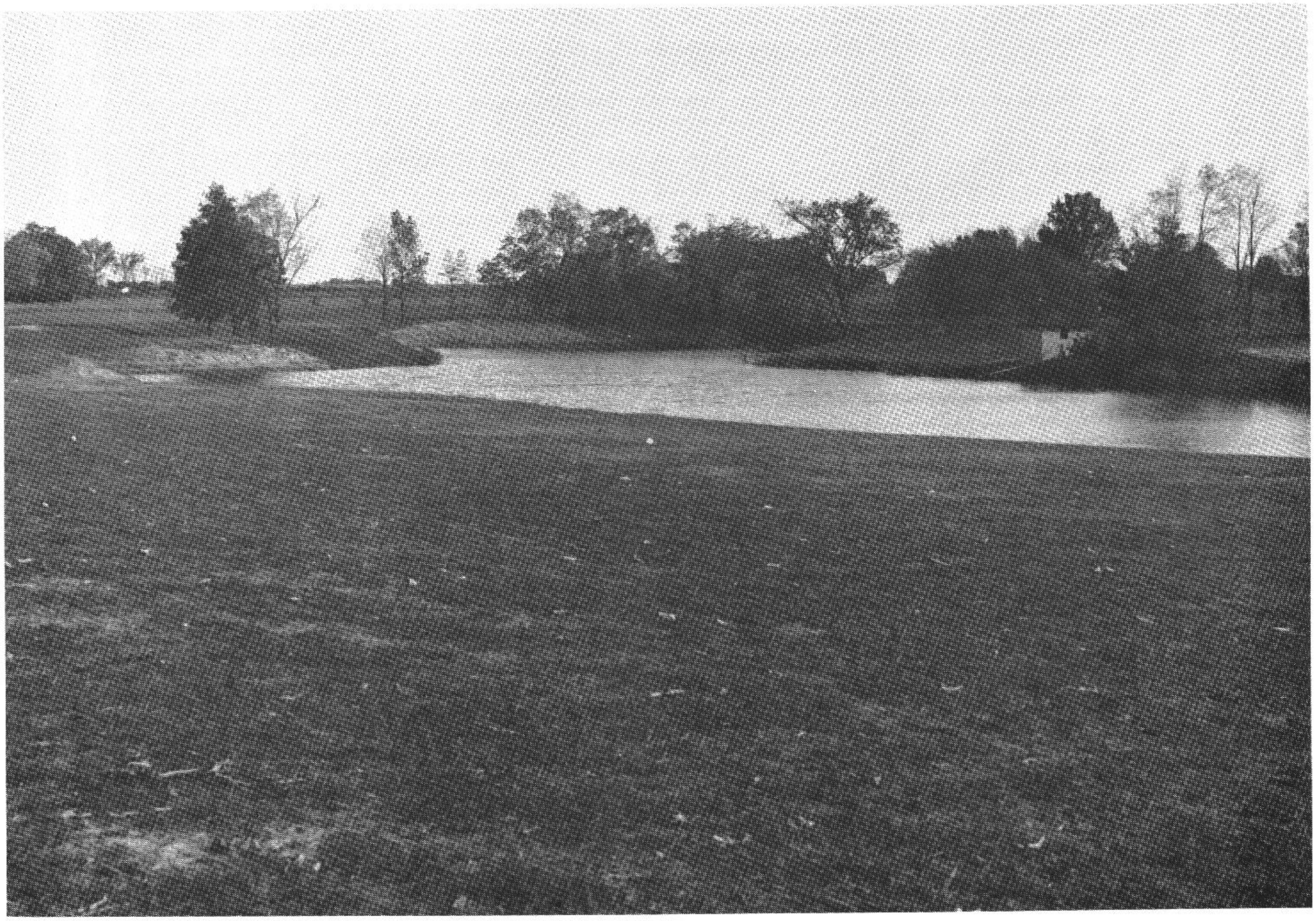

Figure 4.—**Pond used for irrigation of golf greens. The soil is Rossmoyne silt loam, 2 to 6 percent slopes.**

Sanitary land fill.—The trench method of operation is the only system of sanitary land fill considered in this soil survey. Most statements made in this column pertain only to the uppermost 5 feet. Deeper investigation is needed if trenches are to be deeper than 5 feet. Factors that affect the rating of soils for this use include slope, depth to rock, flooding, permeability, texture, and natural drainage. Flooding is a severe limitation because of the pollution hazard. Well-drained soils that have slow permeability are generally most desirable for disposal of trash. Slowly permeable soils generally are wetter, more clayey, and more difficult to work and compact than more permeable soils. Soil texture as it relates to workability and ease of excavation is rated to a depth of 5 feet in most of the soils. Most of the soils in the county have one or more limitations to use for sanitary land fill. Control of surface runoff and use of drainage systems help to minimize some of the wetness limitations.

Cemeteries.—Deep, nearly level, well-drained soils have the fewest limitations for cemeteries. Soil properties that limit use of soils for cemeteries include shallow depth to bedrock, restricted natural drainage, slope, and flooding hazard.

Utility lines.—The installation and maintenance of utility lines are affected by soil properties but are not rated in table 6 or 7. Depth to bedrock, natural drainage, water table characteristics, and corrosion potential are among the properties that affect utility lines. The corrosion potential of all the soils in the county is rated in table 5. The soil descriptions give other properties important to installation and maintenance of utility lines. During planning, the choice of locations for utility lines can be facilitated by use of the soil survey. In addition, the establishment, control, and maintenance of vegetation on utility rights-of-way are affected by soil properties.

Descriptions of the Soils

This section describes the soil series and mapping units of Warren County. The approximate acreage and proportionate extent of each mapping unit are given in table 8.

TABLE 8.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Abscota sand, calcareous variant	776	0.3
Alford silt loam, till substratum, 1 to 4 percent slopes	454	.2
Algiers silt loam	1,069	.4
Avonburg silt loam, 0 to 2 percent slopes	14,300	5.5
Avonburg silt loam, 2 to 6 percent slopes	2,151	.8
Avonburg silt loam, 2 to 6 percent slopes, moderately eroded	407	.2
Birkbeck silt loam, 1 to 4 percent slopes	483	.2
Blanchester silt loam	1,538	.6
Brookston silty clay loam	8,835	3.4
Casco loam, 2 to 6 percent slopes, moderately eroded	70	[1]
Casco loam, 6 to 12 percent slopes, moderately eroded	305	.1
Casco-Rodman complex, 12 to 18 percent slopes, moderately eroded	421	.2
Cincinnati silt loam, 2 to 6 percent slopes	815	.3
Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded	909	.3
Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	2,431	.9
Clermont silt loam	18,276	7.0
Crider silt loam, 2 to 6 percent slopes	333	.1
Cut and fill land	510	.2
Dana silt loam, 0 to 2 percent slopes	260	.1
Dana silt loam, 2 to 6 percent slopes	7,135	2.7
Eden complex, 2 to 6 percent slopes, moderately eroded	144	[1]
Eden complex, 6 to 12 percent slopes, moderately eroded	512	.2
Eden complex, 12 to 18 percent slopes, moderately eroded	1,230	.5
Eden complex, 18 to 25 percent slopes, moderately eroded	748	.3
Eden complex, 25 to 35 percent slopes, moderately eroded	2,022	.8
Eel loam	639	.2
Fairmount-Eden flaggy silty clay loams, 12 to 25 percent slopes, moderately eroded	133	[1]
Fairmount-Eden flaggy silty clay loams, 25 to 50 percent slopes, moderately eroded	3,392	1.3
Fincastle silt loam, 0 to 2 percent slopes	13,104	5.0
Fincastle silt loam, 2 to 6 percent slopes	1,563	.6
Fox loam, 0 to 2 percent slopes	2,749	1.1
Fox loam, 2 to 6 percent slopes	2,379	.9
Fox loam, 2 to 6 percent slopes, moderately eroded	1,118	.4
Fox loam, 6 to 12 percent slopes, moderately eroded	1,504	.6
Fox-Casco complex, 12 to 18 percent slopes, moderately eroded	493	.2
Genesee fine sandy loam	4,515	1.7
Genesee loam	4,612	1.8
Gravel pits	495	.2
Hennepin silt loam, 25 to 35 percent slopes	1,933	.7
Hennepin silt loam, 25 to 35 percent slopes, moderately eroded	2,041	.8
Hennepin-Miamian silt loams, 18 to 25 percent slopes	240	[1]
Hennepin-Miamian silt loams, 18 to 25 percent slopes, moderately eroded	1,654	.6
Hennepin-Miamian complex, 12 to 18 percent slopes, severely eroded	399	.2
Henshaw silt loam, 1 to 4 percent slopes	1,012	.4
Hickory silt loam, 2 to 6 percent slopes, moderately eroded	146	[1]
Hickory silt loam, 6 to 12 percent slopes, moderately eroded	2,902	1.1
Hickory silt loam, 12 to 18 percent slopes, moderately eroded	3,725	1.4
Hickory clay loam, 6 to 12 percent slopes, severely eroded	321	.1
Hickory clay loam, 12 to 18 percent slopes, severely eroded	244	[1]
Hickory-Fairmount complex, 18 to 25 percent slopes, moderately eroded	1,751	.7
Hickory-Fairmount complex, 25 to 50 percent slopes, moderately eroded	7,662	2.9
Iva silt loam, till substratum, 0 to 2 percent slopes	192	[1]
Kendallville loam, 2 to 6 percent slopes	155	[1]
Kendallville loam, 6 to 12 percent slopes, moderately eroded	239	[1]
Kings silty clay loam, thick surface variant	222	[1]
Lanier sandy loam	199	[1]
Miamian clay loam, 2 to 6 percent slopes, severely eroded	270	.1
Miamian clay loam, 6 to 12 percent slopes, severely eroded	1,570	.6
Miamian-Hennepin silt loams, 12 to 18 percent slopes, moderately eroded	3,030	1.2
Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded	9,212	3.5
Muck	71	[1]
Ockley silt loam, 0 to 2 percent slopes	769	.3
Ockley silt loam, 2 to 6 percent slopes	1,167	.4
Ockley silt loam, 2 to 6 percent slopes, moderately eroded	162	[1]
Parke silt loam, 2 to 6 percent slopes	224	[1]
Parke silt loam, 6 to 18 percent slopes, moderately eroded	183	[1]
Patton silt loam, silted	1,011	.4
Patton silty clay loam	5,955	2.3
Plattville silt loam, 1 to 6 percent slopes	247	[1]
Princeton fine sandy loam, 2 to 6 percent slopes	223	[1]
Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded	83	[1]
Ragsdale silty clay loam	51	[1]
Rainsboro silt loam, 0 to 2 percent slopes	160	[1]
Rainsboro silt loam, 2 to 6 percent slopes	198	[1]
Reesville silt loam	130	[1]
Riverwash	58	[1]
Rodman and Casco gravelly loams, 18 to 25 percent slopes, moderately eroded	1,377	.5
Ross loam	3,598	1.4
Rossmoyne silt loam, 0 to 2 percent slopes	4,066	1.6
Rossmoyne silt loam, 2 to 6 percent slopes	15,900	6.1
Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded	10,742	4.1
Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded	3,221	1.2
Rossmoyne silty clay loam, 2 to 6 percent slopes, severely eroded	347	.1
Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded	479	.2
Russell-Miamian silt loams, 0 to 2 percent slopes	442	.2
Russell-Miamian silt loams, 2 to 6 percent slopes	16,384	6.3
Russell-Miamian silt loams, 2 to 6 percent slopes, moderately eroded	16,936	6.5
Shoals silt loam	421	.2
Sloan silty clay loam	286	.1
Uniontown silt loam, 1 to 6 percent slopes	333	.1
Warsaw loam, 0 to 2 percent slopes	1,081	.4
Warsaw loam, 2 to 6 percent slopes	217	[1]
Wea silt loam, 0 to 2 percent slopes	612	.2
Williamsburg silt loam, 0 to 2 percent slopes	156	[1]
Williamsburg silt loam, 2 to 6 percent slopes	529	.2
Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded	166	[1]

See footnote at end of table.

TABLE 8.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent
	Acres	*Percent*
Wynn silt loam, 2 to 6 percent slopes	1, 434	. 5
Wynn silt loam, 2 to 6 percent slopes, moderately eroded	5, 334	2. 0
Wynn silt loam, 6 to 12 percent slopes, moderately eroded	3, 611	1. 4
Wynn silt loam, 6 to 12 percent slopes, severely eroded	608	. 2
Xenia silt loam, 0 to 2 percent slopes	2, 807	1. 1
Xenia silt loam, 2 to 6 percent slopes	13, 854	5. 3
Xenia silt loam, 2 to 6 percent slopes, moderately eroded	1, 557	. 6
Highway rights-of-way	443	. 2
Water areas 3 to 40 acres in size, and streams less than ⅛ mile wide	1, 538	. 6
Soils less than 0.1 of 1 percent each of the county		1. 7
Total	261, 120	100. 0

[1] Less than 0.1 of 1 percent of the county.

A general description of each soil series is given, and this is followed by brief descriptions of the mapping units in that series. For full information on any one mapping unit, it is necessary to read the description of the soil series as well as the description of the mapping unit. Unless otherwise noted, each soil in the series has characteristics similar to those mentioned in the series description.

Each series description includes two descriptions of the same typical profile of a soil of the series. The first is a brief description in paragraph form that many readers will find gives as much information as they need. The second is a longer, more detailed description that soil scientists, engineers, and others can use as a basis for technical interpretations.

Colors, which are described by the Munsell system, are for moist soil unless otherwise indicated. "Light colored" or "dark colored" refers to the color of the surface layer. Surface layers having a color value of 3 or less (Munsell notation) are commonly referred to as dark colored. A color value of 4 or more denotes a light-colored soil; example 10YR 4/2.

Illinoian-age and Wisconsin-age glacial till plains and other geologic terms used in the descriptions are explained in the sections "Formation and Classification of the Soils" and "Geology."

Terms used in the technical descriptions are defined in the Soil Survey Manual (*13*). Some of the terms are described in the Glossary at the back of this survey.

Abscota Series, Calcareous Variant

The Abscota series, calcareous variant, consists of well-drained, dark-colored, sandy soils that are subject to flooding. These soils are nearly level and are generally between well-drained Ross or Genesee soils on the flood plains and the Warsaw or Fox soils on adjacent terraces.

A typical profile has a dark-colored sandy surface layer about 12 inches thick. Brown sand extends from a depth of 12 to 42 inches. The next layer is brown well-sorted sand and gravel.

Soils of the Abscota series, calcareous variant, have rapid permeability and a moderately deep to deep root zone. The available moisture capacity is low within the root zone. Reaction is moderately alkaline throughout.

These soils have been used for general farm crops. Areas in the Miami Conservancy District are rapidly being converted from farming to community development.

Representative profile of Abscota sand, calcareous variant (NW¼ sec. 32. T. 2 N., R. 5 E., Franklin Township):

A—0 to 12 inches, very dark grayish-brown (10YR 3/2) coarse sand; weak, coarse, granular structure parting easily to single grain; loose; many roots; moderately alkaline; calcareous; abrupt, smooth boundary.

C1—12 to 42 inches, brown (10YR 5/3) coarse sand; massive (single grain); loose; common roots; coarse skeleton 10 percent; moderately alkaline, calcareous; gradual, smooth boundary.

C2—42 to 60 inches, brown (10YR 5/3) sand and gravel; well sorted; massive (single grain); loose; contains many shells, common strata of shells 6 to 12 inches thick; moderately alkaline, calcareous.

The A horizon ranges from very dark grayish brown (10YR 3/2) to black (10YR 2/1) or very dark gray (10YR 3/1) but is dominantly very dark grayish brown. It ranges from loamy sand to coarse sand. It most commonly is 12 inches thick but ranges from 10 to 18 inches in thickness. The A horizon is thinner in areas where the C horizon contains a stratum of gravel near the surface. It is thicker in areas where the underlying material is sand. The thickness of the A horizon commonly ranges from 10 to 18 inches within a horizontal distance of 100 feet.

Apparently there has been little if any clay movement in Abscota soils. Clay films have not been observed on the sand grains. Some organic staining extends 2 to 3 inches into the C horizon, but normally the boundary between the A and C horizons is abrupt.

Many roots occur in the A horizon, and numerous fine roots penetrate the upper 6 to 12 inches of the C horizon. A few fine roots occur as deep as 42 inches.

Soils of the Abscota series, calcareous variant, are coarser textured and darker colored than Genesee soils. They are coarser textured than Ross soils, though not so coarse textured or so shallow as Lanier soils. All of these soils are on flood plains.

Soils of the Abscota variant in this county are calcareous throughout, but Abscota soils elsewhere are not. For this reason, the series is correlated as a calcareous variant in this county.

Abscota sand, calcareous variant (AbA).—This nearly level soil occurs along the Miami River and along Twin Creek and the lower part of Clear Creek in Franklin Township. It is droughty in summer, and it may be flooded during moderate and severe floods. It was more subject to flooding before the Miami Conservancy District constructed flood control structures after the flood in 1913, but since then most of the acreage along the Miami River has not been flooded. Some areas of this soil along Twin Creek still are flooded occasionally.

Included with this soil in mapping are small areas of Genesee fine sandy loam, Ross loam, and Warsaw loam.

The Genesee fine sandy loam occupies abandoned stream channels that cross areas of this mapping unit, or small, irregular areas along the present stream channel.

The hazard of flooding is the main limitation for farm or nonfarm use. (Capability unit IIw–2; woodland group 2o1)

Alford Series

The Alford series consists of deep, well-drained soils that formed partly in loess and partly in glacial till of Illinoian age. These soils have a silty mantle more than 40 inches thick. They are nearly level to gently sloping and occur on uplands in Wayne Township, north of Caesar Creek, east of the Little Miami River, and south of the Wisconsin-age terminal moraine.

A typical Alford soil has a dark-brown silt loam plow layer and a dark yellowish-brown subsurface layer that together are 12 inches thick. The subsoil is yellowish-brown silty clay loam to a depth of 53 inches. Below this, and extending to a depth of 95 inches, the subsoil is yellowish-brown clay loam. The underlying material is weathered, massive glacial till.

The permeability of the Alford soils is moderate from the surface to the top of the underlying glacial till and is moderately slow to slow in the till. The root zone is deep and mostly strongly acid. The available moisture capacity is high.

Alford soils are used mostly for general farming. The main crops are corn, soybeans, wheat, and meadow mixtures of legumes and grasses.

Representative profile of Alford silt loam (about 2.75 miles south-southeast of Waynesville, 100 yards west of O'Neall Road, and 100 yards north of Sales Road):

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; common roots; neutral; abrupt, smooth boundary.

A2—8 to 12 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; friable; slightly acid; clear, wavy boundary.

B21t—12 to 23 inches, yellowish-brown (10YR 5/4) silty clay clay loam; moderate, medium, subangular blocky structure; firm; very strongly acid; gradual, wavy boundary.

B22t—23 to 53 inches, yellowish-brown (10YR 5/4) light silty clay loam; moderate, medium and coarse, subangular blocky structure; firm; light yellowish-brown (10YR 6/4), thin, patchy clay films; strongly acid; clear, wavy boundary.

IIB3—53 to 95 inches, yellowish-brown (10YR 5/4) clay loam; massive; firm; some clay films in root channels as deep as 75 inches; medium acid in upper part but grades to neutral in the lower part; gradual, wavy lower boundary.

IIC—95 to 120 inches, yellowish-brown (10YR 5/4) clay loam; massive; moderately alkaline; calcareous; Illinoian glacial till.

The loess ranges from 48 to 72 inches in thickness. The Bt horizon ranges from very strongly acid to medium acid. In this county the Alford soils have a thicker solum and a thicker IIB3 horizon than is typical for the series. The IIB3 horizon is medium acid to slightly acid in the upper part and gradually grades to neutral in the lower part. The IIC horizon is neutral to moderately alkaline. It is dominantly clay loam, but in places is loam.

Alford soils are well-drained members of a drainage sequence that includes the somewhat poorly drained Iva soils. Alford soils have a thicker silt mantle than the nearby Cincinnati and Rossmoyne soils. Carbonates in Alford soils are deeper than in Birkbeck soils and the material more strongly weathered.

Alford silt loam, till substratum, 1 to 4 percent slopes (AfB).—This soil occurs on uplands. Included in areas mapped as this soil are small areas of somewhat poorly drained Iva soils in narrow drainageways. Also included, where the silt mantle is thin, are small areas of Cincinnati soils.

Surface runoff is medium to rapid, and erosion is a moderate hazard in cultivated areas on long slopes. This soil has few limitations for many nonfarm uses. (Capability unit IIe–1; woodland group 1o1)

Algiers Series

The Algiers series consists of deep, somewhat poorly drained soils on flood plains and alluvial fans. These soils are made up of light-colored soil material that overlies a contrasting dark-colored buried soil within a depth of 40 inches. In this county the dark-colored buried soil is mostly in the Sloan series, but some Patton soils occur. Algiers soils are mostly on flood plains along the larger streams in the county.

A typical Algiers soil has a dark grayish-brown silt loam surface layer about 24 inches thick. It is underlain by silty clay loam that is black to a depth of 36 inches and dark gray to 42 inches. The next layer is mottled, dark-brown, firm silty clay loam.

The Algiers soils have a seasonally high water table and are subject to flooding. Internal water moves moderately slow. The root zone is mostly deep when the water table is low. The root zone is neutral in reaction. These soils have a high available moisture capacity.

Algiers soils are used for crops in drained areas and for trees and pasture in undrained areas.

Representative profile of Algiers silt loam (about 2 miles southwest of Corwin, 100 yards east of Corwin Road, and 50 yards north of Middletown Road, Wayne Township):

A1—0 to 24 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

IIA1b—24 to 36 inches, black (10YR 2/1) silty clay loam; moderate, medium and fine, subangular blocky structure; firm; common roots; neutral; clear, smooth boundary.

IIB2bg—36 to 42 inches, dark-gray (10YR 4/1) silty clay loam that has common, medium, faint mottles of brown (10YR 5/3), yellowish brown (10YR 5/4), and dark brown (10YR 4/3); weak, coarse, subangular blocky structure; firm; few roots; neutral; clear, smooth boundary.

IIC—42 to 60 inches, dark-brown (10YR 3/3) silty clay loam that has many, medium, faint mottles of yellowish brown (10YR 5/4) and dark gray (10YR 4/1); weak, coarse, subangular blocky structure; firm; neutral.

The A1 horizon is dominantly dark grayish brown (10YR 4/2) but ranges to dark gray (10YR 4/1). It is dominantly silt loam, but in some areas along the Little Miami River it is loam. The IIA1b horizon of the buried soil ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). The lighter colored soil material ranges from 12 to 30 inches in thickness.

Algiers soils are commonly next to well-drained Genesee soils on the flood plains. In contrast with Genesee soils, they have a buried dark-colored layer and they are not so well drained.

Algiers silt loam (Ag).—This nearly level soil occurs in numerous areas on flood plains throughout the county. The areas are as much as 50 acres in size. In a few areas light-colored alluvial overwash occurs and is up to 42 inches thick. Included with this soil in mapping are small areas of somewhat poorly drained Shoals soils and small areas of dark-colored, very poorly drained Sloan soils.

Surface runoff is slow to ponded. Flooding and seasonal wetness are the major limitations to the use of this soil for farm or nonfarm purposes. Areas that are subject to frequent flooding are better suited to grass or trees than to row crops. (Capability unit IIw–1; woodland group 2w1)

Avonburg Series

The Avonburg series consists of somewhat poorly drained soils that formed in glacial till mantled with silt. The glacial till is of Illinoian age, and the silt mantle is at least 18 inches thick. The Avonburg soils are nearly level or gently sloping and are on uplands throughout the county.

A typical Avonburg soil has a dark grayish-brown silt loam plow layer over a brown silt loam subsurface layer that extends to a depth of 14 inches. The uppermost layers in the subsoil are mottled pale-brown silty clay loam to a depth of about 24 inches. They are over a dense, compact fragipan that extends to a depth of 35 inches and restricts the downward movement of water and the penetration of plant roots. Beneath the fragipan are layers of brown silty clay loam and clay and yellowish-brown clay loam. Weakly calcareous Illinoian till occurs at a depth of 104 inches.

Avonburg soils have slow permeability in the fragipan and in the layers beneath it. The root zone has a medium available moisture capacity and is very strongly acid or extremely acid in areas not limed. A perched water table generally is high in Avonburg soils during winter and spring.

Avonburg soils are used primarily for general farming. Corn and soybeans are the main cultivated crops, but a large acreage is used for pasture or meadow.

Representative profile of an Avonburg silt loam (about 1¾ miles northeast of Butlerville and 0.6 mile southeast of the junction of State Routes 123 and 132, Harlan Township):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; many roots; few, fine and medium, dark-brown concretions; neutral (limed); clear, smooth boundary.

A2—8 to 14 inches, brown (10YR 5/3) silt loam that has many, fine, faint, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/4) mottles; weak, fine, medium, subangular blocky structure; friable; common roots; very strongly acid; clear, wavy boundary.

B1—14 to 18 inches, pale-brown (10YR 6/3) silty clay loam that has medium, faint, yellowish-brown (10YR 5/4 and 5/6) mottles; moderate, medium and fine, subangular blocky structure; friable; common roots; very strongly acid; gradual, wavy boundary.

B21tg—18 to 24 inches, pale-brown (10YR 6/3) silty clay loam that has many, medium, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; few roots; light-gray (10YR 7/1) coatings on ped faces; fillings, up to one-eighth inch thick, between peds, very strongly acid; abrupt, wavy boundary.

IIBxg—24 to 35 inches, yellowish-brown (10YR 5/6) silty clay loam; weak, coarse, prismatic structure parting to strong, coarse, subangular blocky; firm; few roots; gray (10YR 6/1) clay films on ped faces; vertical fillings, up to one-quarter inch thick, between peds; very strongly acid; diffuse, wavy boundary.

IIB22tg—35 to 55 inches, brown (10YR 5/3) silty clay loam that has few, fine, faint, yellowish-brown (10YR 5/4) mottles; strong, coarse, subangular blocky structure; firm; few roots; many iron-manganese concretions; continuous, thick, gray (10YR 6/1) clay films on ped faces; very strongly acid; diffuse, wavy boundary.

IIB31—55 to 69 inches, brown (10YR 5/3) clay that has common, fine, faint, yellowish-brown (10YR 5/4) mottles and distinct, dark grayish-brown (10YR 4/2) mottles; strong, coarse, subangular blocky structure that parts to fine, subangular, blocky; very firm; many iron-manganese concretions; medium acid; diffuse boundary.

IIB32—69 to 86 inches, dark yellowish-brown (10YR 4/4) clay loam that has many, fine, distinct, very dark gray (10YR 3/1), gray (10YR 5/1) and yellowish-brown (10YR 5/4) mottles; weak, coarse, prismatic structure; firm; many iron-manganese concretions; slightly acid in upper part and neutral in lower part; diffuse, irregular boundary.

IIB33—86 to 104 inches, yellowish-brown (10YR 5/4) clay loam that has many, fine and medium, faint, brown (10YR 5/3) and dark yellowish-brown (10YR 4/4) mottles; structureless (massive); firm; neutral; gradual, irregular boundary.

IIC—104 inches, yellowish-brown (10YR 5/4) light clay loam that has a few, fine, faint, light yellowish-brown (10YR 6/4) and light-gray (10YR 7/1) mottles; structureless (massive); firm; weakly calcareous; Illinoian till.

The A horizon generally is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). In uncultivated areas there is a thin, very dark grayish-brown (10YR 3/2) A1 horizon. The loess mantle is 18 to 48 inches thick. The B horizon, which developed in loess, ranges from heavy silt loam to silty clay loam. The IIB horizon, which developed in till, is clay loam, silty clay loam, or clay. The depth to the fragipan ranges from about 20 to 32 inches. The depth to calcareous till is generally 70 to 110 inches. The till ranges from loam to clay but is typically clay loam. The upper part of the B horizon is very strongly acid to extremely acid.

The pH begins to increase at the top of the fragipan, which commonly coincides with the contact of the loess mantle and the weathered till. The reaction normally is medium acid to neutral at a depth of 60 inches. It is neutral and calcareous between depths of 70 and 120 inches.

The somewhat poorly drained Avonburg soils are members of a drainage sequence that includes the well drained Cincinnati soils, the moderately well drained Rossmoyne soils, the poorly drained Clermont soils, and the very poorly drained Blanchester soils. Avonburg soils have weathered and are acid to a greater depth than the Fincastle soils, which occupy similar positions in areas of Wisconsin-age till.

Avonburg silt loam, 0 to 2 percent slopes (AvA).—This soil occupies upland areas. It has a large total acreage in the county and occurs in areas of as much as 100 acres or more. A profile of this soil is described as typical for the series.

This soil commonly is adjacent to wetter Clermont soils, but normally its convex slope is slightly more sloping, though in most areas slopes are less than 2 percent. Included with this soil in mapping are areas of poorly drained Clermont soils in the more nearly level areas where ponding may occur.

Excessive soil moisture is the major limitation to the use of this soil for farming. Although this soil is nearly level, slopes are long and sheet erosion is a hazard in areas left bare through winter. Runoff generally is slow. Seasonal wetness and slow permeability are limitations to the use of this soil for many nonfarm purposes. (Capability unit IIIw–2; woodland group 2w2)

Avonburg silt loam, 2 to 6 percent slopes (AvB).—This soil occurs in numerous areas up to 100 acres in size. Its slope is 2 to 4 percent in most places. Included with this soil are many areas of Avonburg silt loam, 0 to 2 percent slopes, and some areas of moderately well drained Rossmoyne soils on the steeper parts of the landscape.

A seasonally high water table is the major limitation to the use of this soil for farming and many nonfarm purposes. Because this soil may receive rapid runoff from higher adjacent areas, it is moderately susceptible to erosion. (Capability unit IIIw–2; woodland group 2w2)

Avonburg silt loam, 2 to 6 percent slopes, moderately eroded (AvB2).—This soil occupies irregularly shaped areas that generally are 25 acres or less in size. These areas normally occur at the head of drainageways.

This soil has a lighter colored surface layer than the soil described as typical for the series. Because of erosion the surface layer generally is thinner than that described as typical. Tilth is typically poorer than on uneroded Avonburg soils. Included in mapping are areas of the wetter Clermont soils, of Avonburg silt loam, 0 to 2 percent slopes, and of more sloping Rossmoyne soils in small areas.

Cultivated areas of this soil are subject to sheet and rill erosion because runoff is rapid. Seasonal wetness, however, is the dominant limitation to farming and many nonfarm purposes. (Capability unit IIIw–2; woodland group 2w2)

Birkbeck Series

In the Birkbeck series are moderately well drained soils that formed in loess. These soils are nearly level and gently sloping and occur in upland areas in Massie and Wayne Townships.

A typical Birkbeck soil, to a depth of 10 inches, is brown silt loam. Between depths of 10 and 36 inches is the subsoil of yellowish-brown silty clay loam. Yellowish-brown silt loam extends to a depth of 60 inches. The lower part of this layer is calcareous glacial till.

Birkbeck soils have moderate permeability to a depth of 3 to 4 feet. The underlying glacial till is moderately slowly permeable. The root zone of these soils is deep and has a high available moisture capacity. Birkbeck soils are medium acid to neutral in the uppermost 3 to 4 feet and calcareous below.

The Birkbeck soils are used primarily for farming. Corn and soybeans are the main crops.

Representative profile of Birkbeck silt loam (about 2¼ miles southeast of Corwin, 50 feet south of Clarkville Road, and about 2 miles southeast of its intersection with State Route 73, Wayne Township):

Ap—0 to 6 inches, brown (10YR 5/3) silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; neutral; clear, smooth boundary.

A2—6 to 10 inches, brown (10YR 5/3) silt loam that has a few, fine, faint, light yellowish-brown (10YR 6/4) mottles; weak, thin, platy structure; friable; many roots; neutral; clear, wavy boundary.

B1t—10 to 14 inches, yellowish-brown (10YR 5/4) silty clay loam that has common, medium, faint, brownish-yellow (10YR 6/6) and very pale brown (10YR 7/3) mottles; moderate, medium, subangular blocky structure; firm; common roots; very patchy, dark grayish-brown (10YR 4/2) clay films on ped faces; neutral; gradual, wavy boundary.

B2t—14 to 26 inches, yellowish-brown (10YR 5/4) silty clay loam; strong, medium, subangular blocky structure; firm; common roots; continuous, thin, brown (10YR 5/3) clay films on ped faces; neutral; gradual, wavy boundary.

B3t—26 to 36 inches, yellowish-brown (10YR 5/4) light silty clay loam that has a few, fine, faint, grayish-brown (10YR 5/2) mottles; weak, medium, subangular blocky structure; friable; few roots; few, thin, discontinuous clay films on ped faces; neutral; gradual, wavy boundary.

C1—36 to 45 inches, yellowish-brown (10YR 5/4) silt loam; massive; friable; a few small fragments of shells; moderately alkaline; calcareous; gradual, irregular boundary.

IIC2—45 to 60 inches, yellowish-brown (10YR 5/6) silt loam; massive; friable; coarse skeleton and sand increase gradually between 40 and 60 inches; moderately alkaline; calcareous.

The solum ranges from 24 to 42 inches in thickness. Within short horizontal distances, the loess varies in thickness. The Ap horizon is dominantly brown (10YR 5/3) to dark grayish brown (10YR 4/2). The B1t and B2t horizons range from medium acid to neutral. The B3t horizon is neutral, and the C horizon is neutral to moderately alkaline. It is generally calcareous. The C1 horizon is only 6 to 12 inches thick in some areas. It overlies medium-textured, calcareous Wisconsin till.

Birkbeck soils are moderately well drained members of a drainage sequence of soils that includes the somewhat poorly drained Reesville soils and the very poorly drained Ragsdale soils. Birkbeck soils are similar to Xenia soils but formed entirely in loess, and the Xenia soils formed partly in the underlying glacial till. Birkbeck soils are not so deeply leached or so strongly weathered as are the moderately well drained Rossmoyne soils.

Birkbeck silt loam, 1 to 4 percent slopes (BbB).—This soil occupies irregularly shaped areas less than 50 acres in size. Where the soil is nearly level, it generally is on ridgetops and is in areas less than 25 acres in size. Small areas, generally of less than 10 acres, are scattered throughout the northern and western parts of the county in the area of Wisconsin glaciation. Included with this soil in mapping are small areas of moderately eroded Birkbeck soils. Also included are small areas of Xenia silt loam and small areas of dark-colored, moderately well drained Dana soils.

Where it is nearly level, this soil has few limitations to use for farming, though erosion is a moderate hazard in most places. The moderately slow permeability in the substratum is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 1o1)

Blanchester Series

Soils in the Blanchester series are nearly level or depressional, deep, and poorly drained. They occur in upland areas in the southern and eastern parts of the county. These soils formed partly in loess and partly in the underlying glacial till of Illinoian age.

A typical Blanchester soil has a dark-gray silt loam surface layer about 8 inches thick. The subsoil, to a depth of 18 inches, is dark-gray and gray silty clay loam. It is sticky, grayish-brown silty clay loam between depths of 18 and 50 inches. This sticky material is mottled with yellowish brown and various shades of gray. Beneath it is mottled, firm clay loam. At a depth of about 98 inches is firm, calcareous glacial till. Crayfish burrows are common in this soil to a depth of 6 to 8 feet.

Blanchester soils have a seasonally high water table for long periods. Water moves slowly in the soil. The root zone is strongly acid. In summer it is deep in drained areas. These soils have a high available moisture capacity.

Drained areas of Blanchester soils are used for commonly grown field crops.

Representative profile of Blanchester silt loam (about 1.6 miles southeast of Windsor, 100 feet east of the Ross-Lever Road, 1 mile south of State Route 28, Harlan Township):

Ap—0 to 8 inches, dark-gray (10YR 4/1) silt loam; moderate, medium and fine, granular structure; friable; many roots; slightly acid; clear, smooth boundary.

Blg—8 to 13 inches, dark-gray (10YR 4/1) silty clay loam that has few, fine, faint, yellowish-brown (10YR 5/4) and grayish-brown (10YR 5/2) mottles; moderate, medium and fine, subangular blocky structure; firm; many roots; strongly acid; clear, wavy boundary.

B21tg—13 to 18 inches, gray (10YR 5/1) silty clay loam that has common, fine and medium, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mottles; moderate, medium and fine, subangular blocky structure; firm; common roots; thin patchy clay films on ped faces; very strongly acid; diffuse, wavy boundary.

B22tg—18 to 50 inches, grayish-brown (10YR 5/2) silty clay loam that has many, medium, distinct, light-gray (10YR 6/1), gray (10YR 5/1), and dark-gray (10YR 4/1) mottles and a few, fine, distinct, yellowish-brown (10YR 5/4, 5/8) mottles; moderate, medium, subangular blocky structure; firm; few roots; continuous clay films on ped faces; numerous iron-manganese concretions; strongly acid; gradual, wavy boundary.

IIB23tg—50 to 74 inches, light brownish-gray (10YR 6/2) clay loam that has many, medium and fine, faint and distinct, light-gray (10YR 6/1), gray (10YR 5/1), dark-gray (10YR 4/1), yellowish-brown (10YR 5/4) and brownish-yellow (10YR 6/6) mottles; moderate, coarse, subangular blocky structure; firm; few roots; numerous iron-manganese concretions; continuous clay films on ped faces; medium acid in upper part and slightly acid in lower part; diffuse, irregular boundary.

IIB3—74 to 98 inches, yellowish-brown (10YR 5/4) clay loam that has many, medium, faint and distinct, light-gray (10YR 6/1), gray (N 5/0), and yellowish-brown (10YR 5/6, 5/8) mottles; weak, coarse, prismatic structure in upper part and massive in lower part; firm; few roots; numerous iron-manganese concretions; dark-gray (10YR 4/1) silty clay loam fillings, up to 1½ inches in diameter, in crayfish burrows and root channels; neutral; gradual, irregular boundary.

IIC—98 to 110 inches, light yellowish-brown (10YR 6/4) clay loam that has many, medium, distinct, light brownish-gray (10YR 6/2), grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mottles; massive; firm; no roots; moderately alkaline; calcareous; Illinoian till.

The Ap horizon is dominantly dark gray (10YR 4/1) but is very dark grayish brown (10YR 3/2) in some places. The upper B2t horizons are dominantly silty clay loam, but they range to silty clay or clay. The lower IIB horizon, which developed in till, is dominantly clay loam or clay, but it is silty clay loam or silty clay in some places. The solum ranges from 7 to 12 feet in thickness, but it is 7 to 9 feet thick in most places. The unweathered till is typically clay loam, but it ranges from loam to clay. The till commonly contains a large amount of shale and limestone fragments that were derived from the local Ordovician bedrock. In some places, calcareous till does not occur and the solum lies directly on the unweathered bedrock at a depth of 7 to 12 feet or more. Colors in the solum and the till are chiefly in a hue of 10YR, but in layers that have a high content of bedrock, the hue may be 2.5Y.

The Blanchester soils are poorly drained members of a drainage sequence that includes the well drained Cincinnati soils, the moderately well drained Rossmoyne soils, the somewhat poorly drained Avonburg soils, and the poorly drained Clermont soils. Blanchester soils lack the fragipan that occurs in Avonburg and Rossmoyne soils. The surface layer of Blanchester soils is darker than that of the nearby poorly drained Clermont soils.

Blanchester silt loam (Bc).—This soil occupies irregularly shaped areas that range from a few acres to as much as 200 to 300 acres in size. It is nearly level or depressional and occurs in the uplands, at the head of drainageways, and in the channels of shallow drainageways. Included with this soil in mapping are small areas of nearly level Clermont soils and of Sloan, Algiers, or Eel soils along drainageways.

Surface runoff is slow to ponded. A seasonally high water table is the major limitation to the use of this soil for farm and many nonfarm purposes. (Capability unit IIw-3; woodland group 2w1)

Brookston Series

This series consists of dark-colored soils that are very poorly drained. The upper part of these soils formed in silty material, and the lower part formed in loamy glacial till of Wisconsin age. These soils are nearly level or depressional and occur on glacial till plains.

A typical Brookston soil has a very dark gray silty clay loam surface layer and subsurface layer that together are about 12 inches thick. In the subsoil, the layers are silty clay loam and, in descending order, are very dark grayish brown, dark grayish brown, brown, and grayish brown. The subsoil is mottled with brown or yellowish brown throughout. Below a depth of 40 inches is light brownish-gray, calcareous loam glacial till that restricts the movement of water and the penetration of plant roots.

Brookston soils have moderate permeability above the glacial till substratum. The glacial till is moderately slowly permeable. These soils have high organic-matter content and a high available moisture capacity. Unless the soils are drained, the water table is seasonally high. Brookston soils are neutral in their root zone.

Most areas of Brookston soils are used for general farming. Corn is the dominant crop, but soybeans, wheat, and meadows of legume-grass mixtures are also common.

Representative profile of Brookston silty clay loam (3 miles northeast of Lebanon, 100 feet northwest of the intersection of U.S. Highway No. 42 and Liberty Keuter Road, Turtle Creek Township):

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium and fine, subangular blocky structure; friable; many roots; neutral; clear, smooth boundary.

A1—8 to 12 inches, very dark gray (10YR 3/1) silty clay loam that has few, fine, distinct, brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; friable; common roots; neutral; clear, wavy boundary.

B1tg—12 to 16 inches, very dark grayish-brown (10YR 3/2) silty clay loam that has few, fine, distinct, brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; firm; common roots; thin, continuous, dark-gray (10YR 4/1) clay films on ped faces; neutral; gradual, wavy boundary.

B21tg—16 to 27 inches, dark grayish-brown (10YR 4/2) silty clay loam that has common, fine, distinct, brown (10YR 5/3) mottles; moderate, medium, subangular blocky structure; firm; common roots; continuous, thin, dark-gray (10YR 4/1) clay films on ped faces and filling root channels and wormholes; neutral; gradual, wavy boundary.

B22tg—27 to 34 inches, brown (10YR 5/3) silty clay loam that has common, fine, faint, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) mottles and many, fine, distinct, gray (10YR 5/1 and 6/1) mottles;

moderate, medium, subangular blocky structure; firm; few roots; continuous grayish-brown (10YR 5/2) clay films; neutral; clear, wavy boundary.

IIB3tg—34 to 40 inches, grayish-brown (2.5Y 5/2) clay loam that has many, fine and medium, distinct, brown (10YR 4/3) and gray (10YR 5/1) mottles; weak, medium and coarse, subangular blocky structure; firm; few, thin, patchy, grayish-brown (10YR 5/2) clay films; neutral; gradual, wavy boundary.

IIC—40 to 60 inches, light brownish-gray (2.5Y 6/2) loam that has common, medium and coarse, distinct, dark yellowish-brown (10YR 4/4), light olive-brown (2.5Y 5/4), and brown (10YR 5/3) mottles; structureless (massive); firm; calcareous till.

The dark-colored upper horizons range from 10 to 18 inches in thickness. The lowest B horizon, which formed in till, is silty clay loam or clay loam. This horizon commonly contains small igneous pebbles. The loess mantle ranges from 18 to 40 inches in thickness, but its average thickness is about 30 inches. The C horizon is loam or clay loam. The A and B horizons are slightly acid to neutral. Depth to calcareous till ranges from 36 to 50 inches but is 40 to 48 inches in most places. The C horizon is neutral or calcareous.

The Brookston soils in this county are finer textured than Brookston soils elsewhere. The Brookston soils are very poorly drained members of two drainage sequences. One includes the well drained Miamian soils, and the other includes the well drained Russell soils, the moderately well drained Xenia soils, and the somewhat poorly drained Fincastle soils. The Brookston soils are dark colored, and all other members of these drainage sequences are light colored.

Brookston silty clay loam (Br).—This dark-colored, very poorly drained soil is level or slightly depressional. It occurs in upland areas throughout the northern and western parts of the county. The size and shape of the areas vary widely. Areas are long and narrow but only 2 to 5 acres in size in depressions and are irregularly shaped and 100 acres or more in other places.

Included with this soil in mapping, along intermittent waterways and at the base of slopes, are soils covered with overwash of lighter colored silt loam. This overwash is mixed into the soils by cultivation and does not greatly affect soil management. Overwashed areas are small and make up less than 5 percent of the area mapped. Included in some of the larger areas of Brookston silty clay loam are slight rises of lighter colored, somewhat poorly drained Fincastle soils, typically in areas of less than 2 acres. These included areas also make up less than 5 percent of the area mapped. In small level areas bedrock is at a depth of 38 to 42 inches.

Surface runoff is slow to ponded on this soil. Limitations to use are a seasonally high water table and excessive soil moisture. In drained areas, however, this soil is well suited to the field crops commonly grown in the county. (Capability unit IIw-3; woodland group 2w1)

Casco Series

Soils in the Casco series are well drained and typically shallow to limy sand and gravel. These soils are in areas that parallel the larger drainageways in the county and are in a hilly area in Union and Turtle Creek Townships. They formed in loamy glacial outwash materials that overlie the sand and gravel.

A typical profile of a Casco soil has a dark grayish-brown loam surface layer about 8 inches thick. The subsurface layer is yellowish-brown loam. These uppermost layers are friable and easy to till. At a depth of 11 inches is a subsoil of firm dark-brown clay loam. A thin layer of yellowish-brown gravelly sandy loam occurs below the subsoil, and stratified sand and gravel is at a depth of about 2 feet. These lower layers are calcareous.

The Casco soils have moderate permeability and a low available moisture capacity. These soils are droughty and have a shallow root zone in most places because root growth is restricted by the calcareous sand and gravel. Casco soils are slightly acid to neutral above the limy sand and gravel.

Casco soils are not well suited to cultivated crops, because they are droughty. They are mostly used for small grains and for pasture and hay crops. Pollution to underground water supplies is a hazard if Casco soils are used for disposing of sewage effluent or solid waste.

A typical profile of a Casco loam (about 1 mile northeast of Harveysburg, 50 feet west of Harveysburg Road, and 500 feet south of its intersection with Canbytown Road):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, granular structure; friable; many roots; neutral; clear, smooth boundary.

A2—8 to 11 inches, yellowish-brown (10YR 5/4) loam; weak, coarse, subangular blocky structure; friable; common roots; neutral; clear, smooth boundary.

B2t—11 to 18 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium and coarse, subangular blocky structure; firm; common roots; continuous clay films on ped faces; slightly acid in the upper part, neutral in the lower part; clear, wavy boundary.

C1—18 to 24 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive (single grain); loose; no roots; estimated 25 to 50 percent coarse fragments; moderately alkaline; calcareous.

C2—24 to 60 inches, yellowish-brown (10YR 5/4) and brown (10YR 5/3) stratified sand and gravel; loose; moderately alkaline; calcareous.

The A horizon is dominantly loam, but it ranges to silt loam. In some undisturbed areas, there is an A1 horizon 1 to 3 inches thick that is very dark grayish brown (10YR 3/2) in some places. The A horizon ranges from 6 to 12 inches in thickness. In some cultivated areas, the A2 horizon does not occur, because it has been mixed into the Ap horizon.

The B2t horizon has a hue of 7.5YR or 5YR. This horizon is dominantly clay loam, but it ranges to sandy clay loam or clay in some places. In some places there are Bt horizons having thin layers that are as much as 40 percent clay. The solum ranges from 12 to 20 inches in thickness.

The A2 horizon and the upper part of the B2t horizon range from medium acid to neutral. The B2t horizon fingers into the calcareous C horizon for 6 to 12 inches or more in some places.

The C horizon ranges from well-graded, stratified sand and gravel to a well-graded mixture of sand and gravel. The strata range from a few inches to several feet in thickness.

The Casco soils have a thinner solum than Fox soils. They are lighter colored than the Rodman soils, and they have a Bt horizon that is absent in Rodman soils.

Casco loam, 2 to 6 percent slopes, moderately eroded (CcB2).—This soil occurs in only a few small areas. It generally is on long narrow margins of terraces and along the sides of abandoned drainage channels that meander through the terraces on valley trains. Because slopes are short, this soil is difficult to manage separately from adjacent, less eroded soils.

Cultivated areas of this mapping unit commonly have a pavement of sand or gravel on the surface, particularly in a few included severely eroded areas. The severely eroded areas are indicated on the soil map by a special symbol. Also included are some areas of Fox loam. The included Fox soil is less droughty than this Casco soil.

Droughtiness is the major limitation to the use of this soil for farming. Limitations to use for homesites and other nonfarm uses are few. Nearby wells are likely to be contaminated if the soil is used for disposal of septic tank effluent or solid waste. (Capability unit IIIs–1, woodland group 3f1)

Casco loam, 6 to 12 percent slopes, moderately eroded (CcC2).—This soil occurs in many places, generally in areas of less than 20 acres. It occupies long narrow areas on the sloping margins of terraces on valley trains and along the sides of meander scars that cross these terraces. It is along the Miami and the Little Miami Rivers and also is in the Kame area in Union and Turtle Creek Townships.

Included with this soil in mapping are areas of sandy loam or gravelly loam where erosion has left sand and gravel on the surface. These included areas normally are severely eroded, and they are indicated on the map by a symbol. Also included are areas of dark-colored shallow Rodman soils.

This soil is droughty, but the main limitation to use for crops is a very severe erosion hazard. Slope is a limitation for some nonfarm uses. Because this soil generally has short slopes, it commonly is farmed the same way as are the adjacent soils on the terraces or the dominant soil in the field where it occurs. (Capability unit IVe–1, woodland group 3f1)

Casco-Rodman complex, 12 to 18 percent slopes, moderately eroded (CdD2).—This mapping unit occurs in many areas that normally are less than 25 acres in size. They are on terrace escarpments and terrace remnants along the valley walls of the Miami and Little Miami River valleys and are also in the Kame area in Union and Turtle Creek Townships.

The surface layer is loam in most places, but small areas of sandy or gravelly loam or of clay loam occur where erosion is severe.

Both Casco and Rodman soils occur in most areas of this complex. Generally the Casco soils are dominant, but the relative amount of each soil varies from one area to another and from one part of a mapped area to another part. The Casco soils generally occupy about 75 percent of the mapped areas and Rodman soils about 25 percent. A typical profile of Rodman gravelly loam is described for the Rodman series. The Rodman soils are darker colored than the Casco soils.

Runoff from this mapping unit is rapid. The soils are poorly suited to field crops because they are moderately steep and droughty. Slope is a major limitation for many nonfarm uses. (Capability unit VIe–1; woodland group 3f1)

Cincinnati Series

The Cincinnati series consists of well-drained soils that have a fragipan. These soils formed partly in loess and partly in the underlying glacial till of Illinoian age. They are gently sloping or sloping and occupy upland areas, mostly in the southeastern part of the county.

A typical Cincinnati soil has a thin, very dark grayish-brown silt loam surface layer about 2 inches thick. Its brown silt loam subsurface layer extends to a depth of 10 inches. The next layers are yellowish-brown silt loam and silty clay loam that extend to a depth of 36 inches. The fragipan is between depths of 36 to 45 inches and consists of dense, compact, light yellowish-brown loam. It is underlain by firm, yellowish-brown clay loam. Calcareous till occurs at a depth of about 95 inches.

Cincinnati soils have moderate permeability above the fragipan. Permeability in and below the fragipan is moderately slow. The fragipan is weakly formed and is absent in some areas. The root zone is moderately deep to deep and very strongly acid. The normal root zone of these soils has a medium to high available moisture capacity.

Cincinnati soils are used mostly for general farming. Corn and soybeans are the main cultivated crops, but sloping soils normally are used for meadow, pasture, or woodland.

Representative profile of a Cincinnati silt loam (1 mile northeast of Rochester and about ½ mile south of intersection of Woodward Road and U.S. Highway No. 22, Salem Township):

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and medium, granular structure; friable; many roots; strongly acid; gradual, smooth boundary.

A2—2 to 10 inches, brown (10YR 5/3) silt loam; weak, fine, granular structure; friable; many roots; strongly acid; clear, irregular boundary.

B1—10 to 16 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; very strongly acid; gradual, wavy boundary.

B21t—16 to 27 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, medium and fine, subangular blocky structure; firm; thin patchy clay films on ped faces; very strongly acid; gradual, wavy boundary.

B22t—27 to 36 inches, yellowish-brown (10YR 5/6) silty clay loam that has many, fine, faint, yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) mottles; moderate, medium and fine, subangular blocky structure; firm; thin patchy clay films on ped faces; common roots; very strongly acid; clear, smooth boundary.

IIBx—36 to 45 inches, light yellowish-brown (10YR 6/4) loam that has many, medium, faint, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/6) mottles; moderate, coarse, prismatic structure that parts easily to weak, fine and medium, subangular blocky; firm (brittle); few roots; very strongly acid; gradual, wavy boundary.

IIB31—45 to 60 inches, yellowish-brown (10YR 5/6) clay loam; weak, coarse, prismatic structure that parts to moderate, medium and coarse, subangular blocky; firm; strong-brown (7.5YR 5/6) coatings on primary ped faces; strongly acid; gradual, wavy boundary.

IIB32—60 to 95 inches, yellowish-brown (10YR 5/4) clay loam that has medium, faint, pale-brown (10YR 6/3) mottles; weak, coarse, prismatic structure; firm; medium acid in upper part but grades to neutral in lower part; gradual, irregular boundary.

IIC—95 to 100 inches, yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) clay loam; structureless (massive); firm; no roots; calcareous glacial till of Illinoian age.

In cultivated areas the Ap horizon is brown (10YR 5/3) or yellowish-brown (10YR 5/4). The A horizon is silt loam in most places but is silt in some places. The IIB32 horizon developed in till and is dominantly clay loam, but it ranges to clay. In some places the fragipan occurs in the lower part of the loess mantle and extends into the upper part of the weathered till. In other places the fragipan developed entirely in the till. Cincinnati soils are free of mottles to a depth of 20 inches or more. The unweathered till is dominantly loam but ranges to clay. Clay occurs where the content of Ordovician bedrock in the till is high.

The Cincinnati soils are well drained members of a drainage sequence that includes the moderately well drained Rossmoyne soils, the somewhat poorly drained Avonburg soils, the poorly drained Clermont soils, and the darker, poorly drained Blanchester soils. Cincinnati soils are deeper to calcareous till than are the well-drained Russell soils. The loess mantle in which Cincinnati soils formed is thinner than that in which Alford soils formed.

Cincinnati silt loam, 2 to 6 percent slopes (CnB).—This soil occurs in long and relatively narrow areas that normally are 50 acres in size or less and occur on narrow ridgetops between the deeply entrenched tributaries of the Little Miami River. Slopes are short and are only slightly eroded. A profile of this soil is described as typical for the series. Included with this soil in mapping, in some of the broader areas, are areas of moderately well drained Rossmoyne soils on the more nearly level parts of the landscape.

A moderate erosion hazard is the major limitation to use of this soil for farming. The moderately slow permeability is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded (CnB2).—This soil occurs in long narrow areas that are of 50 acres or less in size. It is gently sloping and on uplands between the nearly level areas and the steep slopes along the larger tributaries of the Little Miami River. Where this soil is gently sloping, surface water does not stand on the surface, and where it is steep, internal water moves laterally. For these reasons, water does not remain in the soil long enough for mottles to form.

This soil is moderately eroded by the concentrated surface runoff from higher adjacent areas. Sheet and rill erosion are common. A few areas are gullied and are indicated on the soil maps by a symbol. Part of the original surface soil has been eroded away, and the plow layer consists of a mixture of that layer and the subsoil. Surface tilth, therefore, is generally poorer than in uneroded areas of Cincinnati soils.

Included with this soil in mapping are areas of moderately well drained Rossmoyne soils and a few small areas of Hickory soils.

A moderate erosion hazard is the major limitation to the use of this soil for farming. Moderately slow permeability is a limitation for many nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded (CnC2).—This soil is on the side slopes along the smaller tributaries of the Little Miami River and on upper areas along the larger streams. It occupies areas 50 acres or less in size.

Part of the original surface layer has been eroded away, and the surface soil is a mixture of that layer and subsoil material. Erosion is not uniform.

Included with this soil in mapping are a few areas of slightly eroded and severely eroded Cincinnati silt loam. The slightly eroded areas are in woodlands that have not been pastured. Also included are small areas of moderately well drained Rossmoyne soils and of well drained Hickory soils. The areas make up 25 percent or less of any area mapped.

Surface runoff from this soil is rapid, and erosion is a severe hazard in cultivated areas. The slope and moderately slow permeability are limitations for many nonfarm uses. (Capability unit IIIe–1; woodland group 2o1)

Clermont Series

The Clermont series consists of nearly level, light-colored, poorly drained soils that formed partly in loess and partly in glacial till of Illinoian age. These soils occupy upland areas in the southern and eastern parts of the county.

A typical Clermont soil has a grayish-brown silt loam plow layer about 8 inches thick. A layer of gray silt loam is between depths of 8 to 12 inches. The subsoil, to a depth of 23 inches, is gray light silty clay loam that is mottled with strong brown. Between depths of 23 and 43 inches, the subsoil layers are gray silty clay loam that is very firm. The lower part of the subsoil extends to a depth of 103 inches and consists of strong-brown clay loam that contains more grit and gravel than the upper part of the subsoil. The underlying material is light olive-brown, massive glacial till. The soil, to a depth of about 32 inches, formed in loess, and below that depth it formed in glacial till.

Clermont soils have very slow permeability. They are seasonally saturated with water in winter and spring, and they dry out slowly in spring. The root zone is moderately deep in most places because the roots are restricted by the dense, compact subsoil. The root zone is very strongly acid and has a medium available moisture capacity.

Clermont soils are used primarily for general farming, but some areas are used for pasture and meadow. Corn and soybeans are the main cultivated crops.

Representative profile of Clermont silt loam (800 feet southeast of the intersections of State Route 132 and Whitacre Road, 50 feet east of Whitacre Road at Butlerville, Harlan Township):

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam; weak, medium and fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2g—8 to 12 inches, gray (10YR 6/1) silt loam that has many, fine, prominent, strong-brown (7.5YR 5/8) mottles; moderate, fine, subangular blocky structure; friable; very strongly acid; clear, wavy boundary.

A&Bg—12 to 17 inches, gray (10YR 6/1) light silty clay loam that has many, fine, prominent, strong-brown (7.5YR 5/8) mottles; weak, medium and fine, subangular blocky structure; firm; extremely acid; this horizon appears to be a mixture of silt loam from the A2 horizon and remnants of strong-brown silty clay loam from the B; clear, wavy boundary.

B21tg—17 to 23 inches, gray (10YR 6/1) light silty clay loam that has many, fine and medium, prominent, strong-brown (7.5YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; thin discontinuous clay films on ped faces; a few silty coatings or surfaces and black (10YR 2/1) stains; extremely acid; clear, wavy boundary.

B22tg—23 to 32 inches, gray (10YR 6/1) silty clay loam that has many, fine and medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, medium and coarse, prismatic structure that parts to weak, medium and fine, subangular blocky; firm; gray (10YR 5/1) silt loam tongues 1/8 to 3 inches thick between polygons and extending into horizon below; thin, dark-gray (10YR 4/1) clay films on vertical ped faces; extremely acid; clear, smooth boundary.

IIB23tg—32 to 43 inches, gray (10YR 6/1) silty clay loam that has medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, medium and coarse, prismatic structure that parts to moderate, medium and fine, subangular blocky; very firm; gray (10YR 6/1) silty coatings on vertical surfaces and discontinuous, dark-gray (10YR 4/1), thin clay films; few small pebbles; extremely acid; gradual, wavy boundary.

IIB31tg—43 to 71 inches, strong-brown (7.5YR 5/6) clay loam that has many, coarse, prominent, gray (N 5/0 and N 6/0) mottles and coatings; weak, medium and coarse, prismatic structure grading to massive in lower part; firm; gray vertical coatings that are clayey in lower part of horizon; few small pebbles; very strongly acid grading to slightly acid in lower part; gradual, wavy boundary.

IIB32tg—71 to 103 inches, strong-brown (7.5YR 5/6) clay or clay loam that has common, fine, distinct, light-gray (N 7/0 and N 6/0) mottles; massive; firm; a few dark-gray (N 4/0) clay flows; common pebbles; neutral; abrupt, wavy boundary.

IIC—103 to 110 inches, light olive-brown (2.5Y 5/4) yellowish-brown (10YR 5/6) and gray (N 5/0) light clay loam; structureless (massive); firm; common pebbles; mildly alkaline; calcareous.

The Ap horizon dominantly is grayish brown (10YR 5/2), but it ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). Uncultivated soils have a thin, very dark grayish-brown (10YR 3/2) A1 horizon. The loess mantle ranges from 18 to 48 inches in thickness but is dominantly 24 to 42 inches thick. The IIB horizon is clay loam in most places but ranges to clay. Depth to the calcareous C horizon ranges from 60 to 120 inches but is dominantly 70 to 90 inches. The C horizon is clay loam in most places but ranges from loam to clay. Clay occurs where the till contains a large amount of shale from local Ordovician bedrock. In most places the till is underlain by unweathered Ordovician bedrock near the bottom of the solum.

Clermont soils are the poorly drained members of a drainage sequence that includes the well drained Cincinnati soils, the moderately well drained Rossmoyne soils, the somewhat poorly drained Avonburg soils, and the darker colored, poorly drained Blanchester soils. Clermont soils are grayer in the subsoil than the better drained Avonburg soils and are not so dark in the surface layer as Blanchester soils.

Clermont silt loam (Co).—This level to nearly level soil is on uplands in the southern and eastern parts of the county. It occurs in irregularly shaped areas up to several hundred acres in size. In some places areas of this soil are continuous for several miles. This wet soil is locally called crawdad land and, because it is so light colored when dry, buttermilk soil.

Included with this soil in mapping are areas of the darker colored Blanchester soils. These included areas generally are in depressions. Also included are small areas of nearly level Avonburg soils that generally are slightly better drained than this Clermont soil.

Prolonged seasonal saturation and very slow permeability are serious limitations to practically all uses of this soil. The soil is difficult to drain because of this very slow permeability and because the soil is level or nearly level. (Capability unit IIIw-3; woodland group 2w1)

Crider Series

Soils in the Crider series are deep and well drained. They formed in silt-capped residuum that weathered from limestone. In Warren County these soils occur only on the crest of a limestone hill in Washington Township. This hill is locally called Spring Hill.

A typical cultivated Crider soil has a dark-brown silt loam plow layer about 8 inches thick. The subsurface layer extends to a depth of 12 inches and is dark yellowish-brown silt loam. In the upper part of the subsoil, layers extend to a depth of 42 inches and are dark-brown silty clay loam. Between depths of 42 inches and 73 inches, the subsoil is reddish-brown to dark-red clay that weathered from limestone. The underlying material is yellowish-brown sandy clay loam that extends to a depth of 77 inches and is directly over limestone. The uppermost 42 inches of this soil formed in loess.

Crider soils have a deep root zone that is mostly strongly acid. Permeability is moderate throughout, and the available moisture capacity is high.

The Crider soils in this county are used mostly for corn, soybeans, small grains, and other general farm crops.

Representative profile of Crider silt loam (about 2¼ miles southwest of Hickoryville and 1 mile southeast of the intersection of Interstate Highway No. 71 and Clarksville Road on Spring Hill, Washington Township):

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, medium and fine, granular structure; friable; many roots; neutral; gradual, smooth boundary.

A2—8 to 12 inches dark yellowish-brown (10YR 4/4) silt loam; weak, medium, subangular blocky structure; friable; many roots; neutral; clear, smooth boundary.

B1t—12 to 19 inches, dark-brown (10YR 4/3) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; many roots; thin, discontinuous, dark yellowish-brown (10YR 3/4) clay films on the ped faces; neutral; gradual, wavy boundary.

B2t—19 to 32 inches, dark-brown (7.5YR 4/4) silty clay loam; strong, medium, subangular blocky structure; firm, common roots; continuous dark-brown (7.5YR 4/2) clay films on ped faces; slightly acid; gradual, wavy boundary.

B31—32 to 42 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, medium and fine, subangular blocky structure; firm; thin patchy clay films on ped faces; few roots; tongues of this horizon extend to as much as 18 inches in the underlying horizon and apparently occupy root channels; strongly acid; clear, irregular boundary.

IIB32—42 to 73 inches, reddish-brown (2.5YR 4/4) to dark-red (2.5YR 3/6) clay; weak, coarse and medium, subangular blocky structure; firm when moist, sticky when wet; numerous dark-brown to black concretions and coatings on peds; very strongly acid in upper part to neutral in lower part; abrupt, wavy boundary.

IIC—73 to 77 inches, yellowish-brown (10YR 5/4) sandy clay loam; structureless (massive); friable; mildly alkaline; calcareous; abrupt, irregular boundary.

IIR—77 inches, limestone.

The Ap ranges from dark brown (10YR 4/3 or 3/3) to dark grayish brown (10YR 4/2). The loess mantle ranges from 20 to 48 inches or more in thickness but commonly is 36 to 42 inches thick. The Bt horizons normally have a hue of 10YR or 7.5YR. The IIB horizon is silty clay or clay. The hue of this horizon generally is 2.5YR, but it ranges to 5YR in some places. The IIC horizon is partly weathered bedrock. It normally is only 1 to 2 inches thick or is discontinuous, but it is as much as 6 to 8 inches thick in some places. The IIC horizon is yellowish-brown (10YR 5/4) to pale-brown (10YR 6/3) loam, sandy loam, or sandy clay loam. It is underlain by limestone of the Silurian geologic period. The limestone is hard, but it is fractured or jointed and is weathered along the joints. It is only a few feet thick and overlies the Elkhorn clay shale.

Crider soils are not a part of a drainage sequence in the county. They are adjacent to the Eden soils, which are moderately deep to limestone and shale. Crider soils are underlain by limestone instead of by glacial till, as are the Russell and Cincinnati soils. The lower part of the subsoil is much redder in the Crider soils than in the Russell or Cincinnati soils.

Crider silt loam, 2 to 6 percent slopes (CrB).—This soil occurs only in the northeastern part of Washington Township in one area. It lies on an unglaciated outlier of Silurian limestone. In most places slopes are 2 to 4 percent.

Included with this soil in mapping are areas of a moderately eroded soil that has a thinner surface layer than is typical for the series. The plow layer in these eroded areas commonly has some strong-brown or reddish-brown subsoil material. Also included are a few areas of a nearly level soil. Other inclusions are small areas of a soil that is faintly mottled. These mottled inclusions occur in small depressions that have slightly restricted drainage and that appear to be sinkholes filled with silt. They generally are an acre or less in size.

This Crider soil is well suited to row crops, and crops respond favorably to intensive management. An erosion hazard is the major limitation to use of this soil for cultivated crops. Limitations for many nonfarm uses are few or none. (Capability unit IIe–1; woodland group 2o1)

Cut and Fill Land

Cut and fill land (Cu) generally is in small areas where mixed soil material has been filled into a natural depression or an excavation. The land surface in some recent housing developments on the rural fringe is Cut and fill land. Here the original land surface has been graded. The higher areas have cut away and filled into depressions so that the soil material is mixed and cannot be identified as an individual soil.

Some areas of Cut and fill land occur along highways and railroads, where soil and substratum material has been removed for some use. Such areas generally are 10 acres or less in size. They commonly have steep sides and, in some places, contain ponds or intermittent ponds. (Capability unit and woodland group not assigned)

Dana Series

The Dana series consists of deep, dark-colored soils that are moderately well drained. These soils formed in silt-capped glacial till of Wisconsin age. The silt cap is 18 to 40 inches thick. Dana soils occupy scattered upland areas in the western and northern parts of the county.

A typical Dana soil has a very dark grayish-brown and black silt loam surface layer about 16 inches thick. The upper part of the subsoil is yellowish-brown silty clay loam. Below a depth of 28 inches, the subsoil is yellowish-brown clay loam. Firm, calcareous glacial till is at a depth of 45 inches.

Dana soils are moderately permeable above the till underlying material, but they are moderately slowly permeable in the till. These soils are saturated seasonally to within 2 to 3 feet of the surface. They have a moderately deep to deep root zone that is medium or slightly acid in the upper part in areas not limed. The available moisture capacity is high. The organic-matter content is high in the surface layer.

Dana soils are used mainly for general farming. The main crops are corn, wheat, soybeans, and legume-grass meadow.

Representative profile of a Dana silt loam (about 3½ miles southwest of Hickoryville, ¼ mile east of the intersection of Wilmington and Ward Koebel Roads, and about ¼ mile south of Wilmington Road, Washington Township):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

A1—8 to 16 inches, black (10YR 2/1) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable; many roots; neutral; gradual, wavy boundary.

B1—16 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, medium, subangular blocky structure; firm; many roots; very dark grayish-brown (10YR 3/2) to black (10YR 2/1) stains of organic matter on ped faces and in root channels; neutral; gradual, wavy boundary.

B21t—20 to 28 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, medium and coarse, subangular blocky structure; firm; common roots; dark grayish-brown (10YR 4/2) clay films on ped faces and in root channels and worm burrows; neutral; clear, irregular boundary.

IIB22t—28 to 36 inches, yellowish-brown (10YR 5/4) clay loam; weak, medium, subangular blocky structure; firm; few roots; dark-brown (10YR 4/3) clay films on ped faces; neutral; gradual, wavy boundary.

IIB3—36 to 45 inches, yellowish-brown (10YR 5/4) clay loam; weak, medium and coarse, subangular blocky structure; firm; neutral to mildly alkaline; calcareous; gradual, wavy boundary.

IIC—45 to 60 inches, yellowish-brown (10YR 5/6) loam; massive; firm; mildly alkaline; calcareous.

The A1 horizon ranges from very dark grayish brown (10YR 3/2) to black (10YR 2/1). The dark-colored A horizons range from 10 to 24 inches in total thickness. The loess mantle ranges from 18 to 40 inches in thickness, but it is dominantly 20 to 36 inches thick. The thickness of the loess mantle varies greatly in short horizontal distances. The A horizons and upper Bt horizons range from medium acid to neutral in limed areas. The IIB2t horizon is chiefly neutral, and the IIB3 horizon is neutral to mildly alkaline. The C horizon commonly is underlain by calcareous Ordovician shale and bedrock at a few inches to 10 feet below the solum.

Dana soils are near or adjacent to the lighter colored Xenia and Russell soils. Dana soils are similar to Xenia soils but have a thick, dark-colored surface layer. They have brighter colors in the subsoil than the dark-colored, very poorly drained Brookston soils.

Dana silt loam, 0 to 2 percent slopes (DaA).—This dark-colored soil occurs in areas 25 acres or less in size. It is at the base of gentle slopes. This soil has good tilth. Included with this soil in mapping, in the more nearly level areas, are areas of very poorly drained Brookston soils.

Although erosion is not a hazard, in some places protection from surface water from adjacent higher upland areas is needed. This soil has few limitations to use for farming. The moderately slow permeability is a limitation to use for many nonfarm purposes. (Capability unit I–2; woodland group 2o1)

Dana silt loam, 2 to 6 percent slopes (DaB).—This soil is in irregularly shaped areas on uplands. The areas generally are less than 50 acres in size. The tilth of this soil normally is good.

This soil is likely to receive lime-charged seepage because it is mostly downslope from areas where calcareous shale and limestone are within 4 to 10 feet of the surface. Erosion is likely in cultivated areas. Moderately slow permeability is a limitation for many nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Eden Series

Soils in the Eden series are well drained and moderately deep to shallow to bedrock, They formed in material weathered from interbedded calcareous shale and limestone that is about 60 percent shale and 40 percent thin strata of limestone. These soils are in scattered areas, mostly in the northern half of the county. They occupy upland slopes of 2 to about 35 percent.

A typical Eden soil has a dark grayish-brown silt loam surface layer about 8 inches thick. This is underlain by brown silty clay loam about 2 inches thick. The next layer extends to a depth of 19 inches and consists of olive-brown and light olive-brown plastic clay. Olive clay extends to a depth of 24 inches and is directly above interbedded shale and limestone.

Eden soils have slow permeability and a low to very low available moisture capacity. Their root zone is moderately deep to shallow and is mostly neutral.

Eden soils generally are too steep for cultivated crops. They are used extensively for pasture or as woodland and less extensively as cropland.

Representative profile of an Eden silt loam in a pasture (250 feet north of Elbon Road, 0.6 mile east of the intersection of Elbon and Corwin Roads, and about 2 miles north of Oregonia):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

B1—8 to 10 inches, brown (10YR 4/3) silty clay loam; weak, fine, subangular blocky structure; friable; common roots; slightly acid; abrupt, smooth boundary.

IIB2t—10 to 18 inches, olive-brown (2.5Y 4/4) clay; strong, fine and medium, subangular blocky structure; firm; few roots; thin, patchy, olive-brown (2.5Y 4/3) clay coatings; 10 percent limestone flagstones 8 to 15 inches in diameter; neutral; gradual, smooth boundary.

IIB3—18 to 19 inches, light olive-brown (2.5Y 5/3) clay; weak, coarse, subangular blocky structure; firm; 15 percent limestone flagstones 8 to 15 inches in diameter; neutral to mildly alkaline; calcareous; abrupt, smooth boundary.

IIC1—19 to 24 inches, olive (5Y 5/3) clay; structureless (massive); firm; 15 percent limestone flagstones 8 to 15 inches in diameter; mildly alkaline to moderately alkaline; calcareous; gradual, smooth boundary.

IIC2—24 to 30 inches +, interbedded shale and limestone.

The solum ranges from 14 to 24 inches in thickness. It typically formed in material weathered from clay shale and limestone. The A horizon is dominantly dark grayish brown (10YR 4/2), but it is grayish brown (10YR 5/2), dark brown (10YR 4/3), or dark yellowish brown (10YR 4/4) in some places. The B1 horizon is brown (10YR 5/3), dark brown (10YR 4/3), or dark yellowish brown (10YR 4/4). The lower B horizons formed in shale and limestone residuum. They have hues of 10YR to 5Y, a value of 4 or 5, and a chroma of 3 or 4. The lower B horizons are clay or silty clay. The solum is neutral to slightly acid in the upper part and neutral to mildly alkaline in the lower part. Limestone flagstones cover from 0 to 5 percent of the surface, but they increase in number with depth and make up about 20 percent of the C1 horizon. The flagstones are not oriented in a particular direction in the upper horizons. They are oriented with the bedrock in the lower horizons.

In this county Eden soils are not in a drainage sequence with other soils. Eden soils are near or adjacent to the dark-colored Plattville soils and Hennepin soils, which are shallow to calcareous glacial till.

Eden complex, 2 to 6 percent slopes, moderately eroded (EdB2).—This mapping unit is in only a few areas in the county, and they generally are less than 40 acres in size. Eden soils make up about 70 percent of the mapping unit, and Wynn soils make up about 30 percent. The Wynn soils formed partly in loess and partly in glacial till. The lower part of Wynn soils is similar to the clayey lower layer of the Eden soils. The surface layer of the soils in this mapping unit is most commonly silt loam, but it is silty clay loam, clay loam, or clay in some places.

Included in mapping are small areas of the dark-colored Plattville soils. Limestone flagstones are on the surface in some areas. The shale and limestone bedrock is exposed in drainageways.

Surface runoff is medium to rapid, and the erosion hazard is severe in cultivated areas. These soils are droughty. The flagstones in the Eden soils may damage farm equipment.

Because shale and limestone are only about 24 inches from the soil surface, use of these soils is limited for many nonfarm purposes. (Capability unit IIIe-3; woodland group 3c1)

Eden complex, 6 to 12 percent slopes, moderately eroded (EdC2).—This mapping unit occurs in numerous areas throughout the northern and eastern parts of the county. The areas are 50 acres or less in size. The Eden part of the mapping unit makes up about 70 percent of the areas mapped, and soils formed in glacial till or loess make up 30 percent. The surface layer is silt loam in most places, but it may be silty clay loam, clay loam, or clay where shale bedrock is near the surface. Shale and limestone bedrock is exposed at the surface of convex slopes and in small drainageways in some areas. Limestone flagstones are common on the surface in places.

Seeps are common in areas of this mapping unit. Water percolates through the soil to the nearly impervious bedrock of clayey shale, and then it moves laterally along the bedrock until it reaches the surface downslope. These seeps are intermittent; they dry up in summer.

Included in mapping are areas of soils that formed entirely in glacial till but are underlain by interbedded shale and limestone at a depth of 40 inches or less. Also included are areas of soils that formed mostly from weathered bedrock. Areas of dark-colored Plattville soils, which occur downslope from seeps, also are included in this mapping unit. Other inclusions are soils over hard limestone that have reddish-brown layers in the lower part of the subsoil.

In cultivated areas surface runoff is rapid and erosion is a very severe hazard. Shallowness to bedrock and slope are limitations to use for farm and nonfarm purposes. (Capability unit IVe-2; woodland group 3c1)

Eden complex, 12 to 18 percent slopes, moderately eroded (EdD2).—This mapping unit occurs mostly along the valley walls of streams that have cut through the glacial till and into the underlying shale and limestone bedrock. It also is on upland slopes where, in most places, the bedrock of interbedded shale and limestone is at a shallow depth. About 30 percent of this mapping unit consists of soils that formed entirely in glacial till material that is underlain by bedrock at a depth of 40 inches or less. Some areas contain numerous rills and gullies where bedrock or calcareous till is commonly exposed. The surface layer of the soils is dominantly silt loam, but, particularly in small included areas that are severely eroded, the soils have a silty clay loam, clay loam, or clay surface layer.

Included in mapping are areas of Wynn, Miamian, Hennepin, Plattville, and Fairmount soils, all in a complex pattern. Also included, generally in woods or protected pastures, are a few areas of soils that are only slightly eroded. These included soils have a silty loam surface layer. In a small included area in Washington Township, the lower part of the subsoil is reddish brown. In this included area, the soil overlies hard limestone.

Shallowness to bedrock and slope are limitations to the use of this soil. Unless a protective cover is maintained, surface runoff is rapid and erosion is a severe hazard. (Capability unit VIe–1; woodland group 3c1)

Eden complex, 18 to 25 percent slopes, moderately eroded (EdE2).—This mapping unit is on uplands in the part of the county that was glaciated in Wisconsin age. It most commonly is on steep side slopes along the rivers and other large streams. About 70 percent of this mapping unit consists of Eden soils that formed in material weathered from bedrock of interbedded shale and limestone. About 30 percent consists of Miamian or Hennepin soils that formed in glacial till that is underlain by bedrock at variable depths.

The surface layer of the soils in this mapping unit is a mixture of the original surface layer and subsoil material. The surface layer is silt loam in most places, but it is silty clay loam, clay loam, or clay in some areas. Included with this complex in mapping are small areas of Hennepin, Plattville, and Fairmount soils, all in a complex pattern.

Steep slopes and shallow depth to bedrock are the major limitations to the use of the soils in this mapping unit. Erosion is a very severe hazard if a protective plant cover is not maintained. (Capability unit VIe–1; woodland group 3c1)

Eden complex, 25 to 35 percent slopes, moderately eroded (EdF2).—This mapping unit is on slopes along streams in the part of the county that was glaciated in Wisconsin age. It consists of about 70 percent Eden soils, and about 30 percent Miamian or Hennepin soils. The surface layer of the soils in this mapping unit is silt loam in most places, but it is silty clay loam, clay loam, or clay in included areas. Calcareous shale or bedrock is commonly exposed in shallow gullies and in bottoms along streams.

Most areas of this complex have been cleared and pastured. Included in mapping are areas of darker colored Plattville and Fairmount soils.

Very steep slopes, shallowness to bedrock, and a very severe erosion hazard are the main limitations to most uses of the soils in this mapping unit. The soils are too steep and shallow for cultivated crops. (Capability unit VIe–1; woodland group 4d1)

Eel Series

The Eel series consists of moderately well drained, nearly level soils that are subject to flooding. These soils formed in loamy alluvium on flood plains. They have a small total acreage in this county and occur in small scattered areas.

A typical Eel soil has a dark grayish-brown loam plow layer about 7 inches thick. A dark grayish-brown layer in the upper part of the subsoil extends to a depth of about 18 inches. Below this depth the subsoil is brown loam mottled with yellowish brown and gray. The underlying material is at a depth of about 45 inches and consists of sandy loam, loamy sand, and some gravel.

Eel soils have moderate permeability. They have a deep, mostly neutral root zone and a high available moisture capacity. These soils are subject to flooding and have a seasonal high water table in winter and spring.

The Eel soils are mainly used for general farming. The principal crops are corn and soybeans. Some areas are wooded.

Representative profile of Eel loam (2 miles southeast of Edwardsville, 1/4 mile southeast of the intersection of Middleboro and Henry Plummert Roads, and 50 feet southwest of Middleboro Road along Lick Run, Harlan Township):

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

B21—7 to 18 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, subangular blocky structure; friable; neutral; gradual, wavy boundary.

B22—18 to 36 inches, brown (10YR 5/3) loam that has common, medium, faint, yellowish-brown (10YR 5/6) and gray (10YR 5/1) mottles; weak, medium, subangular blocky structure; firm; few very dark grayish-brown (10YR 3/2) concretions; few roots; neutral; gradual, wavy boundary.

B3—36 to 45 inches, brown (10YR 5/3) loam that has many, medium, faint, yellowish-brown (10YR 5/6) and gray (10YR 5/1) mottles; weak, medium, subangular blocky structure; firm; few, discontinuous, loam and coarse silty clay loam strata up to one-half inch thick; few roots; neutral.

C—45 to 60 inches, stratified sandy loam, loamy sand, and gravel.

The A horizon is dominantly loam, but it ranges from silt loam to fine sandy loam. The B horizon is dominantly loam but is silt loam in some places. The solum ranges from neutral to mildly alkaline. Some areas are calcareous.

The Eel soils are part of a drainage sequence that includes the well-drained Genesee soils, the somewhat poorly drained Shoals soils, and the very poorly drained Sloan soils. Eel soils are better drained than Shoals soils but are not so well drained as Genesee soils. They are lighter colored and much better drained than the Sloan soils.

Eel loam (Ee).—This nearly level soil is on flood plains along most streams in the county. It has a water table that is intermittently high for short periods in the winter and early in spring. Eel loam is subject to periodic flooding.

Included with this soil in mapping are areas where the surface layer is silt loam. Small areas of this kind are along the Little Miami River and its larger tributaries. A larger proportion of areas where the surface layer is silt loam are along the smaller tributaries, particularly in the southern part of the county that was glaciated in Illinoian age. Also included in mapping are small areas of Genesee, Shoals, and Algiers soils.

Flooding is a limitation to use for farming, particularly in the choice of crops to be grown. This soil is well suited to row crops. Flooding is a severe limitation for most nonfarm uses. (Capability unit IIw–2; woodland group 1o1)

Fairmount Series

The Fairmount series consists of well-drained soils that are shallow to interbedded limestone and shale. These soils typically are dark colored at the surface and clayey in the subsoil. They are sloping to very steep and occur along the valley walls of many of the entrenched streams in the southern part of the county.

A typical Fairmount soil has a very dark grayish-brown surface layer that is 9 inches thick. It is silty clay loam in the upper 5 inches and silty clay below. The subsoil is mostly silty clay or clay that is firm when moist and plastic when wet. Interbedded shale and limestone occurs at a depth of 17 inches. Throughout this soil are numerous partly weathered limestone flagstones up to 12 inches across.

Fairmount soils have moderately slow permeability and a shallow root zone. In this county they are flaggy. They have a low available moisture capacity and are mostly neutral.

Areas of Fairmount soils were cleared and cultivated or pastured before this soil survey was made. Most areas now are in pasture or are wooded.

Representative profile of a Fairmount flaggy silty clay loam (about ½ mile west of Hammel, 1¼ miles east of the intersection of State Route 123 and Brant Road, and 20 feet east of Brant Road along Little Miami River, Washington Township):

A11—0 to 5 inches, very dark grayish-brown (10YR 3/2) silty clay loam; moderate, medium, granular structure; friable; many roots; partly weathered limestone flagstones up to 12 inches wide and 1 to 2 inches thick: neutral; gradual, smooth boundary.

A12—5 to 9 inches, very dark grayish-brown (10YR 3/2) silty clay; moderate, medium, subangular blocky structure; firm; numerous limestone flagstones; neutral; gradual, irregular boundary.

B21—9 to 13 inches, very dark grayish-brown (10YR 3/2) silty clay that has patchy, dark grayish-brown (2.5Y 4/2) coatings of organic matter on ped faces; strong, medium, angular blocky structure; firm; common roots; numerous limestone flagstones; neutral; gradual, smooth boundary.

B22—13 to 17 inches, grayish-brown (2.5Y 5/2) to light olive-brown (2.5Y 5/4) clay that has dark grayish-brown (2.5Y 4/2) coatings of organic matter on ped faces; strong, medium, subangular blocky structure; firm; few roots; numerous limestone flagstones; mildly alkaline; gradual, broken boundary.

C—17 to 50 inches, light olive-brown (2.5Y 5/4) and gray (10YR 6/1) silty clay and interbedded shale and limestone; massive; very firm; calcareous.

The solum is 10 to 20 inches thick over limestone and shale. The profile is neutral to mildly alkaline. It normally is calcareous at a depth of 12 to 18 inches. The underlying bedrock is interbedded shale and limestone that averages about 60 percent shale and 40 percent limestone. Limestone strata may range from 1 to 12 inches in thickness, but they are less than 6 inches thick in most places. The bedrock is gray (N 5/0) where it is not weathered but where it is weathered, its hue is 2.5Y or 5Y.

Fairmount soils are commonly adjacent to the well-drained Hickory soils that formed in glacial till of Illinoian age. They are also adjacent to steep Eden soils. In this county Fairmount soils are mapped only with Hickory and with Eden soils in complexes. Fairmount soils are more clayey and darker colored than Hickory soils and are thinner and darker colored than Eden soils.

Fairmount-Eden flaggy silty clay loams, 12 to 25 percent slopes, moderately eroded (FaE2).—The soils of this complex occupy areas on slopes that are longer than they are wide. They generally are on the lower half of the slopes. The Fairmount soils are dark colored, and the Eden soils are lighter colored. Both soils are in the areas mapped. The Fairmount soils occupy about 70 percent of the mapped areas and the Eden soils about 30 percent. Both soils have limestone flagstones 4 to 12 inches wide; these flagstones are on the surface and in the surface layer and subsoil. Surface runoff is very rapid. Wooded areas generally are less eroded than cleared areas. The very dark grayish-brown surface layer of Fairmount soils has been eroded away, and in some spots bedrock is exposed.

Included with these soils in mapping are areas that are severely eroded and some spots where bedrock is exposed. In the severely eroded areas, the dark grayish-brown original surface layer has been washed away. Also included are areas that are steep and areas, generally near the base of slopes, that are only slightly eroded. Other inclusions are of Hickory soils. They are on the upper parts of slopes where drainageways have cut through the Illinoian till. A few areas of outwash material too small to be mapped separately are along the Little Miami River.

The soils in this mapping unit generally are not suited to cultivated crops, because of slope, very rapid surface runoff, and erosion. They are well suited to pasture plants. The steep slopes are a limitation for many nonfarm uses. (Capability unit VIe–1; woodland group 4d1)

Fairmount-Eden flaggy silty clay loams, 25 to 50 percent slopes, moderately eroded (FaF2).—These soils occur on the lower slopes along the Little Miami River and some of its larger tributaries. Areas normally are less than one-quarter mile wide, but they may extend for a mile or more along the deeply entrenched valleys. The Fairmount soils occupy about 70 percent of the complex, and the Eden soils about 30 percent. Slopes are irregular, and erosion varies within short distances. Both soils generally have a thinner surface layer than that in the profile described as typical for their respective series.

The surface of this mapping unit is covered with numerous limestone flagstones that are 1 to 4 inches thick and up to 12 inches wide. These flagstones interfere with the working of these soils, but tree roots penetrate the soils to a considerable depth. The lower slopes commonly have an accumulation of talus.

Included with this complex in mapping are sizable areas of Fairmount soils that are only moderately eroded and some slightly eroded areas that are mostly in trees or protected pastures. Also included are areas of soils that have slopes of up to 50 percent and, on talus slopes and narrow benches, soils that have slopes of 25 percent. Other inclusions, generally on the upper slopes, are of Hickory and Hennepin soils.

The very steep slopes of these soils limit use for farming or nonfarm purposes. (Capability unit VIIe–1; woodland group 4d1)

Fincastle Series

The Fincastle series consists of deep, nearly level and gently sloping soils that occur on uplands and are somewhat poorly drained. These soils formed partly in loess and partly in the underlying glacial till of Wisconsin age.

A typical Fincastle soil has a dark grayish-brown silt loam surface layer 9 inches thick. A heavy silt loam transitional layer extends to a depth of 12 inches. The uppermost layer in the subsoil is grayish-brown silty clay loam that is prominently mottled with yellowish brown. It extends to a depth of 18 inches. Between depths of 18 and 37 inches, the subsoil is yellowish-brown silty clay loam mottled with dark grayish brown in the upper part and with very dark grayish brown in the lower part. Below this layer the subsoil is light olive-brown loam. At a depth of 42 inches is grayish-brown and light olive-brown loam glacial till.

Fincastle soils have moderately slow permeability. The water table is seasonally high for long periods in winter and spring. The root zone is deep when the water table is low. It normally is strongly acid except where these soils are limed. The available moisture capacity is medium to high.

The Fincastle soils are used for the field crops commonly grown in the county. Most areas have been drained. The areas not drained are commonly wooded.

Representative profile of a Fincastle silt loam (about 3½ miles west of Lebanon, ½ mile north of State Route 63, ½ mile east of Otterbein and State Route 741, Turtle Creek Township):

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

A2—6 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thin, platy structure; friable; common roots; thin, continuous, dark-gray (10YR 4/1) silt coatings on ped faces; slightly acid; clear, smooth boundary.

B&A—9 to 12 inches, dark-brown (10YR 4/3) heavy silt loam that has common, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, fine, subangular blocky structure; thin light brownish-gray (10YR 6/2) silty coatings on peds; friable; common roots; strongly acid; clear, smooth boundary.

B1—12 to 18 inches, grayish-brown (10YR 5/2) silty clay loam that has many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; firm; thin, very patchy, dark grayish-brown (10YR 4/2) clay films on some peds; common roots; strongly acid; gradual, wavy boundary.

B21t—18 to 23 inches, yellowish-brown (10YR 5/4) silty clay loam that has many, medium, distinct, dark grayish-brown (10YR 4/2) mottles and common, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; firm; common roots; numerous, fine, dark reddish-brown (5YR 3/2) concretions; thin, continuous, dark grayish-brown (10YR 4/2) clay films; strongly acid; gradual, wavy lower boundary.

B22t—23 to 30 inches, yellowish-brown (10YR 5/6) silty clay loam that has many, medium, distinct, dark grayish-brown (10YR 4/2) mottles; moderate, medium and fine, subangular blocky structure; firm; common roots; numerous, fine, dark reddish-brown (5YR 3/2) concretions; thin very dark grayish-brown (10YR 3/2) clay films; neutral; gradual, wavy boundary.

B31t—30 to 37 inches, yellowish-brown (10YR 5/6) silty clay loam that has common, medium, distinct, very dark grayish-brown (10YR 3/2) mottles; weak, medium and fine, subangular blocky structure; firm; numerous, fine, dark reddish-brown (5YR 3/2) concretions; thin, patchy, dark grayish-brown (10YR 4/2) clay films on vertical ped faces; neutral; abrupt, wavy boundary.

IIB32—37 to 42 inches, light olive-brown (2.5Y 5/4) loam that has many, medium, distinct, strong-brown (7.5YR 5/6) and gray (10YR 6/1) mottles; weak, fine, subangular blocky structure; firm; few, thin, very dark grayish-brown (10YR 3/2) clay flows; light-gray (10YR 7/1) lime flecks; few limestone ghosts in the upper part of horizon; mildly alkaline (calcareous); diffuse, wavy boundary.

IIC—42 to 60 inches, grayish-brown (2.5Y 5/2) and light olive-brown (2.5Y 5/4) loam that has many, medium, distinct, strong-brown (7.5YR 5/8) and gray (10YR 6/1) mottles; massive; firm; light-gray (10YR 7/1) lime flecks; numerous pebbles and limestone fragments and some boulders make up 10 to 20 percent of horizon, by volume; calcareous till.

The loess mantle ranges from 18 to 42 inches in thickness, and thickness varies within short distances. Depth to unweathered till ranges from 34 to 60 inches but is 36 to 48 inches in most places. The A2 and the upper B horizons are strongly acid to medium acid unless these soils have been limed. The Bt horizons range from strongly acid to neutral. The IIB3 horizon is slightly acid to mildly alkaline.

Fincastle soils are the somewhat poorly drained members of a drainage sequence that includes the well drained Russell soils, the moderately well drained Xenia soils, and the dark-colored, very poorly drained Brookston soils. The lower part of the subsoil in Fincastle soils formed in glacial till, whereas the Reesville soils formed entirely in loess. Fincastle soils are less deeply leached and weathered than Avonburg soils.

Fincastle silt loam, 0 to 2 percent slopes (FhA).—This is the most extensive Fincastle soil in the county. It typically occurs on uplands, commonly in areas 100 acres or more in size. It is also in small irregularly shaped areas intermingled with the better drained Xenia soils. This soil has the profile described as typical for the series. It has uniform slopes and is only slightly eroded.

Included with this soil in mapping are areas of Xenia soils on slight rises. Also included are areas of the dark-colored, wetter Brookston soils in small, narrow depressions. In other included areas are Reesville soils that formed in a thicker silty mantle than did this Fincastle soil. These areas of Reesville soils are most common in the northern and northeastern parts of the county.

The dominant limitation to use for farming is long periods of wetness in winter and spring. Drainage is needed for optimum crop growth. The seasonal high water table is a limitation for many nonfarm uses. (Capability unit IIw-4; woodland group 2w2)

Fincastle silt loam, 2 to 6 percent slopes (FhB).—This soil commonly occurs where it receives surface runoff from adjacent higher soils. Slopes are mostly 2 to 4 percent.

Included with this soil in mapping are small areas of an eroded Fincastle silt loam. In these included areas, part of the original surface layer has been eroded away and the remaining surface layer has been mixed with some of the subsoil. These areas of eroded soils generally are in poorer tilth than adjacent areas of uneroded soil. Also included are small areas of Xenia soils that occur on slight rises and on slopes of more than 6 percent slopes. Inclusions of the wetter Brookston soils are along drainageways and in low spots.

Seasonal wetness is the dominant limitation to the use of this soil for farming and for many nonfarm purposes. Erosion is a greater hazard than on Fincastle silt loam, 0 to 2 percent slopes. (Capability unit IIw-4; woodland group 2w2)

Fox Series

Soils in the Fox series are well drained and moderately deep to sand and gravel. They formed in loamy glacial outwash material of Wisconsin age that overlies calcareous outwash sand and gravel. Fox soils occupy outwash plains and stream terraces along the Great Miami and Little Miami Rivers and their tributaries. They also occupy kames.

A typical Fox soil has a dark grayish-brown loam plow layer about 7 inches thick. Next is a thin layer of dark-brown loam. The subsoil extends to a depth of 30 inches and is dark-brown and dark yellowish-brown sandy clay loam and clay. It is underlain by stratified sand and gravel.

The Fox soils have moderate permeability above the sandy and gravelly underlying material and moderately rapid or rapid permeability in it. The root zone of Fox soils is medium acid to neutral, is moderately deep, and has a medium to low available moisture capacity. The available moisture capacity is low where the depth to sand

and gravel is near the minimum depth of 24 inches. The sandy and gravelly underlying material is calcareous. Fox soils tend to be droughty, but they are well suited to irrigation if erosion is controlled. These soils dry out and warm up early in spring.

Fox soils are used for general field crops and specialty crops. They are important soils for farming in the county. Pollution is a danger to underground streams, wells, or nearby springs if these soils are used for disposal of solid waste or of effluent from sewage systems.

Representative profile of a Fox loam (2.4 miles west of Morrow, Salem Township):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; friable; many roots; neutral; gradual, smooth boundary.

A2—7 to 9 inches, dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure; friable; many roots; neutral; abrupt boundary.

B1t—9 to 16 inches, dark-brown (10YR 4/3) sandy clay loam; dark yellowish-brown (10YR 4/4) when crushed; strong, medium, subangular blocky structure; firm; thin patchy clay films on ped faces; common roots.

B2t—16 to 23 inches, dark-brown (10YR 4/3) clay; strong, medium and fine, subangular blocky structure; firm; common roots; brown (7.5YR 4/2) continuous clay films on ped faces; neutral; gradual, wavy boundary.

B3t—23 to 30 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; weak, medium and coarse, subangular blocky structure; firm; thin patchy clay films on ped faces; few roots; mildy alkaline; weakly calcareous; gradual, irregular boundary.

C—30 to 60 inches, dark-brown (10YR 4/3) to brown (10YR 5/3), stratified sand and gravel; 50 percent or more coarse skeleton; loose; no roots; moderately alkaline; calcareous.

The B horizon has a hue of 10YR, 7.5YR, or 5YR, a value of 4 or 5, and a chroma of 3 or 4. The B2t horizon is clay loam, sandy clay loam, or clay. The A horizon and upper part of the B horizon range from medium acid to neutral, and the B3 horizon from slightly acid to mildly alkaline. Depth to calcareous sand and gravel ranges from 24 to 42 inches.

Fox soils are near or adjacent to the deeper well-drained Ockley soils and the shallow well-drained Casco soils. Fox soils are light colored in contrast to the dark-colored Warsaw soils.

Fox loam, 0 to 2 percent slopes (FlA).—This soil occurs along the Miami River in Franklin Township and along the Little Miami River and its tributaries. It has good tilth and is easy to till.

Included with this soil in mapping are areas of a soil that has a silt loam surface layer. These areas are mainly along the Little Miami River and its tributaries. Also included along the Little Miami River are areas of the deeper Ockley soils. Along the Miami River are areas of a soil that has a slightly darker surface layer than have the Fox soils, but this layer is not dark enough for the soil to be placed in the Warsaw series.

This Fox soil is droughty if used for summer field crops, but it is well suited to irrigation and use for specialty crops. It has few limitations for many nonfarm uses. (Capability unit IIs–1; wodland group 2o1)

Fox loam, 2 to 6 percent slopes (FlB).—This soil has good tilth and is easy to till. Its profile is the one described as typical for the series.

Included with this soil in mapping, along the Little Miami River, are areas of a soil that has a silt loam surface layer. Also along the Little Miami River are included areas of the deeper Ockley soils. Other included areas are a few moderately eroded spots that are more droughty than the adjacent soil.

Because surface runoff is medium to rapid, the erosion hazard is moderate where cultivated crops are grown. This soil has few or no limitations for many nonfarm uses. (Capability unit IIe–4; woodland group 2o1)

Fox loam, 2 to 6 percent slopes, moderately eroded (FlB2).—This soil generally occupies areas 25 acres or less in size. It generally is adjacent to the margins of larger, less eroded areas of Fox soils, is on smaller terrace remnants, and is on the gently sloping sides of meander scars and drainageways that cross the terraces. Surface runoff generally is rapid.

This soil has a thinner surface layer than that in the profile described as typical for the Fox series. Because the plow layer is a mixture of the original surface layer and the clay subsoil, there is a greater tendency toward surface crusting and droughtiness on this eroded soil than on uneroded Fox soils. Included with this soil in mapping along the Little Miami River are small areas of a soil that has a silt loam surface layer. Also included are some severely eroded areas where calcareous gravel is at the surface. These areas are shown on the soil map by a symbol.

An erosion hazard is the dominant limitation to use of this soil for cultivated crops. Limitations for many nonfarm uses are few. (Capability unit IIe–4; woodland group 2o1)

Fox loam, 6 to 12 percent slopes, moderately eroded (FlC2).—This soil occurs on terrace remnants near the base of steep slopes of the uplands. It is at the edge of terraces on valley trains along the Miami and Little Miami Rivers. It also occurs on kames and terrace escarpments. The areas generally are small, but a few areas of up to 50 acres occur. In this moderately eroded soil, the plow layer contains varying amounts of subsoil material that have been mixed into it by plowing and cultivation. This soil is droughty.

Included with this soil in mapping are areas of shallow Casco soils that make up as much as 25 percent of the mapped areas. Also included are some severely eroded areas where gravel is exposed at the surface. These gravelly areas are indicated on the soil map by a symbol.

The erosion hazard is severe where this soil is used for cultivated crops. Slope is the dominant limitation for many nonfarm uses. (Capability unit IIIe–2; woodland group 2o1)

Fox-Casco complex, 12 to 18 percent slopes, moderately eroded (FoD2).—This mapping unit occurs in areas of 20 acres or less on terrace escarpments and kames. The surface layer is loam in most places, but in some areas it is fine sandy loam, silt loam, clay loam, or sandy loam. This mapping unit is made up of nearly 50 percent each of Fox and of Casco soils. These soils are in such a complex pattern that they cannot be mapped separately at the scale of the soil map. The Casco part of this mapping unit has the profile described as typical for their series. The Fox part is thinner than shown in the profile described as typical for the series because erosion has removed some of the upper part of the soil. Some mixing of the surface layer and subsoil can be seen in the Casco part. The soils in this mapping unit are droughty.

Included in this mapping unit are small areas of severely eroded soils.

The hazard of erosion is very severe where these soils are used for cultivated crops. Slope and droughtiness are the main limitations for some nonfarm uses. (Capability unit IVe-1; woodland group 3f1)

Genesee Series

The Genesee series consists of well-drained, nearly level soils that are subject to flooding. These soils formed in loamy alluvium on flood plains along almost every stream in the county.

A typical Genesee soil in a cultivated area is brown loam from the surface to a depth of about 24 inches. Next is dark grayish-brown loam that extends to a depth of about 60 inches.

Genesee soils have moderate permeability and a deep root zone. The root zone has a high available moisture capacity and is nearly neutral. Flooding is a particular hazard during winter and spring.

The Genesee soils are used for summer row crops where areas of the soils are large enough to farm. Small areas generally are wooded.

Representative profile of Genesee loam (1¼ miles southeast of Osceola, ¼ mile southwest of the intersection of Edwardsville and Kunker Roads, and 0.2 mile southwest of Edwardsville Road along Sharps Run, Harlan Township):

Ap—0 to 8 inches, brown (10YR 4/3) loam; weak, fine and medium, granular structure; friable; many roots; neutral; gradual, wavy boundary.

B2—8 to 24 inches, brown (10YR 4/3) loam; weak, coarse, subangular blocky structure; friable; common roots; neutral; diffuse, wavy boundary.

C1—24 to 45 inches, dark grayish-brown (10YR 4/2) loam; structureless (massive); friable; few, thin, discontinuous strata; few roots; neutral; diffuse, wavy boundary.

C2—45 to 55 inches, dark grayish-brown (10YR 4/2) loam; structureless (massive); friable; stratified; mildly alkaline; calcareous; diffuse, wavy boundary.

C3—55 to 60 inches, dark grayish-brown (10YR 4/2) loam; structureless (massive); friable; stratified; 10 percent is coarse skeleton; mildly alkaline; calcareous.

The A horizon is dominantly loam or fine sandy loam, but it is silt loam in some places. The C horizon is stratified alluvium in which loam and fine sandy loam are dominant, but strata ranging from silt loam to loamy sand occur. Strata range from ½-inch to 6 inches or more in thickness and normally are discontinuous. At a depth of 5 to 10 feet, the loamy alluvium is underlain by coarser alluvium or by alluvial outwash that consists of sand, gravel, and coarse flaggy limestone.

Genesee soils are the well drained members of a drainage sequence that includes the moderately well drained Eel, the somewhat poorly drained Shoals, and the very poorly drained Sloan soils. Genesee soils are similar to the well-drained but darker colored Ross soils.

Genesee fine sandy loam (Gd).—This nearly level soil occupies large areas along the flood plains of the Miami River, the Little Miami River, and their larger tributaries. Flooding is frequent.

Included with this soil in mapping are many areas that are weakly calcareous and some areas where the surface layer is not fine sandy loam. Also included are small areas of darker colored Lanier soils near the present stream or where a stream has altered its channel. Included along the Miami River are areas of Abscota sand. Dark-colored Ross soils are included along the Miami River, along Caesar Creek, and in some places along the Little Miami River.

Along the Little Miami River, this soil is severely infested with johnsongrass. Flooding is a major limitation to most nonfarm uses. (Capability unit IIw-2; woodland group 1o1)

Genesee loam (Gn).—This nearly level soil is on flood plains along most of the smaller and intermediate-sized streams in the county. Flooding is frequent. A profile of this soil is described as typical for the series.

Included with this soil in mapping are areas where the surface layer is silt loam. These included areas are along streams that originate in the silt-capped material of Illinoian age in the southern and eastern parts of the county. Also included are small areas where the surface layer is fine sandy loam. Other inclusions are small areas of the Eel and Algiers soils and, along streams that have steep gradients, small areas of Lanier soils.

Flooding is a major limitation for many nonfarm uses. (Capability unit IIw-2; woodland group 1o1)

Gravel Pits

Gravel pits (Gp) range from less than an acre to 100 acres or more in size. Gravel is taken from the small pits for use in farm roads and lanes. Pits smaller than 2 acres are shown on the soil map by a gravel pit symbol. The larger gravel pits are a source of sand and gravel for commercial use.

The larger gravel pits commonly contain a part of the pit that has been worked out. These areas generally contain a lake surrounded by sand or gravel of a poor grade and piles of mixed soil and gravelly spoil material from the more recent excavations. Some of these lakes are used for recreation or commercial fishing. A few of the gravel pits that are worked out are used as sanitary land fills for the disposal of trash and garbage. This practice causes a possibility of underground water contamination. Some pits are worked only when there is a local demand for sand or gravel. Some abandoned sites are quickly overgrown with weeds and trees. (Capability unit and woodland group not assigned)

Hennepin Series

The Hennepin series consists of well-drained soils that are shallow or very shallow to calcareous glacial till. These soils occupy steep to very steep uplands. Hennepin soils occur in the area of the county that was glaciated in Wisconsin age.

A typical Hennepin soil has a dark grayish-brown silt loam surface layer about 6 inches thick. It is underlain by a thin subsoil of brown light clay loam. The underlying material is at a depth of 8 inches and is massive, calcareous glacial till of loam texture.

Hennepin soils have low to medium organic-matter content, moderately slow permeability, and a low to very low available moisture capacity.

In most areas, Hennepin soils are too thin and too steep for cultivation. They are used mostly for pasture and as woodland.

Representative profile of a Hennepin silt loam (1¾ miles northwest of Harveysburg and ¼ mile southeast of the intersection of Furnas Road and State Route 73, Massie Township):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable; many roots; mildly alkaline; weakly calcareous; neutral; clear, wavy boundary.

B—6 to 8 inches, brown (10YR 5/3) light clay loam; weak, fine and medium, subangular blocky structure; firm; common roots; moderately alkaline; moderately calcareous; clear, wavy boundary.

C—8 to 60 inches, light yellowish-brown (10YR 6/4) to pale-brown (10YR 6/3) loam; structureless (massive); very firm; few roots that are along vertical cracks in the till; moderately alkaline; calcareous.

The A1 horizon in wooded areas is as dark as very dark grayish-brown (10YR 3/2) in some places. The A horizon ranges from loam to silt loam. The B horizon is mildly alkaline to moderately alkaline. It is lighter colored than the A horizon and has developed structure and evidence of weathering not present in the C horizon. The B horizon ranges from 2 to 14 inches in thickness. In some places the B horizon does not occur, because it has been eroded away or mixed into the plow layer. The C horizon is calcareous loam or clay loam till that is generally massive. It has a thick platy structure in some places.

Hennepin soils commonly are adjacent to steep Miamian soils and are much more shallow to calcareous till than those soils.

Hennepin silt loam, 25 to 35 percent slopes (HeF).—This soil occurs throughout the part of the county glaciated in Wisconsin age. Because most of this soil is wooded and protected from erosion, the surface layer is thicker than that in the profile described as typical for the series. Included with this soil in mapping are a few areas that are more gravelly than typical.

Very rapid surface runoff and steep slopes are the dominant limitations to the use of this soil. Erosion is a severe hazard unless a plant cover is maintained. Slope is a main limitation for most nonfarm uses. (Capability unit VIe–1; woodland group 2r1)

Hennepin silt loam, 25 to 35 percent slopes, moderately eroded (HeF2).—This soil occurs on the side slopes of the principal valleys and generally is in areas 5 to 25 acres in size. A few areas are 25 to 50 acres in size. Because of erosion, the plow layer is a mixture of the remaining surface soil and some of the subsoil. As a result, calcareous glacial till is at or very near the surface in most places. A profile of this Hennepin soil is described as typical for the series.

Included with this soil in mapping are areas of Miamian soils that make up about 10 to 40 percent of each area mapped. These included areas are mostly on the upper parts of slopes above the Hennepin soils.

This Hennepin soil is severely susceptible to erosion if used for pasture. It is too steep to cultivate. Slope is a major limitation for most nonfarm uses. (Capability unit VIe–1; woodland group 2r1)

Hennepin-Miamian silt loams, 18 to 25 percent slopes (HmE).—This is a mapping unit of Hennepin and Miamian soils that are so intermingled that each soil could not be mapped separately at the scale of the soil map. The Hennepin soil occupies about 75 percent of each area mapped and the remaining area commonly is mostly Miamian soil. Areas of this complex have rounded and winding linear shapes and occur on the side slopes adjacent to the principal valleys. They generally contain from 5 to 25 acres, though a few areas are 25 to 50 acres in size.

A profile of the Hennepin soil in this complex is described as typical for the series. The Miamian soil has a profile similar to the one described as typical for the Miamian series except that the depth to till is nearer the minimum described in the range for the series.

On this mapping unit, there is a severe erosion hazard if the soils are used for pasture. These soils generally are too steep and too droughty to be used for cultivated crops. Slope is a major limitation for most nonfarm uses. (Capability unit VIe–1; woodland group 2r1)

Hennepin-Miamian silt loams, 18 to 25 percent slopes, moderately eroded (HmE2).—This is a mapping unit of Hennepin and Miamian soils that are so intermingled that each soil could not be mapped separately at the scale of the soil map. The Hennepin soil occupies about 75 percent of each area mapped, and the rest is mostly Miamian soil. Areas of this complex have rounded and winding linear shapes and occur on the side slopes of the principal valleys. They generally contain from 5 to 25 acres, though a few mapped areas are 25 to 50 acres in size.

Each of these soils has a profile that differs from the one described as typical for their series by being moderately eroded. Because of past erosion, the plow layer of these soils is a mixture of the remaining surface soil and upper part of the subsoil. In the Miamian soil the depth to till is near the minimum described in the range of the series.

Included with this complex in mapping are gravelly areas and many severely eroded areas. Each kind of inclusion is shown on the soil map by a special symbol.

On this mapping unit, there is severe hazard of erosion in areas used for pasture. The soils are too steep to cultivate, and slope is a major limitation for most nonfarm uses. (Capability unit VIe–1; woodland group 2r1)

Hennepin-Miamian complex, 12 to 18 percent slopes, severely eroded (HnD3).—This is a mapping unit of Hennepin and Miamian soils that are so intermingled that each soil could not be mapped separately at the scale of the soil map. Hennepin soils occupy 60 to 75 percent of each area mapped, and Miamian soils occupy most of the rest.

The profiles of these soils are similar to those described as typical for their respective series except that they have been altered by severe erosion. The present plow layer consists mostly of brownish, moderately fine textured material, commonly clay loam, similar to that of the subsoil of the respective typifying profile. In some areas the underlying calcareous till is exposed, and in other areas it has been extensively mixed into the plow layer. Gullies are common in some areas. Included in this mapping unit are a few slightly eroded areas and a few moderately eroded ones.

These soils are severely eroded because they occupy side slopes that were formerly cultivated up and down hill. The plow layer commonly is low in organic-matter content, and it has poor tilth. Where bare of vegetative cover, the surface crusts firmly, and the infiltration of water is restricted. Both crusting and poor moisture content hinder the emergence of seedlings and good growth of plants. These soils have a low available moisture capacity. Because surface runoff is rapid, the erosion hazard is severe.

Slope is a dominant limitation for most nonfarm uses. (Capability unit VIe–1; woodland group 3r1)

Henshaw Series

The Henshaw series consists of soils that are somewhat poorly drained. These soils are nearly level to gently sloping and are mostly on stream terraces. They formed in calcareous, medium-textured to moderately fine textured lacustrine material of Wisconsin age.

A typical Henshaw soil in a cultivated area has a dark grayish-brown silt loam plow layer about 8 inches thick. Below this is a light-gray silt loam subsurface layer also about 8 inches thick. The subsoil, to a depth of about 30 inches, consists of light brownish-gray silty clay loam. In this layer are some grayish and brownish mottles and grayish-brown coatings on many of the peds, or soil aggregates. The lower layers in the subsoil, to a depth of 45 inches, are brown and dark-brown silty clay loam. The underlying material consists of brown silty clay loam that is stratified.

These soils have a seasonally high water table. The grayish coatings indicate that the soils are naturally wet. Where adequately drained, the root zone for most annual crops is moderately deep to deep. The available moisture capacity is high. Permeability is moderately slow throughout. In drained areas Henshaw soils are well suited to the crops commonly grown in the county. Most areas are used as cropland. Corn, soybeans, wheat, and hay are the main crops.

Representative profile of Henshaw silt loam in a cultivated area (1/2 mile north of State Route 63 on the line between sections 6 and 36, R. 3 N., T. 4 E., Turtle Creek Township):

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

A2g—8 to 16 inches, light-gray (10YR 7/1) silt loam that has common, medium and fine, faint, brown (10YR 5/3) and yellowish-brown (10YR 5/6) mottles; weak, thin, platy structure; friable; common roots; strongly acid; gradual, smooth boundary.

B1tg—16 to 24 inches, light brownish-gray (10YR 6/2) and light yellowish-brown (10YR 6/4) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; thin, patchy, grayish-brown (10YR 5/2) clay films on ped faces; very strongly acid; gradual, wavy boundary.

B21tg—24 to 30 inches, light brownish-gray (10YR 6/2) silty clay loam that has many, medium, distinct, yellowish-brown (10YR 5/6) mottles; strong, medium, subangular blocky structure; firm; continuous grayish-brown (10YR 5/2) clay films on ped faces; numerous, fine and medium, black (10YR 2/1) concretions; few roots; strongly acid to medium acid; gradual, wavy boundary.

B22tg—30 to 42 inches, brown (10YR 5/3) silty clay loam that has many, medium, distinct, light brownish-gray (10YR 6/2) mottles; strong, medium, subangular blocky structure; firm; continuous clay films on ped faces; few roots; medium acid in upper part and slightly acid in lower part; gradual, wavy boundary.

B3—42 to 45 inches, dark-brown (10YR 4/3) silty clay loam; weak, medium and coarse, subangular blocky structure; firm; neutral; gradual, wavy boundary.

C—45 to 50 inches, brown (10YR 5/3) silty clay loam; massive (structureless); friable; stratification evident below depth of 45 inches; mildly alkaline; calcareous.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). The surface layer is silt loam in most places, but it is loam or fine sandy loam in some areas. The solum ranges from 36 inches to 60 inches in thickness. The Bt horizons range from very strongly acid to slightly acid, and the B3 horizon is slightly acid to neutral. The pH increases with depth. The C horizon is neutral to moderately alkaline. It is calcareous in most places. The C horizon is stratified and has texture that includes silt loam, silty clay loam, and fine sandy loam.

Henshaw soils are the somewhat poorly drained members of a topographic sequence that includes the higher lying, moderately well drained Uniontown soils and the lower lying, very poorly drained Patton soils. Henshaw soils have more gray throughout the profile than the Uniontown soils and are light colored in contrast to the dark-colored Patton soils. Henshaw soils are similar to Reesville soils but formed in lacustrine instead of loess material and are stratified in the lower part.

Henshaw silt loam, 1 to 4 percent slopes (HoB).—This soil is mostly in broad areas that are rounded. Most of the acreage is in a few areas up to 100 acres in size, but numerous areas range from 3 to 15 acres.

Included with this soil in mapping are a few areas of a soil that has slopes of 4 to 6 percent. Also included are some areas of soil that has a surface layer consisting of 6 to 36 inches of loam or sandy loam. The symbol for sand spots is used on the soil map for areas that have the sandier overlying materials. In some included areas the subsoil is more acid and generally weathered deeper than the subsoil described as typical for the series. Also included are small areas of dark-colored, wetter Patton soils in drainageways and in low spots.

Although there is an erosion hazard in the gently sloping areas, the primary limitation to use of this soil for farming or nonfarm purposes is wetness. (Capability unit IIw-4; woodland group 2w2)

Hickory Series

The Hickory series consists of well-drained soils that formed in glacial till of Illinoian age. In some places the glacial till is mantled with a thin layer of loess. Hickory soils are gently sloping to very steep.

A typical Hickory soil has a dark-brown silt loam surface layer and a yellowish-brown silt loam subsurface layer that together are 7 inches thick. The subsoil is mainly yellowish-brown clay loam to a depth of about 45 inches. It is underlain by yellowish-brown and brown clay loam till of Illinoian age.

Hickory soils have a root zone that is mostly moderately deep. They have moderately slow permeability, have a medium available moisture capacity, and are very strongly acid in the root zone.

Most of the acreage of Hickory soils is in second growth woodland.

Representative profile of a Hickory silt loam (about 1/4 mile south of the intersection of Middleboro Road and U.S. Highway No. 22, Salem Township):

A1—0 to 3 inches, dark-brown (10YR 4/3) silt loam; moderate, medium and fine, granular structure; friable; many roots; strongly acid; clear, smooth boundary.

A2—3 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, granular structure and weak, fine, subangular blocky structure; friable; many roots; strongly acid; clear, wavy boundary.

B1t—7 to 10 inches, yellowish-brown (10YR 5/6) silty clay loam; strong, medium and fine, subangular blocky structure; friable; thin patchy clay films on ped faces; few roots; very strongly acid; clear, wavy boundary.

IIB21t—10 to 26 inches, yellowish-brown (10YR 5/6) clay loam; moderate, medium and fine, subangular blocky structure; firm; continuous clay films on ped faces; few roots; very strongly acid; gradual, wavy boundary.

IIB22t—26 to 36 inches, yellowish-brown (10YR 5/6) clay loam that has a few, fine, faint, pale-brown (10YR 6/3) mottles; moderate, medium and fine, subangular blocky structure; firm; thin continuous clay films; very strongly acid; gradual, wavy boundary.

IIB3t—36 to 45 inches, yellowish-brown (10YR 5/4) clay loam that has a few, fine, faint, pale-brown mottles; weak, medium and coarse, subangular blocky structure; firm; thin clay films on vertical faces of peds; numerous very dark grayish-brown (10YR 3/2) concretions and stains; neutral; clear, irregular boundary.

IIC—45 to 60 inches, yellowish-brown (10YR 5/6) and brown (10YR 5/3) clay loam; structureless (massive); firm; mildly alkaline; calcareous.

The solum ranges from 20 to 50 inches in thickness. The A horizon is generally silt loam in uneroded soils, but it is clay loam or silty clay loam in some eroded areas. The lower part of the B horizon and the C horizon have a hue of 10YR, but hue may be 2.5Y where the till contains a high proportion of shale and limestone fragments. The unweathered till is clay loam or loam.

Hickory soils are near or adjacent to the well-drained Cincinnati and Fairmount soils. The Hickory soils have a thinner silt mantle than the Cincinnati soils. Hickory soils formed mostly from glacial till, but Fairmount soils formed from weathered, residual material.

Hickory silt loam, 2 to 6 percent slopes, moderately eroded (HrB2).—This soil is at the head of drainageways and along the sides of some of the deeply incised streams. It occurs slightly below the uplands. It is below the break from the nearly level uplands and above the steep side slopes along the streams. This soil generally is strongly acid to very strongly acid unless it has been limed. Most of this soil formed in glacial till of Illinoian age, but a few areas included in mapping are underlain by weathered bedrock from which the lower part of the soil formed.

In cultivated areas the erosion hazard is moderate. Limitations other than slope are few for many nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Hickory silt loam, 6 to 12 percent slopes, moderately eroded (HrC2).—This soil occurs in areas up to 100 acres in size along the side slopes of drainageways throughout the part of the county glaciated in Illinoian age. The upper part of this soil formed in glacial till, but in most places this soil is underlain by bedrock at a relatively shallow depth. Up to 50 percent of this soil has bedrock at a depth of about 3 to 4 feet, or the lower part of the soil formed in residuum weathered from bedrock. The plow layer is a mixture of the original surface layer and some subsoil material. Included in mapping are some eroded areas where limestone flagstones are exposed at the surface.

In cultivated areas the erosion hazard is severe. Bedrock near the surface and slope are limitations for many nonfarm uses. (Capability unit IIIe–1; woodland group 2o1)

Hickory silt loam, 12 to 18 percent slopes, moderately eroded (HrD2).—This soil occurs on slopes along drainageways. It is in areas 100 acres or less in size. Erosion has removed part of the original surface layer, and the surface layer in plowed areas is a mixture of material from that layer and from the subsoil.

Most of this soil formed in Illinoian-age till, but the till is underlain by Ordovician bedrock at a depth of 3 to 6 feet. In some areas the lower part of the subsoil formed in residuum weathered from bedrock or in till that was derived from the local bedrock. The soil on the upper slopes was mostly derived from glacial till and in most places is underlain by thicker calcareous till. The soil formed partly in weathered bedrock generally is on the lower part of slopes.

Included with this soil in mapping are some areas where limestone crops out. Also included are numerous small areas of Cincinnati, Fairmount, and Rodman soils.

In cultivated areas the erosion hazard is very severe, for surface runoff is rapid. Slope and bedrock near the surface are the main limitations for many nonfarm uses. (Capability unit IVe–1; woodland group 2r1)

Hickory clay loam, 6 to 12 percent slopes, severely eroded (HsC3).—This soil is on the side slopes of the drainageways. It occurs in irregularly shaped areas of 50 acres or less. This soil has been cleared and used as cropland or for pasture, and most of the original surface layer and part of the subsoil have been eroded away. The present surface layer is mostly subsoil material, and calcareous till or bedrock is exposed at the surface in many places, particularly in the rills and gullies. Nearly all areas of this soil are underlain by limestone and shale within 3 to 4 feet of the surface.

Included with this soil in mapping are areas of silty clay loam, silt loam, or clay. The texture of the surface layer varies within short horizontal distances. The surface of bare areas is mostly covered with a pavement of glacial pebbles or limestone fragments.

Severe past erosion limits use of this soil for cultivated crops, as does the very severe hazard of erosion. Slope and bedrock near the surface are limitations for many nonfarm uses. (Capability unit IVe–1; woodland group 3o1)

Hickory clay loam, 12 to 18 percent slopes, severely eroded (HsD3).—This soil occurs in only a few areas, which are 40 acres or less in size. It occupies the sides of drainageways.

Because this soil has been poorly protected from erosion, the original surface layer and part of the subsoil have been eroded away. Yellowish-brown subsoil material is exposed at the surface, and calcareous till or bedrock is exposed in gullies and drainageways in places.

Included with this soil in mapping are areas of Fairmount soils that developed primarily from the local bedrock, though they do contain some glacial pebbles in places. Also included are small areas of Hennepin soils. In other included areas, the surface layer is silty clay loam, clay, silt loam, or loam. The texture of the surface layer varies within short horizontal distances.

Severe erosion and moderately steep slopes are the dominant limitations to the use of this soil for crops. Slope and limited depth to bedrock are limitations for many nonfarm uses. (Capability unit VIe–1; woodland group 3r1)

Hickory-Fairmount complex, 18 to 25 percent slopes, moderately eroded (HtE2).—The soils in this mapping unit occur on side slopes of tributaries of the Little Miami River. These streams are narrow and deeply entrenched, for they have cut through the Illinoian till into the underlying shale and limestone bedrock. The Fairmount soil of this complex is darker colored and more clayey in the subsoil than the Hickory soil. Most areas are about 70 percent Hickory soil and 30 percent Fairmount soil.

These soils typically occur in small or narrow areas where the soils are so intermingled that they cannot be shown separately on a map of the scale used. Most areas have a silt loam or a silty clay loam surface layer.

Included with these soils in mapping are small areas of Cincinnati and Hennepin soils and areas where limestone and shale crop out. Small severely eroded areas are indicated on the soil map by a symbol.

Steep slopes are the major limitation to the use of this soil for farm or nonfarm purposes. (Capability unit VIe-1; woodland group 4d1)

Hickory-Fairmount complex, 25 to 50 percent slopes, moderately eroded (HfF2).—The soils in this mapping unit are on the side slopes along the Little Miami River, from a short distance above Oregonia to the county line at Loveland. They also are along some of the larger tributaries. Areas are up to 400 to 500 acres in size. These soils are densely wooded in most places.

This mapping unit is variable, mainly because of the nature and thickness of the till deposits; the aspect, steepness, and length of the slope; and past management. Most areas are about 70 percent Hickory soils and about 30 percent Fairmount soils. The proportion and distribution of these soils vary from one area to another. Hickory soils normally are dominant on the upper part of the slopes, and Fairmount soils on the lower part. Surface runoff is very rapid.

Included in mapping are large areas of a soil that is thinner than the Hickory soil and formed in material weathered entirely from till or partly from till and partly from bedrock. These included areas make up as much as 75 percent of some areas. The shallowness does not appear to be entirely the effect of erosion, because some areas less than 20 inches thick have a complete profile. In other included areas are small areas of Cincinnati and Hennepin soils. A few small inclusions of Rodman or Casco soils also occur.

The very steep slopes are a main limitation to the use of this mapping unit for farm or nonfarm purposes. (Capability unit VIIe-1; woodland group 4d1)

Iva Series

The Iva series consists of deep, loamy soils that are somewhat poorly drained. These soils formed partly in a thick mantle of loess and partly in glacial till of Illinoian age. They occupy a small area near the confluence of Caesars Creek and the Little Miami River in Wayne Township.

A typical Iva soil in a cultivated area has a dark grayish-brown silt loam surface layer about 8 inches thick. A mottled grayish-brown silt loam subsurface layer extends to a depth of 18 inches. The subsoil is mostly brown and yellowish-brown silty clay loam to a depth of 58 inches. Below this, and extending to a depth of 96 inches, the subsoil is yellowish-brown silty clay loam and brown silty clay. The lower part of the subsoil formed in glacial till. Glacial till that is only slightly weathered is below a depth of 96 inches.

Iva soils have moderately slow permeability and a seasonally high water table. They dry out slowly in spring unless they are drained. Their root zone is medium acid in most places that have not been limed.

Iva soils are used mostly for farming. The principal crops are corn, soybeans, wheat, and meadow mixtures of legumes and grasses.

Representative profile of Iva silt loam (3 miles southeast of Waynesville, 3/8 mile southeast of intersection of Middletown and Ellis Lincoln Roads, and 50 feet northeast of Ellis Lincoln Road, Wayne Township):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and fine, granular structure; friable; many roots; neutral; clear, smooth boundary.

A2g—8 to 18 inches, grayish-brown (10YR 5/2) silt loam that has common, medium, distinct, dark-gray (10YR 4/1) mottles between depths of 14 and 18 inches; weak, thin, platy structure; friable; common roots; neutral; clear, wavy boundary.

B1tg—18 to 24 inches, brown (10YR 5/3) silty clay loam that has many grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; thin, patchy, grayish-brown (10YR 5/2) clay films; medium acid; clear, wavy boundary.

B21tg—24 to 41 inches, brown (10YR 5/3) silty clay loam that has common, medium, faint, pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; firm; continuous grayish-brown (10YR 5/2) and light brownish-gray (10YR 6/2) clay films on vertical and horizontal faces of peds; numerous dark-brown concretions; strongly acid; gradual, wavy boundary.

B22t—41 to 58 inches, yellowish-brown (10YR 5/4) silty clay loam that has few, fine, faint, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; firm; continuous brown (10YR 5/3) clay films; numerous shotlike concretions; medium acid; clear, smooth boundary.

IIB23t—58 to 66 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, coarse, subangular blocky structure; firm; thin pale-brown (10YR 6/3) clay films; numerous shotlike concretions; slightly acid; clear, wavy boundary.

IIB3—66 to 96 inches, brown (10YR 4/3) silty clay; strong, fine, angular blocky structure; firm; numerous dark-brown (10YR 3/3) concretions; coarse skeleton makes up 1 percent of horizon; neutral; gradual, wavy boundary.

IIC—96 to 120 inches, yellowish-brown (10YR 5/4) clay loam; structureless (massive); firm; mildly alkaline; calcareous.

The Iva soils in this county have a thicker solum than Iva soils elsewhere. The loess ranges from 48 to 72 inches in thickness. The B2t horizons that formed in the loess mantle are silty clay loam. The IIB2t horizon is dominantly silty clay loam. The B2t horizons range from very strongly acid to medium acid. The IIB2t horizon is medium acid to slightly acid in the upper part and gradually grades to neutral in the lower part. The IIC horizon is dominantly clay loam, but it is silt loam or loam in some places. It is neutral to mildly alkaline and is commonly calcareous.

Iva soils are the somewhat poorly drained members of a drainage sequence that includes well-drained Alford soils. Iva soils have a thicker silty mantle than Avonburg soils and are weathered to a greater depth than Reesville soils.

Iva silt loam, till substratum, 0 to 2 percent slopes (IvA).—This soil occurs in one irregularly shaped area. It is susceptible to surface crusting.

Included near the northeastern edge of this soil are areas of Reesville soils in depressions and along drainageways that originate in areas of this soil. Also included are areas of the wetter, dark-colored Patton soils along the western edge of this soil. Other inclusions are small areas of better drained Alford and Rossmoyne soils.

Seasonal wetness and moderately slow permeability are the main limitations to use of this soil for farming or nonfarm purposes. (Capability unit IIw-4; woodland group 1o1)

Kendallville Series

The Kendallville series consists of light-colored, gently sloping and sloping soils that occur on uplands and are well drained. These soils are mostly moderately deep to compact calcareous glacial till of Wisconsin age. They formed partly in a loamy mantle of outwash material and partly in the underlying glacial till.

A typical Kendallville soil in a cultivated area has a dark-brown loam plow layer about 7 inches thick. The subsurface layer is dark yellowish-brown loam that extends to a depth of 11 inches. The subsoil layers are clay loam and sandy clay loam that extend to a depth of about 40 inches. These layers are dark brown to a depth of 25 inches. The subsoil grades from medium acid in the upper part to neutral in the lower part. The lower part of the subsoil formed in the upper part of the underlying till material. The lower part of the subsoil contains some glacial pebbles and limestone fragments. Below a depth of 40 inches, there is massive loam glacial till that is calcareous.

Permeability in the Kendallville soils is moderate above the till and moderately slow in it. The compact underlying till generally restricts root development to a moderately deep zone. Within this zone the available moisture holding capacity is medium.

The Kendallville soils are used mostly as cropland in this county. Corn, soybeans, and wheat are the principal cultivated crops.

Representative profile of a Kendallville loam (150 feet south of Middletown Road and about 1.1 miles southwest of Harveysburg):

Ap—0 to 7 inches, dark-brown (10YR 4/3) loam; weak, medium, granular structure; friable; many roots; medium acid; abrupt, smooth boundary.

A2—7 to 11 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, platy structure that parts easily to medium and fine, granular; friable; many roots; medium acid; clear, wavy boundary.

B1t—11 to 17 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; friable; many roots; thin patchy clay films on ped faces; medium acid; clear, wavy boundary.

B21t—17 to 25 inches, dark-brown (7.5YR 4/4) sandy clay loam; moderate, coarse, subangular blocky structure; firm; common roots; many very dark yellowish-brown (10YR 3/4) and very dark grayish-brown (10YR 3/2) iron concretions or stains; sand grains bridged with clay; medium acid; clear, irregular boundary.

IIB22t—25 to 32 inches, dark-brown (10YR 4/3) clay loam; weak, coarse, subangular blocky structure; firm; few roots; thin patchy clay films on ped faces; slightly acid; gradual, wavy boundary.

IIB3—32 to 40 inches, dark yellowish-brown (10YR 4/4) clay loam; structureless (massive); neutral; diffuse, irregular boundary.

IIC—40 to 60 inches, yellowish-brown (10YR 5/4) loam; structureless (massive); firm; mildly alkaline; weakly calcareous till.

The A horizons are loam in most places, but silt loam and clay loam A horizons do occur. The clay loam A horizons are mostly in eroded areas. The outwash above the till ranges from 24 to 42 inches in thickness, and the thickness of the outwash varies within short horizontal distances. Difference in texture and color between the weathered outwash and the weathered till are abrupt, but the boundary between the outwash and till may be abrupt or clear and wavy or irregular. The B horizons in the outwash material generally have a hue of 7.5YR or 5YR, a value of 4 or 5, and a chroma of 3 or 4. These horizons are clay loam, sandy or gravelly clay loam, or clay. Evidence of stratification is common in the weathered outwash. The B horizons in the weathered till normally have a hue of 10YR, a value of 4 or 5, and a chroma of 3 or 4. These horizons are dominantly loam, but they are clay loam or silt loam in some places. The A2 horizon and upper Bt horizons are normally medium acid, but they range from strongly acid to slightly acid. The slightly acid reaction occurs mostly in the thinner profiles. The IIB2t horizon generally is slightly acid, though in some places it is medium acid where its upper part is in contact with the outwash material.

Kendallville soils are commonly adjacent to Miamian and Fox soils. Horizons in the uppermost 24 to 42 inches of Kendallville soils formed in outwash material, but corresponding horizons in Miamian soils did not. Within a depth of 42 inches, Kendallville soils have a glacial till substratum rather than one, as in Fox soils, of gravel and sand.

Kendallville loam, 2 to 6 percent slopes (KeB).—This soil has the profile described as typical for the series. This soil occurs in small, irregular areas of kames in Union and Turtle Creek Townships. It also occurs at the edges of terraces on valley trains where outwash overlies Wisconsin-age till. Within short distances, the outwash varies in thickness over the till. Tilth is generally good, and the soil dries out quickly in spring.

Included with this soil in mapping are many areas of moderately eroded Kendallville soils. Also included are common areas of Fox and Miamian soils.

A moderate erosion hazard is the dominant limitation to use of this soil for cultivated crops. Moderately slow permeability in the underlying material is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Kendallville loam, 6 to 12 percent slopes, moderately eroded (KeC2).—This soil occurs mostly along the outer edges of the terraces on valley trains. It lies near the edge of the valleys where the outwash sand and gravel is shallow over till. It also occurs in a kame area in Union and Turtle Creek Townships. This soil has a profile similar to that described as typical for the series except that the plow layer is thinner. The plow layer is a mixture of the surface layer and material from the subsoil. Included with this soil in mapping are common areas of Fox, Casco, and Miamian soils.

A severe erosion hazard because of the rapid surface runoff is the major limitation to use of this soil for cultivated crops. Slope and moderately slow permeability are limitations for some nonfarm uses. (Capability unit IIIe–1; woodland group 2o1)

Kings Series, Thick Surface Variant

The Kings series, thick surface variant, consists of dark-colored, very poorly drained soils that are clayey below the surface layer. These soils formed in fine-textured sediments that were deposited in a preglacial valley. They are depressional or nearly level.

A typical profile has a very dark gray silty clay loam surface layer about 20 inches thick. The subsoil is black and dark-gray silty clay that extends to a depth of about 42 inches. The underlying material is sticky, gray silty clay.

These soils have slow or very slow permeability and a seasonally high water table. They commonly are swampy in winter and spring and require drainage before they can be cultivated. These soils are neutral throughout and have a high available moisture capacity.

Soils of this variant are generally too wet for farming, but drained areas are suited to cultivated crops.

Representative profile of Kings silty clay loam, thick surface variant (NE¼ section 34, T. 4 N., R. 3 E., western part of Turtle Creek Township):

A1—0 to 20 inches, very dark gray (10YR 3/1) silty clay loam; strong, fine and medium, granular structure; friable; many roots; neutral; gradual, irregular boundary.

B21g—20 to 30 inches, black (10YR 2/1) silty clay; strong, medium and coarse, angular blocky structure; sticky; many roots; neutral; gradual, irregular boundary.

B22g—30 to 42 inches, dark-gray (N 4/0) silty clay that has common, fine and medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, coarse, angular blocky structure; sticky; few roots; neutral; diffuse, irregular boundary.

C—42 to 60 inches, gray (10YR 6/1) silty clay that has many, medium, faint mottles of brown (10YR 5/3), dark gray (N 4/0), and light brownish gray (2.5Y 6/2); massive; sticky; neutral.

The A horizon is dominantly very dark gray (10YR 3/1), but it ranges to black (N 2/0). The dark-colored upper horizons range from 24 to 40 inches in thickness. The B horizon is silty clay or clay. The C horizon is neutral in most places, but it is mildly alkaline to moderately alkaline and is calcareous in some places. The C horizon normally has a hue of 10YR, but hue is 2.5Y or 7.5YR in some places. Hue is 7.5YR where soils of this variant contain small accumulations of bog iron. Below the C horizon the material varies and includes stratified alluvial or lacustrine deposits that range from loam to clay.

Kings soils, thick surface variant, are commonly adjacent to very poorly drained Patton soils, but they are more clayey below the surface layer than Patton soils.

In this county the surface layer of Kings soils is thicker than normal for the Kings series. For this reason, the series in this county is correlated as a thick surface variant.

Kings silty clay loam, thick surface variant (Kg).—This nearly level to level soil occurs in only a few small areas near the headwaters of Little Muddy Creek in an area locally called Shakers Swamp. Commonly included with this soil in mapping are small areas of Muck.

Because the hazard of wetness is severe, this soil must be drained before it can be farmed or used for anything other than swampy grassland. (Capability unit IIIw-1; woodland group 3w1)

Lanier Series

The Lanier series consists of well-drained, dark-colored, nearly level soils on flood plains. These soils are sandy and gravelly and occur next to streams that have fairly steep gradients. They also occupy alluvial deltas near the base of steep upland slopes.

A typical profile has a very dark grayish-brown sandy loam surface layer that is about 10 inches thick and is 10 to 20 percent coarse fragments. Below this layer, there is very gravelly sandy loam that extends to a depth of 24 inches and has numerous flagstones and cobblestones. Next are strata of gravel and sand.

These soils have rapid permeability and a low to very low available moisture capacity. Their root zone is calcareous and shallow to moderately deep. The soils are subject to periodic flooding.

Some areas of these soils are cultivated, and some are used for pasture or as woodland.

Representative profile of Lanier sandy loam (about ¼ mile west of Blackhawk, 125 yards northwest of State Route 132 along Lick Run, Harlan Township):

A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; friable; many roots; moderately alkaline; calcareous; gradual, wavy boundary.

A12—3 to 10 inches, very dark grayish-brown (10YR 3/2) sandy loam; structureless (single grain); loose; many roots; 10 to 20 percent coarse skeleton; weak stratification; moderately alkaline; calcareous; gradual, irregular boundary.

IIC1—10 to 24 inches, dark grayish-brown, (10YR 4/2) very gravelly sandy loam; structureless (single grain); loose; coarse skeleton about 50 percent of horizon at depth of 10 inches and increases to about 75 percent at depth of 24 inches; coarse skeleton consists of flagstones and cobbles up to 12 inches in diameter; long axis of flagstones parallel to the surface; interstices filled with loose sandy loam alluvium; common roots; moderately alkaline; calcareous; diffuse, irregular boundary.

IIC2—24 to 50 inches, calcareous sand, gravel, and flagstones.

The A horizon ranges from dark grayish brown (10YR 4/2) in cultivated fields to very dark grayish brown (10YR 3/2) or very dark gray (10YR 3/1) in wooded areas, where an A1 horizon has formed. The A horizon is dominantly sandy loam but ranges from loam to loamy sand. It is up to 25 percent coarse material that ranges from gravel to flagstones 12 inches long. The sandy loam A horizon ranges from 4 inches to 20 inches in thickness. The C horizon varies within short distances. It ranges from dominantly gravel to dominantly flaggy material and is stratified in most places. In thickness over bedrock, the C horizon ranges from several feet to as little as 6 inches. The entire solum generally is calcareous.

Lanier soils are typically near or adjacent to Genesee soils. They are coarser textured, thinner to the coarse textured substratum, and darker colored than Genesee soils.

Lanier sandy loam (Lg).—This nearly level soil occurs in areas generally less than 25 acres in size. It is on flood plains or at the edge of flood plains. It is generally adjacent to Genesee soils and most commonly is closer to the streams than those soils. It is commonly on the slope of a stream meander, or in areas where the stream channel has changed and the former stream channel has not been completely filled with alluvium. This soil also occurs along the sides of the flood plain where a smaller stream that has a steep gradient empties into a larger valley, such as that of the Little Miami River. In these places this soil occurs as a delta deposit at the confluence of the two streams and along the sides of the smaller stream.

This soil is subject to flooding, and it is droughty at times. (Capability unit IIw-2; woodland group 2o1)

Miamian Series

The Miamian series consists of well-drained soils that are moderately deep to calcareous till. These soils formed partly in silty material deposited by wind and partly in the underlying calcareous loam till of Wisconsin age. They are gently sloping to steep and occur in the northern part of the county.

A typical Miamian soil in a cultivated area has a brown silt loam plow layer 5 inches thick. The next layer is pale-brown silt loam 3 inches thick. The subsoil extends to a depth of 24 inches and is dark yellowish-brown and yellowish-brown, firm silty clay loam and clay loam. The underlying material is compact, calcareous loam glacial till.

The Miamian soils in this county have a silt mantle that ranges from 2 to 18 inches in thickness. Because of the compact glacial till, the root zone of most annual crops is only moderately deep in many places. Also because of this till, the Miamian soils have moderately slow permeability. The available moisture capacity in the root zone is mostly medium except in severely eroded areas, where it is low. Unless these soils have been limed, the upper part of the root zone is mostly strongly acid.

Miamian soils are important to farming in the county. Cultivated areas are used mostly for corn, wheat, and soybeans. The largest acreage of Miamian soils is mapped in complexes with Russell soils.

Representative profile of a Miamian silt loam in a cultivated area of Russell-Miamian silt loams, 2 to 6 percent slopes, moderately eroded (about 2 miles east and ½ mile south of the intersection of State Route 73 and U.S. Highway No. 42, Massie Township):

Ap—0 to 5 inches, brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; many roots; neutral; clear, smooth boundary.

A2—5 to 8 inches, pale-brown (10YR 6/3) silt loam; weak, fine, subangular blocky structure; friable; many roots; neutral; abrupt, wavy boundary.

B1t—8 to 12 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; friable; common roots; thin patchy clay films on ped faces; slightly acid; clear, wavy boundary.

IIB2t—12 to 24 inches, dark yellowish-brown (10YR 4/3) heavy clay loam; strong, medium, subangular blocky structure; firm; common roots; thin continuous clay films on ped faces; few glacial pebbles; slightly acid in upper part and neutral in lower part; gradual, irregular boundary.

IIC—24 to 60 inches, light yellowish-brown (10YR 6/4) loam; structureless (massive); firm; mildly alkaline to moderately alkaline; calcareous.

The Ap horizon generally is brown (10YR 4/3), but it ranges to grayish brown (10YR 5/2). The A horizons are silt loam except in eroded areas, where they are silty clay loam, clay loam, or clay. The silt mantle ranges from 2 to 18 inches in thickness and varies in thickness within short horizontal distances. The Bt horizon ranges from silty clay loam where it formed in loess to heavy clay loam or clay where it formed in weathered till. The lower part of the solum contains numerous small igneous pebbles and some limestone fragments. The depth to the C horizon ranges from 20 to about 42 inches, but it is 20 to 30 inches in most places. The C horizon is dominantly loam, but it ranges from silt loam to light clay loam in some places. Reaction ranges from slightly acid to strongly acid in the B1t horizon and grades to neutral in the lower part of the IIB2t. The C horizon is calcareous in all areas.

The Miamian soils commonly are adjacent to the well-drained Russell soils. Both kinds of these soils generally occur on the highest part of the landscape. The Miamian soils occur where the loess extends to a depth of less than 18 inches, but the Russell soils occur where the loess extends to a depth of 18 to 30 inches. The Miamian soils are in a drainage sequence that includes the lower lying, very poorly drained Brookston soils. Miamian soils are lighter colored and have a less gray subsoil than Brookston soils.

Miamian clay loam, 2 to 6 percent slopes, severely eroded (MmB3).—This soil commonly occupies knobs and side slopes that have been cultivated up and down hill. Because of this cultivation, and because surface runoff is rapid, severe erosion has occurred.

A profile of this soil is similar to that described as typical for the series except that the present plow layer consists mostly of moderately fine textured material. Much of this soil has its former subsoil exposed at the surface. In a few areas the calcareous till is at or very near the surface. Gullies are common in some areas. Included with this soil in mapping are a few slightly eroded and a few moderately eroded areas.

The plow layer commonly is very low in organic-matter content and has poor tilth. The calcareous till near or at the surface is detrimental to seedlings. When bare of a plant cover, the soil surface is subject to crusting. This crusting slows the infiltration of water. Both crusting and a poor moisture content hinders the emergence of seedlings and good growth of plants. The available moisture capacity is low.

The erosion hazard is severe where this soil is used for crops. The moderately slow permeability is a limitation for some nonfarm uses. (Capability unit IIIe–1; woodland group 2o1)

Miamian clay loam, 6 to 12 percent slopes, severely eroded (MmC3).—This soil commonly occupies knobs and side slopes that have been cultivated up and down hill. Because of this cultivation, and because surface runoff is very rapid, severe erosion has occurred.

A profile of this soil is similar to that described as typical for the series except that the present plow layer consists mostly of moderately fine textured material. It is mostly subsoil material. Depth to limy till is shallow in most places, and in some places the till is exposed at the surface. Gullies are common in some areas. Included with this soil in mapping are a few slightly eroded and a few moderately eroded areas.

The plow layer of this soil is commonly very low in organic-matter content and has poor tilth. Where bare of a plant cover, the surface tends to crust. This crusting slows the infiltration of water. Both crusting and a poor moisture content hinder the emergence of seedlings and good growth of plants. The available moisture capacity is low. The erosion hazard is very severe where this soil is used for crops. Severe erosion and moderately slow permeability are limitations for some nonfarm uses. (Capability unit IVe–1; woodland group 2o1)

Miamian-Hennepin silt loams, 12 to 18 percent slopes, moderately eroded (MnD2).—In this mapping unit, areas of Miamian and Hennepin soils are so intermingled that they cannot be shown on the soil map at the scale used. The Miamian soil occupies 50 to 75 percent of each area mapped, and the remaining acreage is mostly Hennepin soil. This mapping unit occurs on the side slopes of principal valleys in areas that have circular and complex shapes. These areas are 5 to 25 acres in size.

The profile of each of these soils is similar to that described as typical for its series except that, because of erosion and subsequent tillage, the plow layer is a mixture of the remaining surface layer and the upper part of the subsoil. The Hennepin soil is much shallower to calcareous till than the Miamian soil. Small areas that are more gravelly than typical are indicated on the soil map by a symbol.

Because surface runoff is very rapid, the erosion hazard is very severe where these soils are used for crops. (Capability unit IVe–1; woodland group 2r1)

Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded (MrC2).—This mapping unit consists of Miamian and Russell soils that are so intermingled that they could not be shown on the soil map at the scale used. The Miamian soil occupies 50 to 75 percent of each area mapped, and the remaining acreage is mostly Russell soil. The Miamian soil is mostly on the upper convex slopes, and the Russell soil is on the lower concave slopes. The silty mantle is thicker on the lower slopes than on the upper ones.

This mapping unit is on the Wisconsin-age till plain in areas that are roughly circular in shape. Most areas are 5 to 25 acres in size. Slopes are 300 to 400 feet long in places.

The profile of each of these soils is similar to that described as typical for its series except that, because of erosion and subsequent tillage, the plow layer of these soils is a mixture of the remaining surface layer and the upper part of the subsoil. The Russell soil has a thicker silty mantle than the Miamian soil.

The erosion hazard on these soils is very severe in cultivated areas. Slope is the dominant limitation for nonfarm uses. (Capability unit IIIe–1; woodland group 2o1)

Muck

Muck (Mu) consists of black, soft muck that extends from the surface to a depth of 40 to 60 inches. It is commonly underlain by marl, but in some places the underlying material consists of silty and clayey material of lacustrine or alluvial origin. Muck formed in continuously saturated areas where there was an accumulation of partly decomposed plant material mixed with a small amount of mineral soil. It is level and occurs in low-lying bogs and swamps, mostly adjacent to or on flood plains.

When saturated, Muck is smooth, friable, and soft. It is loose and powderlike when dry. If not drained, Muck has a continuously high water table. The available moisture capacity is very high. Permeability is moderate in the organic material and is very slow in the underlying material.

Muck commonly is adjacent to the Shoals, Sloan, and other soils on the flood plains. It consists of organic material, whereas the Shoals and Sloan soils consist of mineral material.

Most areas of Muck are adjacent to Spring Valley Lake in the northern part of Wayne Township. A few small areas occur along the flood plain of Clear Creek in Franklin Township. These small areas commonly are in crescent-shaped sloughs of abandoned stream channels. Most of the larger areas are covered by sedges and water-tolerant trees and shrubs. A few smaller areas are suited to pasture, along with the adjacent soils. The largest single area of this land type is in the Spring Valley Wildlife Area.

Use of this land type is limited by the high water table and susceptibility of flooding. Muck is well suited to crops if it is drained and intensively managed, but drainage outlets are generally difficult to obtain. In drained areas Muck is likely to subside. (Capability unit and woodland group not assigned)

Ockley Series

The Ockley series consists of well-drained, deep soils that formed in medium-textured material over calcareous, stratified, sandy and gravelly material. These soils are nearly level or gently sloping and occur on glacial outwash terraces of Wisconsin age. These terraces are along the Little Miami River and some of its larger tributaries.

The plow layer of a typical Ockley soil in a cultivated area is dark-brown silt loam about 8 inches thick. The next layer is darker yellowish-brown silt loam about 5 inches thick. The subsoil extends to a depth of 54 inches and is mostly dark-brown silty clay loam and clay loam. The underlying material is stratified sand and gravel and is calcareous.

Ockley soils are moderately permeable above the underlying material and rapidly permeable in it. The root zone is deep for most field crops, though root development is severely limited in the calcareous sand and gravel. These soils have a high available moisture capacity and are medium acid in the root zone.

Ockley soils are well suited to crops and are important to farming. Most areas are used as cropland. Corn, wheat, soybeans, and hay are commonly grown. Pollution to underground water supplies is a risk if Ockley soils are used for the disposal of sewage effluent or of solid waste.

Representative profile of an Ockley silt loam that is cultivated (3¼ miles northeast of Waynesville and 500 feet northwest of the intersection of U.S. Highway No. 42 and Cook-Jones Road, Wayne Township):

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

A2—8 to 13 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; slightly acid; clear, smooth boundary.

B1t—13 to 20 inches, dark-brown (7.5YR 4/4) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; common roots; thin patchy clay films on ped faces; slightly acid; gradual, wavy boundary.

B21t—20 to 36 inches, dark-brown (7.5YR 4/4) silty clay loam; strong, medium, subangular blocky structure; firm; common roots; thin continuous clay films on ped faces; medium acid; clear, smooth boundary.

IIB22t—36 to 45 inches, dark-brown (7.5YR 4/4) clay loam; weak, coarse, subangular blocky structure; firm; few roots; thin patchy clay films on ped faces; medium acid; gradual, irregular boundary.

IIB3t—45 to 54 inches, dark-brown (10YR 4/3) to dark yellowish-brown (10YR 4/4) sandy clay loam; weak, coarse, subangular blocky structure; friable; thin patchy clay films; neutral; diffuse, broken boundary.

IIIC—54 to 60 inches, yellowish-brown (10YR 5/4) sand and gravel; structureless (single grain); loose; stratified; mildly alkaline; calcareous.

The Ap horizon is dominantly silt loam, but it is loam in some places. Where the Ap horizon is loam, the Bt horizons are clay loam or sandy clay loam. The B horizons are slightly acid to medium acid in the upper part and range from medium acid to neutral in the lower part. They have a hue of 7.5YR or 10YR. The depth to calcareous sand and gravel ranges from 42 to 66 inches. The C horizon is stratified, and its texture varies from one stratum to another. Texture ranges from loam to sand or gravel, but most strata are a mixture of sand and gravel.

Ockley soils are commonly adjacent to or near Fox, Casco, and Warsaw soils and are deeper to the underlying sand and gravel than are those soils. Ockley soils are light colored in contrast to the moderately deep, dark-colored Warsaw soils. The upper part of the subsoil in Ockley soils is less acid than that in the Williamsburg soils.

Ockley silt loam, 0 to 2 percent slopes (OcA).—Most areas of this soil are on broad terraces. These areas are commonly rounded in shape and are 3 to 10 acres in size. Surface runoff is negligible, and there is little or no hazard of erosion. A profile of this soil is described as typical for the series. Included with this soil in mapping are a few moderately well drained areas.

This Ockley soil is well suited to row crops and specialty crops. It also is well suited to irrigation. Limitations are very few to its use for farming or for many nonfarm purposes. (Capability unit I–1; woodland group 1o1)

Ockley silt loam, 2 to 6 percent slopes (OcB).—This soil occupies broad areas on terraces. Most areas are 3 to 10 acres in size. Included with this soil in mapping are a few moderately well drained areas.

Partly because surface runoff is medium, the erosion hazard is moderate in cultivated areas. This soil is well suited to row crops and specialty crops. It also is well suited to irrigation if erosion is controlled. Slope is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 1o1)

Ockley silt loam, 2 to 6 percent slopes, moderately eroded (OcB2).—Most areas of this soil are in broad areas on terraces. These areas commonly are rounded in shape and are 3 to 10 acres in size. The plow layer is a mixture of some silty surface material and some dark-brown material from the upper part of the subsoil. The surface layer is more sticky than that of an uneroded Ockley soil. Because of past erosion, tillage of the plow layer is moderately difficult. Included with this soil in mapping are a few areas of moderately well drained soils.

This soil is suitable for irrigation if erosion is controlled. If cultivated, it has a moderate erosion hazard. Slope is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 1o1)

Parke Series

The Parke series consists of deep, well-drained soils that formed partly in loess and partly in underlying water-worked material of Illinoian age. The underlying material is acidic and highly weathered. It consists of roughly stratified and mixed silt and sand and includes various amounts of clayey and gravelly material. Parke soils occur in the southern part of the county on terrace remnants and are commonly adjacent to and slightly lower than soils formed in glacial till of Illinoian age. They are generally 100 to 150 feet above streams.

A typical Parke soil in a wooded area has a dark-brown silt loam surface layer about 4 inches thick. The next layer is light yellowish-brown silt loam 10 inches thick. It is underlain by a transitional layer of yellowish-brown silty clay loam that extends to a depth of 20 inches. The subsoil extends to a depth of about 76 inches and is brown or strong-brown silty clay loam and loam. The underlying material is at a depth of 76 inches and consists of sandy loam and sandy clay loam. It contains various amounts of coarse fragments.

The Parke soils are moderately permeable. The underlying material has moderately rapid to rapid permeability. These soils have a deep, extremely acid root zone and a medium to high available moisture capacity.

The gently sloping Parke soils are used for crops, and the steeper soils are used mostly for pasture or trees.

Representative profile of a Parke silt loam in a wooded area (1.5 miles south of Middleboro along Edwardsville Road, 0.4 mile southwest of junction of Kunker Road and Edwardsville Road, and 0.3 mile northeast of junction of Osceola Road and Edwardsville Road, Harlan Township) :

A1—0 to 4 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable; many roots; neutral; clear, smooth boundary.

A2—4 to 14 inches, light yellowish-brown (10YR 6/4) silt loam; weak, thin, platy structure that easily parts to weak, fine, granular structure; friable; many roots; extremely acid; gradual, irregular boundary.

B&A—14 to 20 inches, yellowish-brown (10YR 5/4) silty clay loam that has tongues of light yellowish-brown (10YR 6/4) material from the A2 horizon; moderate, fine, subangular blocky structure; friable; common roots; some peds are surrounded by material from the A2 horizon; extremely acid; clear, wavy boundary.

B21t—20 to 32 inches, strong-brown (7.5YR 5/8) silty clay loam; strong, medium and fine, subangular blocky structure; firm; common roots; strong-brown (7.5YR 5/6) continuous clay films; numerous pebbles up to three-quarter inch in diameter; extremely acid; clear, irregular boundary.

IIB22t—32 to 42 inches, strong-brown (7.5YR 5/8) clay loam; strong, medium and fine, subangular blocky structure; firm; common roots; strong-brown (7.5YR 5/6) continuous clay films on ped faces; numerous very dark grayish-brown (10YR 3/2) concretions and coatings on ped faces; extremely acid; clear, wavy boundary.

IIB23t—42 to 60 inches, brown (7.5YR 5/4) clay loam; strong, medium and fine, subangular blocky structure; firm; numerous dark-brown concretions and coatings on ped faces; very strongly acid; gradual, wavy boundary.

IIB3—60 to 76 inches, strong-brown (7.5YR 5/6) clay loam; moderate, medium, platy structure; friable; very strongly acid; clear, wavy boundary.

IIIC1—76 to 88 inches, strong-brown (7.5YR 5/6) sandy loam; weak, medium, platy structure; friable; very strongly acid; clear, wavy boundary.

IVC2—88 to 108 inches, yellowish-brown (10YR 5/6) sandy clay loam; structureless (massive); friable; iron-manganese stains and concretions present; very strongly acid; clear, irregular boundary.

The loess mantle ranges from 20 to 40 inches in thickness. The upper part of the B horizon formed in loess and is silty clay loam. The IIB horizon generally is clay loam, but it is sandy clay loam in some places. The B horizon has hues of 10YR and 7.5YR. The C horizon is stratified. Strata generally are clay loam, sandy clay loam, and sandy loam, but gravelly strata also occur. The solum ranges from 5 to 10 feet or more in thickness. It is extremely acid to strongly acid to a depth of about 90 inches or more. Below a depth of 90 inches the C horizon is very strongly acid to slightly acid.

The well drained Parke soils are in a drainage sequence with and are commonly adjacent to the moderately well drained Rainsboro soils. The Parke soils do not have gray mottles or other indications of wetness in the subsoil, but the Rainsboro soils do. The lower part of the subsoil of the Parke soils formed in mixed outwash material, whereas corresponding layers in the Cincinnati soils formed in till material. The subsoil of Parke soils is more deeply developed and more acid than that of the Williamsburg soils.

Parke silt loam, 2 to 6 percent slopes (PaB).—This soil occupies small irregularly shaped areas on terraces that are mostly along Todd Fork Creek. A profile of this soil is described as typical for the series.

Included with the soil in mapping are areas that are moderately eroded. Also included are a few areas of soils that are coarser textured in the surface layer and subsoil than this soil and less deep to sandy or gravelly material.

If this soil is used for row crops, the erosion hazard is moderate. Slope is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Parke silt loam, 6 to 18 percent slopes, moderately eroded (PaD2).—Most areas of this soil occupy side slopes of terrace remnants. The areas have winding and rounded shapes and range from 3 to 25 acres in size.

A profile of this soil is similar to the one described as typical for the series except that erosion has thinned the surface layer. The plow layer is a mixture of the remaining surface layer and the brownish upper part of the subsoil. This soil has a lower organic-matter content and poorer tilth than uneroded Parke soil.

Included with this soil in mapping are a few areas that are severely eroded. Also included are areas that have gullies too deep to be crossed by most tillage equipment. These deeply gullied areas are shown on the map by a symbol.

If this soil is used for row crops, the erosion hazard is severe. Slope is a limitation for most nonfarm uses. (Capability unit IIIe–1; woodland group 2o1)

Patton Series

Soils in the Patton series are dark colored and very poorly drained. They are nearly level to depressional and occupy areas that formerly were glacial lakes. The Patton soils formed in silty material that settled in these glacial lakes.

A typical Patton soil has a black light silty clay loam and silt loam surface layer about 8 inches thick. To a depth of 33 inches, the subsoil is mostly very dark gray silty clay loam that is plastic and sticky when wet. Light olive-gray and light-gray silty clay loam extends to a depth of 64 inches. Mottles begin in the lower part of the subsoil and extend into the underlying material to a depth of 84 inches. Strata of loam, sandy loam, and silt loam occur below a depth of 64 inches.

Patton soils have a high organic-matter content and moderately slow permeability. The water table is seasonally high for long periods unless these soils are drained. In drained areas, the root zone is deep enough for crops such as corn and alfalfa. The available moisture capacity is high. These soils are neutral to a depth of 3 to 4 feet.

Drained areas of Patton soils are used for the field crops commonly grown in the county. Undrained areas are used mostly for pasture or as woodland.

Representative profile of Patton silty clay loam (about 1¾ miles north of Wilmington Road on Clarksville Road, Massie Township):

A11—0 to 4 inches, black (10YR 2/1) light silty clay loam, dark gray (10YR 4/1) when dry; moderate, fine, granular structure; friable when moist, slightly sticky and slightly plastic when wet; many roots; neutral; gradual, smooth boundary.

A12—4 to 8 inches, black (10YR 2/1) heavy silt loam; moderate, coarse, granular structure and moderate, fine, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; many roots; neutral; clear, smooth boundary.

B1g—8 to 13 inches, black (10YR 2/1) silty clay loam; moderate, medium and coarse, angular and subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; many roots; neutral; gradual, wavy boundary.

B21tg—13 to 18 inches, very dark gray (2.5Y 3/1) silty clay loam; weak, coarse, prismatic structure that parts to strong, fine to coarse, angular blocky; firm when moist, plastic and slightly sticky when wet; common roots; thin patchy clay films on ped faces; neutral; diffuse, lower boundary.

B22tg—18 to 24 inches, very dark gray (2.5Y 3/1) silty clay loam; weak, coarse, prismatic structure that parts to strong, fine to coarse, angular blocky; firm when moist, plastic and slightly sticky when wet; many roots; thin clay films on ped faces; neutral; clear, smooth boundary.

B23tg—24 to 33 inches, mixed dark-gray (2.5Y 4/1) and yellowish-brown (10YR 5/6) silty clay loam; dark gray makes up about 60 percent of total color and tends to follow old root channels and wormholes through yellowish-brown material; moderate, coarse, angular and subangular blocky structure; firm when moist, plastic and slightly sticky when wet; thin patchy clay films on ped faces; neutral; common roots; clear, wavy boundary.

B3g—33 to 38 inches, light olive-gray (5Y 6/2) silty clay loam that has many, fine, distinct, yellowish-brown (10YR 5/6) mottles; yellowish-brown mottles make up about 35 percent of total color; some dark-gray material in old root channels; structureless (massive); firm when moist, sticky and plastic when wet; many roots; few, coarse, quartz sand grains; neutral; gradual, wavy boundary.

C1—38 to 45 inches, light-gray (5Y 6/1) to light olive-gray (5Y 6/2) silty clay loam that has many, medium, distinct, yellowish-brown (10YR 5/6) mottles; few dark-gray (5Y 4/1) blotches 2 to 3 inches in diameter; structureless (massive); firm when moist, sticky and plastic when wet; common roots; neutral; diffuse, wavy boundary.

C2—45 to 55 inches, strong-brown (7.5YR 5/6) to reddish-yellow (7.5YR 6/6) silty clay loam; many, fine and medium, prominent, light-gray (5Y 6/1) and light olive-gray (5Y 6/2) mottles; gray mottles make up about 30 percent of total color; structureless (massive); very firm when moist, sticky and very plastic when wet; few roots; few dark-gray (5Y 4/1) blotches 1 to 3 inches in diameter; few granitic pebbles up to one-quarter inch in diameter; neutral; gradual, smooth boundary.

C3—55 to 64 inches, light-gray (5Y 6/1) to light olive-gray (5Y 6/2) silty clay loam that has many, medium to coarse, prominent, yellowish-brown (10YR 5/6) mottles making up about 40 percent of total color; structureless (massive); very firm when moist; some gritty material; neutral; clear, smooth boundary.

IIC4—64 to 67 inches, light-gray (5Y 6/1) to light olive-gray (5Y 6/2) loam that has many, medium, distinct, yellowish-brown (10YR 5/6) mottles; structureless (massive); firm when moist, sticky and plastic when wet; neutral; clear, smooth boundary.

IIC5—67 to 70 inches, light olive-gray (5Y 6/2) sandy loam that has yellowish-brown (10YR 5/6) mottles making up about 20 percent of total color; structureless (massive); firm; neutral; clear, smooth boundary.

IIIC6—70 to 84 inches, dark-brown (7.5YR 4/4), dark yellowish-brown (10YR 4/4), and brownish-yellow (10YR 6/6) silt loam that has common, medium, distinct, light-gray (N 6/0) mottles making up about 20 percent of total color; structureless (massive); firm when moist, slightly sticky and slightly plastic when wet; material very smooth and uniform; no grit; neutral.

The A horizon is dominantly very dark gray (10YR 3/1) but ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). Depth to the C horizons is typically 42 to 60 inches, but it ranges from 36 to 72 inches in some places. The loam or sandy loam strata that are described in the IIC horizon of the representative profile may be thin or absent. If present, they are generally discontinuous. The C horizon is neutral or moderately alkaline and calcareous. The Patton glacial sediments of Wisconsin age are near or adjacent to soils formed from Illinoian-age material and in these places the Wisconsin-age sediments overlie the older Illinoian-age materials.

Patton soils are the very poorly drained members of a drainage sequence that includes the moderately well drained Uniontown soils and the somewhat poorly drained Henshaw soils. They differ from very poorly drained Brookston and Ragsdale soils in the kind of material from which they have formed. Brookston soils have formed on loamy glacial till, and Ragsdale soils have formed on thick loess.

Patton silt loam, silted (Pb).—Most of this soil occurs in a partly filled, preglacial valley in Union and Turtle Creek Townships. Small areas are near Patton silty clay loam. Unlike Patton silty clay loam, Patton silt loam, silted, has silt loam overwash. In most places this overwash ranges from 6 to 14 inches in thickness. As a result of mixing when the overwash was deposited, the surface layer of this soil generally is very dark grayish brown.

Included with this soil in mapping are areas of Patton silty clay loam and of Eel, Genesee, Shoals, Sloan, or Algiers soils that occur along streams. These included areas are subject to flooding.

Seasonal wetness is the major limitation to the use of this soil. (Capability unit IIw–3; woodland group 2w1)

Patton silty clay loam (Pc).—This wet soil is nearly level or depressional throughout the county. It has the profile described as typical for the series. The moderately fine textured sediments underlying this soil are especially thick in the west-central part of Turtle Creek Township. Surface runoff is slow to ponded. The soil is seasonally wet and slow to dry out in spring.

Included with this soil in mapping are areas of Algiers, Shoals, and Sloan soils that are subject to flooding. Also included on low rises are areas of better drained Uniontown and Henshaw soils.

Seasonal wetness is the major limitation to the use of this soil. If the soil is drained, however, it is well suited to row crops commonly grown in the county. (Capability unit IIw–3; woodland group 2w1)

Plattville Series

The Plattville series consists of dark-colored, moderately well drained to well drained soils that are moderately deep to limestone. These soils formed partly in loess and partly in till or underlying residuum from limestone, or both. They are nearly level to gently sloping and occur in the northern and central parts of this county that were glaciated in Wisconsin age.

A typical Plattville soil in pasture has a silt loam surface layer about 12 inches thick. The subsoil extends to a depth of 27 inches and consists of firm, yellowish-brown silty clay loam that is sticky and plastic when wet. The underlying material is interbedded, calcareous clay shale and limestone. The shale part of this material is sticky and plastic when wet.

These soils have a moderately deep root zone, the depth of which depends on the depth to the underlying bedrock. Permeability is moderately slow, and the available moisture capacity is medium to low. The root zone is medium acid to neutral.

About 60 percent of the acreage in Plattville soils is used for corn, soybeans, and wheat. The remaining acreage is used for pasture or as woodland.

Representative profile of Plattville silt loam in a pasture (SW¼ section 32, T. 3 N., R. 5 E., Clear Creek Township):

A1—0 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium and fine, granular structure; friable; many roots; neutral; gradual, smooth boundary.

B1t—12 to 16 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; firm; many roots; continuous dark grayish-brown (10YR 4/2) stains of organic matter on ped faces; thin patchy clay films; neutral; gradual, smooth boundary.

IIB2t—16 to 27 inches, yellowish-brown (10YR 5/4) silty clay loam; strong, medium and fine, subangular blocky structure; firm when moist, sticky when wet; common roots; continuous, olive-brown (2.5Y 4/4) and grayish-brown (10YR 5/2) clay films on ped faces; neutral; abrupt, smooth boundary.

IIIC—27 inches, light olive-brown (2.5Y 5/4) and mixed light brownish-gray (2.5Y 6/2) and olive-yellow (2.5Y 6/6), interbedded, calcareous clay shale and limestone; structureless (massive); firm; sticky when wet; no roots.

The A horizon is very dark grayish brown (10YR 3/2) or darker. The solum ranges from 20 to 40 inches in thickness. Depth to shale and limestone also ranges from 20 to 40 inches. The till, where present in the solum, is dominantly clay loam but is loam or clay in some places. The coarse fragments in the till generally have a large proportion of local shale and limestone. The loess mantle ranges from a few inches to 24 inches in thickness. The loess, thickness of the solum, and depth to the bedrock vary within short horizontal distances.

Plattville soils are adjacent to the Dana, Wynn, and Eden soils. The Plattville soils are moderately deep to underlying shale and limestone, whereas the substratum underlying the Dana soils is till. The surface layer of Plattville soils is dark colored, but that of the Wynn and Eden soils is light colored. Plattville soils are deeper to shale and limestone than the dark-colored, well-drained Fairmount soils.

Plattville silt loam, 1 to 6 percent slopes (PlB).—This soil generally has good tilth because its surface layer has a high content of organic matter. It is subject to seepage in some areas and generally is neutral in these areas. Most areas of this soil are about 3 to 25 acres in size. Included in mapping are some moderately eroded areas.

In cultivated areas, surface runoff is medium and the erosion hazard is moderate. Slope and moderately slow permeability are limitations for many nonfarm uses. (Capability unit IIe–2; woodland group 1o1)

Princeton Series

The Princeton series consists of deep, well-drained soils that formed in sandy and loamy, water- and wind-worked material. These soils are gently sloping to moderately steep, and they occupy dissected terraces of Wisconsin age. The terraces are mostly in the western part of Turtle Creek Township.

A typical Princeton soil in a cultivated area has a dark grayish-brown fine sandy loam plow layer about 8 inches thick. A subsurface layer extends to a depth of 16 inches and is dark grayish-brown sandy loam. The subsoil is dark-brown light sandy clay loam between depths of 16 inches and 32 inches. Below a depth of 32 inches, the subsoil is dark-brown sandy loam and is less acid as depth increases. The underlying material begins at a depth of 45 inches and is neutral or calcareous loamy sand.

Princeton soils provide a deep root zone for most annual crops. They have moderate permeability and a low available moisture capacity. The root zone is strongly acid in areas not limed. Princeton soils tend to be droughty.

Princeton soils are used mainly for corn, soybeans, and wheat. A few areas are also used for sweet corn, melons, and other specialized crops.

Representative profile of a Princeton fine sandy loam (NE¼ section 35, T. 4 E., R. 3 N., Turtle Creek Township):

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

A2—8 to 16 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, granular structure; friable; many roots; strongly acid; clear, wavy boundary.

B2t—16 to 32 inches, dark-brown (7.5YR 4/4) light sandy clay loam; weak, coarse and medium, subangular blocky structure; firm when moist, slightly sticky when wet; few roots; thin clay films bridging sand grains; strongly acid; gradual, irregular boundary.

B3—32 to 45 inches, dark-brown (10YR 4/3) sandy loam; structureless (single grain); loose; medium acid; gradual, irregular boundary.
C1—45 to 54 inches, yellowish-brown (10YR 5/4) loamy sand; structureless (single grain); loose; neutral; gradual, irregular boundary.
C2—54 to 60 inches, yellowish-brown (10YR 5/4) loamy sand; structureless (single grain); loose; calcareous.

The solum ranges from 36 to 60 inches in thickness. The B horizons normally have a hue of 10YR or 7.5YR. In some places B1 and B3t horizons have formed.

Princeton soils are in slightly lower areas than Miamian, Russell, and other adjacent soils. The Princeton soils formed in material that is more sandy than the finer textured loess and till in which the Miamian and Russell soils formed.

Princeton fine sandy loam, 2 to 6 percent slopes (PrB).—This soil is mostly on broad dissected terraces. In most places areas are 3 to 15 acres in size. This soil dries out early in spring and is easy to till. Surface runoff is slow to medium. A profile of this soil is described as typical for the series. Included with this soil in mapping are a few areas that are moderately eroded.

This soil is well suited to irrigation and specialty crops, but in most places it is used the same way as larger adjacent areas of other soils. In cultivated areas the erosion hazard is moderate. For most nonfarm uses, this soil has few limitations other than slope and droughtiness. (Capability unit IIe–1; woodland group 1o1)

Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded (PrC2).—The plow layer of this soil is a mixture of the original surface layer and the brownish upper part of the subsoil. It is slightly more sticky than the surface layer of uneroded Princeton soils. Most areas have winding shapes and occur on the side slopes of dissected terraces. Commonly these areas are 3 to 25 acres in size.

Included with this soil in mapping are a few areas that are moderately steep. In a few included areas that are severely eroded, tillage has been up and down hill. These severely eroded areas commonly have a brown surface layer where they are bare of plant cover. Tilth is poorer in these severely eroded areas than it is in areas of uneroded Princeton soils.

In cultivated areas the erosion hazard is severe. Because slopes are short, erosion is difficult to control in intensively cultivated areas. Slope is a limitation for most nonfarm uses. (Capability unit IIIe–1; woodland group 2o1)

Ragsdale Series

The Ragsdale series consists of deep, dark-colored, very poorly drained soils that are nearly level to slightly depressional. These soils formed in thick calcareous loess of Wisconsin age. They are on the glacial till plain where glacial till is below a depth of 60 inches.

A typical Ragsdale soil in pasture has a very dark gray silty clay loam surface layer 12 inches thick. The subsoil is firm and friable, sticky silty clay loam that extends to a depth of about 44 inches. Brown and yellowish-brown mottles and grayish coatings occur in the subsoil. The underlying material consists of mottled, brownish-yellow, calcareous silt loam material that is massive and very friable.

Ragsdale soils have a seasonal high water table. Both mottling and grayish coatings in the subsoil indicate natural wetness. Where they are drained, Ragsdale soils provide a deep root zone for most of the commonly grown annual crops. Their surface layer has a high organic-matter content. Ragsdale soils have a high available moisture capacity and moderately slow permeability. They are neutral in the root zone.

Ragsdale soils are well suited to farming if they are drained. They are used mostly for corn and soybeans.

Representative description of Ragsdale silty clay loam (1½ miles southwest of Harveysburg and 1,500 feet southwest of the intersection of Brooks-Carroll Road and Harveysburg Road, near the Clinton County line, Massie Township):

A1—0 to 12 inches, very dark-gray (10YR 3/1) silty clay loam; moderate, medium and fine, granular structure; friable; many roots; neutral; gradual, wavy boundary.
B21tg—12 to 20 inches, dark-gray (10YR 4/1) silty clay loam; few, fine, faint, brown (10YR 5/3) mottles; moderate, medium, subangular blocky structure; firm; many roots; thin, gray (10YR 5/1) clay films on ped faces; neutral; gradual, irregular boundary.
B22tg—20 to 36 inches, grayish-brown (10YR 5/2) silty clay loam; few, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate, medium and coarse, subangular blocky structure; firm; common roots; continuous gray (10YR 5/1) and dark-gray (10YR 4/1) clay films on ped faces and in root channels and crayfish burrows; neutral; gradual, irregular boundary.
B23t—36 to 44 inches, brown (10YR 5/3) silty clay loam; many, medium, faint, yellowish-brown (10YR 5/4 and 5/6) mottles; weak, coarse, subangular blocky structure; friable; thin, patchy, gray (10YR 5/1) clay films on ped faces, gray (10YR 5/1) clay in old root channels and crayfish burrows up to 1 inch in diameter; neutral; gradual, irregular boundary.
C—44 to 60 inches, brownish-yellow (10YR 6/6) silt loam; many, medium and coarse, faint, light-gray (10YR 7/2) and light brownish-gray (10YR 6/2) mottles; structureless (massive); very friable; mildly alkaline; calcareous.

The A horizon generally is very dark-gray (10YR 3/1), but it ranges from very dark grayish brown (10YR 3/2) to very dark brown (10YR 2/2). The A horizon ranges from 12 to 17 inches in thickness. In some places the dark colors extend deeper than 17 inches in crayfish burrows and root channels. Depth to the C horizon ranges from 36 to 60 inches but is dominantly between 42 and 48 inches. The C horizon is neutral to moderately alkaline and calcareous. The loess is underlain by Wisconsin age till at a depth of more than 60 inches. The A and B horizons are slightly acid to neutral.

The Ragsdale soils are very poorly drained members of a topographic sequence that includes the higher lying, somewhat poorly drained Reesville soils and the moderately well drained Birkbeck soils. Ragsdale soils have a dark-colored surface layer in contrast to other members of this sequence. Ragsdale soils are similar to Brookston soils but formed in a thick mantle of loess. Ragsdale soils also are similar to Patton soils except that the Patton soils formed in lacustrine material.

Ragsdale silty clay loam (Ra).—The moderately fine texture of this soil limits tillage operations unless the moisture content is optimum. This soil dries slowly in spring even in drained areas. Only a few scattered areas of this soil occur in the county. One of these areas is along the Clinton County line and contains 35 acres. Included with this soil in mapping are a few areas of Brookston soils and a few areas of lighter colored Fincastle soils.

This soil has a moderate wetness hazard. A seasonally high water table is a limitation to many nonfarm uses. (Capability unit IIw–3; woodland group 2w1)

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Rainsboro Series

The Rainsboro series consists of moderately well-drained soils that are deep. These soils formed partly in loess and partly in underlying outwash material of Illinoian age. The underlying outwash material is acid and highly weathered. The Rainsboro soils are in the southern part of the county on terrace remnants.

A typical Rainsboro soil in a cultivated area has a dark-brown silt loam plow layer and a thin, brown silt loam subsurface layer. Together these layers are 12 inches thick. The upper part of the subsoil, to a depth of 36 inches, is yellowish-brown silty clay loam. A mottled, yellowish-brown fragipan is between depths of 36 and 60 inches. Yellowish-brown clay loam extends to a depth of 110 inches. The underlying material consists of massive clay loam, sandy clay loam, and variable amounts of coarse fragments.

The fragipan in Rainsboro soils is dense and compact. This fragipan commonly limits the root zone and restricts the downward movement of water. Permeability is moderately slow in the fragipan. The available moisture capacity is medium in the root zone. The root zone is strongly acid below a depth of 12 inches.

Rainsboro soils are used mostly for corn, soybeans, wheat, and hay.

Representative profile of a Rainsboro silt loam (2¼ miles northeast of Butlerville, ¾ mile northwest of the intersection of State Routes 123 and 132, and 250 feet southwest of State Route 123, Harlan Township):

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; many roots; neutral; clear, smooth boundary.

A2—7 to 12 inches, brown (10YR 5/3) silt loam; weak, fine, subangular blocky structure; friable; many roots; medium acid; gradual, wavy boundary.

B1t—12 to 18 inches, yellowish-brown (10YR 5/4) silty clay loam; many, fine, faint, light-gray (10YR 7/2) and brownish-yellow (10YR 6/6) mottles; moderate, medium, subangular blocky structure; friable; many roots; thin, patchy clay films on faces of peds; strongly acid; gradual, wavy boundary.

B2t—18 to 36 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, faint, light brownish-gray (10YR 6/2) mottles; strong, medium and fine, subangular blocky structure; firm; common roots; continuous clay films on ped faces; strongly acid; clear, smooth boundary.

IIBx—36 to 60 inches, yellowish-brown (10YR 5/4) clay loam; many, medium, faint, light brownish-gray (10YR 6/2) and light yellowish-brown (10YR 6/4) mottles; weak, medium, subangular blocky structure; firm and brittle; thin, patchy clay films on vertical ped faces; numerous very dark grayish-brown (10YR 3/2) iron-manganese concretions; strongly acid; gradual, irregular boundary.

IIB3—60 to 110 inches, yellowish-brown (10YR 5/4) clay loam and thin strata of sandy clay loam; weak, medium and coarse, subangular blocky structure; firm; very dark grayish-brown (10YR 3/2) concretions; medium acid; gradual, irregular boundary.

IIC—110 inches +, yellowish-brown (10YR 5/4), stratified sandy clay loam and loam; structureless (massive); friable; some gravelly loam strata are strong brown (7.5YR 5/8); neutral.

The loess mantle ranges from 20 to 40 inches or more in thickness, but 36 inches is the most common thickness. The upper boundary of the fragipan occurs essentially at the contact between the loess and outwash material. The IIB horizons that formed in the outwash material are generally clay loam, but they range from loam to sandy clay loam. The B horizons are strongly acid to medium acid to a depth of 90 inches or more. Below 90 inches this horizon grades to neutral. The B horizon is calcareous in only a few places.

The Rainsboro soils in this county have mottles with a chroma of 2 in the upper 20 inches of the Bt horizons, but Rainsboro soils elsewhere do not.

Rainsboro soils are commonly adjacent to the well-drained Parke soils. The gray mottles in the subsoil of Rainsboro soils indicate wetness, whereas the Parke soils lack these mottles and seasonal wetness. In contrast to the Rossmoyne soils, the Rainsboro soils formed partly in mixed outwash material instead of till. Rainsboro soils are near the well-drained Williamsburg soils, which do not have a fragipan and are more acid in the subsoil than the Rainsboro soils.

Rainsboro silt loam, 0 to 2 percent slopes (RbA).—This soil is commonly in areas that are rounded in shape and are 3 to 10 acres in size. A profile of this soil is described as typical for the series. The soil is only slightly eroded, because surface runoff is slow.

Included with this soil in mapping are a few somewhat poorly drained areas. The wetter inclusions are in low areas and along drains.

Use of this soil for farming is moderately limited by wetness, and drainage helps to improve crop growth. Moderately slow permeability is a limitation for many nonfarm uses. (Capability unit IIw–5; woodland group 2o1)

Rainsboro silt loam, 2 to 6 percent slopes (RbB).—This soil has medium surface runoff but is only slightly eroded. Slopes are slightly convex, and areas are 3 to 15 acres in size. Crossable drainageways occur in this soil. Included with this soil in mapping are a few moderately eroded areas that have a lower organic-matter content and poorer tilth than the slightly eroded areas.

In cultivated areas erosion is a moderate hazard. Moderately slow permeability is a limitation for many nonfarm uses of this soil. (Capability unit IIe–3; woodland group 2o1)

Reesville Series

The Reesville series consists of deep, somewhat poorly drained soils. These soils formed in loess of Wisconsin age. They are nearly level and occur on the glacial till plain in the northern part of the county. Most areas are in Massie Township.

A typical Reesville soil in a cultivated area has a dark grayish-brown silt loam plow layer. It is over a grayish-brown silt loam subsurface layer that extends to a depth of 12 inches. The subsoil is silty clay loam that extends to a depth of 42 inches. It is brown in the upper part and is light yellowish brown in the lower part. Brown mottles and grayish-brown surface films are typical in the subsoil. The underlying material is yellowish-brown, calcareous silt loam and loam that are massive and friable.

Reesville soils have a seasonal high water table. Both mottles and grayish films in the subsoil indicate natural wetness. Drainage is needed for good crop growth. If these soils are adequately drained, the root zone is deep enough for most of the commonly grown annual crops. The organic-matter content of the surface layer is medium. Reesville soils have a high available moisture capacity and moderately slow permeability. They are slightly acid to medium acid in the root zone.

Drained areas of Reesville soils are well suited to farm crops. These soils are used mostly for corn, soybeans, wheat, and hay.

Representative profile of Reesville silt loam (1¼ miles southwest of Harveysburg and 1,320 feet northeast of the intersection of Brooks-Carroll and Harveysburg Roads, near Clinton County line, Massie Township):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium and fine, granular structure; friable; common roots; neutral; clear, smooth boundary.

A2g—8 to 12 inches, grayish-brown (10YR 5/2) silt loam; common, medium, faint, pale-brown (10YR 6/3) mottles; weak, thin, platy structure; friable; common roots; slightly acid; gradual, smooth boundary.

B1tg—12 to 15 inches, brown (10YR 5/3) silty clay loam; common, medium and fine, faint, pale-brown (10YR 6/3) mottles; moderate, medium and fine, subangular blocky structure; firm; common roots; thin, patchy, grayish-brown (10YR 5/2) clay films on ped faces; slightly acid; gradual, irregular boundary.

B2tg—15 to 30 inches, brown (10YR 5/3) silty clay loam; few, fine, faint, light yellowish-brown (10YR 6/4) mottles; strong, fine and medium, subangular blocky structure; firm; common roots; continuous grayish-brown (10YR 5/2) clay films on ped faces; slightly acid; gradual, wavy boundary.

B3t—30 to 42 inches, light yellowish-brown (10YR 6/4) light silty clay loam; weak, coarse, subangular blocky structure; friable; thin, patchy, grayish-brown (10YR 5/2) clay films on vertical faces of peds; slightly acid in upper part, neutral in lower part; gradual, irregular boundary.

C1—42 to 50 inches, yellowish-brown (10YR 5/4 and 5/6) silt loam; structureless (massive); friable; mildly alkaline; calcareous; abrupt, irregular boundary.

IIC2—50 to 60 inches, yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) loam; structureless (massive); firm; gradual increase in coarse skeleton with increasing depth; calcareous loam till.

The Ap horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2). Mottles occur in the A and B horizons between depths of 8 and 30 inches. The C1 horizon is silt loam or silt. It is mildly alkaline in most places but is neutral in some places. This horizon generally is calcareous. The solum ranges from 24 to 48 inches in thickness but is dominantly 30 to 42 inches thick. Reaction ranges from slightly acid or medium acid in the upper B horizons to neutral in the lower B horizons. The C horizon is underlain by Wisconsin-age till at a few inches to 4 to 6 feet below the solum, but the till is not a part of the solum. The calcareous C horizon commonly contains shells or secondary calcite concretions.

The Reesville soils are somewhat poorly drained members of a topographic sequence of soils that includes the higher lying, moderately well drained Birkbeck soils and the lower lying, very poorly drained Ragsdale soils. Reesville soils have a light-colored surface layer in contrast to the dark-colored surface layer of Ragsdale soils. Reesville soils are similar to Fincastle soils but formed in much thicker loess. Reesville soils did not even partly form in till, but the Fincastle soils did.

Reesville silt loam (Re).—This nearly level soil occupies generally rounded areas that range from 3 to 10 acres in size. These areas are mostly in the northern and eastern parts of the county, and are commonly adjacent to Fincastle soils.

Included with this soil in mapping are small areas of Fincastle soils. A few included areas have slopes of 2 to 6 percent. Also included are small areas of better drained Birkbeck soils that have slopes of more than 2 percent.

This soil is too wet seasonally for most farm uses. On this soil seasonal wetness and moderately slow permeability are limitations for many nonfarm uses. (Capability unit IIw-4; woodland group 2w2)

Riverwash

Riverwash (Rh) is a mixture of cobblestones, gravel, and finer textured material that is along the channel of the major streams. Most of the coarse fragments are limestone and range from 1 to 3 inches in diameter. Riverwash is commonly droughty in the uppermost 12 inches.

Most areas are low islands or alluvial spits that are periodically flooded and devoid of vegetation, except for some willow, cattails, marshgrass, and other plants in local areas.

Aquatic birds, insects, and amphibious wildlife commonly are present in areas not polluted or filled with refuse. Because Riverwash provides food and cover for many kinds of wildlife, it is desirable to preserve areas by cleaning them up.

During periods of low water, areas of Riverwash provide good stands for fishing, but in some places these areas are hazardous to boating, particularly for power boats.

Areas of Riverwash are not suited as cropland or for other farm uses. They are suited as wildlife habitat and for recreational uses. (Capability unit and woodland group not assigned)

Rodman Series

The Rodman series consists of sandy and gravelly, steep to very steep soils that are dark colored and well drained. These soils are shallow to stratified gravel and sand. They occur mostly on terrace escarpments.

A typical Rodman soil has a dark reddish-brown gravelly sandy loam surface layer about 8 inches thick. The next layer is dark-brown gravelly sandy loam that extends to a depth of 13 inches. The subsoil is 7 inches thick and consists of dark-brown very gravelly sandy loam. Stratified gravel and sand is below a depth of 20 inches.

Rodman soils have rapid permeability, a shallow root zone, and a very low available moisture capacity. They are extremely droughty.

Rodman soils are too steep and too droughty for cultivated crops. They are used mostly for pasture or as woodland. Pollution of underground water supplies is a hazard if Rodman soils are used for disposal of sewage effluent or of solid waste.

Representative profile of a Rodman gravelly sandy loam in a pastured area (NE¼SW¼ section 21, T. 4 N., R. 3 E., Union Township):

A1—0 to 8 inches, dark reddish-brown (5YR 3/2) gravelly sandy loam; moderate, fine and medium, granular structure; friable; many roots; 20 percent waterworn pebbles; mildly alkaline; calcareous; gradual, smooth boundary.

A3—8 to 13 inches, dark-brown (7.5YR 3/2) gravelly sandy loam; structureless (massive, but easily parted to single grain); loose; common roots; 40 percent waterworn pebbles; mildly alkaline; calcareous; clear, smooth boundary.

B—13 to 20 inches, dark-brown (10YR 4/3) very gravelly sandy loam; structureless (massive, but easily parted to single grain); loose; common roots; 75 percent waterworn pebbles up to 4 inches in diameter; mildly alkaline; calcareous; gradual, irregular boundary.

C—20 to 50 inches +, brown (10YR 5/3) stratified gravel and sand; structureless (single grain); loose; calcareous.

The A horizons range from loam to gravelly sandy loam in texture and from 8 to 14 inches in thickness. Color is dominantly dark brown (7.5YR 3/2) and dark reddish brown (5YR

3/2). The C horizon varies from one strata to another in texture. It ranges from loam to well-sorted sand or gravel. The upper part of the C horizon typically is more loamy than the lower part.

The Rodman soils commonly are adjacent to Casco soils but are less clayey in the subsoil than Casco soils. In addition, an undisturbed surface layer of Rodman soils is dark-colored in contrast to the lighter colored surface layer of Casco soils.

Rodman soils were not mapped individually in this county but were mapped only with Casco soils in a complex and in an undifferentiated unit.

Rodman and Casco gravelly loams, 18 to 25 percent slopes, moderately eroded (RkE2).—Either or both of these soils occur in areas of this mapping unit. A profile of the Rodman soil is similar to the one described as typical for the series except that erosion has thinned the surface layer, and this surface layer has a higher content of sand than the one described as typical. The Casco soil has a profile similar to that described as typical for the Casco series except that erosion also has thinned the surface layer of the soil in this unit and there is a higher content of gravel (20 to 50 percent).

Because of erosion, the surface layer of these soils is a mixture of the upper part of the subsoil or underlying material and remnants of the original surface layer. Included with these soils in mapping are a few severely eroded areas.

This mapping unit is on kames and terrace escarpments. Because the deposits from which the soils were derived vary within short horizontal distances, many differences in soil properties can be expected. Land surfaces are uneven and in most places have rounded and irregular shapes. These areas range from 10 to 50 acres in size.

Although these soils are very droughty, the main limitation to their use for farming is the severe erosion hazard. Steep slopes are a limitation for many uses other than farming. (Capability unit VIIe-1; woodland group 4f1)

Ross Series

The Ross series consists of dark-colored loamy soils that are well drained. These soils formed on flood plains in soil material washed from soils of the uplands.

A typical Ross soil is dark-colored loam that is friable or very friable to a depth of 24 inches. Between depths of 24 and 60 inches or more, layers of dark-brown or yellowish-brown loam occur.

Ross soils are moderately permeable and have a deep root zone. These soils can absorb and retain large amounts of moisture for plants to use. They are subject to periodic flooding, generally during winter and spring. Ross soils have a high organic-matter content, and they are generally neutral.

Ross soils are well suited to summer row crops. Most areas are used for corn and soybeans.

Representative profile of Ross loam (SW¼ section 32 west, T. 2 N., R. 5 E., Franklin Township):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, granular structure; very friable; many roots; neutral; gradual, smooth boundary.

A1—8 to 24 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, subangular blocky structure; very friable; many roots; neutral; gradual, smooth boundary.

B2—24 to 36 inches, dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure; friable; few roots; neutral; gradual, irregular boundary.

C—36 to 60 inches, yellowish-brown (10YR 5/4) loam; structureless (massive); loose; mildly alkaline; calcareous.

The A horizons are most commonly loam, but they are silt loam or light silty clay loam in some places. These horizons are dark colored and range from 20 to 30 inches in thickness. The A and B horizons are neutral. The C horizon is neutral or mildly alkaline and calcareous. It generally is loam, but it contains strata of sandy loam in some places. Stratification in the substratum is variable. The strata commonly are thin and discontinuous.

Ross soils are adjacent to lighter colored Genesee and Eel soils. They also are adjacent to the lighter colored, somewhat poorly drained Shoals soils and the dark-colored, very poorly drained Sloan soils. Ross soils have brighter colors throughout than the Sloan soils. They are similar to the Wea soils, which are underlain by gravel and sand, but Ross soils do not have the well-formed subsoil that is typical for the Wea soils.

Ross loam (Rn).—This nearly level Ross soil occupies linear areas along stream channels. It generally is at a slightly higher elevation and is farther from the stream than Genesee soils.

Included with this soil in mapping are areas of wet soils that dry out more slowly in spring than Ross soils. Also included are a few areas of sandy Abscota soils.

This soil is well suited to summer row crops. Flooding is the principal limitation to the use of this soil for farming, but other limitations are few or none. Flooding is a severe limitation for uses other than farming. (Capability unit IIw-2; woodland group 1o1)

Rossmoyne Series

The Rossmoyne series consists of moderately well drained, nearly level to strongly sloping soils that have a fragipan. These soils formed partly in loess and partly in the underlying glacial till of Illinoian age. They occur in upland areas, mostly in the southern and eastern parts of the county.

A typical Rossmoyne soil has a dark grayish-brown silt loam plow layer 7 inches thick. Between depths of 7 and 13 inches is a layer of brown silt loam. The subsoil is dark yellowish-brown silty clay loam that extends to a depth of 21 inches and dark-brown silty clay loam between depths of 21 and 27 inches. A dense, compact layer of dark yellowish-brown silty clay loam extends to a depth of 39 inches. This layer is a fragipan. Below 39 inches are firm, dark yellowish-brown silty clay loam and dark-brown clay loam. Calcareous glacial till is below a depth of 92 inches.

Rossmoyne soils have moderate permeability above the fragipan. Permeability in the fragipan and below is moderately slow. The normal root zone is above the fragipan and is moderately deep. It is strongly acid unless limed. The root zone has a medium available moisture capacity except in severely eroded areas. These soils generally are saturated above the fragipan during wet periods in winter and spring.

Rossmoyne soils are suited to farm crops commonly grown in the county. Most areas are used for corn, soybeans, wheat, and hay.

Representative profile of a Rossmoyne silt loam in a cultivated area (½ mile south of intersection of Edwardsville and Middleboro Roads at Edwardsville, Harlan Township):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; medium acid; abrupt, smooth boundary.

A&B—7 to 13 inches, brown (10YR 5/3) silt loam; common, fine, faint, grayish-brown (10YR 5/2) mottles and common, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, platy structure; very friable; common roots; slightly acid; clear, wavy boundary.

B1—13 to 16 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, fine, subangular blocky structure; firm; ped surfaces covered with thin, discontinuous, grayish-brown (10YR 5/2) silt coatings; medium acid; clear, smooth boundary.

B21t—16 to 21 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, fine and medium, subangular blocky structure; firm; thin patchy clay films on most peds; thin, grayish-brown (10YR 5/2) silt coatings on few peds; strongly acid; clear, smooth boundary.

B22t—21 to 27 inches, dark-brown (10YR 4/3) silty clay loam; common, fine, faint, grayish-brown (10YR 5/2) mottles and common, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; firm; thin continuous clay films on peds; common black (10YR 2/1) manganese stains and pellets; strongly acid; clear, wavy boundary.

Bx1—27 to 34 inches, dark yellowish-brown (10YR 4/4) silty clay loam; common, fine, faint, brown (10YR 5/3) mottles; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; very firm; brown (10YR 5/3) silt coatings and thin patchy grayish-brown (10YR 5/2) clay films on vertical surfaces; common black (10YR 2/1) manganese pellets and stains; strongly acid; clear, wavy boundary.

IIBx2—34 to 39 inches, dark yellowish-brown (10YR 4/4) silty clay loam that has many, medium, distinct, brown (7.5YR 5/4) and gray (10YR 6/1) mottles; weak, coarse, prismatic structure that parts to coarse, subangular blocky; very firm; grayish-brown (10YR 5/2) clay films on ped faces; many black (10YR 2/1) manganese pellets and stains; strongly acid; gradual, wavy boundary.

IIB31—39 to 56 inches, dark yellowish-brown (10YR 4/4) heavy silty clay loam that has common, medium, distinct, brown (7.5YR 5/4) and grayish-brown (10YR 5/2) mottles; weak, coarse, subangular blocky structure; very firm; dark grayish-brown (10YR 4/2) clay films on vertical faces of peds; many very dark-brown (10YR 2/2) iron-manganese stains; strongly acid; gradual, wavy boundary.

IIB32—56 to 92 inches, dark-brown (10YR 4/3) clay loam that has many, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; very firm; some dark grayish-brown clay seams; many very dark brown (10YR 2/2) iron-manganese stains; medium acid in upper part, neutral in lower part; gradual, wavy boundary.

IIC—92 inches +, yellowish-brown (10YR 5/4) clay loam that has many, medium, faint, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; structureless (massive); very firm; calcareous.

The pH increases slightly with depth in the fragipan. It increases gradually with depth in the lower subsoil and is neutral in the lower part. Depth to calcareous till ranges from 60 to 120 inches but is generally 70 to 100 inches. The till is commonly underlain by Ordovician bedrock, and the lower subsoil occurs in places directly over the bedrock without any intervening unweathered till. The solum does not extend into residuum derived from the underlying bedrock.

Rossmoyne soils are moderately well drained members of a topographic sequence that includes higher lying, well drained Cincinnati soils, the lower lying, somewhat poorly drained Avonburg soils, the poorly drained Clermont soils, and the darker colored, poorly drained Blanchester soils. Rossmoyne soils have a greater depth to calcareous till than moderately well drained Xenia soils. They have a thinner mantle of loess than Alford soils.

Rossmoyne silt loam, 0 to 2 percent slopes (RpA).—This soil is on ridgetops between deeply entrenched streams. Areas are roughly circular in shape and range from 3 to 10 acres in size.

Included with this soil in mapping are a few areas of wetter Avonburg soils in low areas where surface runoff may be ponded. Gently sloping Rossmoyne soils are commonly adjacent to this soil on side slopes.

This soil generally has good surface tilth, but it is subject to crusting. Because surface runoff is slow on this nearly level soil, the soil dries more slowly in spring than other Rossmoyne soils.

Seasonal wetness is a moderate limitation if this soil is used for crops. Moderately slow permeability and seasonal wetness are limitations for some nonfarm uses. (Capability unit IIw–5; woodland group 2o1)

Rossmoyne silt loam, 2 to 6 percent slopes (RpB).—A profile of this soil is described as typical for the series. This soil occupies relatively narrow, convex ridgetops between deeply entrenched streams or convex hillsides that are long and gently sloping.

The upper ends of drainageways typically occur in most areas of this soil. Most areas of this soil have long irregular shapes and range from 3 to 50 acres or more in size.

Included with this soil in mapping are small areas of wetter Avonburg soils in the more nearly level areas.

Because surface runoff is rapid, particularly when the soil is bare of plant cover, the erosion hazard in cultivated areas is moderate. Moderately slow permeability and slope are limitations for some nonfarm uses. (Capability unit IIe–3; woodland group 2o1)

Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded (RpB2).—A profile of this soil is similar to that described as typical for the series except for the effects of past erosion. The plow layer is a mixture of the brownish upper part of the subsoil and the remaining part of the original surface soil. Because of this subsoil material, the range of optimum moisture content for tillage is narrower than that of less eroded Rossmoyne soils. Also, the surface layer is stickier and not so easy to till.

Drainageways commonly cross areas of this soil. Most areas are longer than they are wide and follow a pattern around sloping hillsides. The size of these areas range mostly from 5 to 25 acres. Included in mapping are a few seep areas.

Because surface runoff is rapid, particularly when the surface is bare of plant cover, the hazard of erosion is moderate if this soil is used for crops. Moderately slow permeability and slope are limitations for some nonfarm uses. (Capability unit IIe–3; woodland group 2o1)

Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded (RpC2).—This soil has a profile similar to that described as typical for the series except for the effects of past erosion. The plow layer is a mixture of brownish upper part of the subsoil and the original surface layer. Because of this subsoil material, the optimum moisture content for tillage has a narrower range than that of less eroded Rossmoyne soils. Also, the surface layer is stickier and provides a less suitable seedbed for crops.

Seep areas are common in areas of this soil. Some areas are crossed by drainageways. Most soil areas are longer than they are wide, and they follow a pattern around sloping hillsides. Most areas range from 5 to 25 acres in size, but a few are as much as 50 acres.

Included with this soil in mapping are a few severely eroded areas. Symbols on the soil map indicate gullies that are not generally crossable by tillage equipment.

Because surface runoff is very rapid, particularly when the surface is bare of plant cover, the erosion hazard of this soil is severe. Slope and moderately slow permeability are limitations for some nonfarm uses. (Capability unit IIIe-4; woodland group 2o1)

Rossmoyne silty clay loam, 2 to 6 percent slopes, severely eroded (RsB3).—This soil occupies linear areas along the lower side slopes of ridgetops. Most areas range from 3 to 5 acres in size, but a few are as much as 30 acres.

This soil has a profile that is similar to that described as typical for the series except for the effects of severe erosion. Because of erosion, the plow layer consists mostly of yellowish and brownish material from the upper part of the subsoil and small amounts of the original surface layer. This soil is easily identified from the less eroded Rossmoyne soils by the contrast in surface color and number of coarse fragments on the surface after this soil is freshly plowed or is bare of plant cover. Depth to the underlying fragipan layer is less than indicated in the typical profile. As a result, this soil has a lower available moisture capacity than Rossmoyne silty clay loam, 2 to 6 percent slopes. Gullies of varying depths occur in some areas.

The plow layer of this soil is low in organic-matter content, and it has poor tilth. Where plant cover is sparse, the surface crusts firmly and slows infiltration of water. Crusting and extremes in wetness or dryness hinder the emergence of young plants and their subsequent growth. This soil has a low available moisture capacity and a rapid surface runoff. In cultivated areas the erosion hazard is severe. Severe erosion and moderately slow permeability are limitations of this soil for some nonfarm uses. (Capability unit IIIe-4; woodland group 3o1)

Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded (RsC3).—This soil occupies linear areas along the lower side slopes of ridgetops. Most areas range from 3 to 5 acres in size, but a few are as much as 30 acres. The soil has a profile similar to that described as typical for the series except for the effects of severe erosion. As a result of erosion, the plow layer consists mostly of yellowish and brownish material from the upper part of the subsoil and small amounts of the original surface layer. Where this soil is freshly plowed or bare of plant cover, it can be easily identified from the less eroded Rossmoyne soils by its surface color and more coarse fragments on the surface. Depth to the underlying fragipan layer is less than indicated for the typical profile. Gullies of varying depths occur in some areas of this soil.

The plow layer of this soil is low in organic-matter content, and it has poor tilth. Where plant cover is sparse, the surface crusts firmly and slows infiltration of water. Crusting and extremes in wetness or dryness hinder emergence of young plants and their subsequent growth. This soil has a low available moisture capacity and rapid surface runoff. If row crops are grown, the erosion hazard is very severe. Slope, past erosion, and moderately slow permeability are limitations to use of this soil for some nonfarm purposes. (Capability unit IVe-1; woodland group 3o1)

Russell Series

The Russell series consists of deep, well-drained soils that are nearly level to gently sloping. These soils formed partly in loess and partly in underlying Wisconsin age till. They are in areas that are typical of the till plain in the northern part of the county.

The Russell soils in this county are mapped only in complexes with Miamian soils. Except for having a thicker mantle of loess, Russell soils are similar to Miamian soils. Russell soils and Miamian soils are so intermingled that they cannot be shown separately on the soil map at the scale used.

The plow layer of a typical Russell soil in a cultivated area is dark grayish-brown silt loam about 7 inches thick. The subsoil extends to a depth of 38 inches and is firm silty clay loam. Yellowish brown and dark yellowish brown are the dominant colors in the subsoil. Compact, calcareous clay loam glacial till occurs at a depth of 38 inches.

Russell soils have a deep root zone that has a high available moisture capacity. Permeabiilty is moderately slow.

Russell soils are well suited to cultivated crops and are used mostly for corn, wheat, and soybeans.

Representative profile of a Russell silt loam in a cultivated area (NW¼NW¼ section 22 east, T. 5 N., R. 3 E., Turtle Creek Township):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, subangular blocky structure; friable; slighly plastic when wet; many roots; slightly acid; abrupt, smooth boundary.

B1t—7 to 9 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium and fine, subangular blocky structure; firm when moist, slightly plastic when wet; common roots; continuous very dark grayish-brown (10YR 3/2) clay films on ped faces; medium acid; clear, smooth boundary.

B21t—9 to 16 inches, dark-brown (10YR 4/3) silty clay loam; strong, fine, subangular blocky structure; firm when moist, slightly sticky when wet; common roots; continuous thin dark grayish-brown (10YR 4/2) clay films on ped faces; slightly acid; gradual, smooth boundary.

B22t—16 to 26 inches, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) silty clay loam; strong, fine and medium, subangular blocky structure; firm when moist, slightly sticky when wet; common roots; thin, continuous, dark-brown (10YR 4/3) clay films on ped faces; few dark grayish-brown (10YR 4/2) iron-manganese concretions; neutral; gradual, wavy boundary.

B31t—26 to 29 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm; thin, patchy, dark-brown (10YR 4/3) clay films on vertical faces of peds; common roots; neutral; clear, smooth boundary.

IIB32—29 to 38 inches, light olive-brown (2.5Y 5/4) silty clay loam; many, fine and medium, distinct, dark grayish-brown (10YR 4/2) and yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; friable; few roots; few quartz pebbles; neutral; gradual, wavy boundary.

IIC—38 to 60 inches, light olive-brown (2.5Y 5/4) light clay loam; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, platy structure to structureless (massive); firm; no roots; 10 percent coarse fragments of quartz, limestone, black shale, and chert; mildly alkaline; calcareous.

The loess mantle ranges from 18 to 30 inches in thickness. The solum ranges from 34 to 70 inches in thickness, but it is dominantly 34 to 48 inches thick. Above a depth of 42 inches, the horizons are commonly calcareous, though tongues of weathered material from the B horizon extend into the till to a depth of more than 42 inches. The Russell soils in this county are slightly less deep to carbonates than Russell soils elsewhere. The till is loam or clay loam. Unlimed soils are slightly acid to medium acid in the A horizon and slightly acid to strongly acid in the upper part of the B horizon. Reaction is neutral in the lower part of the B horizon. The unweathered till is calcareous.

Russell soils are adjacent to the well-drained Miamian soils. Both kinds of soils occur on the higher parts of the landscape. The Russell soils occupy areas where the loess mantle is 18 to 30 inches thick, but in areas of Miamian soils, the loess mantle is less than 18 inches thick. Russell soils are in a topographic sequence with the moderately well drained Xenia soils, the somewhat poorly drained Fincastle soils, and the very poorly drained, dark-colored Brookston soils. In contrast to Russell soils, the well-drained Cincinnati soils formed in a thicker layer of loess that overlies Illinoian instead of Wisconsin till.

Russell-Miamian silt loams, 0 to 2 percent slopes (RvA).—This mapping unit occupies broad ridgetops. It is in areas that are roughly circular in shape and range from 5 to 25 acres in size. The Russell soil occupies 50 to 75 percent of each area, and the Miamian soil occupies most of the rest.

A profile of the Russell soil is similar to the one described as typical for the series. The Miamian soil also has a profile similar to the one described as typical for its series, and it is described under the Miamian series. Both soils are friable and generally have good tilth. Surface runoff is slow, and the hazard of erosion is slight.

These soils are well suited to crops. Their moderately slow permeability is a limitation to some nonfarm uses. (Capability unit I–1; woodland group 2o1)

Russell-Miamian silt loams, 2 to 6 percent slopes (RvB).—This mapping unit is in areas that are roughly circular in shape and are in high positions on the glacial till landscape. Slopes are long in some areas. The areas generally range from 5 to 25 acres in size, though a few are as much as 100 acres.

Russell soils occupy 50 to 75 percent of each area mapped, and Miamian soils occupy most of the rest. The Russell soils occupy the lower slightly concave slopes, and the Miamian soils mostly occupy the upper convex slopes. The loess is thicker on the lower slopes.

Profiles of the Russell and the Miamian soils are similar to those described as typical for the respective series. The profile typical of the Miamian series is described under Miamian series.

Included with these soils in mapping are areas of moderately well drained Xenia and Birkbeck soils. Also included are small areas of Wynn soils where limestone is at a moderate depth. A few included areas are moderately eroded.

Partly because surface runoff is medium to rapid, the hazard of erosion is moderate in cultivated areas. Moderately slow permeability is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Russell-Miamian silt loams, 2 to 6 percent slopes, moderately eroded (RvB2).—This mapping unit is in areas that are mostly circular in shape and are high on the till plain landscape. Slopes are long in some places. The areas range from 5 to 25 acres in size, though a few are as much as 100 acres. Miamian soils occupy about 40 to 60 percent of each area mapped, and Russell soils occupy most of the rest. The Miamian soils occur mostly on upper convex slopes. The Russell soils occupy concave lower slopes. The mantle of silt is thicker on the lower slopes.

The profiles of the Russell soil and the Miamian soil are similar to the ones described as typical for their series except that the profiles of these soils show moderate erosion. The plow layer of these soils is a mixture of the remaining surface layer and some of the upper subsoil. Soils of this mapping unit have a lower available moisture capacity and poorer tilth than Russell-Miamian silt loams, 2 to 6 percent.

Included with these soils in mapping are areas of moderately well drained Birkbeck and Xenia soils. Also included are Wynn soils in a few areas where the depth to limestone is moderate.

Because surface runoff is mostly rapid, the hazard of erosion is moderate in cultivated areas. Moderately slow permeability and slope are limitations for many nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Shoals Series

The Shoals series consists of deep, somewhat poorly drained, nearly level soils on flood plains. These soils formed in medium-textured alluvium that washed from soils of the uplands that formed in calcareous till of Wisconsin age. They occupy flood plains along most of the major streams in the county.

A typical Shoals soil in a cultivated area has a dark grayish-brown silt loam plow layer and subsoil. The subsoil extends to a depth of 45 inches. Periodic wetness is indicated by mottles throughout the subsoil. The underlying material is stratified, calcareous, silty, and loamy.

These soils are subject to flooding, and they have a seasonal high water table. Their permeability is moderately slow. If these soils are drained, the crops grown develop a moderately deep to deep root system. Depth of plant roots is chiefly limited by the seasonal high water table. Shoals soils dry out slowly in spring, are normally neutral, and have a high available moisture capacity.

Most areas of these soils are used as cropland. Corn, soybeans, and hay are the commonly grown crops. Drained areas of Shoals soils are suited to these crops. Where flooding is frequent, these soils are better suited to pasture or as woodland than to row crops.

Representative profile of Shoals silt loam in a cultivated area (1 mile northeast of Corwin, along the Little Miami River, Wayne Township):

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

B1—7 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, faint, very dark gray (10YR 3/1) and brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; friable; many roots; neutral; clear, smooth boundary.

B2—12 to 45 inches, dark grayish-brown (10YR 4/2) silt loam; many, medium, distinct, dark yellowish-brown (10YR 4/4) mottles and few, medium, faint, dark-gray (10YR 4/1) and light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; friable; few roots; thin, discontinuous strata of fine sandy loam alluvium between depths of 36 and 45 inches; neutral; gradual, smooth boundary.

C—45 to 60 inches, dark grayish-brown (10YR 4/2) silt loam; many, medium, faint, brown (10YR 4/3) and dark-brown (10YR 3/3) mottles; structureless (massive); friable; mildly alkaline (calcareous).

The A horizon is silt loam in most places, but loam and silty clay loam also occur. The C horizon ranges from fine sand to silty clay loam material and is variable in thickness.

Shoals soils are commonly near the moderately well drained Eel soils, the well drained Genesee soils, and the very poorly drained Sloan soils. Shoals soils are grayer and more mottled than Eel or Genesee soils. Shoals soils are light colored in contrast to the dark-colored Sloan soils.

Shoals silt loam (Sh).—Most areas of this nearly level soil are on broad low flood plains. Areas of this soil range from 5 to 10 acres in size. Included in mapping are a few areas of Sloan soils.

Flooding is a limitation to use of this soil for any purpose. It is a moderate limitation to use for crops. This soil can be drained where suitable outlets can be established. Flooding, which generally occurs during winter and spring, limits the choice of crops to be grown. (Capability unit IIw-1; woodland group 2w1)

Sloan Series

The Sloan series consists of very poorly drained, dark-colored, nearly level soils on flood plains along most streams in the county. These soils formed in alluvium washed from soils of the uplands formed in calcareous till of Wisconsin age.

A typical Sloan soil in a cultivated area has a very dark grayish-brown silty clay loam plow layer about 8 inches thick. At depths between 8 and 24 inches, there is very dark brown silty clay loam. The subsoil is dark grayish-brown silty clay loam mottled with brown, dark brown, and yellowish brown. It extends to a depth of 42 inches. The underlying material consists of calcareous or neutral, stratified silty clay loam and layers of sandy and gravelly material. It is massive.

Sloan soils are subject to flooding and have a seasonal high water table. Grayness and mottling in the soil indicate natural wetness. If these soils are drained, most annual crops develop a deep root system. These soils have a high available moisture capacity, high organic-matter content, and moderately slow premeability. The sandy and gravelly layers in the underlying material are rapidly permeable.

Most areas of these soils are used as cropland. Corn and soybeans are the commonly grown crops. Where flooding is frequent, these soils are used for pasture or as woodland.

Typical profile of Sloan silty clay loam in a cultivated area (1¼ miles north of Harveysburg and 1 mile northeast of the intersection of State Route 73 and Colessy-Harris Roads, Massie Township):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay loam; weak, fine and medium, granular structure; friable; common roots; neutral; clear, smooth boundary.

A1—8 to 24 inches, very dark brown (10YR 2/2) silty clay loam; strong, medium, subangular blocky structure; firm; many roots; neutral; gradual, wavy boundary.

B2g—24 to 42 inches, dark grayish-brown (10YR 4/2) silty clay loam; common, medium, distinct mottles of brown, yellowish brown, and dark brown (10YR 5/3, 5/4, and 4/3); weak, coarse, subangular blocky structure; firm; neutral; diffuse, wavy boundary.

IIC—42 to 60 inches, dark-brown (10YR 3/3) silty clay loam; common, medium, distinct mottles of yellowish brown, brown, and dark gray (10YR 5/4, 5/3, and 4/1); structureless (massive); firm; neutral.

The A horizon ranges from 12 to 24 inches in thickness. The dominant thickness is 20 to 24 inches. The A horizon is dominantly very dark grayish brown (10YR 3/2), but it is very dark gray (10YR 3/1), very dark brown (10YR 2/2), or black (10YR 2/1) in some places. The A and B horizons range from light silty clay loam to silt loam or loam. These horizons contain thin strata of fine sandy material or clay loam material in some places. The C horizon ranges from light silty clay loam to loam. The C horizon is neutral or mildly alkaline. It is also calcareous. The solum is typically underlain by stratified layers of moderately fine textured to medium-textured materials that includes discontinuous lenses of sandy and gravelly material.

Sloan soils are commonly near the somewhat poorly drained Shoals soils, the moderately well drained Eel soils, and the well drained Genesee soils on flood plains. Sloan soils are darker colored and more poorly drained than any of these soils.

Sloan silty clay loam (So).—Most areas of this nearly level soil occupy crescent-shaped sloughs that roughly parallel stream channels. Areas commonly range from 5 to 10 acres in size. Linear flood channels occur in most of the larger areas of this soil. Where this soil occurs along the smaller streams, linear winding shapes are common.

Included with this soil in mapping are areas where the surface layer is silt loam or loam. Also included, along Caesar Creek, are areas of soils that are shallow to coarse material. This coarse material is at a depth of 10 to 20 inches and ranges in size from coarse sand to small boulders. These shallow included soils are not droughty, because the underlying material is continuously replenished by free water. Other inclusions are a few areas of lighter colored, better drained Algiers soils.

Flooding is a limitation to use of this soil for most purposes. It is a severe limitation to use for crops. The seasonal high water table can be lowered by drainage where outlets can be established. Drainage helps to increase the growth of crops. (Capability unit IIIw-1; woodland group 2w1)

Uniontown Series

The Uniontown series consists of moderately well drained, nearly level to gently sloping soils that are deep. These soils formed in medium-textured and moderately fine textured sediments deposited in glacial lakes of Wisconsin age. They occupy areas parallel to present streams.

A typical Uniontown soil has a brown silt loam plow layer 8 inches thick. It normally contains a medium to low amount of organic matter. A silt loam layer that is grayer than the plow layer occurs between depths of 8 and 10 inches. The upper part of the subsoil, to a depth of about 14 inches, is yellowish-brown, firm light silty clay loam. The subsoil contains more clay and is yellowish brown between depths of 14 to 30 inches. Light yellowish-brown silt loam extends to a depth of 36 inches. It is underlain by light yellowish-brown light silty clay loam that is neutral to mildly alkaline. This layer is calcareous.

Uniontown soils have a seasonally high water table, particularly during winter and spring. They have moderately slow permeability, a deep root zone, and a high available moisture capacity. They are soft and compressible when saturated. Unless they have been limed, these soils are medium acid in tho upper part of the root zone.

The Uniontown soils are used primarily for cultivated crops such as corn and soybeans.

Representative profile of Uniontown silt loam in a cultivated area (1¼ miles southwest of Hickoryville and 2,000 feet northeast of the intersection of Sherrod and Clarksville Roads, Massie Township):

Ap—0 to 8 inches, brown (10YR 5/3) silt loam; weak, fine and medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

A2—8 to 10 inches, grayish-brown (10YR 5/2) silt loam; weak, medium and thin, platy structure; friable; many roots; medium acid; clear, wavy boundary.

B1t—10 to 14 inches, yellowish-brown (10YR 5/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; common roots; thin, continuous, dark yellowish-brown (10YR 4/4) clay films on ped faces; medium acid; gradual, wavy boundary.

B2t—14 to 30 inches, yellowish-brown (10YR 5/4) silty clay loam; strong, medium and fine, subangular blocky structure; firm; common roots; thin, continuous, dark yellowish-brown (10YR 4/4) clay films on ped faces; slightly acid; clear, wavy boundary.

B3—30 to 36 inches, light yellowish-brown (10YR 6/4) silt loam; few, fine, faint, light brownish-gray (10YR 6/2) mottles; weak, coarse, subangular blocky structure; friable; few roots; neutral; gradual, irregular boundary.

C—36 to 60 inches, light yellowish-brown (10YR 6/4) light silty clay loam; structureless (massive); friable; some strata of silt loam; weakly calcareous.

In cultivated areas the A horizons are grayish brown and brown (10YR 5/2, 5/3, and 4/3). Uncultivated soils may have a thin A1 horizon that is very dark brown (10YR 2/2). The solum ranges from 36 inches to 60 inches in thickness. It is normally neutral or calcareous within a depth of 42 inches.

Uniontown soils formed in about the same kind of material as Patton and Henshaw soils. Uniontown soils are members of a topographic sequence that includes somewhat poorly drained Henshaw soils and very poorly drained Patton soils. Uniontown soils have a light-colored surface layer in contrast to the dark-colored surface layer of the Patton soils. They are less gray and less mottled in the subsoil than Henshaw soils. Uniontown soils are similar to Birkbeck soils except that Uniontown soils formed in lacustrine material and Birkbeck formed in loess. Uniontown soils have a higher pH in their subsoil than the Alford soils.

Uniontown silt loam, 1 to 6 percent slopes (UnB).—This soil is in areas that vary in size and shape, but it generally occupies linear areas on stream terraces. Locally it has wet areas that dry more slowly in the spring than the rest of the soil. Surface crusting is common on this soil.

Included with this soil in mapping are a few moderately eroded areas. Also included are few areas where the surface layer is fine sandy loam or sandy loam. These sandier areas are indicated on the map by the symbol for sand spots. In Turtle Creek Township a few small areas are underlain by sand at a depth of 4 to 5 feet.

Medium to rapid surface runoff and a moderate erosion hazard are limitations if this soil is used for cultivated crops. Also, this soil tends to be soft and unstable when wet. Moderately slow permeability is a limitation for some nonfarm uses. (Capability unit IIe–1; woodland group 2o1)

Warsaw Series

The Warsaw series consists of dark-colored, nearly level to gently sloping soils that are well drained. These soils formed in loamy material that is underlain by stratified sandy and gravelly outwash. They occupy glacial outwash terraces of Wisconsin age. These soils are thought to have formed under tall grasses of the prairie.

A typical Warsaw soil consists of very dark grayish-brown loam to a depth of 14 inches. Between depths of 14 and 33 inches, the subsoil is dark-brown clay loam that is firm when moist and sticky when wet. The lower part of the subsoil contains some waterworn pebbles. The lowermost layer of the subsoil is brown loam. The underlying material occurs at a depth of 36 inches and is stratified, loose, calcareous sand and gravel.

Warsaw soils have moderate permeability, but the underlying material is rapidly permeable. Most annual crops grown on these soils develop roots that extend to a moderate depth. Depth of root development is normally limited by the depth to the sand and gravel. Underlying material normally limits the development of roots. These soils have a medium to low available moisture capacity. They tend to be droughty for crops that mature late in summer. Warsaw soils warm up early in the spring. Normally they can be tilled soon after a rain. These soils are slightly acid to mildly alkaline in the root zone, but they are medium acid in some areas not limed.

Warsaw soils are not extensive in the county. Most of the acreage is used as cropland. Commonly grown crops are corn, wheat, soybeans, and hay. Pollution of the underground water is a hazard if these soils are used for disposal of sewage effluent or of solid waste.

Representative profile of a Warsaw loam (NW¼ section 11, T. 3 S., R. 4 E., Turtle Creek Township):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

A1—8 to 14 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine, subangular blocky structure; friable; many roots; neutral; gradual, smooth boundary.

B1t—14 to 18 inches, dark-brown (7.5YR 3/2) clay loam; moderate, fine and medium, subangular blocky structure; firm; many roots; thin patchy clay films on ped faces; neutral; gradual, irregular boundary.

B2t—18 to 30 inches, dark-brown (7.5YR 4/4) clay loam; strong, medium and fine, subangular blocky structure; firm; common roots; thin, continuous, dark-brown (10YR 4/3) clay films on ped faces; slightly acid; gradual, irregular boundary.

B31t—30 to 33 inches, dark-brown (7.5YR 4/2) clay loam; weak, medium, subangular blocky structure; firm; few roots; thin, patchy, dark-brown (10YR 4/3) clay films on ped faces; neutral to mildly alkaline; weakly calcareous; clear, wavy boundary.

B32—33 to 36 inches, brown (7.5YR 5/4) loam; structureless (massive, parting to single grain with slight pressure); friable; mildly alkaline; calcareous; clear, wavy boundary.

IIC—36 to 60 inches, brown (10YR 5/3 to 4/3) stratified sand and gravel; massive in place but parts to single grain; loose; no roots; coarse fragments increase with depth; mildly alkaline to moderately alkaline; calcareous.

The A horizons are dominantly very dark grayish brown (10YR 3/2) but range to black (10YR 2/1) and very dark brown (10YR 2/2). These horizons generally are loam, but they are silt loam or fine sandy loam in some places. The A horizons range from 10 to 20 inches in thickness. Depth to the calcareous stratified outwash ranges from 24 to 42 inches. The underlying outwash varies from one stratum to another. It ranges from loam to well-sorted sand or gravel.

Warsaw soils are commonly adjacent to the Wea and Fox soils. These Warsaw soils are dark colored in contrast to the lighter colored Fox soils. Warsaw soils have sand and gravel nearer the surface than do the Wea soils. Also, the content of gravel and sand is higher in the Warsaw soils than in the Wea soils.

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Warsaw loam, 0 to 2 percent slopes (WaA).—Most areas of this soil are 5 to 20 acres in size, but some are as much as 100 acres. A profile of this soil was described as typical for the series. This soil has good tilth and is seldom subject to crusting.

Included with this soil in mapping are a few small areas of Fox soils. Fox soils are lighter colored than Warsaw soils, but otherwise are similar.

This Warsaw soil is well suited to specialty crops and irrigation. It is moderately droughty, but it has few other limitations to use for crops. Limitations to use for most nonfarm purposes also are few. (Capability unit IIs-1; woodland group 2o1)

Warsaw loam, 2 to 6 percent slopes (WaB).—This soil occurs on short terrace breaks and on terraces. Areas of this soil generally range from 3 to 15 acres in size, though some areas are as much as 50 acres. This soil generally has a thinner dark-colored surface horizon than has the profile described as typical for the series, and sand and gravel is nearer the surface. Surface tilth generally is good.

Surface runoff from this soil is slow to medium. Runoff occurs only when rainfall exceeds infiltration. This happens most often during thunderstorms in spring and summer. This soil is well suited to specialty crops and irrigation. The erosion hazard is moderate in cultivated areas. Except for slope, this soil has few limitations for most nonfarm uses. (Capability unit IIe-4; woodland group 2o1)

Wea Series

The Wea series consists of nearly level, dark-colored soils that are deep and well drained. These soils formed in loamy material that overlies outwash of stratified sand and gravel. These soils occupy terraces of Wisconsin-age outwash. The native vegetation probably was tall prairie grasses.

A typical Wea soil has a very dark grayish-brown silt loam plow layer about 10 inches thick. The next layer extends to a depth of 14 inches and is similar to the plow layer in color and texture. The subsoil, between depths of 14 and 40 inches, consists of dark-brown and brown silty clay loam. Below this, the subsoil is yellowish-brown sandy clay loam that extends to a depth of 45 inches. The underlying material is stratified, loose, calcareous sand and gravel.

Wea soils are moderately permeable above the underlying material and rapidly permeable in it. Most annual crops grown on these soils develop deep roots. Wea soils have a high available moisture capacity. They warm up early in spring and can be tilled soon after a rain. They are medium acid to neutral.

These soils are well suited to crops and are important to farming. Most of the acreage is used for corn, wheat, soybeans, and hay. These soils also are well suited to irrigation and specialized crops. Pollution is a hazard to underground water supplies, if Wea soils are used for disposal of sewage effluent or of solid waste.

Representative profile of Wea silt loam in a cultivated area (2¾ miles south of Waynesville and ½ mile northeast of the junction of Caesar Creek and the Little Miami River, Wayne Township):

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

A11—10 to 14 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium and fine, subangular blocky structure; friable; many roots; neutral; gradual, wavy boundary.

B1t—14 to 20 inches, dark-brown (10YR 3/3) silty clay loam; strong, medium, subangular blocky structure; firm; common roots; thin patchy clay films on ped faces; neutral; gradual, irregular boundary.

B21t—20 to 40 inches, brown (10YR 4/3) silty clay loam; strong, medium, subangular blocky structure; firm; common roots; thin continuous clay films on ped faces; neutral; clear, smooth boundary.

IIB22t—40 to 45 inches, yellowish-brown (10YR 5/4) sandy clay loam; moderate, medium and coarse, subangular blocky structure; firm; few roots; thin, patchy, dark-brown (10YR 4/3) clay films on ped faces; neutral; gradual, irregular boundary.

IIIC—45 to 60 inches, yellowish-brown (10YR 5/4), stratified sand and gravel; structureless (single grain); loose; no roots; proportion of coarse fragments increases with depth; mildly alkaline to moderately alkaline; calcareous.

The A horizon is dominantly very dark grayish brown (10YR 3/2) but ranges to black (10YR 2/1). The upper part of the solum developed in 12 to 40 inches of silty or loamy material. The B horizons that developed in the silty mantle are mostly silty clay loam. The B horizons that developed in outwash material are clay loam to sandy clay loam. Clay films are present in the B horizons. These horizons may have a hue of 7.5YR where they developed in outwash. A hue of 10YR is dominant where the B horizons developed from silty material. Depth to the relatively unweathered C horizon ranges from 40 to 60 inches but generally is between 42 and 48 inches. The substratum is stratified, calcareous sand and gravel. The texture and degree of sorting vary from one stratum to another.

Wea soils commonly are near Warsaw and Fox soils. The Wea soils are deeper to the underlying sand and gravel than the Warsaw or Fox soils and have less sand and gravel in the subsoil. Wea soils are darker colored than the light-colored Fox and Ockley soils.

Wea silt loam, 0 to 2 percent slopes (WeA).—Most areas of this soil are on broad terraces, some of which are linear in shape. The areas range from 5 to 20 acres in size. This soil has good surface tilth and a good supply of organic matter in the surface layer.

Included with this soil in mapping are small areas of lighter colored Ockley soils and thinner Warsaw soils. The Warsaw soils are more droughty than this Wea soil. Also included are areas where the surface layer is loam.

This soil has few or no limitations to farm and nonfarm uses. (Capability unit I-2; woodland group 1o1)

Williamsburg Series

The Williamsburg series consists of nearly level to sloping soils that are deep and well drained. These soils formed partly in loess, 18 to 36 inches thick, and partly in underlying, stratified and mixed, medium-textured and moderately fine textured material that includes discontinuous layers of sand and gravel. They occupy areas on the oldest glacial outwash terraces of Wisconsin age.

A typical Williamsburg soil in a cultivated area has a dark-brown silt loam plow layer, about 9 inches thick, that is above a layer of yellowish-brown silt loam 3 inches thick. The upper part of the subsoil extends to a depth of 24 inches and consists of yellowish-brown silty clay loam. The lower part of the subsoil consists of uniform dark yellowish-brown clay loam that extends to a depth of 70 inches. The underlying material is stratified sandy clay loam, loam, and clay loam and loose gravel and sand layers that are calcareous.

Williamsburg soil is moderately permeable above the underlying material and rapidly permeable in it. Most annual crops grown on this soil develop deep roots. Depth of rooting normally is limited by the underlying sand and gravel. These soils have a high available moisture capacity, but they are droughty occasionally, particularly if crops that mature late in summer are grown. Williamsburg soils warm up early in the spring. They normally are strongly acid in the root zone.

Williamsburg soils are used mostly for crops. Commonly grown crops are corn, wheat, soybeans, and hay.

Representative profile of a Williamsburg silt loam in a cultivated area (1¼ miles southeast of Roachester, 2,000 feet south of the intersection of Osceola-Roachester Road and Todd Fork Creek, Harlan Township):

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; weak, fine and medium, granular structure; friable; many roots; neutral (limed); clear, smooth boundary.

A2—9 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; many roots; strongly acid; clear, smooth boundary.

B1t—12 to 17 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; common roots; thin, discontinuous, brown (10YR 4/3) clay films and pale-brown (10YR 6/3) silt coatings on ped faces; strongly acid; gradual, wavy boundary.

B21t—17 to 24 inches, yellowish-brown (10YR 5/4) silty clay loam; strong, medium, subangular blocky structure; firm; common roots; thin, continuous, brown (10YR 4/3) clay films on ped faces; strongly acid; gradual, wavy boundary.

IIB22t—24 to 70 inches, dark yellowish-brown (10YR 4/4) clay loam; strong, medium, subangular blocky structure; firm; few roots; thin patchy clay films on ped faces; stratified; some sandy clay loam strata; strongly acid between 24 and 48 inches and grades gradually to medium acid at 60 inches, and slightly acid to neutral at 70 inches; gradual, wavy boundary.

IIC1—70 to 90 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; structureless (massive); friable; stratified sandy clay loam, loam, and clay loam; neutral; gradual, wavy boundary.

IIC2—90 to 100 inches, brown (10YR 5/3) sandy clay loam; structureless (massive); friable; stratified mixed sand and gravel; mildly alkaline; weakly calcareous.

The silty mantle ranges from 18 to 36 inches in thickness. The IIB2t horizon, which developed in alluvial outwash, ranges from clay loam to sandy clay loam. Evidence of stratification of the original outwash material remains in the weathered lower part of the solum. Some gravelly strata occur, but the outwash material also has sandy strata. The IIB horizons normally decrease in acidity below a depth of about 48 inches, but in some places they remain medium acid or strongly acid to a depth of 70 to 90 inches. Depth to the neutral or calcareous C horizon ranges from 70 to 120 inches. The unweathered C horizon generally is sandy clay loam, but it ranges to clay loam or sandy loam in some places. The C horizon has sand and gravel layers of varying thickness and degree of sorting.

The Williamsburg soils commonly occupy terraces above those on which Fox soils occur and below older higher terraces of Illinoian age occupied by the Parke and Rainsboro soils. Most of the terraces on which the Williamsburg soils formed are of outwash and alluvium beyond the terminal extent of Wisconsin-age glaciation. Most of these terraces extend in a north-south direction and transect upland till areas of Illinoian age.

Williamsburg soils are weathered and developed to a greater depth than the Ockley soils. They also are more acid. Williamsburg soils are similar to Parke soils, except that Williamsburg soils are not so acid and are thinner to calcareous material.

Williamsburg silt loam, 0 to 2 percent slopes (WlA).—This soil lies on terraces in areas that range from 3 to 20 acres in size. It has the profile described as typical for the series. Tilth is generally good, but the soil surface is subject to crusting. Surface runoff is slow, and erosion is a slight or no hazard. Some of the more nearly level areas of this soil are slightly less well drained than typical.

Limitations are few to the use of this soil for farming. The soil is well suited to row crops or specialty crops. It is very well suited to irrigation, and has few limitations for most nonfarm uses. (Capability unit I–1; woodland group 1o1)

Williamsburg silt loam, 2 to 6 percent slopes (WlB).—Most areas of this soil occupy broad terrace areas. These areas commonly are linear in shape, and they contain about 3 to 25 acres.

Included with this soil in mapping are some areas that consist mostly of moderately well drained soils. These included areas dry more slowly than this soil. Also included are eroded areas where the soil is more yellow and more sticky than typical.

Surface runoff and erosion are moderate hazards where this soil is cultivated or otherwise disturbed. Except for slope, there are few or no limitations for most nonfarm uses. (Capability unit IIe–1; woodland group 1o1)

Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded (WlC2).—Because of past erosion, the plow layer of this soil is a mixture of the remaining original surface layer and the yellowish-brown material from the upper part of the subsoil. The tilth of this soil is generally poorer than that of uneroded Williamsburg soils. Areas commonly are linear in shape, and they range from 3 to 25 acres in size.

Included with this soil in mapping are a few severely eroded areas in places where the soil is steep and in places where tillage has been up and down hill. They are suited to only limited cultivation. These severely eroded areas are shown on the map by a symbol.

Because surface runoff is rapid, the erosion hazard is severe if this soil is used for cultivated crops. Slope is the dominant limitation for most nonfarm uses. (Capability unit IIIe–1; woodland group 1o1)

Wynn Series

Soils in the Wynn series are gently sloping to sloping, well drained, and mostly moderately deep. They formed partly in a thin layer of loess and partly in underlying calcareous loam till and residuum weathered from shale and limestone. Wynn soils occupy areas where relatively thin layers of loess and till overlie limestone bedrock.

A typical Wynn silt loam that is cultivated has a dark yellowish-brown silt loam plow layer 8 inches thick. The subsoil, to a depth of 18 inches, is dark-brown silty clay loam. Between depths of 18 and 28 inches, the subsoil is brown clay loam. It is over brown clay that extends to a depth of 32 inches. Till pebbles and limestone fragments are in the lower part of the subsoil. Clay shale and limestone are at a depth of 32 inches.

Wynn soils have moderately slow permeability and a medium to low available moisture capacity. The available moisture capacity varies because the depth to shale and limestone ranges from 24 to 40 inches. The depth of the root zone also is variable. The root zone ranges from medium acid in the upper part to mildly alkaline in the lower part.

Wynn soils are suited to the crops commonly grown in the county, but they are droughty in summer because bedrock is near the surface.

Representative profile of a Wynn silt loam in a cultivated area (SE¼NW¼ section 8, T. 3 E., R. 4 N., Turtle Creek Township):

Ap—0 to 8 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium and fine, granular structure; friable; many roots; neutral; gradual, smooth boundary.

B1—8 to 10 inches, dark-brown (10YR 4/3) light silty clay loam; moderate, medium, subangular blocky structure; friable; many roots; slightly acid; gradual, wavy boundary.

B21t—10 to 18 inches, dark-brown (10YR 4/3) silty clay loam; moderate to strong, medium, subangular blocky structure; firm; many roots; dark-brown (7.5YR 4/4) clay films on ped faces; medium acid; gradual, wavy boundary.

IIB22t—18 to 28 inches, brown (10YR 5/3) clay loam; common, fine, faint, light olive-brown (2.5Y 5/4) mottles; moderate, medium and coarse, subangular blocky structure; firm; common roots; dark-brown (7.5YR 4/4) clay films on ped faces; few igneous pebbles and limestone fragments; medium acid to slightly acid; clear, wavy boundary.

IIIB3—28 to 32 inches, brown (10YR 5/3) clay; common, medium and fine, faint, dark-brown (7.5YR 4/4) and light olive-brown (2.5Y 5/4) mottles; weak, coarse, subangular blocky structure; firm; no roots; few limestone fragments; mildly alkaline; calcareous; abrupt, irregular boundary.

IIIR—32 inches, light olive-brown (2.5Y 5/4) and light olive-gray (5Y 6/2) clay shale and thin-bedded limestone; calcareous.

Eroded areas of Wynn soils commonly have an A horizon of intermingled silt loam, silty clay loam, and clay loam. The loess mantle ranges from 18 to 30 inches in thickness, but it is 18 to 24 inches thick in most places. The IIB2t horizon that developed in till is clay loam, silty clay loam, or clay. The till in which these soils developed contains varying amounts of local bedrock consisting of calcareous clay shale and thin strata of fossiliferous limestone. In some places where the depth to the shale and limestone approaches 40 inches, the solum is underlain by a thin strata of calcareous till. The underlying limestone is commonly fractured, apparently by glacial action.

The part of the solum weathered from loess dominantly has hues ranging from 10YR to 7.5YR. The part of the solum weathered from the till dominantly has a hue of 10YR, but hue is 2.5Y where the content of local bedrock is high. The weathered limestone is dominantly of 2.5Y and 5Y hues. The upper part of the B horizon ranges from medium acid to slightly acid, but the lower part is neutral to mildly alkaline.

Wynn soils are similar to Plattville soils, except that the surface layer of the Wynn soils is lighter colored than that of the dark-colored Plattville soils.

Wynn silt loam, 2 to 6 percent slopes (WyB).—The surface layer of this soil has the best tilth of any of the Wynn soils, but it is subject to crusting.

Included with this soil in mapping are a few areas of deeper Miamian and Russell soils and a few areas of dark-colored Plattville soils. Also included are a few areas of nearly level Wynn soils.

Surface runoff is medium except in the few nearly level included areas. Because of this medium surface runoff, there is a moderate hazard of erosion if the soil is cultivated. Limited depth to shale and limestone and moderately slow permeability are limitations for some nonfarm uses. (Capability unit IIe–2; woodland group 2o1)

Wynn silt loam, 2 to 6 percent slopes, moderately eroded (WyB2).—This soil has a profile similar to that described for the series except for the effects of erosion. Erosion has removed part of the original surface layer of this soil. The present plow layer is a mixture of the remaining original surface layer and the upper brownish part of the subsoil. It has a low to medium content of organic matter. This soil has fair tilth but crusts easily.

Included with this soil in mapping are small areas of deeper Miamian soils and dark-colored Plattville soils. Also included are a few areas where the surface texture is loam.

Surface runoff is medium, and the susceptibility to erosion is moderate. Limited depth to shale and limestone and moderately slow permeability are limitations to many nonfarm uses. (Capability unit IIe–2; woodland group 2o1)

Wynn silt loam, 6 to 12 percent slopes, moderately eroded (WyC2).—This soil is steeper and more eroded than Wynn silt loam, 2 to 6 percent slopes. The present plow layer is a mixture of the original surface layer and the upper brownish part of the subsoil.

Included with this soil in mapping are small areas of deeper Miamian and dark-colored Plattville soils. Also included are a few areas that are slightly eroded. These eroded areas are mostly in pasture or trees.

This soil has a low available moisture capacity and organic-matter content. Surface runoff is rapid, and the erosion hazard is severe if this soil is cultivated. Slope, moderately slow permeability, and shale and limestone near the surface are limitations for many nonfarm uses. (Capability unit IIIe–3; woodland group 2o1)

Wynn silt loam, 6 to 12 percent slopes, severely eroded (WyC3).—The profile of this soil is similar to the one described as typical for the series except for the differences caused by severe erosion. The present plow layer is mostly moderately fine textured material from the upper part of the subsoil. This material makes the plow layer more sticky and more difficult to work than that in less eroded Wynn soils. The plow layer is commonly low in organic-matter content. When bare of plant cover, the surface is likely to crust and to slow the infiltration of water. Both crusting and poor moisture content hinder emergence of seedlings and optimum growth of plants. This soil has a low available moisture capacity. Gullies and rills are common in some areas. This soil commonly occupies knobs, the upper part of long slopes, and side slopes that receive surface runoff from higher areas.

Included with this soil in mapping are a few small slightly eroded and moderately eroded areas. Also included are small areas of deeper Miamian and dark-colored Plattville soils.

Because surface runoff is rapid, the erosion hazard is very severe if this soil is used for cultivated crops. Slope, erosion, moderately slow permeability, and shale and limestone near the surface are limitations for many nonfarm uses. (Capability unit IVe–2; woodland group 3o1)

Xenia Series

The Xenia series consists of deep, moderately well drained, nearly level to sloping soils of the uplands. These soils formed partly in a fairly thick mantle of loess and partly in the underlying glacial till of Wisconsin age. The till is calcareous loam.

A typical Xenia soil has a very dark grayish-brown surface layer about 6 inches thick over a subsurface layer of brown silt loam about 5 inches thick. The subsoil, to a depth of 15 inches, is brown to dark yellowish-brown silt loam that is faintly mottled with yellowish brown. Silty clay loam extends to a depth of 45 inches and is mostly mottled. The underlying material is brown loam that is mottled with yellowish brown and light gray.

Xenia soils have moderately slow permeability. They are seasonally saturated for short periods. The root zone is deep enough for most annual crops, and the available moisture capacity is medium to high. The upper part of the root zone is strongly acid or medium acid in unlimed areas.

These soils are extensive in the county. They are well suited to and are used for corn, soybeans, wheat, hay, and similar crops.

Representative profile of a Xenia silt loam in a pastured area (3½ miles northeast of Waynesville and ¼ mile southeast of the intersection of New Burlington and Furnas Roads, Wayne Township):

A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; many roots; neutral; clear, smooth boundary.

A2—6 to 11 inches, brown (10YR 5/3) silt loam; weak, medium, platy structure that parts to weak, fine, granular; friable; many roots; many dark grayish-brown (10YR 4/2) fillings in worm holes and root channels; neutral; abrupt, wavy boundary.

B1t—11 to 15 inches, brown (10YR 4/3) to dark yellowish-brown (10YR 4/4) heavy silt loam that has common, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate, fine and medium, subangular blocky structure; firm; common roots; thin patchy clay films on ped faces; slightly acid; clear, wavy boundary.

B21t—15 to 20 inches, dark yellowish-brown (10YR 4/4) silty clay loam; strong, fine and medium, subangular blocky structure; firm when moist, slightly sticky when wet; common roots; continuous brown (10YR 5/3) to light olive-brown (2.5YR 5/3) clay films on ped faces; strongly acid; clear, wavy boundary.

B22t—20 to 25 inches, dark yellowish-brown (10YR 4/4) silty clay loam that has few, fine, faint, light brownish-gray (2.5Y 6/2) mottles; strong, fine and medium, subangular blocky structure; firm when moist, sticky and slightly plastic when wet; common roots; thin, continuous, light olive-brown (2.5Y 5/3) and brown (10YR 5/3) clay films on ped faces; strongly acid; clear, wavy boundary.

B23t—25 to 32 inches, dark-brown (10YR 4/3) to dark yellowish-brown (10YR 4/4) silty clay loam; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky structure; firm when moist, sticky and plastic when wet; common roots; thin, continuous, brown (10YR 5/3) clay films on ped faces; few very dark-brown (10YR 2/2) iron-manganese concretions; strongly acid; clear, wavy boundary.

IIB24t—32 to 38 inches, brown (10YR 5/3) silty clay loam that has many, fine, distinct, yellowish-brown (10YR 5/6) and faint, grayish-brown (10YR 5/2 and 2.5Y 5/2) mottles; weak, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; firm when moist, sticky and very plastic when wet; few roots; thin, patchy, grayish-brown (10YR 5/2) clay films; many small glacial pebbles; few dark-brown (10YR 3/3) iron-manganese concretions; slightly acid; gradual, wavy boundary.

IIB3—38 to 45 inches, dark-brown (10YR 4/3) silty clay loam that has many, medium, distinct, yellowish-brown (10YR 5/6) and faint, grayish-brown (10YR 5/2 and 2.5Y 5/2) mottles; weak, medium and coarse, subangular blocky structure; firm when moist, sticky and plastic when wet; few roots; nodules of calcareous till in lower 2 inches, surrounded by noncalcareous material; neutral; clear, irregular boundary.

IIC—45 to 60 inches, brown (10YR 5/3) loam that has common, fine and medium, distinct, yellowish-brown (10YR 5/4) and light-gray (N 6/0) mottles; structureless (massive); firm; no roots; mildly alkaline; calcareous.

Where the A1 and A2 horizons are mixed to form an Ap horizon, the plow layer is mostly dark grayish brown (10YR 4/2). Eroded places have a surface layer of brown or yellowish-brown (10YR 5/3 or 5/4). The loess mantle ranges from 18 to 40 inches in thickness. In many places the entire range occurs within a horizontal distance of 50 feet or less. Depth to grayish mottles that have a chroma of 2 ranges from about 14 to 22 inches.

The upper part of the Bt horizon is silty clay loam that has a clay content of 28 to 35 percent. The lower part of the Bt horizon formed from till, and its clay content may exceed 35 percent. Typically, the content of sand and small glacial pebbles increases in the IIB horizons as depth increases. The IIB3 horizon commonly contains fragments of calcareous material from the C horizon, but structure and weathering commonly extend for a short distance into the till. The calcareous till is mostly loam, but it ranges from silt loam to clay loam. The till commonly contains limestone flagstones up to 12 inches across, and these are parallel with the surface of the soil. They were derived from the local Ordovician bedrock.

The Xenia soils are the moderately well drained members of a topographic sequence that includes the higher lying, well-drained Russell soils, the progressively lower lying, somewhat poorly drained Fincastle soils, and the very poorly drained Brookston soils. Xenia soils have grayish mottles in the upper part of the subsoil, but Russell soils do not. Xenia soils are less gray and less mottled than Fincastle soils. The surface layer of the Xenia soils is lighter colored than the dark-colored surface layer of Brookston soils. Xenia soils formed in a thinner mantle of loess than Birkbeck soils.

Xenia silt loam, 0 to 2 percent slopes (XeA).—This soil occupies broad ridgetops. Areas are generally circular in shape and 3 to 25 acres in size, though some areas are as much as 50 acres.

Included with this soil in mapping are a few areas of wetter Fincastle soils in lower positions. Also included are a few areas of gently sloping Xenia soils and of Russell soils.

This soil has few if any limitations to use for farming. Surface runoff is slow, and there is little or no hazard of erosion. This soil is well suited to row crops. Moderately slow permeability is a limitation for some nonfarm uses. (Capability unit I–1; woodland group 1o1)

Xenia silt loam, 2 to 6 percent slopes (XeB).—A profile of this soil is described as typical for the series. This soil commonly occurs on slightly convex, long slopes. Most areas of this soil are broad and circular. They generally are 3 to 50 acres in size, but some areas are as much as 100 acres. The upper ends of drainageways typically occur in most areas of this soil. Along some of these drainageways, the limestone is at only a moderate depth. Also, the dark-colored surface layer in some of these areas indicates that this soil is similar to the Plattville soils. Included with this soil in mapping are a few small areas of wetter Fincastle soils and of thinner Wynn soils.

Surface runoff is medium to rapid, particularly where this soil is bare of plant cover. The erosion hazard is moderate in cultivated areas. Slope and moderately slow permeability are limitations for many nonfarm uses. (Capability unit IIe–1; woodland group 1o1)

Xenia silt loam, 2 to 6 percent slopes, moderately eroded (XeB2).—The plow layer of this soil is a mixture of the remaining original surface layer and the brown upper part of the subsoil as a result of erosion. Because of this subsoil material, the range of optimum moisture content for tillage is narrower than that of less eroded Xenia soils. Most areas of this soil range from 3 to 50 acres in size.

Included with this soil in mapping are a few small areas of wetter Fincastle soils and thinner Wynn soils. Also included are a few slightly eroded and severely eroded areas.

Surface runoff is generally rapid, especially where the surface is bare of plant cover. Long slopes contribute to the amount of runoff. The erosion hazard is moderate in cultivated areas. Moderately slow permeability and slope are limitations to some nonfarm uses of this soil. (Capability unit IIe-1; woodland group 1o1)

Formation and Classification of Soils

This section discusses the five factors of soil formation and the effects that they have had on the formation of soils in Warren County. Also described are processes that occur in the soils as they develop. In addition, the system of soil classification currently used by the Soil Conservation Service and others is explained, and soil series are placed in some of the categories of this system. The soil series in this county, including a profile representative of each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

The five factors of soil formation are parent material, climate, plant and animal life, relief, and time. These factors interact in the formation of any soil. The climate and the plant and animal life have actively affected the parent material, but this effect is modified by relief and the time that a soil has been developing. Normally, the interaction of all these factors determines the kind of soil that develops in any given place, but the relative importance of each factor differs from place to place. In some places one factor may dominate in the formation of a soil and thus determine most of its properties.

Parent material

Most soils in Warren County formed in glacial materials of Wisconsin age or Illinoian age. These materials consist of glacial till, outwash material, loess, and silty and clayey lacustrine material.

Some soils formed in alluvial material washed from uplands. The Fairmount and similar soils formed in residuum weathered from interbeded limestone and shale. Fairmount soils commonly contain many limestone flagstones.

The Miamian, Russell, Xenia, Fincastle, and Brookston soils formed in Wisconsin-age glacial till covered with loess of variable thickness. These soils are deep because they formed in thick soil materials. The Miamian soils generally are only moderately deep to carbonates because they lack a thick loess cap. Russell, Xenia, and Fincastle soils are deeper to carbonates than Miamian soils and have a thicker loess cap. The underlying glacial till is 20 to 40 percent calcium carbonate, a relatively high percentage. Alford, Iva, Birkbeck, Reesville, and similar soils have a high content of silt because they formed in thick, silty loess. Uniontown and Henshaw soils have a high content of silt because they formed in silty sediments deposited in areas that ponded in postglacial time. Warsaw and Fox soils are moderately deep over calcareous sand and gravel because they formed on Wisconsin-age outwash. Ockley and Wea soils formed in thicker materials of Wisconsin age. The Parke and Rainsboro soils are weathered to greater depths, as they have formed in older Illinoian-age glacial materials.

Some soils in the county formed in material washed from soils and deposited on bottom lands. Because this material is continually deposited, soils on bottom lands show little or no profile development. Ross, Genesee, Eel, Shoals, and Sloan soils formed on bottom lands in thick silty and loamy deposits. They are nearly neutral in reaction because their parent material washed from calcareous till. The sandy Abscota soils formed in coarser textured sediments than Ross, Genesee, and similar soils.

Climate

Climate affects the development of soils in several ways in Warren County. Rainfall and temperature have favored plant growth, and all of the soils have a surface layer that contains significant amounts of organic matter. The dark-colored surface layer of Ragsdale, Brookston, Patton, and other soils contains a large amount of organic matter as a result of a wet microclimate. Most of the parent material in the county is weathered to a moderate depth. In some soils weathering is shallow because of slope and a high calcium carbonate equivalent. In this county, frequent rain and snow have supplied ample moisture for weathering in Miamian, Russell, Wynn, and other soils, and water has leached soluble carbonates to a moderate depth. The water from frequent rains has moved the clay from the surface layer to the subsoil. Evidence of such movement are the clay films in the subsoil of Fox, Fincastle, and Wea soils. In this county the structure of most soils is at least partly the result of freezing and thawing.

Plant and animal life

In addition to climate, organisms, plants, animals, insects, and man are active factors of soil formation. Hardwood trees have been the dominant native vegetation in Warren County for a long time. The Russell, Fincastle, Xenia, and most other soils on uplands have a light-colored surface layer and are acid because they formed under hardwood trees. The dark-colored Dana and Wea soils formed in small areas under mixed prairie vegetation and trees. The dark-colored Brookston, Patton, Ragsdale, and similar soils formed in marshy swales and flats where excessive water has slowed the oxidation of organic matter.

By channeling to considerable depths, insects, worms, tree roots, and small animals make the soils more permeable. Worms, ants, and other insects mix the soil material considerably. Locally, crayfish mix much of the material in soils such as Clermont and Avonburg. In most places crayfish tubes extend to a depth of 4 or 5 feet.

Man also influences soils. Construction work and soil tillage drastically alter the surface layer. When man drains, irrigates, and fertilizes the soils, the natural chemical and climatic soil regime is greatly affected. Man's activity also causes accelerated erosion, and increased losses of organic matter, plant nutrients, and soil material.

Relief

Some differences in the soils of this county and elsewhere are caused by differences in relief or topography. The Cincinnati, Rossmoyne, Avonburg, Clermont, and Blanchester soils formed under similar conditions, except for natural drainage. Natural drainage largely depends on topography. The well-drained, gently sloping to sloping Cincinnati soils occupy slopes where surface and internal drainage are good. Rossmoyne soils are nearly level to sloping and moderately well drained. They occupy slopes and convex positions where the water table is high for relatively short but significant periods. The Avonburg soils are somewhat poorly drained. They are nearly level and generally occur on slight rises. On these rises, surface runoff is mostly slow and the water table is seasonally high for long periods. The nearly level Clermont soils are poorly drained. Water tends to accumulate on the nearly level to depressional, poorly drained Blanchester soils.

Because of the differences in drainage, there are other differences in the soils. For example, mottles are nearer the surface in the Avonburg soils than in Rossmoyne or Cincinnati soils. The Avonburg soils are grayer than the Rossmoyne or Cincinnati soils because they have been saturated for longer periods.

The poorly drained or very poorly drained soils in this county are nearly level or depressional. They occur where surface runoff is slow to ponded and where silty and clayey materials tend to accumulate. The very poorly drained Patton, Brookston, and Kings soils have a thick, dark-colored surface layer because organic matter decomposes slowly in wet soils. Muck has accumulated in a few swampy, depressional areas where the water table is nearly always high.

Steep soils in a given series are, in most places, thinner than less steep soils in the same series. For example, the Hickory soils in the Hickory-Fairmount complex, 18 to 25 percent slopes, moderately eroded, have thinner horizons and a thinner solum (A and B horizons) than Hickory silt loam, 2 to 6 percent slopes, moderately eroded. The Fairmount soils are generally thinner than less steep soils, partly because erosion removes soil material from steeper soils faster than from less steep soils.

Time

Important in soil development is the time that parent material has been in place and exposed to the active factors of climate and vegetation. In Warren County glacial materials of Illinoian age have been exposed for roughly 100,000 to 300,000 years (*7*). Glacial materials of Wisconsin age are much younger, for they range from 10,000 to 20,000 years in age (*7*). Because of the difference in age, the soils that formed on Illinoian-age material are leached to a greater depth than the soils that formed on Wisconsin-age materials. The Miamian, Fox, and similar soils formed in glacial till or outwash of Wisconsin age. In these soils the depth to carbonates ranges roughly from 2 to 4 feet. The depth to carbonates in the Cincinnati, Rainsboro, and similar soils that formed on glacial till or outwash of Illinoian age ranges from 6 to 10 feet or more. Rocks and minerals in Illinoian-age till are weathered more than those in Wisconsin-age till.

Eel, Ross, Genesee, and other soils on bottom lands formed in recently deposited material. They receive new material in periodic floods. In these soils, profile development starts with the accumulation of organic matter in the surface layer. Because this accumulation is interrupted by the next alluvial deposits, these soils have a variable content of organic matter in their strata.

Processes of Soil Formation

The soil-forming processes of addition, loss, transfer, and alteration of soil material and its components are controlled or influenced by the factors of soil formation discussed in the foregoing subsection. Some of these processes promote differences in a soil. Others retard or prevent differences. Among these processes is organic matter added to the soil surface. Also added to the soils are bases in the organic matter and in seepage water, eroded deposits, and bases contained in lime and fertilizer. The dark-colored surface layer of the Brookston, Patton, and other soils indicates the addition of organic matter. A thin layer of organic accumulation formed in the A1 horizon of the soils, but in most places cultivation mixed this accumulation with other soil material. Consequently, the A1 horizon was largely destroyed. Plant nutrients move in a cycle from soil to plants and then back to soil again in the form of litter or other organic materials. This cycle occurs in all of the soils in the county. The Patton, Kings, and Ragsdale soils are examples of soils that are seasonally waterlogged and continually accumulate bases through additions from seepage water. In these soils additions of bases are commonly greater than losses. Floodwaters periodically supply additions of alluvium to Genesee, Ross, Shoals, and Sloan soils. Lime and fertilizer added to cultivated soils counteract or may even exceed the normal losses of plant nutrients that are lost where crops are harvested.

Also, bases are removed by leaching and soil material is lost through erosion. Among the most significant losses in Warren County are those through leaching of carbonates. Carbonates were removed to a depth of 2 to 10 feet or more in the Miamian, Kendallville, Russell, Cincinnati, and most other soils on the glaciated uplands in the county. This indicates that a large amount of carbonates were lost because the original material was 20 to 40 percent calcium carbonate. Removal is slower in materials that are higher in content of carbonate. The Fox, Warsaw, and similar soils have a much higher content of calcium in the underlying sand and gravel than does glacial till. The calcium carbonate equivalent ranges from 40 to 60 percent in the part of the sand and gravel that consists of particles less than 2 millimeters in size. The content of limestone gravel is about 75 to 85 percent.

Other minerals in the soil break down and are lost by leaching, but at a slower rate than the carbonates. Free iron oxides are produced when some minerals are altered in the Parke, Fox, and similar soils, and fairly bright reddish or brownish colors appear. Because of the recurrent water table in Brookston, Patton, and similar soils, iron oxides are reduced and then lost through leaching. This changes the soil color to gray. The mottling in all except the well-drained soils is caused by reduction and resegregation of the iron oxides when the water table fluctuates.

No laboratory data are given in this survey for the soils sampled in Warren County. The Preble County, Ohio, soil survey contains data for Dana silt loam, Miami silt loam, and Russell silt loam. The Miami series in Preble County has been correlated as Miamian in Warren County. Unpublished data on mechanical analysis are available for the soils of the Avonburg, Blanchester, Clermont, Fox, Ockley, Parke, Cincinnati, Genesee, Birkbeck, Rossmoyne, Henshaw, Patton, Kendallville, Eel, Iva, and Alford series. These data are on file at the Department of Agronomy, Ohio State University, Columbus; at the State office of the Soil Conservation Service, Columbus; and at the Ohio Department of Natural Resources, Division of Lands and Soil, Columbus.

Classification of the Soils

Soil classification is an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is used to organize and apply the results of experience and research. Soils are narrowly defined as classes for discussion in detailed soil surveys and for practical application of knowledge in farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories so that information can be applied to large geographic areas.

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 (*12*). It is not discussed in this soil survey. The system currently used by the National Cooperative Soil Survey was adopted in 1965 (*14*). It is under continual study. Readers interested in the development of this system should refer to the latest literature available (*11*).

The current system of soil classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 9 shows the classification of each soil series of Warren County by family, subgroup, and order, according to the current system.

Following are brief descriptions of each of the categories in the current system.

ORDER: 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 define the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions are Entisols and Histosols, which occur in many different climates.

Four of the soil orders are represented in Warren County. They are Entisols, Inceptisols, Mollisols, and Alfisols.

Entisols are mineral soils that have changed little from the geologic parent material in which they formed. The main change is the accumulation of organic matter in the surface layer.

Inceptisols are mineral soils in which horizons have started to develop, but that do not have an accumulation of illuvial clay, or a thick, dark-colored surface layer.

Mollisols are mineral soils that have a dark-colored surface layer, 10 inches or more thick, and a base saturation of more than 50 percent.

Alfisols are mineral soils that have horizons of clay accumulation and a base saturation of 35 percent or more within 50 inches below the top of the layer of clay accumulation, or within 30 inches below the top of a fragipan.

SUBORDER: Each order is divided into suborders, primarily on the basis of those soil characteristics that produce classes having the greatest genetic similarity. The soil properties used to separate suborders mainly indicate the presence or absence of a seasonal high water table or other differences resulting from differences in the climate or vegetation. An example is Aqualfs. The term "Aqualfs" indicates seasonal wetness.

GREAT GROUP: Suborders are separated into great groups according to the presence or absence of genetic horizons and the arrangements of these horizons. The horizons used to make separations are those in which clay, iron, or humus has 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. An example is Fragiaqualfs. In this great group the Fragi stands for fragipan and the aqualfs for seasonally wet Alfisols.

SUBGROUP: Great groups are subdivided into subgroups. One represents the central, or typic, segment of a group. Other subgroups, called intergrades, 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. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Hapludalfs.

FAMILY: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils where they are used for engineering. Among the properties considered are texture, reaction, soil temperature, mineralogy, permeability, thickness of horizons, and consistence. All of the soils in the county are in a mesic (temperature) family. An example of a family is fine-silty, mixed, mesic.

Additional Facts About Warren County

This section provides general information about Warren County. The section discusses the geology; climate; physiography, relief, and drainage; water supply; and farming in the county.

Geology

Glaciers covered about all of Warren County in Illinoian age, which was about 100,000 to 300,000 years ago. Glaciers during Wisconsin age covered most of the county except the southwestern part. The glacial till of Wisconsin age has a carbonate content of 20 to 40 percent. Soils formed in an area of exposed glacial till of Illinoian age are weathered more deeply than those formed in glacial till of Wisconsin age.

Ordovician limestone and shale underlies the glacial till and is exposed on some valley walls. This limestone was exposed when downcutting streams and erosion removed the glacial overburden. The Ordovician bedrock is about 60 percent gray calcareous shale that is interbedded with thin layers of hard, fossiliferous limestone.

The layers of bedrock underlying the soils of Warren County are nearly level, for the county is near the crest of the Cincinnati arch. In a few small areas, the Ordovician Formations are capped with Silurian limestone. The most prominent area in the county is the limestone hill, locally called Spring Hill, in the eastern part of the county. The hill apparently was bypassed by glaciers, for the Crider soils on the crest of this hill show no evidence of former glaciation.

TABLE 9.—*Soil series classified according to the current system of classification*

Series	Current classification		
	Family	Subgroup	Order
Abscota [1]	Mixed, mesic	Typic Udipsamments	Entisols.
Alford [2]	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Algiers	Fine-loamy, mixed, nonacid, mesic	Aquic Udifluvents	Entisols.
Avonburg	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols.
Birkbeck	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Blanchester	Fine-silty, mixed, mesic	Typic Ochraqualfs	Alfisols.
Brookston [2]	Fine-loamy, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Casco	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Cincinnati	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Clermont [3]	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols.
Crider	Fine-silty, mixed, mesic	Typic Paleudalfs	Alfisols.
Dana	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Eden	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Eel	Fine-loamy, mixed, mesic	Aquic Fluventic Eutrochrepts	Inceptisols.
Fairmount	Clayey, mixed, mesic, shallow	Typic Hapludolls	Mollisols.
Fincastle	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols.
Genesee	Fine-loamy, mixed, mesic	Fluventic Eutrochrepts	Inceptisols.
Hennepin	Fine-loamy, mixed, mesic	Typic Eutrochrepts	Inceptisols.
Henshaw	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols.
Hickory	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Iva [2]	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Kendallville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Kings [1]	Fine, montmorillonitic, noncalcareous, mesic	Vertic Haplaquolls	Mollisols.
Lanier	Loamy-skeletal, mixed, mesic	Fluventic Hapludolls	Mollisols.
Miamian	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Ockley	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Parke	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols.
Patton	Fine-silty, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Plattville	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Princeton	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Ragsdale	Fine-silty, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Rainsboro [2]	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Reesville	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Rodman	Sandy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
Ross	Fine-loamy, mixed, mesic	Cumulic Hapludolls	Mollisols.
Rossmoyne	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Russell	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Shoals	Fine-loamy, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols.
Sloan	Fine-loamy, mixed, noncalcareous, mesic	Fluventic Haplaquolls	Mollisols.
Uniontown	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Warsaw	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Argiudolls	Mollisols.
Wea	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Williamsburg	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Wynn	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Xenia	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols.

[1] The Abscota and Kings soils in Warren County are variants from the respective series. Abscota soils have a thick, dark-colored A horizon and are calcareous throughout. Kings soils have a surface layer that is several inches too thick to be in the defined range of the series.

[2] The Alford, Brookston, Iva, and Rainsboro soils in Warren County are taxadjuncts to their respective series. Alford soils have a thicker Bt horizon than is typical for the series. They also have a transitional B horizon in the underlying till. Brookston soils have a higher silt and clay content than that in the defined range for the series. Iva soils have a transitional B horizon in the underlying till and a thicker Bt horizon than that in the defined range for the series. In Rainsboro soils mottles have a chroma of 2 in the uppermost 20 inches of the profile. They also have more sand in the lower part of the B horizon and in the C horizon than is in the defined range for the series.

[3] Clermont soils are under study and positive identification of a fragipan has not been made in the Clermont soils in Warren County. An alternate classification for these soils in this county is Typic Glossaqualfs, fine-silty, mixed, mesic.

Climate [3]

The climate of Warren County is continental. Winters are cold and cloudy and have an average of 5 days when temperatures of zero or below occur. Summers are moderately warm and humid and have an average of 25 days when temperatures exceed 89° F. The county does not have extreme variations of temperature or precipitation within a season. The data on temperature and precipitation given in table 10 for Franklin are representative of the county. Also, the probabilities of the last freezing temperature in spring and the first in fall given in table 11 were calculated from records at Franklin.

The climate of the county has large annual, daily, and day-to-day ranges in temperature. Because the soils of the county are level to steep, probabilities of freezing temperatures in spring and fall may vary considerably throughout the county from those given in table 11. Freezes generally are later in spring and earlier in fall in the valleys. This is because cool air drains down the slopes of valleys on nights when skies are clear and winds are calm. A light frost may form when an outside weather bureau thermometer shows a temperature as high as 36°. This often happens because most of the thermometers at weather stations are about 5 feet above the ground and the colder air sinks to ground level and has a temperature below that recorded on the thermometer.

Precipitation in this county is characteristic of continental climates in that it varies widely from year to year. Precipitation normally is abundant and well distributed throughout the year. Fall is the driest season. Showers and thunderstorms account for most of the rainfall throughout the growing season. About 50 days each year have thunderstorms, most of which occur from May through August. In winter most of the precipitation comes in the form of rain.

Each year soil moisture goes through a seasonal cycle that is not entirely dependent on the amount of precipitation received. The moisture in soils is lowest in October, but it is replenished in winter and spring, when there is more water lost through evaporation. Because the water needs of all crops reach a maximum in July and August, and then rainfall is usually insufficient to meet those needs, there is a progressive drying of all soils.

Except for small grains and hay, crops generally are planted from late in April to early in June. During a 10-year period, more rainfall than 1.2 inches per week can be expected eight times in April and 11 times in June. Hard rains in April, May, and June delay farm operations and can cause soil loss because plant cover is most lacking in those months.

Humidity generally rises and falls inversely with the daily temperature and is lowest in summer and highest in winter. During most days in summer, relative humidity in the afternoon usually ranges from 45 to 55 prcent. Relative humidity for the year averages about 80 percent at 1 a.m. and 7 a.m., 55 percent at 1 p.m., and 65 percent at 7 p.m. Heavy fog that restricts visibility to less than a quarter mile occurs about 20 times each year and is most frequent late in summer and in fall.

On the average in Warren County, there are 105 clear days (0 to 30 percent cloudiness), 113 partly cloudy days (30 to 70 percent cloudiness), and 147 cloudy days (more than 70 percent cloudiness). The prevailing direction of the wind is from the southwest, and wind velocity averages about 8 miles an hour in summer and 11 miles an hour in winter. Damaging winds of 30 to 80 miles per hour are associated with some thunderstorms. Since 1900, two tornadoes have been reported in Warren County. During the past decade, an average of slightly more than 11 tornadoes a year have occurred in Ohio.

[3] By MARVIN E. MILLER, climatologist for Ohio, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature and precipitation at Franklin*

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly highest maximum	Average monthly lowest minimum	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Average snowfall	Average number of days with 1 inch or more of snow
	° F.	*° F.*	*° F.*	*° F.*	*Inches*	*Inches*	*Inches*	*Inches*	
January	37.4	18.9	61	−5	2.96	1.44	4.73	5.2	2
February	41.5	21.8	65	3	2.64	.96	4.66	4.0	2
March	49.5	28.9	73	13	3.42	.97	6.54	2.8	1
April	63.5	40.9	83	24	3.87	1.48	6.78	.2	0
May	73.7	51.0	88	35	3.67	1.70	5.98	0	0
June	82.3	59.3	93	47	3.35	.76	6.75	0	0
July	86.1	63.3	94	53	4.23	2.03	6.79	0	0
August	85.2	60.9	95	48	2.76	.82	5.21	0	0
September	79.6	53.4	93	35	2.78	.66	5.55	0	0
October	68.0	41.0	84	24	1.97	.47	3.90	.1	(1)
November	53.6	31.6	73	14	2.54	1.24	4.06	1.6	1
December	40.7	22.2	64	2	2.26	.86	3.96	2.8	1
Year	63.4	41.1	97	−9	36.45	29.24	44.19	16.7	7

[1] Less than one-half day.

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall at Franklin*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 25	March 31	April 16	May 1	May 19
2 years in 10 later than	March 20	March 27	April 13	April 27	May 13
5 years in 10 later than	March 7	March 18	April 5	April 17	April 29
Fall:					
1 year in 10 earlier than	October 31	October 23	October 21	October 14	September 23
2 years in 10 earlier than	November 7	October 29	October 24	October 17	September 27
5 years in 10 earlier than	November 23	November 11	October 31	October 25	October 7

Physiography, Relief, and Drainage

The western and northern parts of the county are nearly level to undulating and are underlain by glacial till of Wisconsin age. In these parts of the county, the Fincastle, Brookston, Russell, and Miamian soils are dominant. Several areas of postglacial lakes occur along the southern edge of the Wisconsin terminal moraine. These former lakes range in size from a few to several hundred acres. Patton, Henshaw, and Kings soils are common in these old lacustrine areas.

In the southern and southeastern parts of the county, there is an Illinoian-age till plain that is level to gently sloping but highly dissected. The numerous streams in this part of the county are narrow and deeply entrenched. Cincinnati, Rossmoyne, Avonburg, and Clermont soils are the dominant soils that formed on Illinoian-age till that is capped with silt.

The valley walls along these streams have outcrops of limestone and shale. The Fairmount, Eden, and Hickory soils occupy these steep areas.

Most of the county is drained by the Little Miami River and its tributaries, including Todd Fork and Caesars Creek. The northwestern part of the county is drained by the Miami River. The major streams flow in a southerly direction through the county.

Water Supply

Most farms and rural homes depend on wells or cisterns for their water supply. In most wells water is obtained from the glacial drift that overlies the bedrock. Where the drift is thick, the water may be adequate for domestic use. When it is available, the water supplied by the underlying bedrock is often salty or high in minerals that make it distasteful.

On most farms water from wells must be supplemented with water stored in cisterns or farm ponds. In much of the county, the soils are favorable for construction of ponds. Pond water is mostly used by livestock and for fire protection and recreation.

Water lines are rapidly being constructed in much of the western half of the county to supply water to new community developments. This water comes from wells drilled into buried valleys.

Farming

The figures given in this subsection are from the 1964 Census of Agriculture (*16*). The average size of farms increased from 128 acres in 1959 to 136 acres in 1964. Farms decreased in number from 1,469 to 1,368. Corn grown for all purposes declined from 43,835 acres in 1959 to 36,310 acres in 1964. During this period, soybeans increased from 7,013 acres to 17,957 acres. The wheat acreage remained relatively constant at about 11,000 acres. Clover-grass mixtures cut for hay decreased from 12,339 acres in 1959 to 10,326 acres in 1964. There were 4,810 acres of alfalfa and alfalfa-grass mixtures cut for hay and dehydrating in 1964. Truck crops grown in the county included tomatoes, sweet corn, cucumbers, snap beans, cabbage, sweet peppers, squash, and asparagus. In 1964, 168 acres of these vegetables were harvested for sale. The number of cattle and calves in the county stayed nearly constant between 1959 and 1964 at about 14,000 head. Hogs and pigs decreased during this period from 51,432 to 40,724 head.

Literature Cited

(1) ALLAN, PHILIP F., GARLAND, LLOYD E., and DUGAN, R. FRANKLIN.
1963. RATING NORTHEASTERN SOILS FOR THEIR SUITABILITY FOR WILDLIFE HABITAT. Transactions of the Twenty-Eighth N. Am. Wildlife and Natural Resources Conference. pp. 247–261, illus.

(2) AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS.
1961. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., illus. Washington, D.C.

(3) BALDWIN, MARK, KELLOGG, CHARLES, E., and THORP, JAMES.
1938. SOIL CLASSIFICATION. U.S. Dept. Agr. Ybk., pp. 970–1001, illus.

(4) BARRETT, JAMES P. and ALLEN, PETER H.
1966. PREDICTING YIELD OF EXTENSIVELY MANAGED WHITE PINE STANDS. Univ. N.H. Agr. Expt. Sta., Tech. Bul. 108.

(5) BECK, DONALD E.
1962. YELLOW-POPLAR SITE INDEX CURVES. U.S. Dept. Agr., Forest Service, Southeastern Forest Expt., Sta., Research Note No. 180, 2 pp., illus.

(6) DOOLITTLE, WARREN T. and VIMMERSTEDT, JOHN P.
1960. SITE INDEX CURVES FOR NATURAL STANDS OF WHITE PINE IN THE SOUTHERN APPALACHIANS. U.S. Dept. Agr., Forest Service, Southeastern Forest Expt. Sta., Research Note No. 141, 2 pp., illus.

(7) FLINT, RICHARD FOSTER.
1947. GLACIAL GEOLOGY AND THE PLEISTOCENE EPOCH. 589 pp., illus. New York.

(8) McCarthy, E. F.
1933. yellow-poplar characteristics, growth, and management. U.S. Dept. Agr. Tech. Bul. 356, 58 pp., illus.
(9) Portland Cement Association.
1962. pca soil primer. 86 pp., illus.
(10) Schnur, G. Luther.
1937. yield, stand, and volume tables for even-aged upland oak forest. U.S. Dept. Agr. Tech. Bul. 560, 88 pp., illus. [Reprinted in 1961]
(11) Simonson, Roy W.
1962. soil characteristics in the united states. Sci. 137: 1027–1034, illus.
(12) Thorp, James and Smith, Guy D.
1949. higher categories of soil classification: order, suborder, and great soil groups. Soil Sci. 67: 117–126.
(13) United States Department of Agriculture.
1951. soil survey manual. U.S. Dept. Agr. Handbook No. 18, 503 pp., illus.
(14) ———
1960. soil classification, a comprehensive system, 7th approximation. 265 pp., illus. [Supplements issued in March 1967 and in September 1968]
(15) United States Department of Commerce.
1960. U.S. census of population, ohio.
(16) ———
1964. preliminary report of u.s. census of agriculture, warren county, ohio. Series AC 64–PL.
(17) United States Department of Defense.
1968. unified soil classification system for roads, airfields, embankments, and foundations. MIL–STD–619B, 30 pp., illus.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited in 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.

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

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

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 materials.

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

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

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

Drainage. See Natural soil drainage.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flaggy. A soil that contains thin fragments 6 to 15 inches long of sandstone, limestone slate, or shale.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter 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 and 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.

Glacial drift. Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted materials deposited by streams flowing from glaciers.

Glacial outwash. Cross-bedded gravel, sand, and silt deposited by meltwater as it flowed from glacial ice.

Glacial till. Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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.

Infiltration. Downward entry into immediate soil surface or other material, as contrasted to percolation, which is movement of water through soil layers or material.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Leaching. Removal of soluble materials from soils or other material by percolating water.

Microclimate. Local climatic conditions, brought about by the changes in the general climate resulting from local differences in elevation and exposure.

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 dimensions; *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.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

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

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

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

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

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

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

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil series or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, akalinity; and a lower value, acidity.

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		

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

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.

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 acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

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

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates long than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the 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.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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

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.

Valley train. Aggraded valley bottoms, floored by glacio-fluvial debris, that were formed by overloaded streams emerging from valley glaciers. When the glacier melts completely, the streams generally erode the valley train into a series of terraces.

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. In referring to a capability unit, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Estimated yields, table 1, p. 12.
Woodland groups and factors in management, table 2, p. 16.
Suitability of soils for elements of wildlife habitat and kinds of wildlife, table 3, p. 20.
Engineering uses of the soils, tables 4, 5, and 6, pp. 24 through 49.
Estimated degree and kinds of limitations for soils for specified land uses, table 7, p. 52.
Acreage and extent, table 8, p. 67.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group
			Symbol	Page	Symbol
AbA	Abscota sand, calcareous variant	68	IIw-2	8	2o1
AfB	Alford silt loam, fill substratum, 1 to 4 percent slopes	69	IIe-1	7	1o1
Ag	Algiers silt loam	70	IIw-1	8	2w1
AvA	Avonburg silt loam, 0 to 2 percent slopes	70	IIIw-2	10	2w2
AvB	Avonburg silt loam, 2 to 6 percent slopes	71	IIIw-2	10	2w2
AvB2	Avonburg silt loam, 2 to 6 percent slopes, moderately eroded	71	IIIw-2	10	2w2
BbB	Birkbeck silt loam, 1 to 4 percent slopes	71	IIe-1	7	1o1
Bc	Blanchester silt loam	72	IIw-3	8	2w1
Br	Brookston silty clay loam	73	IIw-3	8	2w1
CcB2	Casco loam, 2 to 6 percent slopes, moderately eroded	73	IIIs-1	11	3f1
CcC2	Casco loam, 6 to 12 percent slopes, moderately eroded	74	IVe-1	11	3f1
CdD2	Casco-Rodman complex, 12 to 18 percent slopes, moderately eroded	74	VIe-1	11	3f1
CnB	Cincinnati silt loam, 2 to 6 percent slopes	75	IIe-1	7	2o1
CnB2	Cincinnati silt loam, 2 to 6 percent slopes, moderately eroded	75	IIe-1	7	2o1
CnC2	Cincinnati silt loam, 6 to 12 percent slopes, moderately eroded	75	IIIe-1	9	2o1
Co	Clermont silt loam	76	IIIw-3	10	2w1
CrB	Crider silt loam, 2 to 6 percent slopes	76	IIe-1	7	2o1
Cu	Cut and fill land	77	------	--	---
DaA	Dana silt loam, 0 to 2 percent slopes	77	I-2	7	2o1
DaB	Dana silt loam, 2 to 6 percent slopes	77	IIe-1	7	2o1
EdB2	Eden complex, 2 to 6 percent slopes, moderately eroded	78	IIIe-3	9	3c1
EdC2	Eden complex, 6 to 12 percent slopes, moderately eroded	78	IVe-2	11	3c1
EdD2	Eden complex, 12 to 18 percent slopes, moderately eroded	78	VIe-1	11	3c1
EdE2	Eden complex, 18 to 25 percent slopes, moderately eroded	79	VIe-1	11	3c1
EdF2	Eden complex, 25 to 35 percent slopes, moderately eroded	79	VIe-1	11	4d1
Ee	Eel loam	79	IIw-2	8	1o1
FaE2	Fairmount-Eden flaggy silty clay loams, 12 to 25 percent slopes, moderately eroded	80	VIe-1	11	4d1
FaF2	Fairmount-Eden flaggy silty clay loams, 25 to 50 percent slopes, moderately eroded	80	VIIe-1	11	4d1
FhA	Fincastle silt loam, 0 to 2 percent slopes	81	IIw-4	8	2w2
FhB	Fincastle silt loam, 2 to 6 percent slopes	81	IIw-4	8	2w2
FlA	Fox loam, 0 to 2 percent slopes	82	IIs-1	9	2o1
FlB	Fox loam, 2 to 6 percent slopes	82	IIe-4	8	2o1
FlB2	Fox loam, 2 to 6 percent slopes, moderately eroded	82	IIe-4	8	2o1
FlC2	Fox loam, 6 to 12 percent slopes, moderately eroded	82	IIIe-2	9	2o1
FoD2	Fox-Casco complex, 12 to 18 percent slopes, moderately eroded	82	IVe-1	11	3f1
Gd	Genesee fine sandy loam	83	IIw-2	8	1o1
Gn	Genesee loam	83	IIw-2	8	1o1
Gp	Gravel pits	83	------	--	---
HeF	Hennepin silt loam, 25 to 35 percent slopes	84	VIe-1	11	2r1
HeF2	Hennepin silt loam, 25 to 35 percent slopes, moderately eroded	84	VIe-1	11	2r1
HmE	Hennepin-Miamian silt loams, 18 to 25 percent slopes	84	VIe-1	11	2r1
HmE2	Hennepin-Miamian silt loams, 18 to 25 percent slopes, moderately eroded	84	VIe-1	11	2r1
HnD3	Hennepin-Miamian complex, 12 to 18 percent slopes, severely eroded	84	VIe-1	11	3r1
HoB	Henshaw silt loam, 1 to 4 percent slopes	85	IIw-4	8	2w2

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Capability unit Page	Woodland group Symbol
HrB2	Hickory silt loam, 2 to 6 percent slopes, moderately eroded	86	IIe-1	7	2o1
HrC2	Hickory silt loam, 6 to 12 percent slopes, moderately eroded	86	IIIe-1	9	2o1
HrD2	Hickory silt loam, 12 to 18 percent slopes, moderately eroded	86	IVe-1	11	2r1
HsC3	Hickory clay loam, 6 to 12 percent slopes, severely eroded	86	IVe-1	11	3o1
HsD3	Hickory clay loam, 12 to 18 percent slopes, severely eroded	86	VIe-1	11	3r1
HtE2	Hickory-Fairmount complex, 18 to 25 percent slopes, moderately eroded	86	VIe-1	11	4d1
HtF2	Hickory-Fairmount complex, 25 to 50 percent slopes, moderately eroded	87	VIIe-1	11	4d1
IvA	Iva silt loam, till substratum, 0 to 2 percent slopes	87	IIw-4	8	1o1
KeB	Kendallville loam, 2 to 6 percent slopes	88	IIe-1	7	2o1
KeC2	Kendallville loam, 6 to 12 percent slopes, moderately eroded	88	IIIe-1	9	2o1
Kg	Kings silty clay loam, thick surface variant	89	IIIw-1	10	3w1
Lg	Lanier sandy loam	89	IIw-2	8	2o1
MmB3	Miamian clay loam, 2 to 6 percent slopes, severely eroded	90	IIIe-1	9	2o1
MmC3	Miamian clay loam, 6 to 12 percent slopes, severely eroded	90	IVe-1	11	2o1
MnD2	Miamian-Hennepin silt loams, 12 to 18 percent slopes, moderately eroded	90	IVe-1	11	2r1
MrC2	Miamian-Russell silt loams, 6 to 12 percent slopes, moderately eroded	90	IIIe-1	9	2o1
Mu	Muck	91	------	--	---
OcA	Ockley silt loam, 0 to 2 percent slopes	91	I-1	7	1o1
OcB	Ockley silt loam, 2 to 6 percent slopes	92	IIe-1	7	1o1
OcB2	Ockley silt loam, 2 to 6 percent slopes, moderately eroded	92	IIe-1	7	1o1
PaB	Parke silt loam, 2 to 6 percent slopes	92	IIe-1	7	2o1
PaD2	Parke silt loam, 6 to 18 percent slopes, moderately eroded	92	IIIe-1	9	2o1
Pb	Patton silt loam, silted	93	IIw-3	8	2w1
Pc	Patton silty clay loam	94	IIw-3	8	2w1
PlB	Plattville silt loam, 1 to 6 percent slopes	94	IIe-2	7	1o1
PrB	Princeton fine sandy loam, 2 to 6 percent slopes	95	IIe-1	7	1o1
PrC2	Princeton fine sandy loam, 6 to 12 percent slopes, moderately eroded	95	IIIe-1	9	2o1
Ra	Ragsdale silty clay loam	95	IIw-3	8	2w1
RbA	Rainsboro silt loam, 0 to 2 percent slopes	96	IIw-5	9	2o1
RbB	Rainsboro silt loam, 2 to 6 percent slopes	96	IIe-3	7	2o1
Re	Reesville silt loam	97	IIw-4	8	2w2
Rh	Riverwash	97	------	--	---
RkE2	Rodman and Casco gravelly loams, 18 to 25 percent slopes, moderately eroded	98	VIIe-1	11	4f1
Ru	Ross loam	98	IIw-2	8	1o1
RpA	Rossmoyne silt loam, 0 to 2 percent slopes	99	IIw-5	9	2o1
RpB	Rossmoyne silt loam, 2 to 6 percent slopes	99	IIe-3	7	2o1
RpB2	Rossmoyne silt loam, 2 to 6 percent slopes, moderately eroded	99	IIe-3	7	2o1
RpC2	Rossmoyne silt loam, 6 to 12 percent slopes, moderately eroded	99	IIIe-4	10	2o1
RsB3	Rossmoyne silty clay loam, 2 to 6 percent slopes, severely eroded	100	IIIe-4	10	3o1
RsC3	Rossmoyne silty clay loam, 6 to 12 percent slopes, severely eroded	100	IVe-1	11	3o1
RvA	Russell-Miamian silt loams, 0 to 2 percent slopes	101	I-1	7	2o1
RvB	Russell-Miamian silt loams, 2 to 6 percent slopes	101	IIe-1	7	2o1

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group
			Symbol	Page	Symbol
RvB2	Russell-Miamian silt loams, 2 to 6 percent slopes, moderately eroded	101	IIe-1	7	2o1
Sh	Shoals silt loam	102	IIw-1	8	2w1
So	Sloan silty clay loam	102	IIIw-1	10	2w1
UnB	Uniontown silt loam, 1 to 6 percent slopes	103	IIe-1	7	2o1
WaA	Warsaw loam, 0 to 2 percent slopes	104	IIs-1	9	2o1
WaB	Warsaw loam, 2 to 6 percent slopes	104	IIe-4	8	2o1
WeA	Wea silt loam, 0 to 2 percent slopes	104	I-2	7	1o1
WlA	Williamsburg silt loam, 0 to 2 percent slopes	105	I-1	7	1o1
WlB	Williamsburg silt loam, 2 to 6 percent slopes	105	IIe-1	7	1o1
WlC2	Williamsburg silt loam, 6 to 12 percent slopes, moderately eroded	105	IIIe-1	9	1o1
WyB	Wynn silt loam, 2 to 6 percent slopes	106	IIe-2	7	2o1
WyB2	Wynn silt loam, 2 to 6 percent slopes, moderately eroded	106	IIe-2	7	2o1
WyC2	Wynn silt loam, 6 to 12 percent slopes, moderately eroded	106	IIIe-3	9	2o1
WyC3	Wynn silt loam, 6 to 12 percent slopes, severely eroded	106	IVe-2	11	3o1
XeA	Xenia silt loam, 0 to 2 percent slopes	107	I-1	7	1o1
XeB	Xenia silt loam, 2 to 6 percent slopes	107	IIe-1	7	1o1
XeB2	Xenia silt loam, 2 to 6 percent slopes, moderately eroded	108	IIe-1	7	1o1

Accessibility Statement