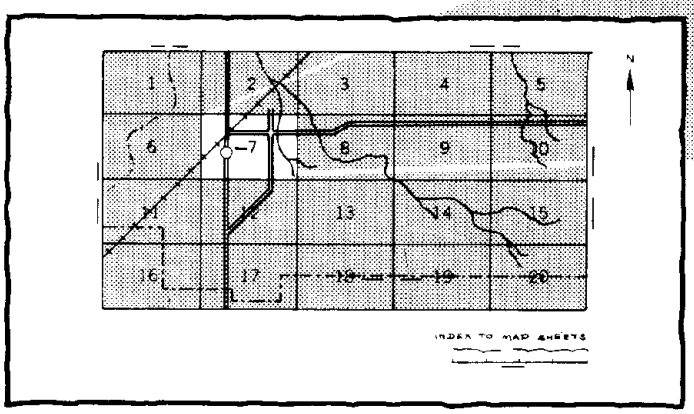
Soil survey of

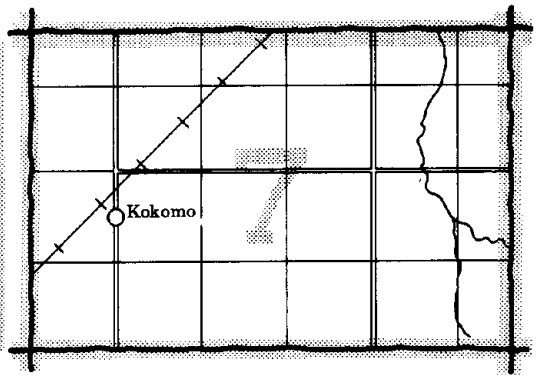
Dearborn and Ohio Counties, Indiana

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Purdue University Agricultural Experiment Station and
Indiana Department of Natural Resources,
Soil and Water Conservation Committee

HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).





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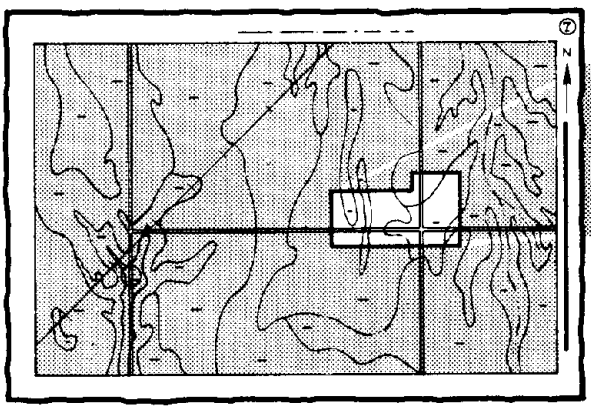

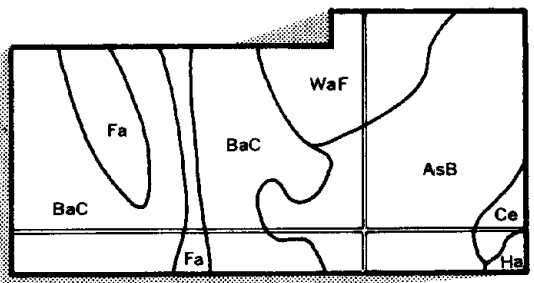

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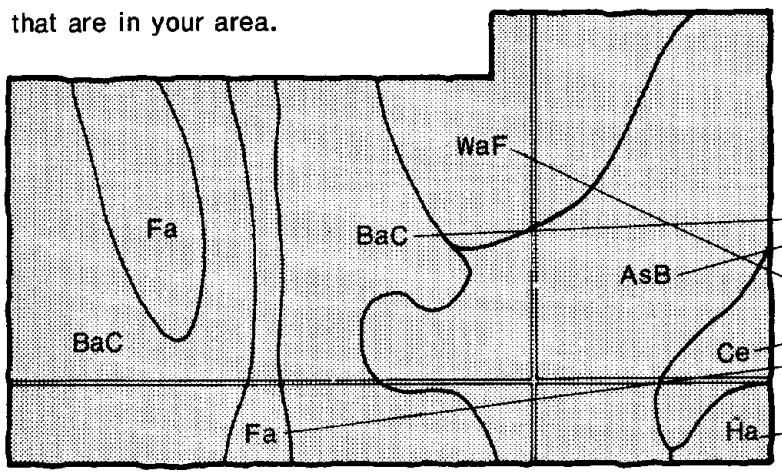

Symbols

AsB
BaC
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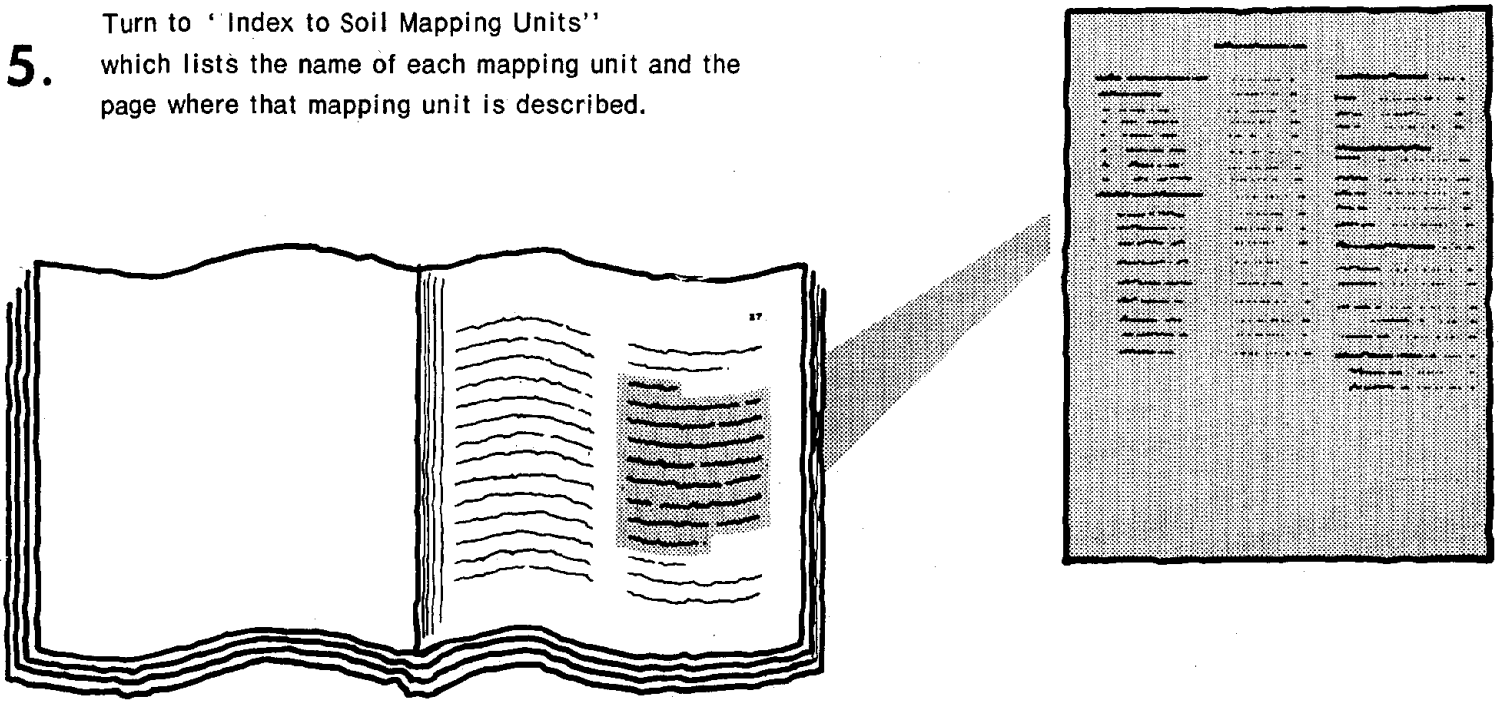
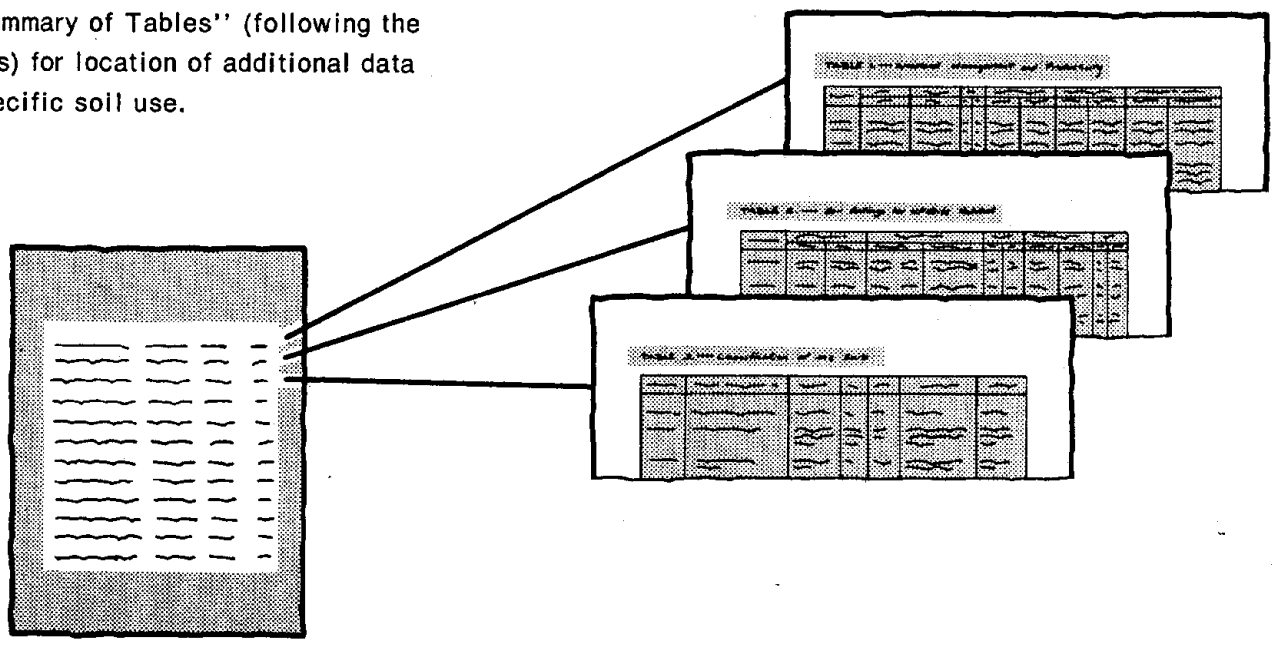
THIS SOIL SURVEY

5. Turn to "Index to Soil Mapping Units" which lists the name of each mapping unit and the page where that mapping unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service, Purdue University Agricultural Experiment Station, and Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Dearborn and Ohio Counties Soil and Water Conservation District. Financial assistance was made available by the Indiana Department of Natural Resources and the local county governments. Major fieldwork was performed in the period 1973-77. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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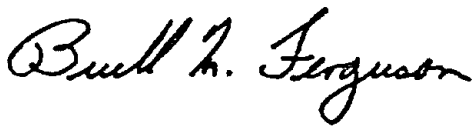
foreword

This soil survey contains information that can be used in land-planning programs in Dearborn and Ohio Counties, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



Buell M. Ferguson
State Conservationist
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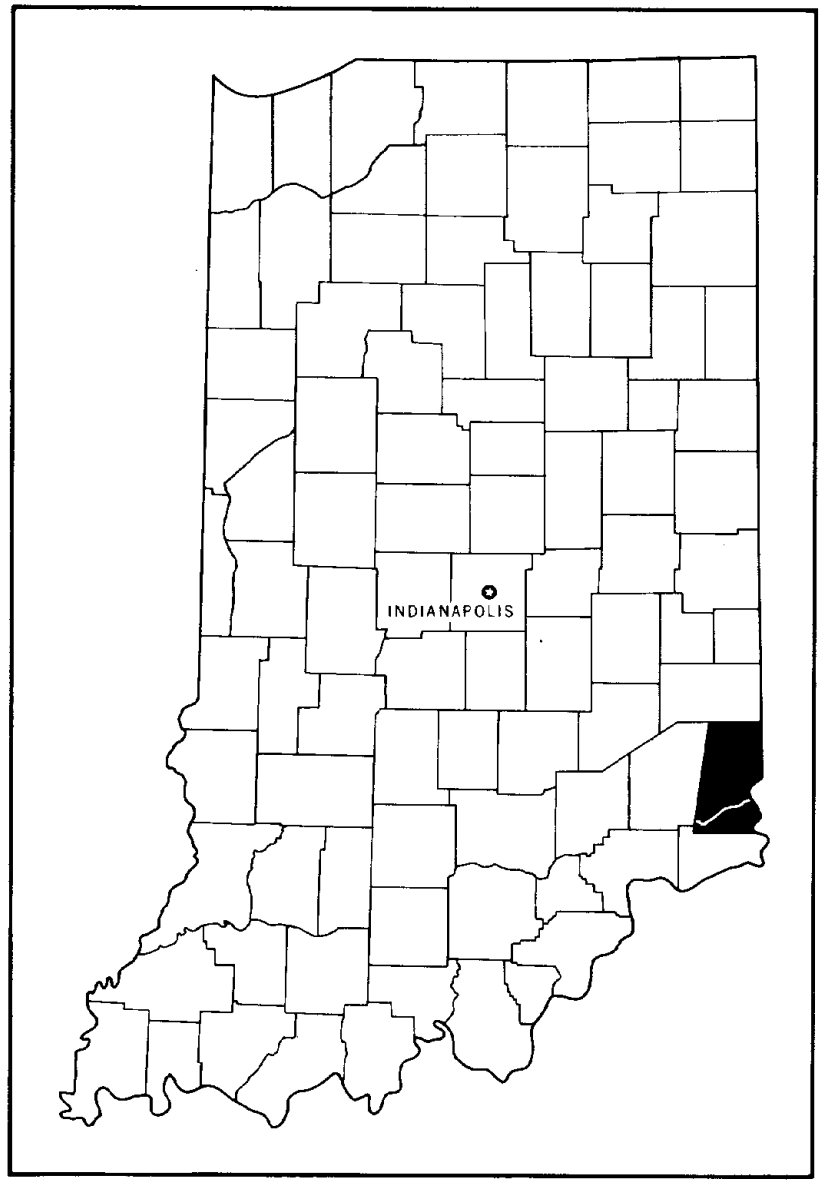

Location of Dearborn and Ohio Counties in Indiana.

soil survey of Dearborn and Ohio Counties, Indiana

By Allan K. Nickell, Soil Conservation Service

Fieldwork by Allan K. Nickell and Byron G. Nagel,
Soil Conservation Service,
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Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service
in cooperation with
Purdue University Agricultural Experiment Station and
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DEARBORN and OHIO COUNTIES are in the southeastern part of Indiana. They have a land area of 393 square miles, or 251,670 acres. The area extends about 28 miles from north to south and 14 miles from east to west. Lawrenceburg is the county seat of Dearborn County, and Rising Sun is the county seat of Ohio County. The population is about 35,000 (*4*). Businesses in the survey area employ over half the work force of the area. They also employ some people from the surrounding counties. About 42 percent of the work force is engaged in manufacturing.

About 70 percent of the survey area is farmed. The farmed areas are in corn, soybeans, and hay and pasture. Wheat and tobacco are also grown. Urban development is continually decreasing the acreage in farms.

The features influencing soil use are briefly discussed in the following pages.

general nature of the area

This section gives general information on physiography, relief, and drainage; water supply; climate; industries, transportation, and markets; trends in population and land use; history and development; and farming.

physiography, relief, and drainage

Dearborn and Ohio Counties are dissected by numerous creeks, streams, rivers, and drainageways, which flow into the Ohio River. The Ohio River forms the southeastern boundary of Dearborn County and the eastern boundary of Ohio County. The area is one of diversified relief. Broad flat upland plains and narrow ridges dissected by steep-sided valleys characterize the physiography of the area.

The towns of Lawrenceburg, Aurora, and Rising Sun border the Ohio River. A levee protects Lawrenceburg from severe flooding. Aurora and parts of Rising Sun are subject to occasional flooding.

The Whitewater River drains the extreme eastern edge, the northeast area, and the upper northwest area of Dearborn County. The Whitewater River is bordered by valleys that range from one-half mile to 1 mile in width. Laughery Creek separates Dearborn and Ohio Counties. It drains the northern part of Ohio County and the southern part of Dearborn County. North and South Hogan Creeks drain the south-central part of Dearborn County, and Tanners Creek drains the north-central part.

Valleys border Laughery Creek, North and South Hogan Creeks, and Tanners Creek. The valleys range from a few rods to one-half mile in width. In these valleys, the soils on bottom lands and terraces generally are well drained, but in some areas the soils are moderately well drained and somewhat poorly drained. The soils on bottom lands near the mouths of these creeks are usually flooded several times late in winter and early in spring by backwaters of the Ohio River. Smaller streams in the area are tributaries of these creeks or of the Whitewater River.

The highest point in the survey area, about 1,040 feet above sea level, is located near the junction of North Dearborn and Fackley Roads in Jackson Township, Dearborn County. The lowest point, 455 feet above sea level, is located in the southeastern corner of Ohio County adjacent to the Ohio River in Randolph Township.

water supply

Most of the water for Dearborn and Ohio Counties comes from deep wells located in gravelly outwash material along the Ohio River. Public rural water lines from these wells distribute water to small towns and farms throughout the area.

In places where water is not available from public water lines, water is obtained from either dug wells, drilled wells, springs, cisterns, or ponds. However, in many places the flow from springs is not sufficient for both domestic and farm use and the water from drilled wells is sometimes too salty for drinking. When rainfall is low, dug wells and cisterns may become dry and small ponds and reservoirs are used to supplement them. There are several sites suitable for farm ponds and lakes. Many have already been built to meet domestic needs.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Dearborn and Ohio Counties are cold in winter and quite hot in summer. The precipitation in winter, which includes frequent snowfalls, results in a large accumulation of soil moisture by spring. The soil moisture minimizes drought in summer on most soils. The normal annual precipitation is adequate for all crops that are adapted to the temperature and length of growing season in the area.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Brookville, Indiana, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 30 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Brookville on January 29, 1963, is -25 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on September 1, 1951, is 104 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 38 inches. Of this, 23 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.30 inches at Brookville on July 21, 1973. Thunderstorms occur on about 45 days each year, and most occur in summer.

Average seasonal snowfall is 18 inches. The greatest snow depth at any one time during the period of record was 12 inches. On an average of 12 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 11 miles per hour, in March.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local and of short duration. They cause damage in a variable pattern.

industries, transportation, and markets

Several industries are located in the two counties. Two distilleries and a glass bottle manufacturing company are located in Greendale. A veneer and lumber company is located in Lawrenceburg, and near Lawrenceburg is an electrical power plant. In and near Aurora are manufacturers of mortuary supplies, a furniture company, a machinery company, and a machine tools manufacturer. A machine tools manufacturer is also in West Harrison.

Two separate interstate systems traverse the survey area. Interstate Highway 74 runs east-west across the northern part of Dearborn County, and I-275 makes a loop into the southeast corner of Dearborn County. U.S. Highway 50 crosses Dearborn County in an east-west direction. Several state highways cross the survey area. They mainly follow the ridges and valleys.

There are two small private airports. One is located just west of Aurora and the other is near West Harrison.

Two railroad lines serve the area and cross it in an east-west direction.

A bridge on Interstate 275 crosses the Ohio River.

All major barge lines on the Ohio River serve the area around Lawrenceburg and Aurora.

Markets for livestock, horticultural crops, and fruit crops are available in Cincinnati. Tobacco is generally marketed in Madison, Indiana.

trends in population and land use

Dearborn and Ohio Counties have a total population of about 35,000 people. The population density is 95 people per square mile. The population increased 2.7 percent between 1960 and 1970 and is anticipated to be about 38,000 by 1985 and 41,000 by 2000 (*4*).

Acreage in agriculture and forestry has gradually been decreasing as more land is used for development. It was estimated that in 1967 about 19,625 acres was used for other than agriculture or forestry. Of this acreage, approximately 6,356 acres was urban build-up and the rest was roads, water areas, gravel pits, quarries, and other types of development. The acreage in urban use has been growing at the rate of about 400 acres per year.

history and development

Prehistoric people in what is now Dearborn and Ohio Counties lived mainly along the Ohio River and its larger tributaries. Archaeologists consider these areas prime hunting grounds for artifacts.

In 1781 Indians, supported by the British, attacked Colonel Archibald Lochry and 107 recruits. This battle, which occurred at the mouth of Laughery Creek, was the only Revolutionary War battle fought on Indiana soil.

In the late 1790's, after the Revolutionary War, settlers began arriving in the area. Dearborn County was formed in 1803 and included what is now Ohio, Switzerland, and part of Ripley Counties. Ohio County was organized in 1845.

Lawrenceburg is the county seat of Dearborn County. Lawrenceburg became a town in 1802 and Aurora in 1819.

Rising Sun is the county seat of Ohio County.

farming

The Census of Agriculture (*7*) for the 5-year period from 1969 to 1974 reports that the number of farms in the area decreased from 1,399 to 1,257, a decrease of 142. The average size of farms in Dearborn County increased from 115 acres to 118 acres. The average size of farms in Ohio county decreased from 133 acres to 124 acres.

During the same 5-year period, the number of farm owners farming full time decreased from 1,130 to 1,017. The number of farm owners farming part time increased from 165 to 181. Tenancy dropped from 104 to 59. Generally, the number of livestock in the area has dropped. The number of beef cattle and horses has slightly increased. The number of hogs has made the sharpest decrease during the 5-year period.

Farming consists mainly of raising livestock, mainly beef cattle, although some dairy cattle, hogs, chickens, and sheep are also raised. Grain farming is also important, especially in the northwest part of Dearborn County, the southwest part of Ohio County, and in the valleys along the Ohio River and its tributaries.

Corn and soybeans are the main crops. Wheat and tobacco are also important. About 70 percent of the farmers in Ohio County and about 30 percent of the farmers in Dearborn County derive much of their income from small acreages of tobacco. A major part of the area is used for hay and pasture. Most hayfields and pastures consist of Kentucky 31 fescue or orchardgrass and alfalfa or red clover.

A few commercial apple and peach orchards are in Dearborn County. Many of the steeper hillsides throughout the area are woodland.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study 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, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, specialty crops, woodland, urban uses,* and *recreation areas.* Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness.

soil descriptions

1. Jules-Stonelick-Chagrin

Deep, nearly level, well drained soils that formed in silty and loamy alluvium; on bottom lands

This map unit is on bottom lands along the major streams that flow through the area. The areas are few in number but large in size.

This map unit makes up about 3 percent of the survey area. It makes up about 3 percent of Dearborn County and 3 percent of Ohio County. About 25 percent of the map unit is Jules soils, 22 percent is Stonelick soils, 19 percent is Chagrin soils, and 34 percent is soils of minor extent.

Jules soils are deep, well drained, and calcareous. They are adjacent to large streams. These soils have a surface layer of dark brown silt loam about 20 inches thick. The substratum is dark brown and dark yellowish brown silt loam.

Stonelick soils are deep and well drained. They are on bottom lands adjacent to streams. They have a surface layer of dark grayish brown sandy loam about 10 inches thick. The substratum is dark grayish brown and dark brown sandy loam in the upper part, brown stratified silt loam and loamy sand in the middle part, and brown loamy sand in the lower part.

Chagrin soils are deep and well drained. They are on the lower lying bottom lands adjacent to streams. They have a surface layer and subsurface layer of dark grayish brown silt loam and loam. The subsoil is dark brown and dark yellowish brown friable loam and silt loam. The substratum is dark brown loam.

The minor soils in this map unit are the deep, well drained Elkinsville and Fox soils and the deep, somewhat poorly drained Bartle soils on terraces; the deep, well drained Huntington soils on bottom lands; and the deep, well drained Hennepin soils on uplands.

The soils making up this map unit are suited to cultivated crops and are used mainly for cultivated crops. The main crops are corn, soybeans, and small grains. Flooding is the major hazard.

Flooding is such a severe hazard and so difficult to prevent that the soils are poorly suited to residential and other urban uses. Their suitability is fair for the more intensive types of recreational development.

2. Huntington-Markland-Ockley

Deep, nearly level to steep, well drained and moderately well drained soils that formed in silty and loamy alluvium, in loess over clayey lacustrine material, or in loess and loamy outwash material over sand and gravel; on bottom lands and terraces

This map unit is in one very large area that includes nearly level bottom lands along the Ohio River, sloping to steep lacustrine terraces along tributaries of the Ohio River, and nearly level to gently sloping outwash terraces.

This map unit makes up about 5 percent of the survey area. It makes up about 4 percent of Dearborn County and 9 percent of Ohio County. About 43 percent of the map unit is Huntington soils, 16 percent is Markland soils, 11 percent is Ockley soils, and 30 percent is soils of minor extent.

Huntington soils are deep and well drained. They are on the lower lying areas adjacent to the Ohio River. These soils have a surface layer of dark brown silt loam about 13 inches thick. The subsoil is dark brown friable silt loam, and the substratum is dark brown loam.

Markland soils are deep and well drained to moderately well drained. They are on high lacustrine terraces along the major tributaries of the Ohio River. They have a surface layer of dark brown and yellowish brown silt loam about 7 inches thick. The subsoil is yellowish brown firm silty clay loam in the upper part and yellowish brown and dark yellowish brown very firm silty clay in the lower part. The substratum is yellowish brown silty clay that has strata of silty clay loam and silt loam.

Ockley soils are deep and well drained. They are on loess-covered outwash terraces. They have a surface layer of dark brown silt loam about 8 inches thick. The subsoil is dark brown friable loam in the upper part and dark yellowish brown firm clay loam and gravelly clay loam in the lower part. The substratum is dark brown stratified sand and gravel.

The minor soils in this map unit are the deep, somewhat poorly drained Newark soils and the deep, well drained Jules soils on bottom lands; the deep, somewhat poorly drained Rahm soils on high bottoms and low terraces; the deep, well drained Fox soils on outwash terraces; and the deep, well drained Wheeling soils on terraces along the Ohio River.

The soils making up this map unit are suited to cultivated crops and pasture. They are used mainly for cultivated crops and pasture. They are also used for residential and urban development. The main crops are corn, soybeans, and small grains. Flooding is a major hazard on the bottom lands, and erosion is the major hazard on the sloping terraces.

Flooding on the bottom lands is such a severe hazard and so difficult to control that the soils in those areas are poorly suited to residential and urban uses. The soils that formed in lacustrine material also are poorly suited mainly because they have such high shrink-swell potential. The sloping soils on terraces are suited to pasture, but erosion needs to be controlled. Those soils are also suited to the more intensive types of recreation development.

3. Avonburg-Clermont

Deep, nearly level, somewhat poorly drained and poorly drained soils that formed in loess and the underlying glacial till; on uplands

This map unit is on nearly level glacial till plains that are characterized by smooth topography. The areas are at the highest elevation in the survey area. They are relatively small and not extensive.

This map unit makes up about 6 percent of the survey area. It makes up about 7 percent of Dearborn County and 2 percent of Ohio County. About 40 percent of the map unit is Avonburg soils, 31 percent is Clermont soils, and 29 percent is soils of minor extent (fig. 1).

Avonburg soils are deep and somewhat poorly drained. They have a seasonal high water table. They are on broad ridges, at the edge of broad ridges, and near the head of drainageways. There is a very slowly permeable fragipan in the subsoil. These soils have a surface layer of dark grayish brown silt loam about 9 inches thick. The subsurface layer is light yellowish brown silt loam. The subsoil in the upper part is light yellowish brown, friable silt loam, in the middle part it is gray and yellowish brown, very firm and extremely firm silt loam (fragipan), and in the lower part it is brownish yellow, mottled friable loam.

Clermont soils are deep and poorly drained. They have a seasonal high water table. They are on the broadest ridges where the glacial till is the thickest and the elevation is the highest in the survey area. They have a surface layer of very dark grayish brown silt loam. The subsurface layer is grayish brown and light brownish gray mottled silt loam. The subsoil in the upper part is gray, mottled firm and very firm silty clay loam; in the lower part it is light brownish gray, mottled friable and firm silt loam.

The minor soils in this map unit are the deep, moderately well drained Rossmoyne soils on narrow ridges and the deep, well drained Cincinnati soils on narrow ridges and hillsides.

The soils making up this map unit are suited to cultivated crops and are used mainly for cultivated crops. In some areas they are used for pasture or remain in woods. In most of the cultivated areas the surface is artifically drained. The main crops are corn, soybeans, and small grains. Wetness is the main limitation to use of the soils for farming.

Wetness is such a severe limitation and so difficult to correct that the soils are poorly suited to residential and other urban uses and to the more intensive types of recreation development. An adequate drainage system must be considered if these soils are to be used for urban development.

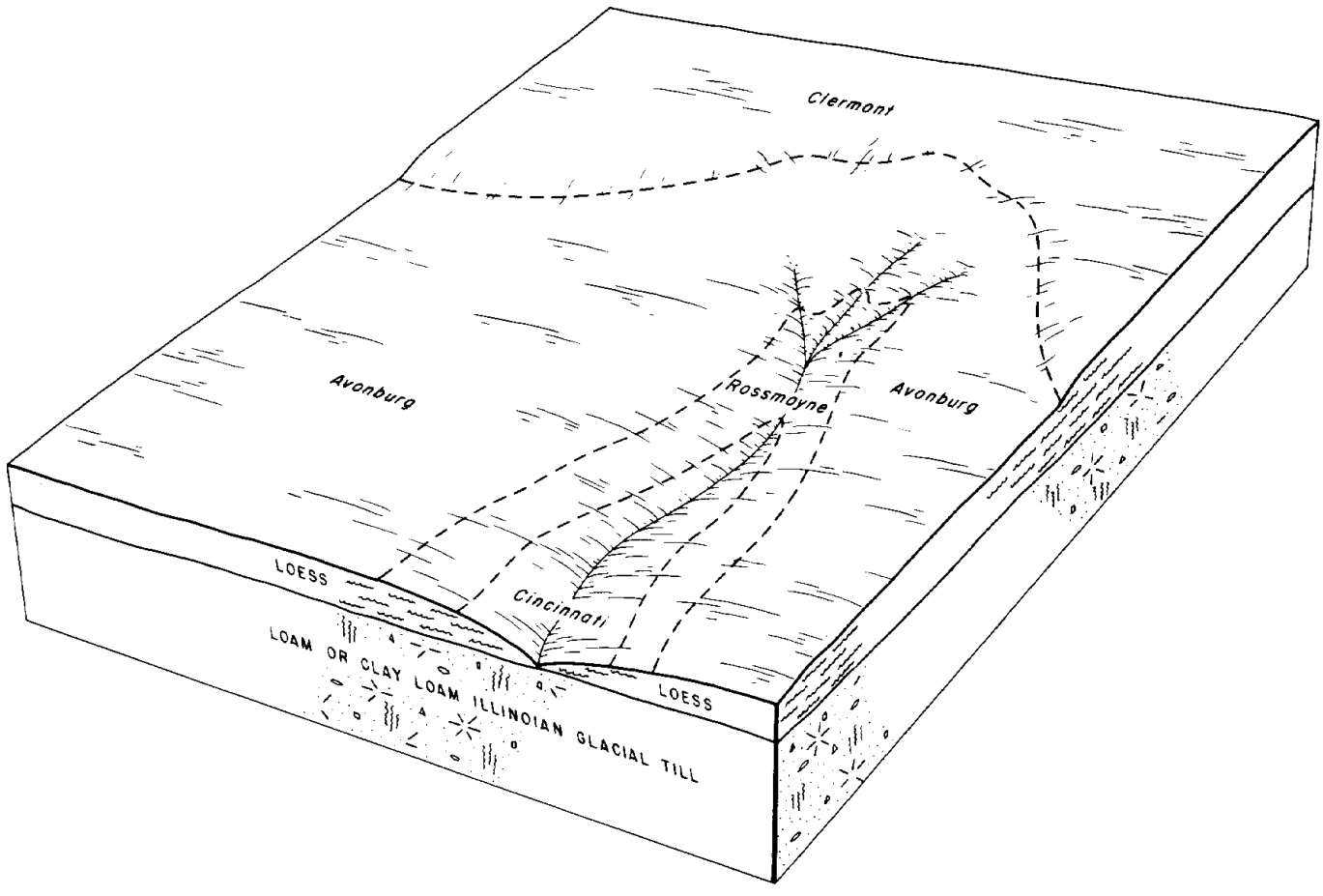

Figure 1.—Relationship of soils, topography, and underlying material in the Avonburg-Clermont map unit.

4. Cincinnati-Rossmoyne-Bonnell

Deep, nearly level to steep, well drained and moderately well drained soils that formed in loess and the underlying glacial till; on uplands

This map unit is on glacial till plains that are characterized by rolling to hilly topography. The areas are large and scattered throughout the survey area.

This map unit makes up about 24 percent of the survey area. It makes up about 25 percent of Dearborn County and 23 percent of Ohio County. About 23 percent of the map unit is Cincinnati soils, 15 percent is Rossmoyne soils, 25 percent is Bonnell soils, and 37 percent is soils of minor extent (fig. 2).

Cincinnati soils are deep and well drained. They are on ridges and side slopes. There is a slowly permeable fragipan in the subsoil. These soils have a surface layer of dark brown silt loam about 7 inches thick. The subsoil is yellowish brown and dark yellowish brown, friable silt loam in the upper part; yellowish brown, mottled, very firm silt loam (fragipan) in the middle part; and yellowish brown and strong brown, firm silty clay loam in the lower part.

Rossmoyne soils are deep and moderately well drained. They are on ridges and short, convex side slopes. There is a slowly permeable fragipan in the subsoil. These soils have a surface layer of brown silt loam about 10 inches thick and a subsurface layer of light yellowish brown silt loam. The subsoil in the upper part is brown and yellowish brown, mottled silt loam and silty clay loam; in the middle part it is yellowish brown, mottled, extremely firm silt loam (fragipan); and in the lower part it is yellowish brown, mottled firm clay loam.

Bonnell soils are deep and well drained. They are on narrow ridges and hillsides. They have a surface layer of very dark gray silt loam. The subsurface layer is dark grayish brown silt loam. The subsoil in the upper part is yellowish brown friable loam; in the middle part it is dark brown and dark yellowish brown, very firm silty clay and clay; and in the lower part it is yellowish brown, dark

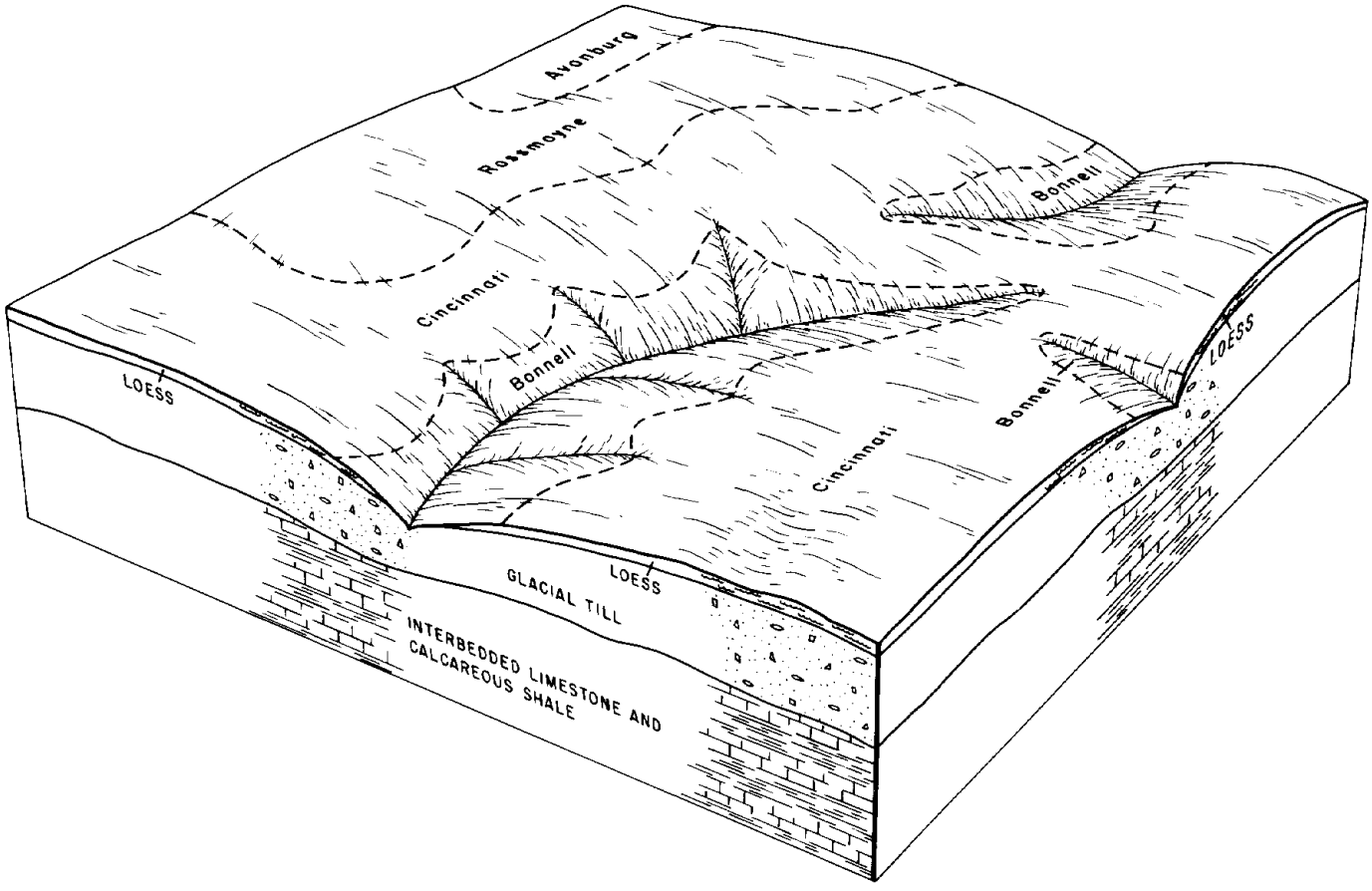

Figure 2.—Relationship of soils, topography, and underlying material in the Cincinnati-Rossmoyne-Bonnell map unit.

yellowish brown and brown firm clay loam. The substratum is brown clay loam.

The minor soils in this map unit are the deep, somewhat poorly drained Avonburg soils on the broader part of ridges; the deep, well drained Weisburg soils on ridges and side slopes; the deep, well drained Switzerland and Carmel soils and moderately deep, well drained Eden soils on hillsides; and the deep, well drained Chagrin soils and somewhat poorly drained Orrville soils on narrow bottom land.

The soils making up this map unit are suited to cultivated crops in the more level areas and to pasture and hay in the steeper areas. They are used mainly for cultivated crops, hay, and pasture, but some areas remain woodland. The main crops are corn, soybeans, small grains, and tobacco. Erosion is the major hazard.

The soils on the steeper slopes are poorly suited to cultivated crops because erosion is a severe hazard. The soils are suitable for residential and urban uses in the more level areas and in areas where public sewer systems can be installed. The soils are only fairly suitable for intensive types of recreation development because of either slow soil permeability or steep slopes.

5. Eden-Carmel

Moderately deep and deep, moderately sloping to very steep, well drained soils that formed in residuum or in loess and residuum of interbedded limestone and calcareous shale; on uplands

This map unit is in sloping to very steep, highly dissected nonglaciated areas. The areas are large and are scattered throughout the survey area.

This map unit makes up about 62 percent of the survey area. It makes up about 61 percent of Dearborn County and 63 percent of Ohio county. About 50 percent of the map unit is Eden soils, 19 percent is Carmel soils, and 31 percent is soils of minor extent.

Eden soils are moderately deep and well drained. They are on long hillsides. They have a surface layer of

very dark grayish brown flaggy silty clay loam. The subsoil in the upper part is dark brown, firm channery silty clay; in the middle part it is dark yellowish brown, very firm channery silty clay; and in the lower part it is light olive brown, very firm very flaggy clay. The substratum is light olive brown flaggy silt loam. Limestone and clay shale are below.

Carmel soils are deep and well drained. They are on narrow ridges, short hillsides, and the upper part of long hillsides. They have a surface layer of yellowish brown silt loam. The subsoil in the upper part is strong brown, firm silty clay loam and clay, and in the lower part it is yellowish brown, extremely firm clay. The substratum is pale olive and olive yellow flaggy clay.

The minor soils in this map unit are the deep, well drained Cincinnati, Switzerland, Weisburg and Bonnell soils on ridgetops and hillsides; the deep, well drained Pate soils on the lower part of hillsides; and the deep, well drained Dearborn soils on narrow bottom land.

The soils making up this map unit are suitable for improved pasture and trees. They are used mainly for pasture and trees. In some areas the soils are also used for hay and cultivated crops. Tobacco is the major cultivated crop. Steep slopes are the major limitation, and erosion is the major hazard.

Erosion is such a severe hazard on the steeper slopes that cultivated crops, logging roads, and skid trails are impractical. Slope is a severe limitation. It restricts the use of logging equipment. Because of the slope, the suitability of the soils for residential and urban uses and for intensive types of recreation development is poor.

broad land use considerations

Each year, more and more land along the Ohio River and in small areas throughout the survey area is developed for urban uses. Nearly 3 percent of the survey area, about 6,356 acres, is urban or built-up land. The general soil map can be useful in planning the general outline of urban areas; it cannot be used to select specific sites for urban structures.

There are extensive areas of soils that are not suited to urban development. The soils in the Jules-Stonelick-Chagrin map unit, for example, are on flood plains, and flooding is a severe hazard. An extensive drainage system is necessary on the wet soils in the Avonburg-Clermont map unit. Huntington soils in the Huntington-Markland-Ockley map unit and the steeper soils in the Eden-Carmel map unit have severe limitations for urban development.

Ockley soils in the Huntington-Markland-Ockley map unit can be developed for urban uses at a lower cost than Huntington and Markland soils. Ockley, Fox, and Wheeling soils are well suited to urban development. Ockley and Wheeling soils are also excellent for farming. Markland soils are not suited to urban development because of high shrink-swell potential and low strength.

Cincinnati soils in the Cincinnati-Rossmoyne-Bonnell map unit can be developed for urban uses in many areas.

The soils in the Avonburg-Clermont map unit have good potential for farming mainly because they have been drained sufficiently for crops. The soils have poor potential for nonfarm uses unless the wetness is corrected by drainage as in farmed areas. The soils in the Jules-Stonelick-Chagrin map unit have good potential for farming. Flooding, however, is a hazard. The steeper soils in the Eden-Carmel map unit have good potential for pasture if erosion is controlled.

Huntington, Ockley, Fox, and Wheeling soils in the Huntington-Markland-Ockley map unit are suited to vegetables and other specialty crops. Timely seeding and planting on Huntington soils prevents damage from flooding streams. All of these soils are well drained, and they warm up earlier in spring than wet soils. These soils are well suited to nurseries except where flooding is a hazard.

Most soils in the survey area have good or fair potential for use as woodland. On the wetter soils in the Avonburg-Clermont map unit, commercially valuable trees are less common and generally do not grow so rapidly as they do on the soils in the other units.

The soils in the Cincinnati-Rossmoyne-Bonnell map unit have good potential for use as parks and extensive recreation areas.

The soils in the Jules-Stonelick-Chagrin map unit are severely limited for intensive recreation uses because of flooding. The soils, however, have good potential for recreation that can be restricted to the periods of the year when flooding is unlikely.

The soils in the Eden-Carmel map unit, in most areas, are severely limited for intensive recreation uses because of steep slopes. In many small areas, these soils have good potential for certain types of recreation development. There are numerous small ravines that have potential as sites for small lakes and ponds. Wooded areas are abundant on most of the soils in this map unit.

Soils in all of the map units provide habitat for many important species of wildlife.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Switzerland silt loam, 6 to 12 percent slopes, eroded, is one of several phases in the Switzerland series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Russell-Fincastle silt loams, 1 to 4 percent slopes is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

AvA—Avonburg silt loam, 0 to 2 percent slopes. This is a nearly level, deep, somewhat poorly drained soil on broad ridges on uplands. The mapped areas are broad and irregular in shape and range from 5 to 1,000 acres in size. Most are about 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is light yellowish brown, mottled, silt loam about 8 inches thick. The subsoil is 63 inches thick. In the upper part it is light yellowish brown, mottled, friable silt loam; below that, it is gray and yellowish brown, mottled, very firm and extremely firm silt loam (fragipan); in the lower part it is brownish yellow, mottled, friable loam. In places, the slope is 2 to 4 percent.

Included with this soil in mapping are small areas of nearly level Clermont soils near the center of the broad ridges. Also included are small areas of nearly level and gently sloping, deep Rossmoyne soils near slope breaks. The included soils make up about 8 to 12 percent of the map unit.

The available water capacity of this Avonburg soil is moderate. Permeability is very slow. Runoff is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. A fragipan in this soil restricts the downward movement of roots. The surface layer is dominantly neutral in reaction. A perched high water table fluctuates between depths of 1 and 3 feet late in winter and in spring.

In most areas, this soil is used for cultivated crops. In a few areas, it is used for hay and pasture, and in other areas, it is used as woodland.

This soil is suited to corn, soybeans, and small grains. The wetness and the very slowly permeable fragipan are

the major limitations. An artificial drainage system should be established for a conservation cropping system that includes row crops. Land smoothing and shallow surface drains help remove excess surface water. Plowing to the same depth in fields of continuous row crops causes the formation of a plowpan that restricts the downward movement of roots and water. Cover crops, green manure crops, and conservation tillage that leaves all or part of the crop residue on the surface help maintain and improve the content of organic matter and soil tilth. Erosion is a hazard on slopes of 2 to 4 percent.

This soil is suited to grasses for hay and pasture. It is poorly suited to deep-rooted legumes such as alfalfa because the fragipan restricts the downward movement of roots and water. Overgrazing or trampling by livestock when the soil is wet damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of wetness. Artificial drainage can help remove excess water, but the soil is nearly level and suitable outlets for drainage are hard to find. Soils better suited to building sites are nearby. This soil has severe limitations for local roads and streets because of frost action and low strength. Drainage ditches along roads can lower the water table and thus reduce frost action. The road base should be strengthened with a suitable material.

Limitations for septic tank absorption fields are severe because of the slow permeability and the wetness. The soil is generally not suited to this use.

This soil is in Capability subclass IIw and in woodland suitability subclass 3o.

BaA—Bartle silt loam, 0 to 3 percent slopes. This is a nearly level, deep, somewhat poorly drained soil on old stream terraces. It is a few feet higher in elevation than the adjoining alluvial soils. The areas are irregular in shape and range from 10 to 60 acres in size. Most are about 30 acres in size.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The subsurface layer is pale brown, mottled silt loam about 6 inches thick. The subsoil is about 42 inches thick. In the upper part, it is pale brown, mottled, friable silt loam, and in the lower part it is light gray, mottled, very firm silt loam and silty clay loam. The lower part is a fragipan. The substratum to a depth of about 60 inches is yellowish brown clay loam. In a few areas the soil is gently sloping.

Included with this soil in mapping are a few small areas of nearly level and gently sloping deep, moderately well drained soils near slope breaks. The included soils make up about 8 percent of the map unit.

The available water capacity of the Bartle soil is moderate. Permeability is very slow. Runoff from cultivated areas is slow. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. It is dominantly medium acid. A fragipan in this soil restricts the downward movement of roots. A perched high water table fluctuates between depths of 1 and 2 feet late in winter and in spring.

This soil is used mainly for cultivated crops. In a few areas it is used for hay and pasture.

This soil is suited to corn, soybeans, and small grains. The wetness and the very slowly permeable fragipan are major limitations. Artificial drainage should be established and maintained if a conservation cropping system that includes row crops is used. Land smoothing, shallow surface drains, and diversions help remove excess surface water. Cover crops and green manure crops and conservation tillage that leaves all or part of the crop residue on the surface help maintain and improve the content of organic matter and soil tilth. Erosion is a hazard on slopes of 2 to 4 percent.

This soil is suited to grasses for hay and pasture. It is poorly suited to deep-rooted legumes such as alfalfa because the fragipan restricts the downward movement of roots and water. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. A drainage system can help correct the wetness, but this soil is difficult to drain because it is nearly level, and suitable drainage outlets are hard to find. Also, the very slow permeability of the soil hinders drainage. This soil has severe limitations for local roads and streets because of frost action. Drainage ditches along roads can lower the water table and thereby reduce frost action. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of the very slow permeability and wetness. This soil is generally not suited to this use.

This soil is in capability subclass IIw and in woodland suitability subclass 3o.

BeC2—Bonnell silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping soil on narrow

ridges and side slopes. The mapped areas are narrow and irregular in shape and range from 5 to 50 acres in size. Most are about 10 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of yellowish brown subsoil material. It is about 6 inches thick. The subsoil is about 74 inches thick. In the upper part it is yellowish brown, friable silt loam; below that, it is strong brown, firm silty clay loam; and in the lower part is yellowish brown, very firm clay and clay loam. In some areas the upper 24 inches of this soil formed in loess. In a few small areas, there is more silt and less clay in the subsoil. The lower part of the subsoil formed in clayey residuum.

Included with this soil in mapping are a few small areas of moderately sloping Cincinnati soils and severely eroded Bonnell soils. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is rapid. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly slightly acid.

In most areas, this soil is used as woodland. In some areas, the soil is used for hay and pasture, and in a few small areas, it is used for row crops.

This soil is suited to corn, soybeans, and small grains. Erosion is the major hazard. Conservation practices help control erosion and surface water runoff where cultivated crops are grown. They include crop rotation, conservation tillage, contour farming, or grassed waterways. Crop residue left on the surface and cover crops also help to control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of plants, reduces forage yields. It also causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. The clayey subsoil limits the use of harvesting and planting equipment. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of shrinking and swelling. Backfilling along foundations with sand and gravel and properly designed foundations and footings help prevent structural damage.

This soil has severe limitations for local roads and streets because of low strength and shrinking and swelling. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of slow permeability. Commercial sewer systems should be used, if available, or absorption fields should be enlarged to overcome the restricted permeability of the soil.

This soil is in capability subclass IIIe and in woodland suitability subclass 2c.

BeC3—Bonnell silt loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping soil on narrow ridges and side slopes. The mapped areas are narrow and irregular in shape and range from 5 to 40 acres in size. Most are about 10 acres in size. This soil is deep and well drained.

Typically, the surface layer is yellowish brown silt loam about 2 inches thick. The subsoil is about 55 inches thick. In the upper part it is yellowish brown, friable silt loam, and in the lower part it is strong brown and yellowish brown, very firm clay. The substratum to a depth of 60 inches is brown clay loam. In some places, the upper 24 inches of this soil formed in loess. In a few small areas, there is more silt and less clay in the subsoil or the lower part of the subsoil formed in clayey residuum.

Included with this soil in mapping are a few small areas of moderately sloping Cincinnati soils where ridges are broad and a few small areas of moderately eroded Bonnell soils. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is rapid. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. It is dominantly slightly acid.

This soil is used mainly for hay and pasture, and in some areas, it is in row crops.

This soil is suited to corn, soybeans, and small grains. Erosion is a major hazard. Conservation practices are needed to control erosion and runoff where crops are grown. They include crop rotation, conservation tillage, contour farming, and grassed waterways. Cover crops and crop residue left on the surface help control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition and the seedling mortality rate are moderate. The clayey subsoil limits the use of planting and harvesting equipment. Seedlings survive and grow well if competing vegetation

is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

The soil has severe limitations for use as sites for buildings because of shrinking and swelling. Backfilling along foundations with sand and gravel and properly designed foundations and footings help prevent structural damage.

This soil has severe limitations for local roads and streets because of shrinking and swelling. The road base should be strengthened with a suitable material. This soil has severe limitations for septic absorption fields because of slow permeability. Commercial sewer systems should be used, if available, or the absorption field should be enlarged to overcome the reduced permeability of the soil.

This soil is in capability subclass IVe and in woodland suitability subclass 3c.

BeD2—Bonnell silt loam, 12 to 18 percent slopes, eroded. This is a strongly sloping soil on narrow ridges and side slopes. The areas are narrow and irregular in shape and range from 5 to 160 acres in size. Most are about 20 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of yellowish brown subsoil material. It is about 5 inches thick. The subsoil is about 68 inches thick. In the uppermost part it is yellowish brown and brown, friable silt loam and silty clay loam; in the next part it is strong brown, very firm silty clay and clay; and in the part below that, it is brown, firm clay loam. In the lowermost part it is light yellowish brown, friable loam. The substratum to a depth of 80 inches is brown clay loam. In some small areas, the soil formed in a thin mantle of loess and limestone and shale residuum. In a few small areas, the upper 24 inches of this soil formed in loess or there is more sand and less clay in this soil.

Included with this soil in mapping are a few small areas of a moderately deep soil that developed in less than 36 inches of glacial till and the underlying clay residuum. The areas are near steep hillsides. Also included are a few small areas of moderately sloping Cincinnati soils on the upper part of the slope and areas of Weisburg soils that have a very slowly permeable fragipan. These included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is very rapid. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly slightly acid. This soil is mainly in woodland, and in some areas, it is used for hay and pasture. In other small areas, it is used for row crops.

This soil is suited to corn, soybeans, and small grains. Erosion is the major hazard. Conservation practices help control erosion and runoff when crops are grown. They are crop rotation, conservation tillage, contour farming or grassed waterways. Cover crops and crop residue left on the surface help to control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture also helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The slope severely limits the use of harvesting and planting equipment. Erosion is a moderate hazard. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil is severely limited for use as sites for buildings because of the slope and the shrinking and swelling. Soil slippage is a hazard in areas where the soil has been disturbed. The slope can be modified by grading. Foundations and footings should be properly designed to prevent structural damage caused by soil slippage and the shrinking and swelling. This soil is severely limited for local roads and streets because of the slope, the low strength, and the shrinking and swelling. Soil slippage is a problem in the construction of roads. The road base should be strengthened with a suitable material.

This soil has severe limitations for septic tank absorption fields because of the slow permeability and the slope. Commercial sewer systems should be used, if available, or absorption fields should be enlarged to overcome the restricted permeability. Absorption fields should also be designed according to the slope.

This soil is in capability subclass IVe and in woodland suitability subclass 2c.

BeD3—Bonnell silt loam, 12 to 18 percent slopes, severely eroded. This is a strongly sloping soil on narrow ridges and side slopes. The areas are narrow and irregular in shape and range from 5 to 60 acres in size. Most are about 20 acres in size. This soil is deep and well drained. Severe erosion has removed most of the organic matter in the surface layer.

Typically, the surface layer is dark yellowish brown silt loam about 2 inches thick. The subsoil is about 49 inches thick. In the uppermost part it is yellowish brown, firm silty clay loam; below that, it is yellowish brown, very firm silty clay; and in the part below that, it is yellowish brown, mottled, very firm clay and clay loam. In the lowermost part it is yellowish brown, firm clay loam. The substratum to a depth of about 62 inches is yellowish

brown clay loam. In a few small areas where most of the original surface layer has been eroded away, the surface layer is clay loam, silty clay loam, or clay. This soil formed in a thin mantle of loess and interbedded limestone and shale, but in a few small areas, the soil to a depth of more than 24 inches formed in loess. Also, in a few small areas, there is more silt and less clay in the profile.

Included with this soil in mapping are a few small areas of soils that formed in less than 30 inches of glacial till and the underlying clay residuum. The areas are near steep hillsides. Also included are a few small areas of moderately sloping Bonnell and Cincinnati soils on the upper part of the slope. Also included are areas of strongly sloping, severely eroded Weisburg soils and a few gullied areas. The included areas make up about 25 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is very rapid. The content of organic matter in the surface layer is low. The surface layer is dominantly slightly acid.

In most areas, this soil is used for hay and pasture; in some areas it is idle; and in a few small areas, it is in row crops.

This soil generally is not suited to row crops because of the slope and because erosion is a severe hazard. Occasionally, small grains are grown to reestablish stands of grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture effectively controls erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The slope severely limits the use of harvesting and planting equipment. Erosion is a moderate hazard. Plant competition and the seedling mortality rate are moderate. It may be necessary to replant some seedlings. Seedlings survive and grow well if competing vegetation is controlled and livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of the slope and the shrinking and swelling. In areas where the soil is cleared and disturbed, soil slippage is a hazard. Foundations and footings should be properly designed to prevent structural damage caused by soil slippage or shrinking and swelling. This soil has severe limitations for local roads and streets because of slope, low strength, and shrinking and swelling. Soil slippage is a hazard in areas where the soil is disturbed. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of slow permeability and slope. Commercial sewer systems should be used, if available, or absorption fields should be enlarged to overcome the slow permeability. Also, absorption fields should be designed according to the slope.

This soil is in capability subclass VIe and in woodland suitability subclass 3c.

BeE—Bonnell silt loam, 18 to 35 percent slopes. This is a moderately steep and steep soil on side slopes. The areas are narrow and irregular in shape and range from 5 to 95 acres in size. Most are about 20 acres in size. This soil is deep and well drained.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is about 64 inches thick. In the upper part it is yellowish brown, friable loam; in the next part it is dark brown and dark yellowish brown, very firm silty clay and clay; and in the lower part it is yellowish brown, dark yellowish brown and brown, firm clay loam. The substratum to a depth of 80 inches is brown clay loam. In some areas, this soil formed in a thin mantle of loess and interbedded limestone and shale. In a few small areas, there is more sand and less clay in the subsoil.

Included with this soil in mapping are areas of severely eroded Bonnell soils. Also included are a few small areas of moderately steep and steep Eden soils on the lower part of the slope and a soil that formed in glacial till less than 30 inches deep and in the underlying clay residuum. The included soils make up about 20 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is very rapid. The content of organic matter in the surface layer is moderate. The surface layer is slightly acid.

In most areas, this soil is in woodland. In some areas, it is used for hay and pasture, and in a few areas, it is idle.

This soil generally is not suited to row crops because of the slope and because erosion is a severe hazard.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees (fig. 3). The slope severely limits the use of planting and harvesting equipment. Erosion is a moderate hazard. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

Figure 3.—A stand of mixed hardwoods on Bonnell silt loam, 18 to 35 percent slopes.

This soil has severe limitations for use as sites for buildings because of the slope and the shrinking and swelling. In areas where this soil is cleared and graded, soil slippage is a hazard. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling. This soil has severe limitations for local roads and streets because of slope, low strength, and shrinking and swelling. Soil slippage is a hazard in construction areas. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of slow permeability and slope. It is generally not suited to this use. It is very difficult for machinery to operate on this soil because of slope.

This soil is in capability subclass VIe and in woodland suitability subclass 2c.

CaC2—Carmel silt loam, 6 to l2 percent slopes, eroded. This is a moderately sloping soil on narrow ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 30 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 6 inches thick. The subsoil is about 30 inches thick. In the upper part it is dark yellowish brown, friable silt loam; in the next part it is dark yellowish brown and yellowish brown, very firm silty clay; and in the lower part

it is light olive brown clay. The substratum to a depth of about 60 inches is light olive brown flaggy clay. In small areas, this soil formed in more than 18 inches of loess or in a thin mantle of loess and the underlying clayey glacial till. In other areas, this soil formed in 30 to 36 inches of glacial till and in the underlying clay residuum.

Included with this soil in mapping are small areas of severely eroded Carmel soils. The included soils make up about 8 percent of the map unit.

The available water capacity of this soil is moderate, and permeability is very slow. Runoff is rapid. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. The surface layer is dominantly neutral in reaction.

In most areas, this soil is used for hay and pasture. In some areas, it is used for row crops or is idle or in woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices help control erosion and runoff where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Cover crops and crop residue left on the surface help to control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The seedling mortality rate and windthrow hazard are severe. Plant competition is moderate. It may be necessary to replant some seedlings. Seedlings grow well if competing vegetation is controlled and livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of the shrinking and swelling of the soil. Backfilling with sand and gravel along foundation walls and properly designed foundations and footings help prevent structural damage caused by shrinking and swelling. This soil has severe limitations for local roads and streets because of shrinking and swelling and low strength. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of very slow permeability. It is generally not suited to this use. In some areas, this limitation can be overcome by enlarging the absorption field.

This soil is in capability subclass IIIe and in woodland suitability subclass 1c.

CaD2—Carmel silt loam, 12 to 18 percent slopes, eroded. This is a strongly sloping soil on narrow ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 210 acres in size. Most are about 30 acres in size. This soil is deep and well drained.

Typically the surface layer consists of yellowish brown silt loam mixed with a small amount of subsoil material. It is about 6 inches thick. The subsoil is about 30 inches thick. In the upper part it is strong brown, firm silty clay and clay, and in the lower part it is yellowish brown, extremely firm clay. The substratum, to a depth of about 44 inches, is pale olive and olive yellow flaggy clay. Below that is interbedded soft shale and limestone flagstone. In some small areas, the soil formed in more than 18 inches of loess or in a thinner mantle of loess and clayey glacial till. In other areas, the soil formed in 30 to 36 inches of glacial till and in the underlying clay residuum.

Included with this soil in mapping are small areas of severely eroded Carmel soils. Also included are small areas of moderately sloping Switzerland and Carmel soils near the upper part of the slope and small areas of Eden soils near the end of ridges and lower slope breaks. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is moderate, and the permeability is very slow. Runoff is very rapid. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. It is dominantly neutral.

This soil is used mainly for hay and pasture. In some areas it is used for row crops or is idle or in woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices help control erosion and runoff where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Crop residue left on the surface and cover crops help control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The seedling mortality rate and the windthrow hazard are severe. It may be necessary to replant some seedlings. Seedlings normally grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of slope and shrinking and swelling. In areas where this soil is cleared and disturbed, soil slippage is a hazard.

Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling. This soil has severe limitations for local roads and streets because of slope, shrinking and swelling, and low strength. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of very slow permeability and slope. It is generally not suited to this use.

This soil is in capability subclass IVe and in woodland suitability subclass 1c.

CaE2—Carmel silt loam, 18 to 25 percent slopes, eroded. This is a moderately steep soil on short side slopes along drainageways. The areas are narrow and elongated in shape and are mainly on northfacing slopes. They range from 5 to 170 acres in size. Most are about 15 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of yellowish brown subsoil material. It is about 6 inches thick. The subsoil is about 32 inches thick. In the upper part it is yellowish brown, firm silty clay loam; in the part below that, it is yellowish brown, very firm silty clay; and in the lower part it is light olive brown, very firm clay. The substratum to a depth of about 60 inches is pale olive flaggy clay. In a few small areas, this soil formed in a thin mantle of loess and clayey glacial till.

Included with this soil in mapping are moderately steep and steep flaggy Eden soils on lower slopes. Also included are a few small areas of a moderately deep soil where the lower part of the subsoil formed in clay residuum. The areas are near the upper part of the slope. The included soils make up about 10 percent of the map unit.

The available water capacity is moderate, and the permeability is very slow. Runoff is very rapid. The content of organic matter in the surface layer is low. The surface layer is dominantly neutral in reaction.

This soil is mainly in woodland. In some areas, it is used for hay and pasture.

This soil is generally not suited to row crops because of the moderately steep slope. Erosion is a severe hazard. Occasionally, small grains are grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Erosion is a moderate hazard. The slope limits the use of harvesting and planting equipment. The seedling mortality rate and the windthrow hazard are severe. It may be necessary to replant some seedlings. Seedlings grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of slope and shrinking and swelling. Soil slippage is also a hazard. The moderately steep slope limits construction, design, and installation of facilities. Grading to modify the slope should be confined to small areas. Foundations and footings should be properly designed to prevent structural damage caused by the shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of slope, shrinking and swelling, and low strength. Roads should be built on the contour, and the road base should be strengthened with a suitable material. If large areas of this soil are cleared or disturbed, soil slippage is a hazard. This soil has severe limitations for septic tank absorption fields because of the very slow permeability and the slope. It is generally not suited to this use.

This soil is in capability subclass VIe and in woodland suitability subclass 1c.

CcC3—Carmel silty clay loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping soil on ridges and side slopes. The areas are narrow and elongated in shape, and most are about 10 acres in size. This soil is deep and well drained. It consists of part of the original surface layer and some of the subsoil, but is mostly subsoil. Although this soil is naturally fertile, severe erosion has removed most of the organic matter from the surface layer. It also has caused poor tilth by increasing the content of clay in the surface layer.

Typically, the surface layer is dark yellowish brown silty clay loam about 3 inches thick. The subsoil is about 26 inches thick. In the upper part it is dark yellowish brown, firm silty clay loam, and in the lower part it is yellowish brown, very firm silty clay. The substratum to a depth of about 60 inches is light olive brown flaggy clay. In some areas the soil formed in more than 18 inches of loess, and in a few small areas the lower part of the subsoil formed in clay residuum. In a few places, the slope is more than 12 percent.

Included with this soil in mapping are small areas of moderately sloping, severely eroded Bonnell soils near the upper part of the slope. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is high, and the permeability is very slow. Runoff is rapid. The content of organic matter in the surface layer is low. The surface layer is firm and should be tilled under proper moisture conditions. It is dominantly neutral. If this soil is

tilled when it is too wet, large clods form and become very firm when they dry. The clods make it difficult to prepare a good seedbed.

In most areas, this soil is used for hay and pasture. In some areas, it is used for row crops or is idle or in woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices help control erosion and runoff where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Crop residue left on the surface and cover crops help control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. If the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Slope limits the use of planting and harvesting equipment. The windthrow hazard and the seedling mortality rate are severe. It is usually necessary to replant some seedlings. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of slope and shrinking and swelling. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling. This soil has severe limitations for local roads and streets because of shrinking and swelling. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of very slow permeability. Commercial sewer systems should be used, if available, or absorption fields should be enlarged to overcome the restricted permeability of this soil.

This soil is in capability subclass IVe and in woodland suitability subclass 2c.

CcD3—Carmel silty clay loam, 12 to 18 percent slopes, severely eroded. This is a strongly sloping soil on ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 170 acres in size. Most are about 30 acres in size. The soil is deep and well drained.

Typically, the surface layer is brown silty clay loam about 3 inches thick. The subsoil is about 26 inches thick. In the upper part it is dark brown and dark yellowish brown, very firm silty clay; and in the lower part it is light olive brown, very firm clay. The substratum to a depth of about 60 inches is pale olive flaggy clay. In some small areas, the soil formed in a thin mantle of loess and clayey glacial till. In other small areas, this soil formed entirely in residuum from limestone and shale. In some places, the lower part of the subsoil formed in clay residuum.

Included with this soil in mapping are small areas of moderately eroded soils. Also included are small areas of moderately steep Eden soils near the lower part of the slope and small areas of moderately sloping Lowell soils near the upper part of the slope. Also included are a few small areas of a moderately deep soil that formed in less than 30 inches of glacial till and the underlying clay residuum. The areas are near the upper part of the slope. The included soils make up about 30 percent of the map unit.

The available water capacity of this soil is moderate, and the permeability is very slow. Runoff is very rapid. The content of organic matter in the surface layer is low. The surface layer is firm and should be tilled under proper moisture conditions. It is dominantly neutral in reaction. This soil is used mainly for hay and pasture. In some areas, it is used as woodland or is idle.

This soil is not generally suited to row crops because of the slope and because erosion is a severe hazard. Occasionally, small grains are grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. If the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Slope limits the use of planting and harvesting equipment. The windthrow hazard and the seedling mortality rate are severe. Sometimes it is necessary to replant some seedlings. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, and girdling.

This soil has severe limitation for use as sites for buildings because of the slope and the shrinking and swelling. Soil slippage is a hazard in areas where the soil has been disturbed. Foundations and footings should be properly designed and foundation drain tile should be used to prevent structural damage caused by shrinking and swelling. This soil has severe limitations for local roads and streets because of slope and shrinking and swelling. Soil slippage is a hazard. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of the very slow permeability and the slope. Commercial sewer systems should be used, if available,

or absorption fields should be enlarged to overcome the restricted permeability and the slope.

This soil is in capability subclass VIe and in woodland suitability subclass 2c.

CcE3—Carmel silty clay loam, 18 to 25 percent slopes, severely eroded. This is a moderately steep soil on short side slopes along drainageways. The areas are narrow and elongated in shape and are mostly on south-facing slopes. They range from 5 to 50 acres in size. Most are about 10 acres in size.

Typically, the surface layer is dark yellowish brown silty clay loam about 3 inches thick. The subsoil is about 29 inches thick. In the upper part it is yellowish brown, firm silty clay loam; and in the lower part it is yellowish brown, very firm silty clay. The substratum to a depth of about 60 inches is pale olive flaggy clay. In some areas, the soil formed entirely in limestone and shale.

Included with this soil in mapping are a few small areas that are moderately eroded. Also included are a few small areas of steep, moderately deep, well drained, flaggy Eden soils on the lower part of the slope. Also included are a few small areas of a moderately deep soil that formed in less than 30 inches of glacial till and the underlying clay residuum. The areas are near the upper part of the slope. The included soils make up about 20 percent of the map unit.

The available water capacity of this soil is moderate, and the permeability is very slow. Runoff is very rapid. The content of organic matter in the surface layer is low. The surface layer is dominantly neutral in reaction.

This soil is used mainly for hay and pasture. In some areas it is idle or in woodland.

This soil is generally not suited to row crops because of the moderately steep slope and because erosion is a severe hazard. Occasionally, small grains are grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The slope limits the use of harvesting and planting equipment. Erosion is a moderate hazard. The windthrow hazard and the seedling mortality rate are severe. It may be necessary to replant some seedlings. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of slope and shrinking and swelling. It is generally not suited to this use. Soil slippage is a hazard in areas where the soil has been disturbed. The moderately steep slope hinders construction, design, and installation of facilities. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling. This soil has severe limitations for local roads and streets because of slope and shrinking and swelling. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of very slow permeability and slope. It is generally not suited to this use.

This soil is in capability subclass VIIe and in woodland suitability subclass 2c.

Ch—Chagrin silt loam. This is a nearly level soil on bottom land along the major tributaries of the Ohio River. The areas are narrow in shape and extend for long distances along streams. They range from 5 to 180 acres in size, and most are about 40 acres in size. This deep, well drained soil is frequently flooded for brief periods in winter and early in spring.

Typically, the surface layer is dark grayish brown silt loam and loam about 7 inches thick. The subsurface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 34 inches thick. In the upper part it is dark brown, friable loam; and in the lower part it is dark yellowish brown, friable silt loam. The substratum, to a depth of about 58 inches, is dark brown loam. Below this to a depth of 60 inches it is yellowish brown sand. In some small areas, the surface layer is sandy loam.

In other small areas, this soil has more silt and less sand and clay and is more acid. In a few areas, it is gently sloping.

Included with this soil in mapping are small areas of nearly level Stonelick and Dearborn soils near or adjacent to stream channels. Also included are small areas of soils that have carbonates above a depth of 40 inches. The areas are near stream channels. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is high and the permeability is moderate. Runoff is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is neutral to mildly alkaline in reaction. A high water table is between depths of 4 and 6 feet late in winter.

This soil is used mainly for cultivated crops. In some areas, it is used for hay and pasture.

This soil is suited to corn and soybeans. It is not suited to small grains because of occasional flooding. Flooding is the major hazard. Crop residue left on the surface, cover crops, and green manure help to improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Periods of flooding may severely damage alfalfa. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the

plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as a site for buildings, local roads and streets, and septic tank absorption fields. It is generally not suited to these uses because of frequent flooding. Alternate sites for these uses should be considered.

This soil is in capability subclass IIw and in woodland sutiability subclass 1o.

CnB2—Cincinnati silt loam, 2 to 6 percent slopes, eroded. This is a gently sloping soil on narrow ridges and short breaks between nearly level areas and sloping hillsides. The areas are narrow, elongated, and irregular in shape and range from 5 to 170 acres in size. Most are about 30 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 80 inches thick. In the uppermost part it is yellowish brown and dark yellowish brown, friable; below that, it is yellowish brown, very firm silt loam (fragipan); and in the part below that, it is yellowish brown, mottled, very firm silt loam (fragipan). In the lowermost part it is yellowish brown and strong brown, firm silty clay loam. In some areas, the subsoil in the lower part is silty clay or clay.

Included with this soil in mapping are areas of moderately sloping Switzerland soils on the lower part of the slope. The included soils make up about 5 percent of the map unit.

Available water capacity of this soil is high. Permeability is moderate above the fragipan and slow in and below the fragipan. Runoff is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly neutral in reaction. A fragipan in this soil restricts the downward movement of roots. A perched high water table is between depths of 4 and 6 feet late in winter or early in spring.

This soil is used mainly for hay and pasture. In some areas, it is used for corn, soybeans, small grains, and tobacco. In a few areas, it is used for urban development or as woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. The slowly permeable fragipan is the major limitation, and erosion is the major hazard. Conservation practices help control runoff and prevent excessive soil loss where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Crop residue left on the surface and cover crops help to control erosion and improve and maintain tilth and the content of organic matter. In some areas that are seepy, the drainageways need subsurface tile for drainage.

This soil is suited to grasses and legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because the slowly permeable fragipan restricts root growth. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition and the windthrow hazard are moderate. Seedling mortality is moderate, and it may be necessary to replant some seedlings. Seedlings normally grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for use as sites for buildings without basements. It has moderate limitations for use as sites for buildings with basements because of wetness. An artificial drainage system helps control wetness.

This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of the slow permeability. Commercial sewer systems should be used, if available, or absorption fields should be enlarged.

This soil is in capability subclass IIe and in woodland suitability subclass 2d.

CnC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping soil on narrow ridges and elongated side slopes. The areas are narrow and elongated in shape and range from 5 to 50 acres in size. Most are about 10 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of yellowish brown subsoil material. It is about 6 inches thick. The subsoil is 80 inches thick. In the uppermost part it is yellowish brown, friable silt loam; below that, it is yellowish brown, mottled, extremely firm silt loam (fragipan); and in the part below that, it is light yellowish brown and yellowish brown, friable silt loam. In the lowermost part it is yellowish brown, firm clay loam. In some areas, the subsoil in the lower part is clay or silty clay.

Included with this soil in mapping are gently sloping areas of Cincinnati soils on the upper part of the slope and strongly sloping areas of Cincinnati soils on the

lower part of the slope. In severely eroded areas, the surface layer generally is dark yellowish brown or yellowish brown. Also included are areas of moderately sloping Bonnell soil on the lower part of slope breaks or near the end of ridges. The included soils make up about 20 percent of the map unit.

The available water capacity of this soil is moderate. Permeability is moderate above the fragipan, and it is slow in and below the fragipan. Runoff is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly neutral in reaction. A fragipan in the soil restricts the downward movement of roots and water. A perched high water table is between depths of 4 and 6 feet late in winter and early in spring.

In most areas, this soil is used for hay or pasture. In some areas, it is used for corn, soybeans, and small grains. In other areas, it is used as woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. The slowly permeable fragipan is the major limitation, and erosion is the major hazard. Conservation practices help control runoff and prevent excessive soil loss where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Crop residue left on the surface and cover crops help control erosion and improve and maintain tilth and the content of organic matter. Seepy areas in some of the drainageways need subsurface tile for adequate drainage.

This soil is suited to grasses and legumes for hay and pasture. It is not suited to a deep-rooted legume, for example, alfalfa, because the slowly permeable fragipan restricts root growth. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods will help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition and the windthrow hazard are moderate. The seedling mortality rate is moderate, and it may be necessary to replant some seedlings. Seedlings generally survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of the slope. It has limitations for use as sites for buildings with basements because of wetness and slope. The soil can be graded to modify the slope. Diversions that intercept runoff help reduce the wetness. Foundations, footings, and basement walls should be properly designed to prevent structural damage. Foundation drains are needed to remove excess water. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base also helps reduce the potential for frost action. This soil has severe limitations for septic tank absorption fields because of slow permeability. Commercial sewer systems should be used, if available, or absorption fields should be enlarged to overcome the slow permeability.

This soil is in capability subclass IIIe and in woodland suitability subclass 2d.

CnC3—Cincinnati silt loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping soil on ridges and elongated side slopes. The areas are narrow and elongated in shape and range from 5 to 60 acres in size. Most are about 20 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark yellowish brown silt loam mixed with yellowish brown subsoil material. It is about 3 inches thick. The subsoil extends to a depth of more than 80 inches. In the uppermost part, it is yellowish brown, friable silt loam; below that, it is yellowish brown, mottled, extremely firm silt loam (fragipan); and in the part below that, it is light yellowish brown and yellowish brown, firm clay loam and loam. In the lowermost part it is yellowish brown, friable loam. In some areas, the lower part of the subsoil is silty clay or clay, and in other areas, the surface layer is darker in color.

Included with this soil in mapping are small areas of moderately sloping Bonnell soils on the lower part of the slope or near the end of ridges. The included soils make up about 10 percent of the map unit.

The available water capacity is moderate. Permeability is moderate above the fragipan and slow in and below the fragipan. Runoff is medium. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. It is dominantly neutral in reaction. A fragipan in this soil restricts root growth. A perched high water table is between depths of 4 and 6 feet late in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas, it is also used for hay and pasture.

This soil is suited to corn, soybeans, and small grains. The slowly permeable fragipan is the major limitation, and erosion is the major hazard. Conservation practices help control runoff and prevent excessive soil loss where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Crop residue left on the surface and cover crops help control erosion and improve and maintain tilth and the content of organic matter in this soil. Seepy areas in some of the drainageways need subsurface tile for adequate drainage.

This soil is suited to grasses for hay and pasture. It is not suited to a deep-rooted legume, for example, alfalfa, because the slowly permeable fragipan, which is close to

the surface, restricts the downward movement of roots and water. Growing grasses for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition, windthrow hazard, and the seedling mortality rate are moderate. It is usually necessary to replant some seedlings. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings because of slope. Buildings with basements are limited by wetness. The soil can be graded to modify the slope. Diversion ditches that intercept runoff help reduce wetness. Foundations, footings, and basement walls should be properly designed to prevent structural damage. Foundation drains are needed to remove excess water. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of the slow permeability. Commercial sewer systems should be used, if available, or absorption fields should be enlarged.

This soil is in capability subclass IVe and in woodland suitability subclass 2d.

Ct—Clermont silt loam. This is a nearly level soil on broad ridges on uplands. The areas are broad and irregular in shape and range from 5 to 3,000 acres in size. Most are about 300 acres in size. This soil is deep and poorly drained.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is grayish brown and light brownish gray, mottled silt loam about 21 inches thick. The subsoil extends to a depth of 80 inches. In the upper part it is gray, mottled, firm and very firm silty clay loam; and in the lower part it is light brownish gray, mottled, friable to firm silt loam.

Included with this soil in mapping are small areas of Avonburg soils that are nearer the drainageways than Clermont soils. The included soils make up about 8 percent of the map unit.

The available water capacity of this soil is high. Permeability is very slow. Runoff is very slow or ponded. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly slightly acid. A high water table is between depths of 0 and 1 feet during most of the year.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture, and in others, it is used as woodland.

This soil is suited to corn and soybeans. This soil is not suited to small grains because of excessive wetness in winter and early in spring. The wetness and the very slow permeability are the major limitations. An artificial drainage system should be established for a conservation cropping system that includes row crops. Land smoothing and shallow surface drains help remove excess surface water. In areas where row crops are grown continuously, plowing to an unvarying depth can cause the formation of a plowpan that restricts the downward movement of roots and water. Cover crops and green manure crops and conservation tillage that leaves all or part of the crop residue on the surface help maintain and improve the content of organic matter and soil tilth.

This soil is suited to grasses for hay and pasture. It is not suited to deep-rooted legumes, for example alfalfa, because excessive wetness restricts root development. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Water-tolerant species are favored for timber stands. Prolonged seasonal wetness hinders harvesting and logging operations and the planting of seedlings. The use of equipment is severely limited. The windthrow hazard and the seedling mortality rate are moderate. It is necessary to replant some seedlings to maintain the density of stands. If competing vegetation is controlled, and if livestock are kept out of the area, a large percentage of seedlings survive. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of wetness. An artificial drainage system helps reduce wetness, but some areas are difficult to drain because they are nearly level and suitable drainage outlets are hard to find. Alternate building sites nearby should be selected, especially for buildings with basements. This soil has severe limitations for local roads and streets because of low strength, frost action, and wetness. Drainage ditches along roads lower the water table and reduce frost action. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of very slow permeability and wetness. Commercial sewer systems are needed.

This soil is in capability subclass IIIw and in woodland suitability subclass 2w.

De—Dearborn silt loam. This is a nearly level soil on bottom land. The areas are narrow and elongated in

shape and range from 5 to 40 acres in size. Most are about 10 acres in size. The areas are adjacent to rapidly flowing streams that drain steep soils in the uplands that are underlain with calcareous shale and limestone bedrock. This soil is deep and well drained. It is subject to frequent flooding of very brief duration.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark brown silty clay loam about 6 inches thick. The subsoil is dark brown firm clay loam about 6 inches thick. The substratum to a depth of 60 inches is dark brown very channery loam and very channery clay loam. In a few areas, this soil has a surface layer of clay loam. In some areas, the subsoil is more silty or clayey and less sandy, and in other areas, it is slightly acid or neutral. In a few small areas, the slope is 2 to 6 percent.

Included with this soil in mapping are small areas of a soil that has a surface layer overlying the substratum. The areas are near stream channels. Also included are small areas of nearly level Huntington and Chagrin soils at a slightly higher elevation and farther from stream channels than Dearborn soils. Also included are areas of soils with less than 35 percent coarse fragments between depths of 10 and 40 inches. The areas are farther from stream channels than Dearborn soils. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is low, and permeability is moderate. Runoff from cultivated areas is slow. The content of organic matter in the surface layer is high. Flooding occurs only when there are heavy rains. The surface layer is friable and easy to work. It is moderately alkaline. This soil is high in natural fertility, and it has a relatively high percentage of calcium, magnesium, phosphorus, and potassium.

This soil is used mainly for hay and pasture, but in many areas it is used for corn and tobacco. In some areas it is idle, and in a few areas it is used as woodland.

This soil is suited to corn and tobacco. Occasional flooding is the major hazard. The major limitation is droughtiness in summer because of the low available water capacity.

This soil is suited to grasses and legumes for hay or pasture. The major limitation is droughtiness in summer because of low available water capacity. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of frequent flooding. It is generally not suited to this use. Building sites should be protected from flooding, or alternate sites should be located nearby. This soil has severe limitations for local roads and streets and septic tank absorption fields because of frequent flooding. It is generally not suited to these uses.

This soil is in capability subclass IIw and in woodland suitability subclass 2f.

Df—Dearborn flaggy loam. This is a nearly level soil on bottom land. The areas are narrow and elongated in shape and range from 5 to 80 acres in size. Most are about 30 acres in size. They are adjacent to rapidly flowing streams that drain steep and very steep soils on uplands that are underlain with calcareous shale and limestone bedrock. This soil is deep and well drained. It is subject to frequent flooding of very brief duration. Fragments of limestone are scattered on the surface.

Typically, the surface layer is dark brown flaggy loam about 10 inches thick. The subsoil is dark brown friable loam about 5 inches thick. The substratum to a depth of 60 inches is dark brown, friable very channery clay loam and very flaggy silt loam. In a few areas, the surface layer is sandy loam, flaggy sandy loam, or flaggy silt loam. In a few small areas, the slope is 2 to 6 percent.

Included with this soil in mapping are small areas of riverwash adjacent to stream channels. Also included are small areas of a soil that has a surface layer overlying the substratum. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is low and permeability is moderate. Runoff is slow. The content of organic matter in the surface layer is high. Flooding occurs only when there are heavy rains. The surface layer is friable but difficult to work because of the flagstones on the surface. The surface layer is moderately alkaline in reaction. This soil is high in natural fertility, and it has a relatively high percentage of calcium, magnesium, phosphorus, and potassium.

This soil is used mainly for hay and pasture, but in many areas it is idle. In a few areas it is used as woodland.

This soil is suited to cultivated crops. Occasional flooding is the major hazard. The major limitation is droughtiness in summer because of the low available water capacity. This soil is difficult to till because of the flaggy surface layer.

This soil is suited to grasses and legumes for hay and pasture. The major limitations are droughtiness in summer because of the low available water capacity and the flaggy surface layer, which is difficult to work. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and the soil in good condition.

This soil is suited to trees. Plant competition is moderate. Rooting depth somewhat restricts the growth

of trees that require a soil free of coarse fragments, for example black walnut. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings. Because of frequent flooding it is generally not suited to this use. Building sites should be protected from flooding, or alternate sites should be selected nearby. This soil has severe limitations for local roads and streets and septic tank absorption fields because of flooding. It is generally not suited to this use.

This soil is in capability subclass IIw and woodland suitability subclass 2f.

EcE2—Eden silty clay loam, 15 to 25 percent slopes, eroded. This is a moderately steep soil on side slopes. The areas are narrow, elongated, and irregular in shape and range from 5 to 800 acres in size. Most are about 40 acres in size. This soil is moderately deep and well drained.

Typically, the surface layer consists of very dark grayish brown silty clay loam mixed with a small amount of subsoil material. It is about 6 inches thick. The subsoil is about 24 inches thick. In the upper part it is dark brown, firm silty clay loam; and in the lower part it is light olive brown, very firm flaggy silty clay. The substratum, to a depth of about 38 inches, is pale olive flaggy silty clay. Below this, to a depth of 60 inches are thin layers of limestone and clay shale. In small areas, the soils are strongly sloping.

Included with this soil in mapping are small areas of strongly sloping Pate soils on lower slopes. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is low, and permeability is slow. Runoff is very rapid. The content of organic matter in the surface layer is moderate. The surface layer is dominantly neutral in reaction. The natural fertility is high, and this soil has a relatively high content of calcium, magnesium, phosphorus, and potassium.

This soil is used mainly as woodland. In some areas it is in hay and pasture, and in a few areas it is idle.

This soil is generally not suited to cultivated crops because of the moderately steep slopes and because erosion is a severe hazard.

This soil is suited to grasses and legumes for hay and pasture (fig. 4). The moderately steep slope is the major limitation, and erosion is the major hazard. Permanent stands of grasses and legumes, contour and conservation tillage during seedbed preparation, and crop residue left on the surface help control runoff and erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The use of harvesting equipment is severely limited by the slope. Plant competition, the seedling mortality rate, the windthrow hazard, and the erosion hazard are moderate. It may be necessary to replant some seedlings. If competing vegetation is controlled and livestock kept out of the area, seedlings will survive and grow. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of slope. Alternate building sites nearby should be selected. This soil has severe limitations for local roads and streets because of slope and low strength. Roads and streets should be built on the contour wherever possible because soil slippage is a hazard in areas where the soil has been disturbed. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of slope, slow permeability, and the depth to bedrock. It is generally not suited to this use.

This soil is in capability subclass VIe and in woodland suitability subclass 3c.

EdE3—Eden flaggy silty clay loam, 15 to 25 percent slopes, severely eroded. This is a moderately steep soil on hillsides on uplands. The areas are narrow, elongated, and irregular in shape and range from 5 to 1,000 acres in size. Most are about 40 acres in size. This soil is deep and well drained. There are limestone fragments on the surface.

Typically, the surface layer is dark brown flaggy silty clay loam about 3 inches thick. The subsoil is about 18 inches thick. In the upper part it is yellowish brown, very firm silty clay; and in the lower part it is light olive brown, very firm flaggy silty clay. The substratum, to a depth of about 30 inches, is light olive brown very flaggy silty clay. Below this, to a depth of 60 inches, are thin layers of limestone and clay shale. In small areas, the soils are steep.

Included with this soil in mapping are small areas of strongly sloping, severely eroded Bonnell soils on upper slopes. Also included are small areas of strongly sloping Pate soils on lower slopes. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is low, and permeability is slow. Runoff is very rapid. The content of organic matter in the surface layer is low. The surface layer is dominantly neutral. This soil is high in natural fertility and has a relatively high content of calcium, magnesium, phosphorus, and potassium.

This soil is used mainly for grasses and legumes for hay and permanent pasture. In some areas it is in woodland, and in a few areas it is idle.

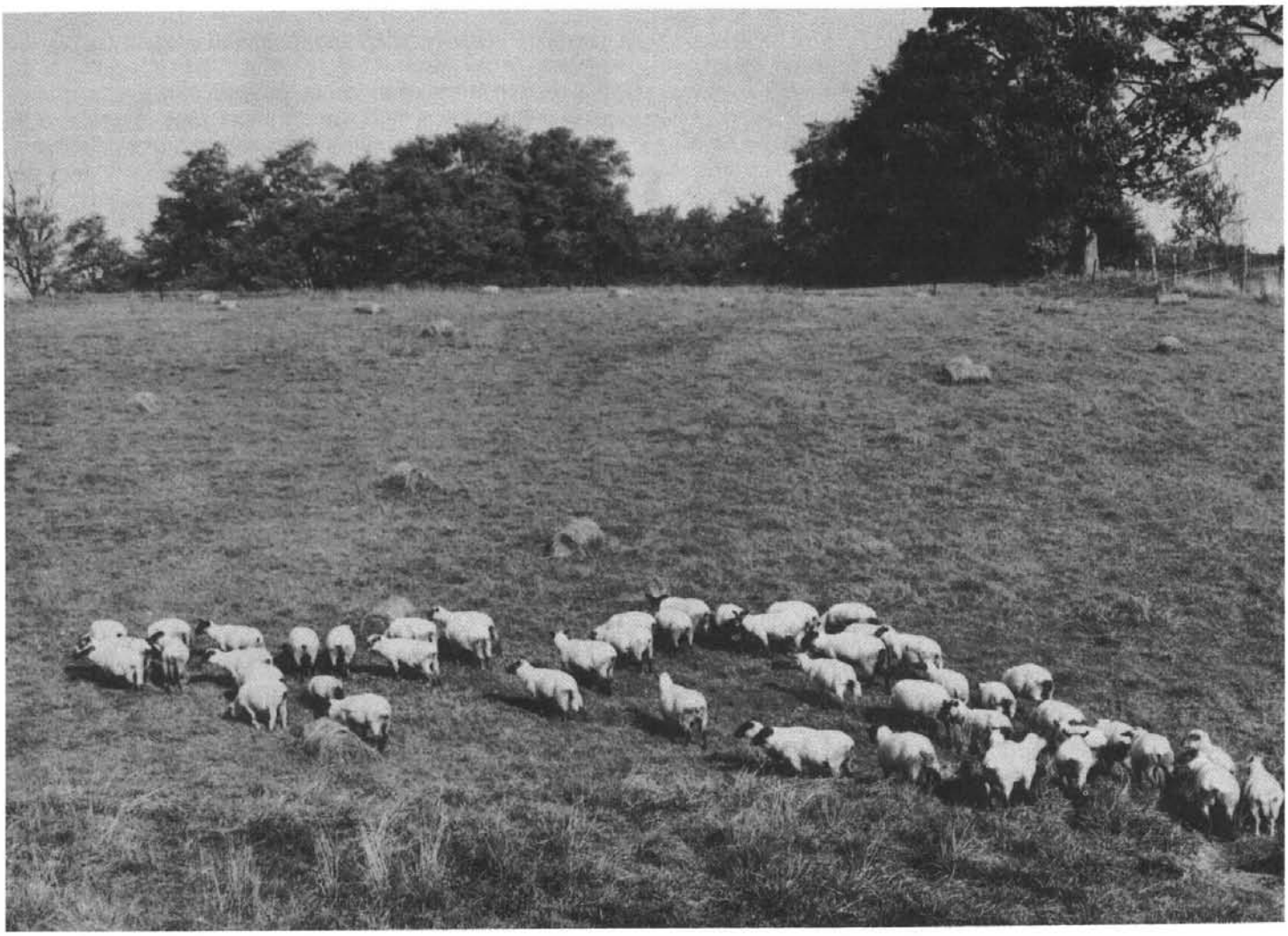

Figure 4.—Fescue pasture on Eden silty clay loam, 15 to 25 percent slopes, eroded.

This soil is generally not suited to cultivated crops because of the moderately steep slope and because erosion is a severe hazard.

This soil is suited to grasses and legumes for hay and permanent pasture. The moderately steep slope is the main limitation and erosion is the main hazard. Permanent stands of grasses and legumes, contour and conservation tillage during seedbed preparation, and crop residue left on the surface help control runoff and erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The use of harvesting and planting equipment is severely restricted by slope. Plant competition and the windthrow hazard are moderate. The seedling mortality rate is severe. It may be necessary to replant some seedlings. If competing vegetation is controlled and if livestock are kept out of the area, seedlings can survive and grow. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of the slope. Alternate building sites should be located nearby. This soil has severe limitations for local roads and streets because of slope and low strength. Roads and streets should be built on the contour whenever possible, because soil slippage is a hazard in areas where the soil has been disturbed. The road base should be strengthened with a suitable material. Limitations are severe for septic tank absorption fields because of slope, slow permeability, and depth to bedrock. It is generally not suited to this use.

This soil is in capability subclass VIIe and in woodland suitability subclass 4c.

EdF—Eden flaggy silty clay loam, 25 to 50 percent slopes. This is a steep soil on upland hillsides. The areas are elongated and irregular in shape and range from about 40 to several thousand acres in size. Most are about 500 acres in size. This soil is deep and well drained. Fragments of limestone are scattered on the surface.

Typically, the surface layer is very dark grayish brown flaggy silty clay loam about 3 inches thick. The subsoil is about 33 inches thick. In the uppper part it is dark brown, firm channery silty clay; in the next layer it is dark yellowish brown, very firm channery silty clay; and in the lower part it is light olive brown, very firm very flaggy clay. Soft, light olive brown massive siltstone is at a depth of about 36 inches.

In some places, the soils are moderately steep and steep and severely eroded. In other places, bedrock is within a depth of 20 inches.

Included with this soil in mapping are small areas of moderately steep Eden and Bonnell soils on the upper part of hillsides. Also included are areas of nearly level Dearborn soils along creek bottoms. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is low, and permeability is slow. Runoff is very rapid. The content of organic matter in the surface layer is moderate. The surface layer is dominantly neutral in reaction. Natural fertility is high, and this soil has a relatively high percentage of calcium, magnesium, phosphorus, and potassium.

This soil is used mainly as woodland, but in many areas it is used for grasses and legumes for pasture. In a few areas it is idle.

This soil is generally not suited to cultivated crops because of the steep slope and because erosion is a severe hazard.

This soil is suited to grasses and legumes for permanent pasture. It is not suited to hay production because of the steep slope. The steep slope is the main limitation and erosion is the major hazard. Machinery that can be operated on the steep slope should be used in preparation of the seedbed. Permanent stands of grasses and legumes help control runoff and erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and the soil in good condition.

This soil is suited to trees. Erosion is a severe hazard. The use of planting and harvesting equipment is severely limited by slope. Ground cover should be disturbed as little as possible. Plant competition, the seedling mortality rate, and the windthrow hazard are moderate. If competing vegetation is controlled and if livestock are kept out of the area, seedlings survive and grow. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of the steep slope. It is generally not suited to this use. Alternate building sites should be located nearby. This soil has severe limitations for local roads and streets because of slope and low strength. In areas where this soil is disturbed, soil slippage is a hazard. Roads should be built on the contour. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of slope, slow permeability, and depth to bedrock. It is generally not suited to this use.

This soil is in capability subclass VIIe and woodland suitability subclass 3c.

EkA—Elkinsville silt loam, 0 to 2 percent slopes. This is a nearly level soil on old stream terraces that are a few feet higher in elevation than the adjoining alluvial soils. The areas are irregular in shape and range from about 5 to 100 acres in size. Most are about 10 acres in size. This soil is deep and well drained. It is rarely flooded.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is dark yellowish brown silt loam about 4 inches thick. The subsoil is about 47 inches thick. In the uppermost part it is dark yellowish brown friable silt loam; below that, it is strong brown firm silty clay loam; and in the part below that, it is dark brown friable loam. In the lowermost part it is dark brown firm clay loam. The substratum to a depth of about 60 inches is dark yellowish brown clay loam. In some places, the slope is 2 to 6 percent. In other places, this soil formed in a thin deposit of loess and loamy outwash over stratified gravel and sand.

Included with this soil in mapping are nearly level and gently sloping, deep, moderately well drained soils near the center of areas. Also included are small areas of moderately sloping Elkinsville soils near slope breaks. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is moderate. Runoff from cultivated areas is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly medium acid.

This soil is used mainly for cultivated crops, including tobacco. In some areas it is in hay and pasture.

This soil is suited to corn, soybeans, small grains, and tobacco. This soil has no severe limitations for use as cropland. Cover crops and green manure crops and conservation tillage that leaves all or part of the residue on the surface help maintain and improve the content of organic matter and soil tilth.

This soil is suited to grasses and legumes for hay and pasture. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface

compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is severe, but seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because most areas are subject to rare flooding. It is generally not suited to this use. In a few areas, this soil is not subject to flooding. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base also reduces the potential for frost action. This soil has moderate limitations for septic tank absorption fields even though it is not subject to flooding in some areas. If the areas to be used for this purpose are not protected from flooding, alternate sites should be located nearby.

This soil is in capability class I and in woodland suitability subclass 1o.

EkB2—Elkinsville silt loam, 2 to 6 percent slopes, eroded. This is a gently sloping soil on old stream terraces and terrace breaks that are a few feet higher in elevation than the adjoining alluvial soils. The areas are irregular in shape, and most are about 10 acres in size. This soil is deep and well drained. It is subject to rare flooding.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 42 inches thick. In the upper part it is yellowish brown firm silty clay loam, and in the lower part it is yellowish brown friable loam. The substratum to a depth of about 60 inches is dark brown.

Included with this soil in mapping are areas of moderately sloping soils on the lower part of the slope. The included soils make up about 8 percent of the map unit.

The available water capacity of this soil is high, and permeability is moderate. Runoff from cultivated areas is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly medium acid.

This soil is used mainly for cultivated crops. In some areas it is in hay and pasture.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices help control erosion and runoff where crops are grown. They are crop rotation, conservation tillage, diversions, contour farming, grassed waterways, and grade stabilization structures. Cover crops and conservation tillage that leaves all or part of the crop residue on the surface help control erosion and improve and maintain tilth and the content of organic matter in this soil.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

The soil has severe limitations for use as sites for buildings because of rare flooding. It is generally not suited to this use. In a few high areas, this soil is not subject to flooding. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base also reduces the potential for frost action. This soil has moderate limitations for septic tank absorption fields even though it is not subject to flooding in some areas. If areas to be used for this purpose are not protected from flooding, alternate sites should be located nearby.

This soil is in capability subclass IIe and in woodland suitability subclass 1o.

EkC2—Elkinsville silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping soil on old stream terraces and terrace breaks that are a few feet higher in elevation than the adjoining alluvial soils. The areas are narrow and irregular in shape and range from about 5 to 30 acres in size. Most are about 10 acres in size. This soil is deep and well drained. It is subject to rare flooding.

Typically, the surface layer consists of dark yellowish brown silt loam mixed with a small amount of subsoil material. It is about 6 inches thick. The subsoil is about 34 inches thick. In the upper part it is yellowish brown friable silt loam, and in the lower part it is yellowish brown firm silty clay loam. The substratum to a depth of about 60 inches is dark brown clay loam and silty clay loam. In small areas, this soil formed in a thin deposit of loess and loamy outwash over stratified gravel and sand.

Included with this soil in mapping are small areas of gently sloping soils near the upper part of the slope. Also included are small areas of strongly sloping soils near the lower part of the slope. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is high, and permeability is moderate. Runoff from cultivated areas is rapid. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly medium acid.

This soil is used mainly for cultivated crops. In some areas it is in hay and pasture.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices help control erosion and runoff where crops are grown. They are crop rotation, conservation tillage, diversions, contour farming, grassed waterways, or grade stabilization structures. Cover crops and conservation tillage that leaves all or part of the crop residue on the surface help control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of rare flooding and slope of more than 8 percent. It is generally not suited to this use. Flooding can be prevented by installing levees. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a more suitable material. Strengthening the road base also reduces the potential for frost action. This soil has moderate limitations for septic tank absorption fields. It has only slight limitations for this use in areas where the soil is not subject to flooding and where the slope is less than 8 percent. If areas are not protected from flooding, alternate sites should be located nearby.

This soil is in capability subclass IIIe and in woodland suitability subclass 1o.

FoB2—Fox silt loam, 1 to 4 percent slopes, eroded. This is a nearly level and gently sloping soil on slightly convex ridges and short convex breaks on terraces along the Ohio River and Whitewater River. The areas are narrow and irregular in shape and range from 5 to about 60 acres in size. Most are about 30 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 25 inches thick. In the upper part it is dark brown friable silt loam, and in the lower part it is reddish brown firm clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is yellowish brown very gravelly coarse sand. In a few areas the surface layer is sandy loam. In places the soils are more than 40 inches deep to stratified calcareous sand and gravel.

Included with this soil in mapping are the very steep Rodman soils on hillsides. Also included are areas of moderately sloping Fox soils near slope breaks. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is low, and permeability is moderate in the subsoil and rapid in the underlying material. Runoff is slow or medium. The content of organic matter in the surface layer is moderate. The surface layer is dominantly medium acid, except in areas that have been limed.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture.

This soil is suited to corn, soybeans, small grains, and tobacco. The major limitation is droughtiness in summer because of the low available water capacity. Erosion is the major hazard. If cultivated crops are grown on the gently sloping areas, conservation practices help control runoff and help prevent excessive soil loss. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Cover crops and crop residue left on the surface help control erosion and improve and maintain tilth and the content of organic matter in this soil. This soil is suited to intensive row crop production in areas where irrigation is practical.

This soil is suited to grasses and legumes for hay and pasture. The major limitation is droughtiness in summer because of the low available water capacity. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. The limitations to woodland use are slight.

This soil has moderate limitations for use as sites for buildings because of shrinking and swelling. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling. This soil has moderate limitations for local roads and streets because of frost action and shrinking and swelling. The road base material should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields. The underlying sand and gravel, which have poor filtering qualities, may allow the leachate or effluent to flow into the ground water.

This soil is in capability unit subclass IIe and in woodland suitability subclass 2o.

HcG—Hennepin loam, 40 to 60 percent slopes. This is a very steep soil on elongated side slopes along Johnsons Fork Creek and its drainageways. The areas are narrow and elongated in shape and range from 10 to

130 acres in size. Most are about 30 acres in size. This soil is deep and well drained.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is dark brown firm clay loam about 8 inches thick. The substratum to a depth of about 60 inches is yellowish brown gravelly clay loam.

Included with this soil in mapping are a few areas of Hennepin soils that have slopes of 25 to 40 percent. Also included are small areas of Russell soils on the upper part of the slope. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is moderately slow. Runoff is very rapid. The content of organic matter in the surface layer is low. The surface layer is neutral or mildly alkaline. This soil is high in natural fertility, and it has a relatively high percentage of calcium and magnesium.

This soil is used mainly as woodland. In a few areas it is in pasture.

This soil is generally not suited to cultivated crops because of the very steep slopes and because erosion is a severe hazard.

This soil is generally not suited to hay and pasture because of the very steep slopes and because erosion is a severe hazard.

This soil is suited to trees. Erosion is a severe hazard. The use of planting and harvesting equipment is severely limited by the slope. The ground cover should be disturbed as little as possible. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings, local roads and streets, and septic tank absorption fields because of the very steep slopes. It is generally not suited to these uses. Alternate sites for these uses should be located nearby.

This soil is in capability subclass VIIe and in woodland suitability subclass 1r.

Hu—Huntington silt loam. This is a nearly level soil on bottom land along the Ohio River and its larger tributaries. The areas are broad and elongated along the Ohio River and narrow and elongated along smaller streams. They range from 10 to 200 acres in size. Most are about 100 acres in size. This soil is deep and well drained. It is frequently flooded in winter and early in spring. Most areas are adjacent to the river channel. Along the smaller streams, they are on the highest level of bottom land adjacent to terraces or uplands.

Typically, the surface layer is dark brown silt loam about 13 inches thick. The subsoil is dark brown friable silt loam about 47 inches thick. The substratum to a depth of about 80 inches is dark brown loam. In some areas, the soil has a surface layer of silty clay loam or loam. In some areas, a deposit of recent calcareous silty alluvium 6 to 18 inches thick is on the surface.

Included with this soil in mapping is a nearly level, deep, moderately well drained soil that formed in 20 to 36 inches of neutral alluvium over underlying acid alluvium. Also included are small areas of nearly level, deep, well drained Dearborn soils at a slightly lower elevation and closer to stream channels than Huntington soils. Also included are small areas of deep, somewhat poorly drained Newark soils near old sloughs. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is high, and permeability is moderate. Runoff is medium. The content of organic matter in the surface layer is high. The surface layer is friable and easy to work. It is slightly acid to mildly alkaline. This soil is high in natural fertility. A high water table fluctuates between depths of 3 and 6 feet in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture.

This soil is suited to corn and soybeans. It is not suited to small grains because of severe damage from prolonged periods of flooding. The main hazard is frequent flooding. Cover crops and crop residue left on the surface and green manure crops help to improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Alfalfa is subject to severe damage during periods of prolonged flooding. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of frequent flooding. It is generally not suited to this use. Alternate building sites should be located nearby. This soil has severe limitations for local roads and streets because of frequent flooding and frost action. It also has severe limitations for septic tank absorption fields because of frequent flooding. It is generally not suited to this use.

This soil is in capability subclass IIw and in woodland suitability subclass 1o.

Ju—Jules silt loam. This is a nearly level soil on bottom land along the Ohio River and its tributaries. The areas are adjacent to stream channels. They are broad and irregular in shape and extend for long distances along streams. They range from 5 to 1,000 acres in size. Most are about 45 acres in size. This soil is deep and

well drained. It is frequently flooded in winter and early in spring.

Typically, the surface layer is dark brown silt loam about 20 inches thick. The substratum, to a depth of about 33 inches, is dark brown silt loam. Below that, it is dark yellowish brown silt loam. In small areas, the soil formed in alluvium that has more clay and less silt.

Included with this soil in mapping are deep, moderately well drained and somewhat poorly drained soils near the center of areas. The included soils make up about 8 percent of the map unit.

The available water capacity of this soil is very high, and permeability is moderate. Runoff is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is mildly alkaline or moderately alkaline.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture.

This soil is suited to corn and soybeans. It is not suited to small grains because of severe damage from prolonged periods of flooding. The main hazard is frequent flooding. Cover crops, green manure crops, and crop residue left on the surface help to improve and maintain tilth and the content of organic matter in this soil.

This soil is suited to grasses and legumes for hay and pasture. Alfalfa is subject to severe damage during prolonged periods of flooding. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of frequent flooding. It is generally not suited to this use. This soil has severe limitations for local roads and streets because of frequent flooding and frost action. It also has severe limitations for septic tank absorption fields because of frequent flooding. It is generally not suited to this use.

This soil is in capability subclass IIw and in woodland suitability subclass 1o.

MaB2—Markland silt loam, 2 to 12 percent slopes, eroded. This is a gently and moderately sloping soil on narrow convex ridgetops and slope breaks on terraces. The areas are narrow and irregular in shape and range from 5 to 90 acres in size. Most are about 10 acres in size. This soil is deep and well drained and moderately well drained.

Typically, the surface layer consists of dark brown and yellowish brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 22 inches thick. In the upper part it is yellowish brown firm silty clay loam, and in the lower part it is yellowish brown and dark yellowish brown very firm silt clay. The substratum to a depth of about 60 inches is yellowish brown firm silty clay and strata of silty clay loam and silt loam. In some areas, the depth to carbonates is greater than 44 inches. In some areas, the soil formed in more than 15 inches of loess. Also in a few small areas, this soil has slopes of 0 to 2 percent, and in some areas, the soil is severely eroded.

Included with this soil in mapping are a few small areas of a nearly level, deep, somewhat poorly drained soil near the centers of the broad ridges. The included areas make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly medium acid, except in areas that have been limed. The perched high water table is between depths of 3 and 6 feet late in winter and early in spring.

This soil is used mainly for hay and pasture. In some areas it is used for cultivated crops such as corn and soybeans, and in a few areas it is used for urban development.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices help control runoff and help prevent excessive soil loss where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue left on the surface help to control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture is effective in controlling erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition and the seedling mortality rate are moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of shrinking and swelling. Foundations, footings, and basement walls should be properly designed and base materials should be strengthened to help correct these limitations. Installing foundation drain tile to remove excess water can help prevent structural damage caused by the shrinking and

swelling of the soil. This soil has severe limitations for local roads and streets because of low strength and shrinking and swelling. The road base should be strengthened with a more suitable material. This soil has severe limitations for septic tank absorption fields because of slow permeability and wetness. Commercial sewer systems should be used, if available, or absorption fields should be enlarged.

This soil is in capability subclass IIIe and in woodland suitability subclass 2c.

MaF2—Markland silt loam, 18 to 35 percent slopes, eroded. This is a steep soil on breaks and along drainageways on terraces. The areas are narrow and elongated in shape and range from 5 to 80 acres in size. Most are about 15 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark grayish brown silt loam mixed with a small amount of subsoil material. It is about 3 inches thick. The subsoil is about 12 inches thick. In the upper part it is brown firm silty clay loam, and in the lower part it is yellowish brown very firm silty clay. The substratum to a depth of about 60 inches is yellowish brown stratified silty clay, silty clay loam, and silt loam.

Included with this soil in mapping are a few areas of severely eroded soils that have a surface layer of silty clay loam that is mildly alkaline. Also included are a few areas of soils that have slopes of more than 35 percent. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is very rapid. The content of organic matter in the surface layer is moderate. The surface layer is medium acid to mildly alkaline.

This soil is mainly in woodland, and in a few areas it is used for hay and pasture.

This soil is generally not suited to corn, soybeans, and small grains because erosion is a severe hazard and because of the slope.

This soil is generally not suited to grasses and legumes for hay and pasture because of the steep slope and because erosion is a severe hazard.

This soil is suited to trees. The seedling mortality rate and plant competition are moderate. Erosion is a moderate hazard. The use of planting and harvesting equipment is limited by the slope. Ground cover should be disturbed as little as possible to prevent erosion. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of shrinking and swelling and slope. It is generally not suited to this use. The steep slope limits construction, design, and installation of facilities. Alternate sites for buildings should be located nearby. In areas where the soil is disturbed, soil slippage is a hazard. This soil has severe limitations for local roads and streets because of slope, shrinking and swelling, and low strength. The road base should be strengthened with a suitable material. Alternate sites for local roads and streets should be located. This soil has severe limitations for septic tank absorption fields because of the slow permeability and the slope. It is generally not suited to this use.

This soil is in capability subclass VIIe and in woodland suitability subclass 2c.

MbD3—Markland silty clay loam, 6 to 18 percent slopes, severely eroded. This is a moderately and strongly sloping soil on breaks and along drainageways on terraces. The areas are narrow and elongated in shape and range from 5 to 30 acres in size. Most are about 10 acres in size. This soil is deep and well drained.

Typically, the surface layer is yellowish brown silty clay loam about 3 inches thick. The subsoil is dark yellowish brown very firm silty clay about 4 inches thick. The substratum to a depth of about 60 inches is yellowish brown stratified silty clay, silty clay loam, and silt loam. In some areas, the surface layer is mildly alkaline.

Included with this soil in mapping are areas of moderately steep or steep Markland soils on the lower part of the slope. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. Runoff is rapid. The content of organic matter in the surface layer is low. The surface layer is firm and the soil should be tilled under proper moisture condition. The surface layer is medium acid. Tilling this soil when it is too wet causes the formation of large clods that become very firm when dry. The clods make it difficult to prepare a good seedbed. A perched high water table is between depths of 3 and 6 feet early in spring.

This soil is used mainly for hay and pasture, and in some areas it is used for cultivated crops, such as corn and soybeans.

This soil generally is not suited to corn, soybeans, and small grains because erosion is a severe hazard. Occasionally, small grains are grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition and the seedling mortality rate are moderate. It may be necessary to replant some seedlings. Seedlings survive

and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of the shrinking and swelling and the slope. Foundations, footings, and basement walls and base material should be strengthened to help correct these limitations. Also, installing foundation drain tile helps remove excess water and prevent structural damage caused by shrinking and swelling of the soil. Soil slippage is a hazard in areas where the soil has been disturbed. This soil has severe limitations for local roads and streets because of slope, low strength, and shrinking and swelling of the soil. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of slow permeability, slope, and wetness. Commercial sewer systems should be used, if available, or absorption fields should be enlarged. Absorption fields should also be designed according to the slope.

This soil is in capability subclass VIe and in woodland suitability subclass 2c.

Ne—Newark silt loam. This is a nearly level soil in old sloughs on the Ohio River flood plain. The areas are narrow and elongated in shape and range from 10 to 40 acres in size. Most are about 25 acres in size. This soil is deep and somewhat poorly drained. It is subject to frequent flooding of brief duration.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The substratum in the upper part is yellowish brown and grayish brown, mottled friable silt loam; in the next part it is dark brown, mottled firm silty clay loam; and in the lower part to a depth of about 60 inches it is gray, mottled firm silty clay loam.

Included with this soil in mapping are areas of moderately well drained and somewhat poorly drained, nearly level soils that formed in neutral alluvium 20 to 36 inches thick over buried soils formed in acid alluvium. These soils are a few feet higher in elevation than Newark soils. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is moderate. Runoff is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly medium acid except in areas that have been limed. A high water table is between depths of 0.5 and 1.5 feet in winter and spring.

This soil is used mainly for hay and pasture.

This soil is suited to corn and soybeans. It is generally not suited to small grains because flooding is a severe hazard. Wetness is the major limitation, and flooding is the major hazard. An artificial drainage system should be established for a conservation cropping system that includes row crops. Subsurface drains and shallow surface drains help remove excess surface water, but suitable outlets for drainage are difficult to locate. Cover crops and green manure crops and conservation tillage that returns all or part of the crop residue to the surface help maintain and improve the content of organic matter and soil tilth.

This soil is suited to grasses and legumes for hay and pasture. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of frequent flooding and wetness. It is generally not suited to this use. This soil also has severe limitations for local roads and streets and septic tank absorption fields because of frequent flooding and wetness. It is generally not suited to this use.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

OcA—Ockley silt loam, 0 to 3 percent slopes. This is a nearly level soil on outwash terraces along major tributaries of the Ohio River. The areas are irregular in shape and range from 5 to 100 acres in size. Most are about 15 acres in size. This soil is deep and well drained.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 42 inches thick. In the upper part it is dark yellowish brown firm clay loam and gravelly clay loam. The substratum to a depth of about 60 inches is dark brown stratified sand and gravel. In a few areas, the surface layer is sandy loam. In a few areas, this soil is gently sloping. In areas on Ohio River terraces, the soil is deep and well drained and formed in 24 to 36 inches of loess and loamy glacial outwash.

Included with this soil in mapping are a few small areas of Fox soils and a deep, well drained soil that formed in calcareous stratified silt, sand, and clay material. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high. Permeability is moderate in the subsoil, and it is very rapid in the underlying material. Runoff is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly medium acid except in areas that have been limed.

This soil is used mainly for cultivated crops. In some areas it is in hay and pasture.

This soil is suited to corn, soybeans, small grains, and tobacco. There are no severe limitations for use as cropland. Cover crops and green manure crops and conservation tillage that returns all or part of the crop residue to the surface help maintain and improve the content of organic matter and soil tilth. This soil is suited to intensive row crop production in areas where irrigation is practical.

This soil is suited to grasses and legumes for hay and pasture. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for buildings because of the shrinking and swelling of the soil. Foundations, footings, and basement walls should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. The road base for local roads and streets should be strengthened with a suitable material. The soil has slight limitations for septic tank absorption fields.

This soil is in capability subclass I and in woodland suitability subclass 1o.

Or—Orrville silt loam. This is a nearly level soil on bottom land. It is subject to frequent flooding for brief periods. The areas are narrow and elongated in shape and range from 5 to 100 acres in size. Most are about 40 acres in size. This soil is deep and somewhat poorly drained.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil is about 17 inches thick. In the upper part it is brown, mottled friable silt loam, and in the lower part it is grayish brown, mottled friable silt loam. The substratum to a depth of about 60 inches is mottled silt loam, loamy sand, and stratified loam, sandy loam, and gravel. In some areas, the soil has a surface layer of loam. In some areas, the soil has more silt and less sand and clay and is more acid. In some areas, there are no mottles in the upper part of the subsoil.

Included with this soil are small areas near stream channels of a soil that has carbonates within a depth of 40 inches. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is high and permeability is moderate. Runoff is slow. The content of organic matter is low. A high water table is between depths of 1 and 2.5 feet in winter and spring. The surface layer is friable and easy to work. It is slightly acid in reaction.

This soil is used mainly for hay and pasture. In some areas it is used for cultivated crops such as corn or soybeans.

This soil is suited to corn and soybeans. It is not suited to small grains because flooding is a severe hazard. Wetness is the major limitation and flooding is the major hazard. An artificial drainage system should be established for a conservation cropping system that includes row crops. Subsurface drains and shallow surface drains help remove excess surface water. Cover crops and green manure crops and conservation tillage that leaves all or part of the crop residue on the surface help maintain and improve the content of organic matter and soil tilth.

This soil is suited to grasses and legumes for hay and pasture. Alfalfa is subject to severe damage during periods of flooding. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is a severe hazard. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of flooding and wetness. It is generally not suited to this use. Alternate sites for buildings should be located nearby. This soil has severe limitations for local roads and streets because of frequent flooding, frost action, and wetness. If the soil is used for roads, artificial drainage is needed to lower the water table and reduce frost action. Elevating the roadbed helps to reduce wetness. This soil has severe limitations for septic tank absorption fields because of frequent flooding and wetness. It is generally not suited to this use.

This soil is in capability subclass IIw and in woodland suitability subclass 2o.

PaD2—Pate silt loam, 12 to 18 percent slopes, eroded. This is a strongly sloping soil on the lower part of side slopes. The areas are narrow and elongated in shape and range from 5 to 300 acres in size. Most are about 80 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 25 inches thick. In the upper part it is dark brown firm silty clay loam, and in the lower part it is light olive brown firm silty clay loam. The substratum to a depth of about 60 inches is light olive brown silty clay. In small areas on the lower

part of the slope, this soil has a slope of less than 12 percent.

Included with this soil in mapping are a few small areas of moderately or strongly sloping, well or moderately well drained soils that formed in colluvial material from limestone and calcareous shale. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is moderate, and permeability is very slow. Runoff is rapid. The content of organic matter in the surface layer is moderate. The surface layer is medium acid to neutral. Natural fertility is moderate.

This soil is used mainly for growing grasses and legumes for hay and pasture. In many areas, it is idle or used as woodland.

This soil is suited to corn, soybeans, and small grains. Conservation practices help control erosion and runoff and prevent excessive soil loss where cultivated crops are grown. They are crop rotation, conservation tillage, contour farming, grassed waterways, or grade stabilization structures. Cover crops and crop residue left on the surface help to control erosion and improve and maintain tilth and the content of organic matter in this soil.

This soil is suited to grasses and legumes for hay and permanent pasture. Erosion is the main hazard. Contour and conservation tillage help control erosion and runoff during the preparation of seedbeds for grasses and legumes. When the soil is too wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of the shrinking and swelling and the slope. Soil slippage is a hazard in areas where the soil has been disturbed. The soil can be graded to modify the slope, and buildings should be designed according to the slope. Developing random lots in subdivisions helps to prevent excessive soil loss. Diversions and grassed waterways between lots help control erosion. The existing vegetation should be maintained as much as possible. In areas where the soil has been disturbed, the topsoil should be stockpiled and replaced during final landscaping. The exposed areas should be revegetated as quickly as possible to prevent soil loss. This soil has severe limitations for local roads and streets because of shrinking and swelling, low strength, and slope. Roads and streets should be built on the contour wherever possible to help reduce cut and fill areas. The road base should be strengthened with a suitable material. This soil is severely limited for septic tank absorption fields because of the slope and the slow permeability. It is generally not suited to this use.

This soil is in capability subclass IVe and in woodland suitability subclass 1o.

PaE2—Pate silt loam, 18 to 25 percent slopes, eroded. This is a moderately steep soil on the lower part of side slopes.

The areas are narrow and elongated in shape and range from 10 to 100 acres in size. Most are about 50 acres in size. This soil is deep and well drained. In some areas, coarse fragments of limestone are scattered on the surface, especially on the upper part of the slope.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 6 inches thick. The subsoil is about 66 inches thick. In the uppermost part it is dark brown firm and very firm silty clay loam; in the part below that, it is dark brown and dark yellowish brown very firm silty clay; and below that, it is light olive brown firm channery silty clay and channery silty clay loam. In the lowermost part it is pale olive and gray very firm flaggy silty clay. The substratum to a depth of about 80 inches is interbedded limestone and gray calcareous shale. In some areas, this soil is moderately steep, or it has a surface layer of flaggy silt loam or flaggy silty clay loam.

Included with this soil in mapping are small areas of moderately steep or steep Eden soils on the upper part of the slope. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is moderate, and permeability is very slow. Runoff is rapid. The content of organic matter in the surface layer is moderate. The surface layer is medium acid to neutral. Natural fertility is moderate.

This soil is used mainly for grasses and legumes for hay and pasture. In many areas it is idle or used as woodland.

This soil is not generally suited to row crops because of the moderately steep slope and because erosion is a severe hazard. Occasionally, small grains are grown so that stands of grasses and legumes can be reestablished.

This soil is suited to grasses and legumes for hay and permanent pasture. The moderately steep slope is the main limitation, and erosion is the main hazard. Permanent stands of grasses and legumes, contour and conservation tillage during seedbed preparation, and crop residue left on the surface help control runoff and erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The use of equipment is moderately limited because of slope. Plant competition is moderate, and erosion is a moderate hazard. The ground cover should be disturbed as little as possible to prevent erosion. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled and removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of shrinking and swelling of the soil and the slope. The moderately steep slope limits construction, design, and installation of facilities. The soil can be graded to modify the slope. Buildings should be designed according to the slope. This soil has severe limitations for local roads and streets because of slope, low strength, and shrinking and swelling. Soil slippage is a hazard (fig. 5). Cuts and fills should be considered, and roads and streets should be built on the contour wherever possible. The road base should be strengthened with a suitable material. This soil has severe limitations for septic tank absorption fields because of the slope and the very slow permeability. It is generally not suited to this use.

This soil is in capability subclass VIe and in woodland suitability subclass 1r.

Pg—Pits, gravel. This map unit consists of miscellaneous areas where sand and gravel have been excavated for use as construction material. The areas are nearly level to very steep and range from 5 to 40 acres in size. Most are about 30 acres in size.

Typically, the areas consist of gravel and gravelly sand. Stratified sand and gravel are exposed in areas where deep cuts have been made.

Included with this soil in mapping are small areas of water.

In most areas, the gravel pits are currently being mined. Areas where the gravel pits are no longer mined are barren because of the very low available water capacity, the very rapid permeability, and the low fertility of the sand and gravel. These areas need special management practices. If these areas are used for crops, they should be leveled and covered with topsoil or a mixture of topsoil and subsoil. In gently sloping to very

Figure 5.—Road slippage in an area of Pate silt loam, 18 to 25 percent slopes, eroded.

steep areas, conservation practices are needed to control erosion.

An onsite investigation is needed if these areas are used for building sites for local roads and streets, or for septic tank absorption fields.

This area is in capability class VIII.

Ra—Rahm silt loam. This is a nearly level soil on high bottom land or low terraces along the Ohio River. The areas are broad in shape except in sloughs and swales, where they are narrow and elongated. They range from 20 to 60 acres in size. Most are about 40 acres in size. This soil is deep and somewhat poorly drained. It is subject to occasional flooding of brief duration.

Typically, the surface layer is dark brown silt loam about 11 inches thick. The subsoil is about 37 inches thick. In the upper part it is grayish brown, mottled friable silt loam, and in the lower part it is grayish brown, mottled firm silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled firm silty clay loam. In places, the surface layer is silty clay loam. In small areas, the soil is more acid in the upper part of the subsoil or the soil is less acid in the lower part of the subsoil.

Included with this soil in mapping are areas of somewhat poorly drained Newark soils. Also included are small areas of deep, somewhat poorly drained and very poorly drained soils that formed in lacustrine material. The areas are along tributaries to the larger streams. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high, and permeability is slow. The content of organic matter in the surface layer is moderate. Runoff is slow or ponded. The surface layer is friable and easy to work. It is dominantly neutral. A high water table is between depths of 1 and 3 feet late in winter and in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture.

This soil is suited to corn and soybeans. It is not generally suited to small grains because the soil has been severely damaged by periods of flooding. Wetness is the major limitation, and flooding is the major hazard. An artificial drainage system should be established in a conservation cropping system that includes row crops. Subsurface drains and fallow surface drains help remove excess surface water, but drainage outlets are difficult to locate. Cover crops and green manure crops and conservation tillage that leaves crop residue on the surface help maintain and improve the content of organic matter and soil tilth.

This soil is suited to grasses and legumes for hay and pasture. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction and poor tilth. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Water-tolerant species are favored for timber stands. Prolonged seasonal wetness limits harvesting and logging operations and the planting of seedlings. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings because of shrinking and swelling of the soil, occasional flooding, and wetness. This soil has severe limitations for local roads and streets because of occasional flooding, low strength, and frost action. This soil has severe limitations for septic tank absorption fields because of occasional flooding, wetness, and slow permeability. It is generally not suited to these three uses.

This soil is in capability subclass IIw and in woodland suitability subclass 1o.

RdG—Rodman sandy loam, 40 to 60 percent slopes. This is a very steep soil on outwash terraces along the Whitewater and Ohio Rivers. The areas are narrow and elongated in shape and range from about 5 to 70 acres in size. Most are about 30 acres in size. This soil is deep and excessively drained.

Typically, the surface layer is very dark gray sandy loam about 5 inches thick. The subsoil is about 8 inches thick. It is dark brown very friable sandy loam. The substratum to a depth of about 60 inches is yellowish brown stratified gravelly sand and gravel. The surface layer in some areas is loam, gravelly loam, or silt loam. In some areas the slope is steeper than 60 percent.

Included with this soil in mapping are a few small areas of Fox soils on the upper part of the slopes. The included soils make up about 8 percent of the map unit.

The available water capacity of this soil is low, and permeability is very rapid. Runoff is rapid. The content of organic matter in the surface layer is moderate. The surface layer is neutral to mildly alkaline. This soil is high in natural fertility and has a relatively high percentage of calcium and magnesium.

This soil is used mainly as woodland.

This soil is generally not suited to cultivated crops because of the very steep slopes, and because erosion is a severe hazard.

This soil is generally not suited to hay and pasture because of the very steep slopes, and because erosion is a severe hazard.

This soil is suited to trees. The use of harvesting and planting equipment is severely limited by slope. Erosion is a severe hazard. Seedling mortality is severe. It is usually necessary to replant some seedlings. Seedlings normally grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site

preparation or by spraying, cutting, or girdling. Ground cover should be disturbed as little as possible to prevent erosion.

This soil has severe limitations for use as sites for buildings, for local roads and streets, and for septic tank absorption fields because of the very steep slopes. It is not suited to these uses. Another severe limitation for septic tank absorption fields is the poor filtering qualities of the underlying sand and gravel which allow the leachate or effluent to flow into the ground water. Alternate sites for each of these uses should be located nearby.

This soil is in capability subclass VIIs and in woodland suitability subclass 3s.

RoA—Rossmoyne silt loam, 0 to 2 percent slopes. This is a nearly level soil on narrow upland ridges. The areas are narrow and irregular in shape and range from 5 to 130 acres in size. Most are about 20 acres in size. This soil is deep and moderately well drained.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsurface layer is light yellowish brown silt loam about 6 inches thick. The subsoil is about 80 inches thick. In the uppermost part it is brown, mottled friable silt loam; in the part below that, it is yellowish brown, mottled firm silty clay loam; and below that, it is a yellowish brown, mottled extremely firm silt loam (fragipan). In the lowermost part it is yellowish brown, mottled firm clay loam. In a few areas, the slope is 2 to 6 percent.

Included with this soil in mapping are a few small areas of the nearly level Avonburg soils in the centers of the ridges. The included soils make up about 8 percent of the map unit.

The available water capacity of this soil is moderate. The permeability is slow in and below the fragipan. Runoff is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly slightly acid. A fragipan in this soil restricts the downward movement of roots and water. A perched high water table is between depths of 1.5 and 3 feet late in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture, and in a few areas it is used as woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. The wetness and the slowly permeable fragipan are the major limitations. Cover crops and green manure crops and conservation tillage that leaves crop residue on the surface help maintain and improve the content of organic matter and soil tilth.

This soil is suited to grasses and legumes for hay and pasture, but deep-rooted legumes such as alfalfa are restricted in growth because the slowly permeable fragipan restricts the downward movement of roots. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition, the seedling mortality rate, and the windthrow hazard are moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of the wetness and the shrinking and swelling. It has severe limitations for use as sites for buildings with basements because of wetness. An artificial drainage system can help correct this limitation. Foundations, footings, and basement walls should be properly designed and foundation drain tile should be used to remove excess water and help prevent structural damage. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base also reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of slow permeability and wetness. Commercial sewer systems should be used, if available, or absorption fields should be enlarged to overcome the restricted permeability of the soil.

This soil is in capability subclass IIw and in woodland suitability subclass 2d.

RoB2—Rossmoyne silt loam, 2 to 6 percent slopes, eroded. This is a gently sloping soil on ridges and short convex side slopes. The areas are narrow, elongated, and irregular in shape and range from 5 to 300 acres in size. Most are about 75 acres in size. This soil is deep and moderately well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 80 inches thick. In the upper part it is yellowish brown, friable silt loam; in the middle part it is yellowish brown, mottled, extremely firm silt loam and loam (fragipan); and in the lower part it is gray, mottled, firm clay loam. In a few areas, the slope is 0 to 2 percent. In a few areas, the soil is gently sloping, deep, and well drained.

Included with this soil in mapping are a few small areas of gently sloping Avonburg soils at the head of drainageways. Also included are a few small areas of moderately sloping Cincinnati soils on the lower part of the slopes. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is moderate. Permeability is slow. Runoff is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly slightly acid. A fragipan in this soil restricts the downward movement of roots and water. A perched high water

table is between depths of 1.5 and 3 feet late in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture, and in a few areas it is used as woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard, and the very slowly permeable fragipan is the major limitation. The wetness early in spring and other wet seasons is also a limitation. Conservation practices help control runoff and prevent excessive soil loss where crops are grown. They include crop rotation, conservation tillage, contour farming, grassed waterways (fig. 6), and grade stabilization structures. Cover crops and crop residue left on the surface help control erosion and improve or maintain tilth and the content of organic matter. Seepy areas in the drainageways need subsurface drainage.

This soil is suited to grasses and legumes for hay and pasture. The slowly permeable fragipan, however, restricts the downward movement of roots of deep-rooted legumes, for example alfalfa. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition, the seedling mortality rate, and the windthrow hazard are moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of wetness, shrinking and swelling, and slope. It has severe limitations for use as sites for buildings with basements because of wetness. An artificial drainage system helps correct this limitation. Foundations, footings, and basement walls should be properly designed and foundation drain tile should be used to help prevent structural damage. This soil has severe limitations for local roads and streets because of frost action and low

Figure 6.—Fescue sod waterway in a field of soybeans. The soil is Rossmoyne silt loam, 2 to 6 percent slopes, eroded.

strength. The road base should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of slow permeability and wetness. Commercial sewer systems should be used, if available, or absorption fields should be enlarged to overcome the slow permeability of the soil.

This soil is in capability subclass IIe and in woodland suitability subclass 2d.

RxB—Russell-Fincastle silt loams, 1 to 4 percent slopes. This map unit consists of nearly level and gently sloping, deep somewhat poorly drained and well drained soils that formed in loess and the underlying loamy glacial till. The map unit is made up of about 55 percent Russell soils and 30 percent Fincastle soils. The mapped areas are elongated and irregularly shaped and are about 10 to 60 acres in size. Russell soils are gently sloping and well drained. They are on narrow ridges. Fincastle soils are somewhat poorly drained. They are on broad flat ridges.

Typically, Russell soils have a surface layer that is dark grayish brown silt loam about 5 inches thick. The subsurface layer is light yellowish brown silt loam about 4 inches thick. The subsoil is about 33 inches thick. In the upper part it is brownish yellow, friable silt loam, and in the lower part it is yellowish brown, firm silty clay loam and clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam. In a few areas of Russell soils, the slope is 0 to 2 percent. Also in a few areas, the soils are moderately well drained.

Typically, Fincastle soils have a surface layer that is grayish brown silt loam about 7 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 3 inches thick. The subsoil is about 35 inches thick. In the upper part it is grayish brown, mottled firm silty clay loam; in the middle part it is yellowish brown, mottled, firm silty clay loam; and in the lower part it is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown clay loam.

Included with these soils in mapping are small areas of moderately sloping, deep, well drained, severely eroded soil that formed in less than 22 inches of loess and the underlying loamy glacial till. The soil is near slope breaks adjacent to Russell soils. It makes up about 5 percent of the map unit. Also included, near slope breaks adjacent to Fincastle soils, are nearly level and gently sloping, deep, moderately well drained soils. These soils make up about 10 percent of the map unit.

The available water capacity of Russell and Fincastle soils is high. The permeability of Russell soils is moderate, and that of Fincastle soils is low. Runoff is medium on Russell soils and slow on Fincastle soils. The surface layer of these soils is friable and easy to work and is dominantly medium acid. A seasonal high water table in Fincastle soils fluctuates between depths of 1 and 3 feet late in winter and in spring.

In most areas, Russell and Fincastle soils are used for hay and pasture. In a few areas, they are used as woodland.

These soils are suited to corn, soybeans, and small grains. On Russell soils, however, erosion is a major hazard. If cultivated crops are grown, conservation practices that help control surface runoff and prevent excessive soil loss are needed. Such practices include crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Returning crop residue to the surface and using cover crops also help control erosion and improve and maintain tilth and the content of organic matter.

On Fincastle soils, wetness is the major limitation to use and management. If a conservation cropping system includes row crops, an artificial drainage system should be used. Tile drainage can help remove excess water. Minimum tillage, using crop residue, cover crops, green manure crops, and other conservation practices help maintain and improve the organic matter content and soil tilth.

The soils in this unit are suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture is effective in controlling erosion. When the soils are wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

The soils are suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

Russell soils have moderate limitations for use as sites for buildings because of shrinking and swelling of the soil. Fincastle soils have severe limitations because of wetness. On Fincastle soils, a tile drainage system can help correct the wetness, but alternate sites nearby should be selected for dwellings with basements. Foundations, footings, and basement walls should be properly designed and reinforced, and foundation drain tile should be used to prevent damage caused by the shrinking and swelling of the soil. Buildings should be designed to accommodate the slope.

Russell and Fincastle soils have severe limitations for local roads and streets because of frost action. Drainage is needed on Fincastle soils to lower the water table and thereby reduce frost action. On both soils the road base should be strengthened with a suitable material.

Russell soils have moderate limitations for septic tank absorption fields because of the moderate permeability.

Septic systems on these soils can function properly if the field is larger than usual. Fincastle soils have severe limitations because of the slow permeability and wetness. Commercial sewer systems should be used.

Russell and Fincastle soils are in capability subclass IIe; Russell soils are in woodland suitability subclass 1o, and Fincastle soils are in woodland suitability subclass 3o.

St—Stonelick sandy loam. This is a nearly level soil on bottom lands adjacent to rapidly flowing streams. The areas are broad and elongated along the Whitewater River, and they are narrow and elongated along other small streams. The areas are mainly on the inside bend of the river channels, and they range from 10 to 675 acres in size. Most are about 100 acres in size. This soil is deep and well drained. It is subject to frequent flooding.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. In the upper part the substratum is dark grayish brown and dark brown sandy loam; in the middle part it is brown stratified silt loam and loamy sand; and in the lower part to a depth of 60 inches it is brown loamy sand. In some places, the surface layer is gravelly sandy loam, silt loam, fine sandy loam, loamy fine sand, or gravelly sand.

Included with this soil in mapping are small areas of nearly level Chagrin soils at a slightly higher elevation and farther from stream channels than Stonelick soils. Also included are areas of riverwash in or near stream channels and old meander channels. The mostly calcareous, gravelly or sandy sediment in these areas supports little or no vegetation. In a few areas, there are sandbars, mainly near old meander channels. The included soils make up about 10 percent of the map unit.

The available water capacity of this soil is moderate, and permeability is moderately rapid. Runoff is slow. The content of organic matter in the surface layer is low. The surface layer is very friable and easy to work. It is mildly alkaline. This soil is high in natural fertility and has a relatively high percentage of calcium and magnesium.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture, and in a few areas it is used as woodland.

This soil is suited to corn, soybeans, and small grains. Occasional or frequent flooding is the main hazard. In summer the major limitation is droughtiness caused by the moderate available water capacity. Cover crops and green manure crops and crop residue left on the surface help to improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. In summer the main limitation is droughtiness caused by the moderate available water capacity. When this soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, and reduces forage yields. Proper seeding rates, pasture rotation, and timely grazing help keep the pasture in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as sites for buildings and septic tank absorption fields because of frequent flooding. This soil also has severe limitations for local roads and streets because of frequent flooding.

This soil is in capability subclass IIw and in woodland suitability subclass 2o.

SwB2—Switzerland silt loam, 2 to 6 percent slopes, eroded. This is a gently sloping soil on narrow ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 160 acres in size. Most are about 15 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 45 inches thick. In the upper part it is strong brown and yellowish brown, friable silt loam; in the middle part it is yellowish brown, mottled, firm silty clay loam; and in the lower part it is yellowish brown, very firm clay. The substratum to a depth of about 60 inches is yellowish brown clay. In some areas, the subsoil has an impermeable layer that restricts the downward movement of roots and water.

Included with this soil in mapping are small areas of gently sloping Weisburg soils in the same positions as the Switzerland soil. Also included are areas of moderately sloping Switzerland soils on the lower part of the slope. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high. Permeability is moderate in the upper part of the subsoil and slow in the lower part. Runoff is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly neutral in reaction.

This soil is used mainly for hay and pasture. In some areas it is used for row crops or is idle or in woodland.

This soil is suited to corn, soybeans, small grains, and tobacco (fig. 7). Erosion is the major hazard. Conservation practices help control erosion and runoff where cultivated crops are grown. They include crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue left on the surface help control erosion and improve and maintain tilth and the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod,

Figure 7.—Burley tobacco that has been cut, in foreground, and is standing, in background. The soil is Switzerland silt loam, 2 to 6 percent slopes, eroded.

reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements. The limitations for buildings with basements are severe because of shrinking and swelling. Foundations and footings should be properly designed to prevent structural damage caused by the shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of the slow permeability in the lower part of the soil. Commercial sewer systems should be used, if available, or absorption fields should be enlarged.

This soil is in capability subclass IIe and in woodland suitability subclass 1o.

SwC2—Switzerland silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping soil on narrow ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 240 acres in size. Most are about 35 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 37 inches thick. In the upper part it is strong brown and brown, friable silt

loam; in the middle part it is strong brown, light yellowish brown, and dark brown firm silty clay loam and silt loam; and in the lower part it is yellowish brown, very firm clay. The substratum to a depth of about 60 inches is brownish yellow clay. In some areas, the soil formed in less than 18 inches of loess and is shallower to bedrock.

Included with this soil in mapping are small areas of strongly sloping Carmel soils. Also included are moderately sloping Weisburg soils near the upper part of the slope. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high. Permeability is moderate in the upper part of the subsoil and slow in the lower part. Runoff is rapid. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. It is dominantly neutral in reaction.

This soil is used mainly for hay and pasture. In some areas it is used for row crops or is idle or in woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices that help control erosion and runoff where cultivated crops are grown include crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Cover crops and crop residue left on the surface help control erosion and improve or maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture helps control erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

The soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if the competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of the slope and the shrinking and swelling of the soil. It has severe limitations for use as sites for buildings with basements because of the shrinking and swelling. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of the slow permeability in the lower part of the soil. Commercial sewer systems should be used, if available, or absorption fields should be enlarged.

This soil is in capability subclass IIIe and in woodland suitability subclass 1o.

SwC3—Switzerland silt loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping soil on narrow ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 60 acres in size. Most are about 15 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark yellowish brown silt loam and some yellowish brown material from the subsoil. It is about 3 inches thick. The subsoil is about 54 inches thick. In the upper part it is strong brown, friable silt loam and silty clay loam; in the middle part it is dark brown and dark yellowish brown, very firm silty clay; and in the lower part it is light olive brown, very firm clay. The substratum to a depth of about 60 inches is light olive brown flaggy clay. In some areas the soil formed in less than 18 inches of loess, and it is shallower to bedrock.

Included with this soil in mapping are small areas of strongly sloping, severely eroded Carmel soils on the upper part of slopes and areas of moderately sloping, severely eroded Weisburg soils near the upper part of slopes. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is high. Permeability is moderate in the upper part of the subsoil and slow in the lower part. Runoff is rapid. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. It is dominantly neutral in reaction.

This soil is used mainly for hay and pasture. In some areas it is used for row crops or is idle or in woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. Erosion is the major hazard. Conservation practices help control erosion and runoff where crops are grown. Suitable practices are crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Crop residue left on the surface and cover crops also help control erosion and improve and maintain tilth and the content of organic matter in this soil.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture is effective in controlling erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good conditon.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of shrinking and swelling and slope. It has severe limitations for buildings with basements because of the shrinking and swelling. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of frost action and low strength. The road base material should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of the slow permeability in the lower part of the soil. Commercial sewer systems should be used, if available, or absorption fields should be enlarged.

This soil is in capability subclass IVe and in woodland suitability subclass 2o.

SwD2—Switzerland silt loam, 12 to 18 percent slopes, eroded. This is a strongly sloping soil on narrow ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 70 acres in size. Most are about 15 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt loam mixed with a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 45 inches thick. In the upper part it is yellowish brown friable silt loam; in the middle part it is yellowish brown firm silty clay loam; and in the lower part it is yellowish brown very firm silty clay and clay. The substratum to a depth of about 60 inches is light yellowish brown clay and flaggy clay. In some areas, the soil formed in less than 18 inches of loess, and it is shallower to bedrock.

Included with this soil in mapping are small areas of Carmel soils. Carmel soils make up about 10 percent of the map unit.

The available water capacity of this soil is high. Permeability is moderate in the upper part of the subsoil and slow in the lower part. Runoff is rapid. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly neutral in reaction.

This soil is used mainly for hay and pasture. In some areas it is used for row crops or is idle or in woodland.

This soil is suited to corn, soybeans, and small grains. Erosion is the major hazard. Conservation practices help control erosion and runoff where cultivated crops are grown. They include crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Crop residue left on the surface and cover crops also help control erosion and improve and maintain tilth and the content of organic matter in this soil.

This soil is suited to grasses and legumes for hay and pasture. Growing grasses and legumes for hay and pasture is effective in controlling erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for use as a site for buildings because of slope and the shrinking and swelling of the soil. The soil can be graded to modify the slope. Buildings should be designed to accommodate the slope. Foundations and footings should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of frost action, slope, and low strength. The road base should be strengthened with a suitable material. Strengthening the road base also reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of the slope and the slow permeability in the lower part of the soil. Commercial sewer systems should be used, if available, or absorption fields should be enlarged. Absorption fields also should be designed to accommodate the slope.

This soil is capability subclass IVe and woodland suitability subclass 1o.

Ud—Udorthents, loamy. This is a nearly level to very steep soil in disturbed areas on uplands and terraces and in bottom lands around highway interchanges, shopping centers, and sanitary landfills. The areas range from 3 to 40 acres in size. Most are about 10 acres in size. This soil is shallow to deep and is moderately well drained. In some areas, deep cuts have been made in the original surface layer; the soil material has been removed to fill in lower lying areas. In other places, the soil material has been removed for use as landfill for highway grades, overpasses, and exit ramps.

Typically, the soil in a filled area consists of some of the surface layer and material from the subsoil and the substratum. It is silt loam, loam, silty clay loam, clay loam, silty clay, and clay. In places there are gravel and limestone fragments. Typically, in an area where a deep cut has been made, the exposed material is interbedded limestone and calcareous shale.

Included with this soil in mapping are small areas of soils on short steep slopes, escarpments, and areas where bedrock outcrops. Also included are areas where the soil is covered by highways. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is moderate, and the permeability is slow. The content of organic

matter in the surface layer is low. The surface layer is slightly acid to mildly alkaline.

This soil is mainly in permanent grass or low growing shrubs. It has limitations for cultivated crops. Many areas of this soil are surrounded by heavily travelled highways. Special management practices are necessary in areas of this soil. If this soil is used for crops, organic residue or manure should be incorporated into the soil. Conservation practices help control erosion where the soil is gently sloping to very steep. Suitable practices include diversions, box inlet structures, grade stabilization structures, and grassed waterways. If the soil is exposed, it should be revegetated as soon as possible after construction.

An onsite investigation is needed if this soil is to be used for buildings. The depth to bedrock should be considered. The soil is quite variable, and engineering test data should be collected. The soil properties significant to the design of a structure vary from one location to another. If this soil is used as sites for buildings, as little vegetation as possible should be removed and protective plant cover should be established as quickly as possible to reduce erosion.

Onsite soil investigations are needed if the soil is to be used for sanitary facilities. Limitations include permeability, clayey material, slope, and depth to coarse fragments or bedrock.

This soil is in capability subclass VIe and is not assigned to a woodland suitability subclass.

WbB2—Weisburg silt loam, 2 to 6 percent slopes, eroded. This is a gently sloping soil on narrow ridges and short side slopes. The areas are narrow, elongated, and irregular in shape and range from 5 to 240 acres in size. Most are about 50 acres in size.

Typically, the surface layer consists of dark brown, mottled silt loam and a small amount of subsoil material. It is about 7 inches thick. The subsoil is about 39 inches thick. In the uppermost part it is strong brown, friable and firm silt loam and silty clay loam; in the part below that, it is brown very firm silty clay loam (fragipan); and below that, it is yellowish brown, very firm clay loam (fragipan). Beneath the fragipan, the subsoil to a depth of about 80 inches is strong brown or yellowish brown very firm silty clay and clay. In some areas the soil formed in a thin layer of loess and in the underlying loamy glacial till.

Included with this soil in mapping on the lower part of the slope are moderately sloping areas of Switzerland soils that make up about 10 percent of the map unit.

The available water capacity of this soil is moderate. Permeability is moderate above the fragipan, and it is very slow in and below the fragipan. Runoff is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly neutral in reaction. A fragipan in this soil restricts the downward movement of roots.

This soil is used mainly for hay or pasture. In some areas it is used for corn, soybeans, small grains, and tobacco. In a few areas it is used for urban development or for woodland.

This soil is suited to corn, soybeans, small grains, and tobacco. The moderately slow permeability of the fragipan is the major limitation, and erosion is the major hazard. Conservation practices help control runoff and prevent excessive soil loss where crops are grown. They include crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Crop residue left on the surface and cover crops help control erosion and improve and maintain tilth and the content of organic matter in this soil. Some seepy areas in the drainageways need subsurface drains.

This soil is suited to grasses and legumes for hay and pasture, but deep-rooted legumes such as alfalfa are restricted in growth because the slowly permeable fragipan restricts the downward movement of roots. Growing grasses and legumes for hay and pasture is effective in controlling erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good conditon.

This soil is suited to trees (fig. 8). Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of the shrinking and swelling and the slope. It has severe limitations for use as sites for buildings with basements because of the shrinking and swelling. Foundations, footings, and basement walls should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of frost action. The road base should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of very slow permeability. Commercial sewer systems should be used when available. It is generally not suited to this use.

This soil is in capability subclass IIe and in woodland suitability subclass 2o.

WbC2—Weisburg silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping soil on narrow ridges and side slopes. The areas are narrow and elongated in shape and range from 5 to 250 acres in size. Most are about 30 acres in size. This soil is deep and well drained.

Typically, the surface layer consists of dark brown silt

Figure 8.—Apple orchard on Weisburg silt loam, 2 to 6 percent slopes, eroded.

loam mixed with a small amount of yellowish brown subsoil material. It is about 6 inches thick. The subsoil is about 44 inches thick. In the uppermost part it is yellowish brown friable silt loam; in the part below that, it is yellowish brown firm silty clay loam; and below that , it is yellowish brown and strong brown, mottled, very firm and extremely firm silt loam (fragipan). In the lowermost part it is strong brown, firm silty clay loam. The substratum to a depth of about 60 inches is strong brown silty clay. In some areas the soils formed in a thin layer of loess and in the underlying loamy glacial till.

Included with this soil in mapping are gently sloping Cincinnati soils on the upper part of the slope. Also included are moderately sloping Switzerland soils and moderately sloping Bonnell soils. Switzerland and Bonnell soils are generally on the lower part of slope breaks or near the end of ridges. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is moderate. Permeability is moderate above the fragipan and very slow in and below the fragipan. Runoff is medium. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly neutral in reaction. A fragipan in this soil restricts root growth.

This soil is used mainly for hay and pasture. In some areas it is used for corn, soybeans, and small grains. In a few areas it is used as woodland.

This soil is suited to corn, soybeans, and small grains. The slowly permeable fragipan is the major limitation, and erosion is the major hazard. Conservation practices are needed to control runoff and to prevent excessive soil loss where cultivated crops are grown. They include crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Crop residue left on the surface and cover crops help to control erosion and improve and maintain tilth and the content of organic matter in this soil. Some seepy areas in the drainageways need subsurface drains.

This soil is suited to grasses and legumes for hay and pasture, but deep-rooted legumes such as alfalfa are restricted in growth because the slowly permeable

fragipan restricts the downward movement of roots. Growing grasses and legumes for hay and pasture is effective in controlling erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of the shrinking and swelling and the slope. It has severe limitations for buildings with basements because of the shrinking and swelling. The soil can be graded to modify the slope. Buildings should be designed to accommodate the slope. Foundations, footings, and basement walls should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of frost action. The road base should be strengthened with a suitable material. Strengthening the road base helps reduce the potential for frost action. This soil has severe limitations for septic tank absorption fields because of very slow permeability. It is generally not suited to this use. Commercial sewer systems should be used if available.

This soil is in capability subclass IIIe and in woodland suitability subclass 2o.

WbC3—Weisburg silt loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping soil on narrow ridges and elongated side slopes. The areas are narrow and elongated in shape and range from 5 to 100 acres in size. Most are about 30 acres in size. This soil is deep and well drained.

Typically, the surface layer is yellowish brown silt loam about 2 inches thick. The subsoil is about 40 inches thick. In the upper part it is yellowish brown, firm silty clay loam; in the middle part it is a yellowish brown, extremely firm silt loam (fragipan); and in the lower part it is yellowish brown or strong brown, firm silty clay loam. The substratum to a depth of about 60 inches is strong brown silty clay. In some areas, the soil formed in a thin layer of loess and in the underlying loamy glacial till.

Included with this soil in mapping are gently sloping Cincinnati soils on the upper part of the slope. Also included are moderately sloping Switzerland and Bonnell soils on the lower part of slope breaks or near the end of ridges. The included soils make up about 15 percent of the map unit.

The available water capacity of this soil is low. The permeability is moderate above the fragipan, and it is very slow in and below the fragipan. Runoff is medium. The content of organic matter in the surface layer is low. The surface layer is friable and easy to work. It is dominantly neutral in reaction. A fragipan in this soil restricts root growth.

This soil is used mainly for cultivated crops. In some areas it is used for hay and pasture.

This soil is suited to corn, soybeans, and small grains. The slowly permeable fragipan and the low available water capacity are the major limitations. Erosion is the major hazard. Conservation practices are needed to control runoff and to prevent excessive soil loss where cultivated crops are grown. They include crop rotation, conservation tillage, contour farming, grassed waterways, and grade stabilization structures. Crop residue left on the soil and cover crops help control erosion and improve and maintain tilth and the content of organic matter in this soil. Some seepy areas in the drainageways need subsurface drains.

This soil is suited to grasses for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because the slowly permeable fragipan, which is close to the surface, restricts the downward movement of roots and water. Growing grasses for hay and pasture is effective in controlling erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excessive runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good conditon.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for use as sites for buildings without basements because of the shrinking and swelling and the slope. It has severe limitations for buildings with basements because of the shrinking and swelling. The soil can be graded to modify the slope. Buildings should be designed according to the slope. Foundations, footings, and basement walls should be properly designed to prevent structural damage caused by the shrinking and swelling of the soil. This soil has severe limitations for local roads and streets because of frost action. The road base should be strengthened with a suitable material. Strengthening the road base reduces the potential for frost action. This soil has severe limitations for septic tank absorption fields because of the very slow permeability. It is generally not suited to this use.

This soil is in capability subclass IVe and in woodland suitability subclass 2o.

WhA—Wheeling silt loam, 0 to 2 percent slopes. This is a nearly level soil on broad terraces along the Ohio River. They are broad and irregular in shape and range from 30 to 80 acres in size. Most are about 50 acres in size. This soil is deep and well drained. It is between higher lying, nearly level soils and lower lying soils on bottom lands.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 49 inches thick. In the upper part it is yellowish brown, friable silt loam, and in the lower part it is yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, friable silt loam. In some areas, the slope is 2 to 6 percent.

Included with this soil in mapping are small areas of deep, moderately well drained soils that have a slowly permeable layer in the subsoil. The areas are near the center of areas of Wheeling soils and along swales. Also included are areas of moderately sloping and strongly sloping soils near slope breaks. The included soils make up about 20 percent of the map unit.

The available water capacity of this soil is high. The permeability is moderate in the subsoil and rapid in the underlying material. Runoff is slow. The content of organic matter in the surface layer is moderate. The surface layer is friable and easy to work. It is dominantly neutral in reaction. A seasonal high water table fluctuates between depths of 4 to 6 feet in winter and early in spring.

This soil is used mainly for cultivated crops. In some areas it is in pasture or hay, or it has been used for urban development.

This soil is suited to corn, soybeans, and small grains. There are no severe limitations or hazards affecting the use of this soil as cropland. Cover crops and green manure crops and conservation tillage that leaves crop residue on the surface help improve and maintain tilth and the content of organic matter in this soil. Some seepy areas in the drainageways and swales need subsurface drains.

Growing grasses and legumes for hay or pasture is effective in controlling erosion. When the soil is wet, overgrazing or trampling by livestock damages the sod, reduces the density of the plants, reduces forage yields, and causes surface compaction, poor tilth, and excess runoff. Proper seeding rates, pasture rotation, timely grazing, and restricted grazing during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled and if livestock are kept out of the area. Unwanted trees and shrubs can be controlled or removed in site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for use as sites for buildings. It has moderate limitations for local roads and streets because of frost action. Frost action can be reduced by building drainage ditches along the road to remove excess water and by strengthening the road base with a suitable material. The soil has moderate limitations for septic tank absorption fields because of wetness. A seasonal high water table fluctuates between depths of 4 and 6 feet. In some areas drainage may be needed.

This soil is in capability class I and in woodland suitability subclass 2o.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

David F. Berna, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1967 in Dearborn and Ohio Counties, more than 172,705 acres was used for crops, hay, and pasture, according to the Conservation Needs Inventory (*3*). Of this total, 20,128 acres was used for row crops, mainly corn; 5,711 acres for close-growing crops, mainly wheat and oats; 30,849 acres for permanent or rotation hay; 98,346 acres for permanent pasture; the rest was idle or diverted for conservation programs.

The potential of the soils for increased food production is good. About 7,246 acres of potentially good cropland is currently used as woodland, and about 16,926 acres is used as pasture (*3*). In addition to the reserve productive capacity represented by this land, food production in the survey area could be increased considerably by extending the latest crop production technology to all cropland.

The acreage used for agriculture and forestry has gradually been decreasing as more land is developed for other purposes. In 1967, an estimated 19,708 acres was used for purposes other than agriculture or forestry. Approximately 6,356 acres was urban buildup. The remaining acreage consisted of roads, water areas, gravel pits, quarries, and other uses. The number of acres of land not being used for agriculture or forestry has been growing at a rate of about 400 acres per year. The use of this soil survey to help make land use decisions that will influence the future role of farming is discussed in "General soil map units."

Soil erosion is the major hazard on about 60 percent of the cropland, hayland, and pasture. If the slope is more than 2 percent, erosion is a hazard.

Erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and as part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, for example, Eden, Carmel, and Switzerland soils, and also on soils that have a layer in or below the subsoil that limits the depth of the root zone. For example, the fragipan in Cincinnati soils is impenetrable to plant roots. The root zone in these soils

consists only of the soil above the fragipan. As erosion removes the surface layer, it reduces the depth of the root zone. Erosion also reduces productivity on soils that tend to be droughty, for example, Fox and Rodman soils. Second, soil erosion causes sediment to enter streams. Controlling erosion reduces the sedimentation of streams and maintains the quality of the water for municipal use, recreation, and fish and wildlife.

On many sloping soils, preparing a good seedbed and tilling are difficult on clayey spots where the original friable surface layer has been eroded away. Clayey spots are common in areas of moderately eroded Fox and Carmel soils.

Soil conservation practices provide surface cover, reduce runoff, and increase infiltration. A cropping system that keeps a vegetative cover on the soil for extended periods reduces soil loss and helps maintain the productive capacity of the soil. On livestock farms, which require forage, the legume and grass crops used in crop rotation reduce erosion on sloping soils, add nitrogen to the soils, and improve tilth for the next crop.

To control erosion on sloping soils, it is necessary to use a cropping system that provides substantial vegetative cover unless conservation tillage is practiced. Conservation tillage and leaving crop residue on the surface help increase infiltration and reduce runoff and erosion. These practices can be adapted to most soils in the survey area, but it is more difficult to adapt them successfully to the eroded soils and to soils that have a clayey surface layer. The acreage in no-tillage for corn is increasing. No-tillage reduces erosion on sloping soils. It can be adapted to most soils in the survey area. It is more difficult to adapt successfully to soils that have a clayey surface layer and to soils that warm up slowly in spring.

Diversions and cross-slope drainage ditches are used to shorten the effective length of the slope and help reduce sheet, rill, and gully erosion. These measures are most practical on deep soils that are highly susceptible to erosion. They reduce soil loss and the loss of fertilizer elements, they reduce sediment pollution, which damages crops and watercourses, they reduce the need for grassed waterways, which may use productive land that is used for row crops, and they reduce the difficulty of contour farming, the amount of fuel used, and the amount of pesticides entering watercourses. Terraces and diversions are less suited to soils that have bedrock at a depth of less than 40 inches and soils that have a heavy clayey subsoil.

Soil drainage is the major soil problem on about 30 percent of the cropland, hayland, and pasture in Dearborn and Ohio Counties. In most areas, the poorly drained and somewhat poorly drained soils, for example, Clermont, Avonburg, Bartle, and Orrville soils, are adequately drained and are highly productive as cropland, hayland, and pasture. In areas where they are not adequately drained, artificial drainage may be needed to reduce the crop damage that occurs in most years. These soils make up about 13,403 acres.

Surface and subsurface drainage systems should be designed according to the kind of soil. Shallow surface drainage in combination with land leveling is needed on Clermont soils that are used for intensive row cropping. Tile drainage is of limited benefit on Clermont soils.

Grassed waterways are needed in many areas of gently sloping and moderately sloping soils, for example, Rossmoyne and Cincinnati soils. In many other areas, grassed waterways are needed where large watersheds drain across the soils. Tile drainage is usually needed for waterways installed in Avonburg and Rossmoyne soils. Tile drainage is needed in many areas of Cincinnati soils that are seepy along drainageways.

Soil fertility is naturally low or moderate in most soils on uplands and terraces. The soils on flood plains, for example, Jules, Chagrin, and Stonelick soils, are neutral or mildly alkaline, and they are naturally higher in plant nutrients than most soils on uplands and terraces. The well-drained soils, for example, Cincinnati, Carmel, and Switzerland soils, are on ridgetops and hillsides and have been subject to leaching. They are mainly strongly acid or very strongly acid.

In most areas, the soils on uplands and terraces are strongly acid or very strongly acid. These soils usually require applications of ground limestone to raise the pH level for good growth of alfalfa and for other crops that grow only on nearly neutral soils. The available phosphorus and potash levels are naturally low in most areas of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is important in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous. Soil tilth depends primarily on methods of cultivation and on additions of organic matter.

Many of the soils that are used for crops have a surface layer of silt loam that is light or moderately dark in color and is low in content of organic matter. Generally, the structure of these soils is moderate to weak, and heavy rainfall causes crust to form on the surface. In some areas, the crust becomes hard and impervious to water when it dries. A hard crust, once formed, reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help improve soil structure and reduce crust formation.

Fall plowing is generally not a good practice. In many areas, after fall plowing the soils are nearly as dense and hard at planting time as they were before tillage. About 76 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in fall. In many areas, the soils on bottom lands are subject to scouring because of flash flooding in winter and early in spring.

Field crops suited to the soils and climate include many that are not now commonly grown. Corn and soybeans are the main row crops.

Wheat and oats are the common close-growing crops. It is possible to grow rye and to produce grass seed from bromegrass, fescue, redtop, and bluegrass.

Special crops are commercially important. Only a small acreage is used for tobacco, vegetables, and small fruits. Deep, well drained soils that warm up early in the spring are especially well suited to these crops. Although special crops are grown on other soils, generally they can be planted and harvested earlier on deep, well drained soils. These soils are Dearborn, Elkinsville, Fox, Ockley, and Wheeling soils, in areas where they have a slope of less than 6 percent. They make up about 8,000 acres. Dearborn and Fox soils need irrigation for optimum production.

In areas where they are artificially drained, the poorly drained Clermont soils and the somewhat poorly drained Avonburg soils are suited to a limited number of crops and to limited plantings of vegetable crops. Clermont and Avonburg soils make up about 12,000 acres.

In most areas the well drained soils are suitable for use as orchards and nurseries. But in low positions where frost is frequent and air drainage is poor, the soils generally are poorly suited to early vegetables, small fruits, and orchards. The latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined 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. The classes are defined as follows:

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

Class IV soils have very severe limitations that reduce the choice of plants or that 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.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly

corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The acreage of soils in each capability subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil

Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, sorghum, and sunflower.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, lovegrass, bromegrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, beech, cherry, sweetgum, willow, black walnut, apple, hawthorn, dogwood, hickory, hazelnut, blackberry, elderberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, pondweed, spikerush, wild millet, wildrice, saltgrass, cordgrass, algae, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite, pheasant, dove, meadowlark, field sparrow, cottontail, red fox, and woodchuck.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to

bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper tranches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low

seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic

matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations generally can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sols*. An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Avonburg series

The Avonburg series consists of deep, somewhat poorly drained soils on till plains. The soils formed in thin loess and the underlying loamy glacial till. They have a very slowly permeable fragipan. Slopes range from 0 to 2 percent.

Avonburg soils are similar to Bartle soils and are adjacent to Clermont and Rossmoyne soils. Bartle soils have stratified silty and loamy material in the lower part of the solum. Clermont soils are grayer in the upper part of the subsoil than Avonburg soils. They are on broad ridgetops that are farther from the drainageways. Rossmoyne soils have fewer gray mottles in the upper

part of the subsoil than Avonburg soils have. They are on narrow ridgetops or slope breaks on uplands.

Typical pedon of Avonburg silt loam, 0 to 2 percent slopes, in a cultivated field, 580 feet east and 1,900 feet south of the northwest corner of sec. 35, T. 7 N., R. 3 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine and medium granular structure; friable; many fine roots; common fine dark brown (7.5YR 4/4) stains; neutral; abrupt smooth boundary.

A2—9 to 17 inches; light yellowish brown (10YR 6/4) silt loam; many medium distinct light gray (10YR 7/2) and yellowish brown (10YR 5/6) mottles; weak medium and thick platy structure; friable; common fine roots; few fine black (10YR 2/1) stains; strongly acid; clear smooth boundary.

B2t—17 to 26 inches; light yellowish brown (10YR 6/4) silt loam; many medium distinct light gray (10YR 7/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak and moderate medium subangular blocky structure; friable; few fine and medium roots; patchy light yellowish brown (10YR 6/4) and light brownish gray (10YR 6/2) clay films on faces of peds; few fine black (10YR 2/1) accumulations; very strongly acid; clear wavy boundary.

Bx1g—26 to 36 inches; gray (10YR 6/1) silt loam; common medium prominent yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate coarse subangular blocky; very firm; very brittle; few fine and medium roots in old root channels; continuous gray (10YR 6/1) and discontinuous light yellowish brown (10YR 6/4) clay films on faces of peds; discontinuous light gray (10YR 7/2) silt films on faces of peds; few fine very dark brown (10YR 2/2) accumulations; very strongly acid; gradual wavy boundary.

Bx2—36 to 46 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent gray (10YR 6/1) and common medium distinct strong brown (7.5YR 5/8) mottles; strong very coarse prismatic structure parting to moderate thick platy; extremely firm; very brittle; few fine and medium roots in old root channels; continuous gray (10YR 6/1) clay films on faces of peds; discontinuous light gray (10YR 7/2) silt films on faces of peds and light gray (10YR 7/2) silt in channels; few fine black (N 2/0) accumulations; very strongly acid; gradual wavy boundary.

IIBx3—46 to 72 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent gray (10YR 6/1) mottles; strong very coarse prismatic structure parting to moderate thick platy; extremely firm; very brittle; continuous gray (10YR 6/1) clay films in channels; patchy light gray (10YR 7/2) silt films on faces of peds; few fine black (N 2/0) accumulations; few till pebbles; very strongly acid; gradual wavy boundary.

IIB3t—72 to 80 inches; brownish yellow (10YR 6/6) loam; many medium prominent gray (10YR 6/1) and common medium distinct strong brown (7.5YR 5/8) mottles; massive; friable; continuous gray (10YR 6/1) clay films in channels; few fine black (N 2/0) accumulations; few till pebbles; strongly acid; gradual wavy boundary.

The solum is 60 to 96 inches thick. The loess is 20 to 48 inches thick. The depth to carbonates ranges from 96 to 120 inches, and the depth to the fragipan ranges from 24 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from strongly acid to neutral.

The B2t horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6, and it is distinctly mottled. It is silt loam or silty clay loam and is very strongly acid or strongly acid.

The Bx and IIBx horizons have hue of 10YR, value of 5 or 6, and chroma of 1 to 6, and they are distinctly mottled. They are silt loam or silty clay loam and very strongly acid or strongly acid.

Bartle series

The Bartle series consists of deep, somewhat poorly drained soils on loess-covered terraces. The soils formed in loess and the underlying stratified silty materials. They have a very slowly permeable fragipan. Slopes range from 0 to 3 percent.

Bartle soils are similar to Avonburg and Fincastle soils, and they are adjacent to Elkinsville soils. Avonburg soils have less silt in the lower part of the solum than Bartle soils have. Fincastle soils do not have a fragipan and are less acid in the lower part of the solum and below the solum. Elkinsville soils do not have gray mottles in the upper part of the subsoil and are on terraces near bottom lands or stream channels.

Typical pedon of Bartle silt loam, 0 to 3 percent slopes, in a cultivated field, 950 feet north and 75 feet west of the southeast corner of sec. 3, T. 4 N., R. 3 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

A2—10 to 16 inches; pale brown (10YR 6/3) silt loam; many fine and medium faint light gray (10YR 7/2) and few fine distinct brownish yellow (10YR 6/6) mottles; weak thick platy structure; friable; common fine roots; very strongly acid; clear smooth boundary.

B2t—16 to 28 inches; pale brown (10YR 6/3) silt loam; many fine and medium faint light gray (10YR 7/2) and common medium prominent strong brown

(7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; continuous light gray (10YR 7/2) silt films on faces of peds; few fine strong brown (7.5YR 5/6) accumulations; very strongly acid; clear smooth boundary.

Bx1g—28 to 35 inches; light gray (10YR 7/2) silt loam; common fine prominent brownish yellow (10YR 6/6) mottles; moderate very coarse prismatic structure parting to moderate medium angular blocky; very firm; brittle; discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; discontinuous white (10YR 8/2) silt films on faces of peds; common fine strong brown (7.5YR 5/6) accumulations; strongly acid; clear smooth boundary.

Bx2g—35 to 58 inches; light gray (10YR 7/2) silty clay loam; many coarse prominent strong brown (7.5YR 5/6) mottles; strong coarse prismatic structure parting to moderate medium angular and subangular blocky; very firm; brittle; common light brownish gray (10YR 6/2) clay films on faces of peds; light brownish gray (10YR 6/2) silt loam in old root channels 7 inches in diameter; many fine strong brown (7.5YR 5/6) accumulations; strongly acid; gradual wavy boundary.

IIC—58 to 60 inches; yellowish brown (10YR 5/6) clay loam; thin strata of loam; massive; firm; light brownish gray (10YR 6/2) clay flows in old root channels; many fine irregularly shaped strong brown (7.5YR 5/6) accumulations; medium acid.

The solum is 42 to 60 inches thick. The depth to the fragipan ranges from 24 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. It ranges from strongly acid to neutral.

The B2t horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4, and it is distinctly mottled. It is silt loam or silty clay loam and is very strongly acid or strongly acid.

The Bx horizon has hue of 10YR, value of 5 to 7, and chroma of 1 to 3, and it is distinctly mottled. It is loam, silt loam, or silty clay loam.

The IIC horizon is stratified fine sandy loam, loam, clay loam, or silty clay loam.

Bonnell series

The Bonnell series consists of deep, well drained, slowly permeable soils on till plains. The soils formed in loess and the underlying glacial till. Slopes range from 6 to 35 percent.

Bonnell soils are similar to Carmel soils and are adjacent to Cincinnati soils. Carmel soils have subsoils that formed in residuum, and interbedded limestone and calcareous shale are within a depth of 60 inches. Cincinnati soils have a thicker loess capping than Bonnell soils have, a fragipan, and more acid in the subsoil and below the subsoil. They are on narrow ridgetops and hillsides.

Typical pedon of Bonnell silt loam, 18 to 35 percent slopes, in a mixed hardwood forest, 700 feet north and 2,000 feet east of the southwest corner of sec. 14, T. 4 N., R. 3 W.

A1—0 to 3 inches; very dark gray (10YR 3/1) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many coarse roots; slightly acid; clear smooth boundary.

A2—3 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine and coarse roots; strongly acid; clear wavy boundary.

B1—6 to 9 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; common fine and medium roots; medium acid; clear wavy boundary.

IIB21t—9 to 26 inches; dark brown (7.5YR 4/4) silty clay; moderate medium angular blocky structure; firm; common fine and medium roots; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

IIB22t—26 to 36 inches; dark yellowish brown (10YR 4/4) clay; moderate medium subangular and angular blocky structure; firm; common fine and medium roots; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; few black (10YR 2/1) accumulations; few pebbles less than 3 inches in diameter; strongly acid; clear wavy boundary.

IIB23t—36 to 44 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; firm; few fine and medium roots; discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few black (10YR 2/1) accumulations; strongly acid; clear wavy boundary.

IIB24t—44 to 60 inches; dark yellowish brown (10YR 4/4) clay loam; weak coarse subangular blocky structure; firm; few fine and medium roots; discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few black (10YR 2/1) accumulations; few pebbles less than 3 inches in diameter; slightly acid; gradual wavy boundary.

IIB25t—60 to 70 inches; brown (10YR 5/3) clay loam; weak coarse subangular blocky structure; friable; patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; common black (10YR 2/1) accumulations; few pebbles less than 3 inches in diameter; strong effervescence; moderately alkaline; gradual wavy boundary.

C—70 to 80 inches; brown (10YR 5/3) clay loam; massive; friable; strong effervescence; moderately alkaline.

The solum is from 50 to 80 inches thick. The loess is from 3 to 18 inches thick. The depth to carbonates ranges from 50 to 80 inches, and the depth to clay residuum is more than 30 inches.

The A1 horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The Ap horizon has hue of 10YR,

value of 4 or 5, and chroma of 2 to 4. The A horizon is loam or silt loam and ranges from very strongly acid to neutral.

The IIB2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay, or clay and ranges from very strongly acid to slightly acid.

The IIC horizon is loam or clay loam.

Carmel series

The Carmel series consists of deep, well drained, very slowly permeable soils on hillsides. The soils formed in loess and in residuum from the underlying interbedded limestone and gray calcareous shale, but mostly in the residuum from the shale. Slopes range from 6 to 25 percent.

Carmel soils are similar to Switzerland soils, and they are adjacent to Switzerland and Eden soils. Switzerland soils formed in thicker deposits of loess than Carmel soils did and have a thicker solum. They are on narrow ridgetops and hillsides. Eden soils are moderately deep and formed entirely in the underlying limestone and shale. They are on moderately steep to very steep hillsides.

Typical pedon of Carmel silt loam, 12 to 18 percent slopes, eroded, in a cultivated field, 700 feet south and 1,700 feet east of the northwest corner of sec. 33, T. 4 N., R. 2 W.

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B1—6 to 11 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; discontinuous yellowish brown (10YR 5/4) silt coatings on faces of peds; strongly acid; clear smooth boundary.

IIB21t—11 to 19 inches; strong brown (7.5YR 5/6) clay; moderate medium subangular blocky structure; firm; common fine roots; discontinuous dark brown (7.5YR 4/4) clay films and brown (10YR 5/3) silt films on faces of peds; common fine black (N 2/0) concretions; strongly acid; clear wavy boundary.

IIB22t—19 to 36 inches; yellowish brown (10YR 5/6) clay; strong coarse and very coarse prismatic structure parting to strong angular and subangular blocky; extremely firm; few fine roots; discontinuous yellowish brown (10YR 5/4) clay films on faces of peds and on lining of pores; many black (N 2/0) concretions; slickensides 2 to 8 inches wide (fig. 9); medium acid; clear wavy boundary.

IIC—36 to 44 inches; pale olive (5Y 6/4) and olive yellow (2.5Y 6/6) flaggy clay; weak platy structure; extremely firm; few dark brown (7.5YR 4/4) clay films along old fracture lines; 40 percent limestone flagstones; violent effervescence; moderately alkaline; abrupt wavy boundary (0 to 16 inches thick).

IIC4—44 to 60 inches; interbedded soft calcareous clay shale and limestone flagstones.

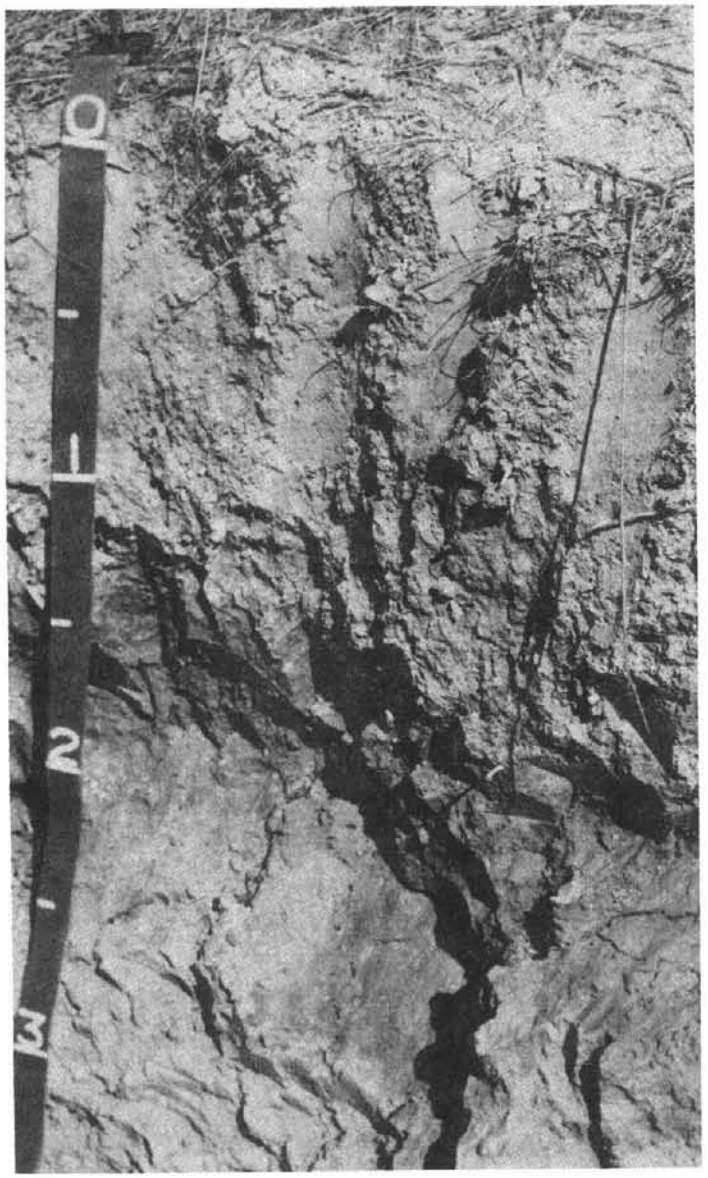

Figure 9.—Slickensides in a profile of Carmel silt loam, 12 to 18 percent slopes, eroded.

The solum is 30 to 50 inches thick. The loess is 6 to 18 inches thick, and the depth to underlying bedrock ranges from 40 to 80 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly silt loam but the range includes silty clay loam. The surface layer ranges from strongly acid to neutral.

The IIB2t horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay, and it ranges from strongly acid to slightly acid.

The IIC horizon, if present, is flaggy silty clay, flaggy clay, silty clay, or clay.

Chagrin series

The Chagrin series consists of deep, well drained, moderately permeable soils on flood plains. The soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Chagrin soils are similar to Stonelick soils and are adjacent to Orrville and Stonelick soils. Orrville soils have gray mottles in the subsoil and upper substratum, and they are on bottom land along sluggish streams or they are far from stream channels. Stonelick soils formed in loamy calcareous alluvium. They have moderately rapid permeability, and they are on bottom land adjacent to stream channels.

Typical pedon of Chagrin silt loam, in a cultivated field, 200 feet east and 1,700 feet south of the northwest corner of sec. 14, T. 7 N., R. 1 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; moderate fine and medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—7 to 12 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; friable; many fine roots; neutral; clear smooth boundary.

B1—12 to 17 inches; dark brown (10YR 4/3) loam; moderate medium subangular blocky structure; friable; many fine roots; neutral; clear smooth boundary.

B21—17 to 29 inches; dark yellowish brown (10YR 4/4) silt loam with moderate sand content; moderate medium subangular blocky structure; friable; common fine roots; continuous dark brown (10YR 4/3) coatings on faces of peds; neutral; gradual smooth boundary.

B22—29 to 36 inches; dark yellowish brown (10YR 4/4) silt loam with moderate sand content; moderate medium subangular blocky structure; friable; few fine roots; discontinuous dark brown (10YR 4/3) coatings on faces of peds; neutral; gradual wavy boundary.

B3C—36 to 46 inches; dark yellowish brown (10YR 4/4) silt loam and pockets of loam; weak medium subangular blocky structure; friable; few fine roots; discontinuous dark brown (10YR 4/3) coatings on faces of peds; neutral; gradual irregular boundary.

C1—46 to 58 inches; dark brown (10YR 4/3) loam; massive; friable; neutral; gradual irregular boundary.

C2—58 to 60 inches; yellowish brown (10YR 5/4) sand; massive; very friable; strong effervescence; moderately alkaline.

The solum is 24 to 48 inches thick. The depth to carbonates and the underlying sand, loamy sand, or loam ranges from 40 to 60 inches.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is loam or silt loam and is slightly acid or neutral.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam, loam, clay loam, or silty clay loam. It is slightly acid or neutral.

The C horizon is stratified loam, sandy loam, loamy sand or sand.

Cincinnati series

The Cincinnati series consists of deep, well drained soils on ridgetops and hillsides on till plains. The soils are moderately permeable above the fragipan and slowly permeable in and below the fragipan. They formed in loess and the underlying loamy glacial till. Slopes range from 2 to 12 percent.

Cincinnati soils are similar to Rossmoyne and Weisburg soils and are adjacent to them. Rossmoyne soils have more gray mottles in the upper part of the subsoil than Cincinnati soils, and they are on narrow ridgetops or slope breaks near drainageways. Weisburg soils formed in thin deposits of loess, till, and the underlying interbedded limestone and gray calcareous shale, and they have a thinner solum. They are on narrow ridgetops or hillsides.

Typical pedon of Cincinnati silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 100 feet east and 1,300 feet south of the northwest corner of sec. 34, T. 7 N., R. 1 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine and medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B1—7 to 13 inches; dark yellowish brown (10YR 4/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.

B21t—13 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine roots; patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—18 to 23 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B23t—23 to 29 inches; yellowish brown (10YR 5/6) silt loam; moderate medium angular blocky structure; friable; slightly brittle; few fine roots; discontinuous grayish brown (10YR 5/2) and discontinuous dark brown (7.5YR 4/4) clay films on faces of peds;

continuous light yellowish brown (10YR 6/4) silt films on faces of peds; strongly acid; clear wavy boundary.

IIBx1—29 to 39 inches; yellowish brown (10YR 5/4) silt loam; strong very coarse prismatic structure parting to moderate medium angular and subangular blocky; very firm; brittle; few fine roots on faces of prisms; continuous grayish brown (10YR 5/2) clay films on faces of prisms; discontinuous dark brown (10YR 4/3) clay films on faces of peds; patchy very pale brown (10YR 7/3) silt films on faces of peds; few fine dark reddish brown (5YR 3/3) concretions and few fine yellowish red (5YR 5/6) stains; few till pebbles; strongly acid; clear wavy boundary.

IIBx2—39 to 50 inches; yellowish brown (10YR 5/4) silt loam; common fine faint grayish brown (10YR 5/2) mottles; moderate very coarse prismatic stucture parting to moderate medium angular and subangular blocky; very firm; very brittle; continuous grayish brown (10YR 5/2) clay films on faces of prisms; few fine dark reddish brown (5YR 3/3) concretions and few fine yellowish red (5YR 5/6) stains; few till pebbles; strongly acid; gradual wavy boundary.

IIB32t—50 to 66 inches; yellowish brown (10YR 5/6) silty clay loam; common fine prominent light brownish gray (10YR 6/2) mottles; moderate fine and medium angular and subangular blocky structure; firm; continuous dark brown (7.5YR 4/4) and discontinuous grayish brown (10YR 5/2) clay films on faces of peds; few fine yellowish red (5YR 4/6) stains; few till pebbles; slightly acid; gradual wavy boundary.

IIB32—66 to 80 inches; strong brown (7.5YR 5/6) silty clay loam; many medium prominent light brownish gray (10YR 6/2) mottles; massive; firm; few till pebbles; slightly acid.

The solum is 72 to 100 inches thick. The loess is 18 to 40 inches thick. The depth to the fragipan ranges from 18 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 to 5, and chroma of 2 or 3. It ranges from strongly acid to neutral.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loam, silt loam, or silty clay loam. It is very strongly acid or strongly acid.

The Bx and IIBx horizons have hue of 10YR, value of 4 or 5, and chroma of 4 to 6. They are loam, silt loam, or silty clay loam.

The IIB3 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6, and it is mottled. It is loam, silt loam, or silty clay loam.

Clermont series

The Clermont series consists of deep, poorly drained, very slowly permeable soils on till plains. The soils formed in loess and the underlying loamy glacial till. Slopes range from 0 to 2 percent.

Clermont soils are similar to and are adjacent to Avonburg soils. Avonburg soils are browner in the upper part of the subsoil than Clermont soils, and they have a fragipan. They are on broad ridgetops on till plains.

Typical pedon of Clermont silt loam, in a recently cleared wooded area, 100 feet north and 1,155 feet east of the southwest corner of sec. 5, T. 1 N., R. 2 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, light gray (10YR 7/2) dry; moderate fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A21g—3 to 9 inches; grayish brown (2.5Y 5/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium and thick platy structure; friable; common fine roots; common black (10YR 2/1) accumulations; slightly acid; clear wavy boundary.

A22g—9 to 16 inches; light brownish gray (2.5Y 6/2) silt loam; common fine prominent dark yellowish brown (10YR 4/4) and dark brown (10YR 3/3) and common fine distinct yellowish brown (10YR 5/4) mottles; weak thick platy structure; friable; common fine medium roots; common black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

A23g—16 to 24 inches; light brownish gray (2.5Y 6/2) silt loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; slightly brittle; common fine and medium roots; common black (N 2/0) iron and manganese oxide accumulations; strongly acid; clear irregular boundary.

B21tg—24 to 31 inches; gray (10YR 6/1) silty clay loam; many medium distinct strong brown (7.5YR 5/8) and dark brown (7.5YR 4/4) mottles; moderate medium and coarse prismatic structure parting to weak medium subangular and angular blocky; firm; common fine roots; light gray (2.5Y 7/2) silt films on faces of peds and fillings in channels; patchy gray (10YR 5/1) clay films on faces of peds and linings of few voids; very strongly acid; clear wavy boundary.

B22tg—31 to 42 inches; gray (10YR 6/1) silty clay loam; many medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure; very firm; common fine roots on faces of prisms; discontinuous gray (10YR 5/1) clay films on faces of peds and as linings in voids; discontinuous white (10YR 8/1) silt films on faces of peds; common black (N 2/0) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

IIBxg—42 to 50 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6) mottles; weak very coarse

prismatic structure; massive inside peds; very firm; brittle; few fine roots on faces of peds; continuous gray (5Y 5/1) and light gray (10YR 7/2) silt films and patchy gray (10YR 6/1) clay films on faces of peds; few till pebbles; strongly acid; gradual wavy boundary.

IIB3—50 to 80 inches; light brownish gray (2.5Y 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) and many medium distinct light yellowish brown (10YR 6/4) mottles; weak coarse and very coarse prismatic structure; firm to friable; patchy gray (10YR 6/1) clay films on faces of peds; few till pebbles; slightly acid.

The solum is 72 to 108 inches thick. The loess is 36 to 48 inches thick. The depth to the brittle layer ranges from 36 to 48 inches.

The A1 horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. It ranges from strongly acid to neutral.

The B2tg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2, and it is mottled. It is silt loam or silty clay loam. It is very strongly acid or strongly acid.

The IIBx horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2, and it is mottled. It is loam, silt loam, or silty clay loam. It is very strongly acid or strongly acid.

Dearborn series

The Dearborn series consists of deep, well drained, moderately permeable soils on flood plains. The soils formed in local alluvium. Slopes range from 0 to 2 percent.

Dearborn soils are similar to and adjacent to Huntington and Chagrin soils. Both Huntington and Chagrin soils have less rock fragments in the solum and below the solum. These soils are on slightly higher elevations and farther from stream channels.

Typical pedon of Dearborn silt loam, in an idle field, 400 feet west and 90 feet north of the southeast corner of sec. 7, T. 7 N., R. 1 W.

A11—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

A12—4 to 10 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; friable; common fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

B2—10 to 16 inches; dark brown (10YR 4/3) clay loam; weak coarse subangular blocky structure; firm; common fine roots; patchy dark grayish brown (10YR 4/2) coatings in channels and on faces of peds; violent effervescence; moderately alkaline; abrupt smooth boundary.

IIC1—16 to 48 inches; dark brown (10YR 4/3) very channery loam; massive; friable; common fine roots; about 70 percent limestone fragments; violent effervescence; moderately alkaline; clear smooth boundary.

IIC2—48 to 60 inches; dark brown (10YR 4/3) very channery clay loam; massive; firm; few fine roots; about 60 percent limestone fragments; violent effervescence; moderately alkaline.

The solum is 15 to 30 inches thick. The depth to underlying channery or flaggy alluvium ranges from 15 to 30 inches.

The A1 horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 or 3. It is dominantly silt loam and flaggy loam, but the range includes loam and silty clay loam and their channery analogues. The A horizon is mildly alkaline or moderately alkaline.

The B2 horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 2 to 4. It is loam, silt loam, silty clay loam, or clay loam, and their gravelly, channery, or flaggy phases. It is mildly alkaline or moderately alkaline.

The IIC horizon is very channery silt loam, very channery loam, very channery sandy loam, very channery coarse sandy loam, very channery loamy sand, very channery sandy clay loam, or very channery clay loam, and their very gravelly or very flaggy phases.

Eden series

The Eden series consists of moderately deep, well drained, slowly permeable soils on hillsides. The soils formed in residuum from interbedded limestone and gray calcareous shale (fig. 10). Slopes range from 15 to 50 percent.

Eden soils are similar to Pate soils, and they are adjacent to Carmel and Pate soils. Carmel soils are deep and formed in thin loess and residuum from the underlying limestone and shale. They are on narrow ridgetops and hillsides. Pate soils are deep and formed in residuum containing a higher percentage of shale than Eden soils. They are on the lower part of long hillsides on upland.

Typical pedon of Eden flaggy silty clay loam, 25 to 50 percent slopes, in a forest of mixed hardwood, 900 feet south and 1,250 feet east of the northwest corner of sec. 33, T. 4 N., R. 2 W.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) flaggy silty clay loam, grayish brown (10YR 5/2) dry; moderate medium and fine granular structure; friable; many fine and coarse roots; 20 percent limestone flagstones; neutral; abrupt smooth boundary.

B1—3 to 6 inches; dark brown (10YR 4/3) channery silty clay, brown (10YR 5/3) dry; weak medium subangular blocky structure; firm; common fine and coarse roots; dark brown (10YR 3/3) organic coatings on faces of peds; about 15 percent

Figure 10.—Profile of Eden silty clay loam, 15 to 25 percent slopes, eroded. Interbedded limestone and calcareous shale are at a depth of 40 inches.

limestone fragments; neutral; clear smooth boundary.

B21t—6 to 11 inches; dark yellowish brown (10YR 4/4) channery silty clay; moderate medium subangular blocky structure; very firm; common fine and coarse roots; patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; 15 percent limestone fragments; neutral; clear wavy boundary.

B22t—11 to 23 inches; dark yellowish brown (10YR 4/4) channery silty clay; moderate fine prismatic structure parting to moderate medium subangular blocky; very firm; common fine and coarse roots; discontinuous dark brown (10YR 4/3) clay films on faces of peds; 15 percent limestone fragments; neutral; clear wavy boundary.

B23t—23 to 36 inches; light olive brown (2.5Y 5/4) very flaggy clay; weak medium subangular blocky structure; very firm; few medium roots; patchy dark brown (10YR 4/3) clay films on faces of peds; 60 percent limestone flagstones; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—36 to 50 inches; light olive brown (2.5Y 5/4) soft siltstone; massive; very firm; 30 percent limestone flagstone and fractured layers of limestone; violent effervescence; moderately alkaline.

R—50 to 60 inches; fractured layers of limestone about 4 inches thick and layers of clay shale.

The solum is 16 to 40 inches thick. The depth to a paralithic contact ranges from 20 to 40 inches.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 4. It is dominantly flaggy silty clay loam, but the range includes channery silty clay loam or silty clay loam. The A horizon is neutral or mildly alkaline.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is channery silty clay, channery clay, silty clay, or clay. It ranges from neutral to moderately alkaline.

The Cr horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is soft siltstone, silty shale, or clayey shale. It is mildly alkaline or moderately alkaline.

Elkinsville series

The Elkinsville series consists of deep, well drained, moderately permeable soils on loess-covered terraces. The soils formed in loess and the underlying stratified silty materials. Slopes range from 0 to 12 percent.

Elkinsville soils are similar to Wheeling soils, and they are adjacent to Bartle soils. Wheeling soils have more coarse silt and fine sand in the solum and more sand and gravel below the solum than in Elkinsville soils. Bartle soils have gray mottles in the upper part of the subsoil, and they have a fragipan. They are on terraces farther from stream channels.

Typical pedon of Elkinsville silt loam, 0 to 2 percent slopes, in a cultivated field, 800 feet west and 1,000 feet south of the northeast corner of sec. 8, T. 4 N., R. 3 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

A2—7 to 11 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium granular structure; friable; common fine roots; medium acid; clear smooth boundary.

B21t—11 to 17 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—17 to 33 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; gradual smooth boundary.

IIB23t—33 to 44 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; few pebbles less than 3 inches in diameter; very strongly acid; gradual smooth boundary.

IIB3t—44 to 58 inches; dark brown (7.5YR 4/4) clay loam; weak medium subangular blocky structure; firm; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; many fine very dark grayish brown (10YR 3/2) stains; few pebbles less than 3 inches in diameter; very strongly acid; diffuse smooth boundary.

IIC—58 to 60 inches; dark yellowish brown (10YR 4/4) clay loam and thin strata of loam; massive; firm; many fine very dark grayish brown (10YR 3/2) stains; few pebbles less than 3 inches in diameter; medium acid.

The solum is 42 to 72 inches thick. The loess ranges from 24 to 40 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It ranges from medium acid to neutral.

The B2t and IIB2t horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are loam, silt loam, or silty clay loam. They are very strongly acid or strongly acid.

The IIC horizon is stratified fine sandy loam, loam, clay loam, or silty clay loam.

Fincastle series

The Fincastle series consists of deep, somewhat poorly drained, slowly permeable soils on till plains. The soils formed in loess and the underlying loamy glacial till. Slopes range from 1 to 2 percent.

Fincastle soils are similar to Avonburg soils and are adjacent to Russell soils. Avonburg soils have a very slowly permeable fragipan in the subsoil, and they are more acid in the lower part of the solum and below the solum than Fincastle soils. Russell soils do not have gray mottles in the upper part of the subsoil, and they are on gently sloping ridgetops on loess-covered till plains.

Typical pedon of Fincastle silt loam in an area of Russell-Fincastle silt loams, 1 to 4 percent slopes, in a cultivated field, 300 feet south and 1,235 feet west of the center of sec. 12, T. 7 N., R. 2 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

A2—7 to 10 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common fine and medium roots; medium acid; clear smooth boundary.

B1—10 to 14 inches; grayish brown (10YR 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and few fine distinct brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; firm; common medium roots; strongly acid; clear smooth boundary.

B21—14 to 29 inches; yellowish brown (10YR 5/4) silty clay loam; many medium faint grayish brown (10YR 5/2) and few fine distinct brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; firm; few medium roots; continuous grayish brown (10YR 5/2) clay and silt films on faces of peds; patchy very pale brown (10YR 7/3) silt films in channels; common fine rounded black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

B22t—29 to 36 inches; yellowish brown (10YR 5/4) silty clay loam; many fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular and angular blocky structure; firm; few medium roots; continuous grayish brown (10YR 5/2) clay films on faces of peds; patchy light brownish gray (10YR 6/2) silt films in channels; common fine rounded black (10YR 2/1) iron and manganese oxide accumulations; neutral; gradual wavy boundary.

IIB3t—36 to 45 inches; yellowish brown (10YR 5/6) clay loam; many fine distinct grayish brown (10YR 5/2) and common fine distinct brownish yellow (10YR 6/8) mottles; weak coarse subangular and angular blocky structure; firm; few medium roots; discontinuous grayish brown (10YR 5/2) clay films on faces of peds; few pebbles less than 3 inches in diameter; common fine rounded black (10YR 2/1) iron and manganese oxide accumulations; slight effervescence; mildly alkaline.

IIC—45 to 60 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct grayish brown (10YR 5/2) and common fine distinct brownish yellow (10YR 6/8) mottles; massive; firm; few pebbles less than 3 inches in diameter; common fine rounded black (10YR 2/1) iron and manganese oxide accumulations; strong effervescence; moderately alkaline.

The solum is 36 to 48 inches thick. The loess is 26 to 36 inches thick. The depth to carbonates ranges from 36 to 48 inches.

The Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 2. It ranges from strongly acid to slightly acid.

The B2t horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4, and it is distinctly mottled. It is silty clay loam or clay loam and ranges from strongly acid to neutral.

The IIC horizon is loam or clay loam.

Fox series

The Fox series consists of well drained soils on outwash terraces. The soils are moderately deep over sand and gravel. They are moderately permeable in the subsoil and rapidly permeable below the subsoil. They formed in loamy outwash, and they are underlain by stratified calcareous sand and very gravelly sand. Slopes range from I to 4 percent.

Fox soils are similar to the Ockley soils, and they are adjacent to Wheeling soils. Ockley soils formed in thicker deposits of loess than Fox soils did and have a thicker solum than Fox soils have. Wheeling soils are adjacent to Fox soils, but they are on lower landscapes. Wheeling soils are underlain with noncalcareous sand or with sand and gravel.

Typical pedon of Fox silt loam, 1 to 4 percent slopes, eroded, in a cultivated field, 150 feet south and 1,100 feet east of the northwest corner of sec. 35, T. 4 N., R. 1 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

B1—7 to 13 inches; dark brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; few round pebbles; medium acid; abrupt smooth boundary.

IIB21t—13 to 23 inches; reddish brown (5YR 4/4) gravelly clay loam; moderate medium and fine angular and subangular blocky structure; firm; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 30 percent gravel; medium acid; gradual smooth boundary.

IIB22t—23 to 32 inches; reddish brown (5YR 4/4) clay loam; weak medium and fine angular and subangular blocky structure; firm; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; few round pebbles less than 3 inches in diameter; slightly acid; abrupt irregular boundary.

IIIC—32 to 60 inches; yellowish brown (10YR 5/4) very gravelly coarse sand; single grain; loose; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick The loess is 6 to 20 inches thick. The depth to carbonates and underlying stratified gravel, gravelly sand, and sand ranges from 24 to 40 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. The A horizon ranges from strongly acid to neutral.

The IIB2t horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 3 to 5. It is loam, sandy clay loam, gravelly clay loam, or clay loam. It ranges from strongly acid to neutral.

The IIIC horizon is stratified very gravelly coarse sand, sand, or coarse sand.

Hennepin series

The Hennepin series consists of deep, well drained, moderately slowly permeable soils on till plains. The soils formed in loamy glacial till. Slopes range from 40 to 60 percent.

Hennepin soils are similar to Bonnell soils, and they are adjacent to Russell soils. Bonnell soils have a solum that has more clay and is thicker than that in Hennepin soils. Russell soils have a solum that contains more silt and is thicker than that in Hennepin soils. They are on loess-covered ridgetops on till plains.

Typical pedon of Hennepin loam, 40 to 60 percent slopes, in a mixed hardwood forest, 100 feet west and 1,800 feet north of the southeast corner of sec. 11, T. 7 N., R. 1 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; moderate medium

and fine granular structure; friable; many fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

B2—5 to 13 inches; dark brown (10YR 4/3) clay loam; moderate fine and medium subangular blocky structure; firm; common medium roots; few pebbles less than 3 inches in diameter and few cobbles; strong effervescence; moderately alkaline; clear wavy boundary.

C—13 to 60 inches; yellowish brown (10YR 5/4) gravelly clay loam; massive; firm; violent effervescence; moderately alkaline.

The solum is less than 20 inches thick. The depth to loamy glacial till is less than 20 inches.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam or clay loam, and it is mildly alkaline or moderately alkaline.

The C horizon is clay loam, loam, or sandy loam and their gravelly analogues.

Huntington series

The Huntington series consists of deep, well drained, moderately permeable soils on flood plains. The soils formed in recent, neutral, silty and loamy alluvium. Slopes range from 0 to 2 percent.

Huntington soils are similar to Chagrin and Jules soils, and they are adjacent to Rahm soils. Chagrin soils have more sand in the subsoil than Huntington soils have. Jules soils have carbonates throughout the solum. Rahm soils are more acid below a depth of 36 inches than Huntington soils and have gray mottles in the upper part of the subsoil. They are on high bottoms or low terraces.

Typical pedon of Huntington silt loam, in a cultivated field, 1,000 feet east and 1,200 feet north of the southwest corner of sec. 25, T. 4 N., R. 1 W.

Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many medium roots; many fine mica flakes; neutral; abrupt smooth boundary.

A12—6 to 13 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; friable; many fine roots; many fine mica flakes; neutral; clear smooth boundary.

B21—13 to 43 inches; dark brown (10YR 4/3) silt loam; moderate medium and coarse subangular blocky structure; friable; common fine roots; patchy dark brown (10YR 3/3) clay films on faces of peds; few fine mica flakes; neutral; gradual smooth boundary.

B22—43 to 60 inches; dark brown (7.5YR 4/4) silt loam; weak medium and coarse subangular blocky structure; friable; few fine roots; patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine mica flakes; neutral; gradual smooth boundary.

C—60 to 80 inches; dark brown (7.5YR 4/4) loam; massive; friable; patchy dark yellowish brown (10YR 4/4) clay films in root channels; few fine mica flakes; neutral.

The solum is 50 to 70 inches thick. The mollic epipedon ranges from 10 to 20 inches thick.

The Ap horizon has hue of 10YR, value of 2 to 3, and chroma of 2 to 3. It ranges from medium acid to neutral.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam and ranges from medium acid to neutral.

The C horizon is loam or sandy loam.

Jules series

The Jules series consists of deep, well drained, moderately permeable, calcareous soils on flood plains. The soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Jules soils are similar and adjacent to Huntington soils. Huntington soils have a darker surface layer than Jules soils, and they are more acid and formed in alluvium that had more clay.

Typical pedon of Jules silt loam, in a cultivated field, 410 feet north and 1,520 feet east of the center of sec. 22, T. 4 N., R. 2 W.

A1—0 to 20 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate coarse granular structure; friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C1—20 to 33 inches; dark brown (10YR 4/3) silt loam; weak medium and coarse subangular blocky structure; friable; few fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C2—33 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; very friable; strong effervescence; moderately alkaline.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is very fine sandy loam, loam, or silt loam, and it is mildly alkaline or moderately alkaline. In some pedons, it is stratified.

Markland series

The Markland series consists of deep, well drained and moderately well drained, slowly permeable soils on loess-covered lacustrine terraces. The soils formed in loess and the underlying calcareous clayey lacustrine sediments. Slopes range from 2 to 35 percent.

Markland soils are similar and adjacent to Pate soils. Pate soils are on the lower part of hillsides on uplands, and they are underlain with interbedded limestone and calcareous shale.

Typical pedon of Markland silt loam, 2 to 12 percent slopes, eroded, in a cultivated field, 1,000 feet east and 1,500 feet south of the northwest corner of sec. 30, T. 5 N., R. 1 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) and yellowish brown (10YR 5/4) silt loam, light gray (10YR 7/2) dry; moderate fine and medium granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

B1—7 to 13 inches; yellowish brown (10YR 5/4) silty clay loam; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; moderate medium subangular blocky structure; firm; common fine roots; medium acid; clear smooth boundary.

IIB21t—13 to 23 inches; yellowish brown (10YR 5/4) silty clay; strong medium angular and subangular blocky structure; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; very firm; few fine roots; few fine black (10YR 2/1) accumulations; medium acid; gradual smooth boundary.

IIB22t—23 to 29 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strong medium angular blocky structure; very firm; few fine roots; slightly acid; gradual smooth boundary.

IIC—29 to 60 inches; yellowish brown (10YR 5/4) silty clay and thin strata of silty clay loam and silt loam; massive; firm; many fine irregular segregated lime accumulations; strong effervescence; moderately alkaline.

The solum is 20 to 44 inches thick. The loess is I5 inches thick. The depth to carbonates ranges from 20 to 44 inches.

The Ap or A1 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is dominantly silt loam, but the range includes silty clay loam. The surface layer ranges from medium acid to neutral.

The IIB2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is distinctly mottled in the lower part. It is silty clay loam, silty clay, or clay. It is medium acid or slightly acid.

The IIC horizon is stratified fine sand, very fine sand, silt loam, silty clay loam, silty clay, or clay. It is mildly alkaline or moderately alkaline.

The map units, MaF2 Markland silt loam, 18 to 35 percent slopes, eroded, and MbD3 Markland silty clay loam, 6 to 18 percent slopes, severely eroded, have a solum that is slightly thinner than the range for the series. This difference does not alter the use or behavior of these soils.

Newark series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. The soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Newark soils are similar to Huntington soils, and they are commonly adjacent to Rahm soils. Huntington soils do not have gray mottles in the upper part of the subsoil. Rahm soils are more acid below a depth of 36 inches than Newark soils.

Typical pedon of Newark silt loam, in a cultivated field, 350 feet east and 800 feet south of the northwest corner of sec. 35, T. 4 N., R. 1 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

C1—9 to 15 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown (10YR 5/2) and many medium distinct dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.

C2—15 to 25 inches; grayish brown (10YR 5/2) silt loam; weak fine angular and subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C3—25 to 38 inches; dark brown (10YR 4/3) silty clay loam; many medium and large prominent gray (5Y 5/1) mottles; weak fine angular and subangular blocky structure; firm; few fine black (10YR 2/1) iron and manganese oxide concretions; slightly acid; gradual smooth boundary.

C4—38 to 60 inches; gray (5Y 5/1) silty clay loam; many medium prominent dark yellowish brown (10YR 4/4) mottles; massive; firm; common fine black (10YR 2/1) iron and manganese oxide concretions; neutral.

The Ap horizon has hue of 10YR or 2.5Y, value of 4, and chroma of 2 to 4. It is dominantly silt loam, but the range includes silty clay loam. The A horizon ranges from medium acid to neutral.

The C horizon has hue of 10YR, 2.5Y or 5Y, value of 4 or 5, and chroma of 1 to 4, and it is distinctly mottled.

Ockley series

The Ockley series consists of deep, well drained soils on loess-covered outwash terraces. The soils are moderately permeable in the subsoil and very rapidly permeable below the subsoil. They formed in loess and loamy outwash over stratified calcareous gravel and sand. Slopes range from 0 to 3 percent.

Ockley soils are similar to Fox soils, and they are adjacent to Fox soils. Fox soils have a solum that is 24 to 40 inches thick, and they are on outwash terraces.

Typical pedon of Ockley silt loam, 0 to 3 percent slopes, in a cultivated field, 500 feet north and 1,900 feet east of the southwest corner of sec. 12, T. 7 N., R. 1 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

B1—8 to 14 inches; dark brown (10YR 4/3) loam; weak medium and coarse subangular blocky structure; friable; few fine roots; medium acid; clear smooth boundary.

B21t—14 to 22 inches; dark brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous dark brown (10YR 4/3) clay films on faces of peds; medium acid; gradual smooth boundary.

IIB22t—22 to 31 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous dark brown (10YR 4/3) clay films on faces of peds; medium acid; gradual wavy boundary.

IIB23t—31 to 38 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; few fine roots; discontinuous dark brown (10YR 4/3) clay films on faces of peds; medium acid; gradual wavy boundary.

IIB3—38 to 50 inches; dark yellowish brown (10YR 3/4) gravelly clay loam; massive; firm; few fine roots; slightly acid; abrupt irregular boundary.

IIIC—50 to 60 inches; dark brown (10YR 4/3) stratified sand and gravel; single grain; very friable; strong effervescence; moderately alkaline.

The solum is 40 to 60 inches thick. The loess is 0 to 24 inches thick. The depth to carbonates ranges from 32 to 60 inches, and the depth to underlying stratified gravel and sand is 40 to 60 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly silt loam, but the range includes loam. The A horizon is medium acid or slightly acid.

The B2t horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or silty clay loam, and it is strongly acid or medium acid.

The IIB2t horizon has hue of 10YR to 5YR, value of 3 to 5, and chroma of 3 to 6.

Orrville series

The Orrville series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. The soils formed in loamy alluvium. Slopes range from 0 to 2 percent. These soils have a slightly thinner solum and a slightly higher pH than defined for the series, and they appear to have a weakly developed cambic horizon. These differences do not alter the use or behavior of the soil.

Orrville soils are adjacent to Chagrin soils. Chagrin soils do not have gray mottles in the upper part of the subsoil, and they are on narrow bottom land adjacent to stream channels.

Typical pedon of Orrville silt loam, in a cultivated field, 500 feet north and 600 feet west of the southeast corner of sec. 34, T. 9 N., R. 13 E.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; common fine faint grayish brown (10YR 5/2) mottles; moderate fine and medium granular structure; friable; many fine roots; few fine dark brown (7.5YR 4/4) stains; slightly acid; abrupt smooth boundary.

B1—8 to 13 inches; brown (10YR 5/3) silt loam; common fine faint grayish brown (10YR 5/2) and few faint pale brown (10YR 6/3) mottles; weak thick platy structure; friable; common fine roots; few fine dark brown (7.5YR 4/4) stains; slightly acid; clear smooth boundary.

B2—13 to 25 inches; grayish brown (10YR 5/2) silt loam; many fine faint brown (10YR 5/3) and pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure parting to moderate medium granular; friable; few fine roots; many fine dark brown (7.5YR 4/4) stains; neutral; clear smooth boundary.

C1—25 to 29 inches; grayish brown (10YR 5/2) silt loam; few fine faint brown (10YR 5/3) and pale brown (10YR 6/3) mottles; massive; friable; few fine roots; few fine dark brown (7.5YR 4/4) stains; neutral; gradual smooth boundary.

C2—29 to 41 inches; grayish brown (10YR 5/2) loam; few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few fine roots; few fine dark brown (7.5YR 4/4) stains; neutral; clear smooth boundary.

C3—41 to 48 inches; grayish brown (10YR 5/2) loamy sand; massive; very friable; few fine dark brown (7.5YR 4/4) stains; a few thin strata of dark gray (10YR 4/1) loam; neutral; clear smooth boundary.

C4—48 to 60 inches; gray (10YR 5/1) stratified loam, sandy loam, and gravel; few medium olive brown (2.5Y 4/4) mottles; massive; very friable; few fine soft calcium carbonate accumulations; slight effervescence; mildly alkaline.

The solum is 24 to 50 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from medium acid to neutral.

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is loam or silt loam and is medium acid or slightly acid. This horizon is not present in some pedons.

The C horizon to a depth of 40 inches has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It ranges from medium acid to neutral.

Pate series

The Pate series consists of deep, well drained, very slowly permeable soils on hillsides on uplands. The soils formed in residuum of interbedded limestone and gray calcareous shale. The residuum is mostly shale (fig.11). Slopes range from 12 to 25 percent.

Figure 11.—Profile of Pate silt loam, 12 to 18 percent slopes, eroded. The volume of limestone fragments increases with depth throughout the clayey subsoil, but shale predominates.

Pate soils are similar to Eden soils, and they are adjacent to Eden and Markland soils. Eden soils are moderately deep and formed in residuum that has a higher percentage of limestone than Pate soils. They are on hillsides on uplands. Markland soils formed in a thin deposit of loess and the underlying calcareous clayey lacustrine sediments. They are on high terraces.

Typical pedon of Pate silt loam, 18 to 25 percent slopes, eroded, in a cultivated field, 900 feet east and 900 feet south of the northwest corner of sec. 33, T. 4 N., R. 2 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—6 to 14 inches; dark brown (10YR 4/3) silty clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common fine roots; patchy very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; clear smooth boundary.

B22t—14 to 21 inches; dark brown (10YR 4/3) silty clay loam; moderate coarse prismatic structure parting to moderate coarse subangular and angular blocky; firm; common fine roots; discontinuous dark brown (7.5YR 3/2) clay films on faces of all peds; slightly acid; clear smooth boundary.

B23t—21 to 27 inches; dark brown (10YR 4/3) silty clay; moderate coarse prismatic structure parting to moderate coarse blocky; very firm; common fine roots; discontinuous dark brown (10YR 3/3) clay films on faces of all peds; few fine black (N 2/0) iron and manganese oxide concretions; slightly acid; clear smooth boundary.

B24t—27 to 36 inches; dark yellowish brown (10YR 4/4) silty clay; weak medium prismatic structure parting to medium angular blocky; very firm; fine roots; continuous dark brown (10YR 4/3) clay films on faces of peds; common fine black (N 2/0) iron and manganese oxide concretions; neutral; clear wavy boundary.

B31t—36 to 52 inches; light olive brown (2.5Y 5/4) channery silty clay; moderate medium subangular blocky structure; firm; few fine roots; discontinuous grayish brown (2.5Y 5/2) and dark grayish brown (10YR 4/2) clay films on faces of peds; 15 percent limestone rock fragments (5 percent greater than 3 inches); strong effervescence; moderately alkaline; clear wavy boundary.

B32—52 to 66 inches; light olive brown (2.5Y 5/4) channery silty clay loam; weak medium subangular blocky structure; firm; olive gray (5Y 5/2) films on faces of peds; 25 percent rock fragments (10 percent greater than 3 inches); strong effervescence; moderately alkaline; clear wavy boundary.

B33—66 to 72 inches; pale olive (5Y 6/4) and gray (5Y 6/1) flaggy silty clay; weak medium subangular and

angular blocky structure; very firm; 35 percent rock fragments (20 percent greater than 3 inches); strong effervescence; moderately alkaline.
Cr—72 to 80 inches; interbedded limestone and gray calcareous shale.

The solum is 50 to 72 inches thick. Coarse fragments make up 10 to 50 percent of the lower part of the solum.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. It is dominantly silt loam, but the range includes silty clay loam. The A horizon ranges from medium acid to neutral.

The B1 horizon, if present, has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. It ranges from medium acid to neutral.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is flaggy silty clay, flaggy clay, silty clay loam, silty clay, or clay. It ranges from medium acid to neutral.

The B3 horizon has hue of 2.5Y or 5Y, value of 4 to 7, and chroma of 1 to 6. It is flaggy silty clay, flaggy clay, channery silty clay loam, channery silty clay, channery clay, silty clay, or clay. It ranges from neutral to moderately alkaline.

Rahm series

The Rahm series consists of deep, somewhat poorly drained, slowly permeable soils on high bottoms or low terraces. The soils formed in alluvium overlying buried soils that formed in acid alluvium. Slopes range from 0 to 2 percent.

Rahm soils are adjacent to Huntington and Newark soils. Huntington and Newark soils are less acid below a depth of 36 inches than Rahm soils and Huntington soils do not have gray mottles in the upper part of the subsoil. They are on bottom lands along the Ohio River.

Typical pedon of Rahm silt loam, in a cultivated field, 750 feet north and 1,200 feet east of the center of sec. 26. T. 4 N., R. 1 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.
A12—8 to 11 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; common fine faint dark grayish brown (10YR 4/2) mottles; weak medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.
B21g—11 to 15 inches; grayish brown (10YR 5/2) silt loam; weak medium subangular blocky structure; friable; few fine roots; patchy grayish brown (10YR 5/2) silt film on faces of peds; neutral; clear smooth boundary.
B22g—15 to 23 inches; grayish brown (10YR 5/2) silt loam; many fine and medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; patchy grayish brown (10YR 5/2) silt films on faces of peds; slightly acid in upper part and strongly acid in lower part; gradual smooth boundary.
IIB23gb—23 to 48 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few fine roots; patchy grayish brown (10YR 5/2) silt and clay films on faces of peds; few fine very dark brown (10YR 2/2) accumulations; very strongly acid; gradual smooth boundary.
IIC—48 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; many fine faint grayish brown (10YR 5/2) mottles; massive; firm; common fine very dark brown (10YR 2/2) accumulations; medium acid.

The solum is 45 to 72 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is slightly acid or neutral.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4, and it is distinctly mottled. It is silt loam or silty clay loam. It is slightly acid or neutral except in the lower part, where it is strongly acid or medium acid.

The IIB2 horizon has hue of 10YR, 7.5 YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is distinctly mottled. It is silt loam, silty clay loam, or silty clay.

The IIC horizon, in most pedons, is stratified silt loam, silty clay loam, or silty clay.

Rodman series

The Rodman series consists of deep, excessively drained, very rapidly permeable soils. The soils formed in calcareous loamy material over loose, stratified, gravelly sand and sand. Slopes range from 40 to 60 percent.

Rodman soils are similar to Fox soils, and they are adjacent to Fox and Ockley soils. Fox soils formed in loamy outwash over the underlying gravelly sand and sand. Ockley soils formed in thin loess and loamy outwash over the underlying gravelly sand and sand. Fox and Ockley soils are on outwash terraces.

Typical pedon of Rodman sandy loam, 40 to 60 percent slopes, in a wooded area, 580 feet west and 740 feet south of the center of sec. 11, T. 7 N., R. 1 W.

O1—1/2 inch to 0; loose undecomposed leaves and twigs from mixed hardwoods.
A1—0 to 5 inches; very dark gray (10YR 3/1) sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; very friable; many fine and medium roots; slight effervescence; mildly alkaline; abrupt smooth boundary.
B2—5 to 13 inches; dark brown (10YR 3/3) sandy loam; weak medium subangular blocky structure; very friable; common medium and coarse roots; 5 to 10

percent gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.

C—13 to 60 inches; yellowish brown (10YR 5/4) gravelly sand and strata of gravel; single grain; loose; few fine and medium roots; 35 to 50 percent gravel; strong effervescence; moderately alkaline.

The solum is 8 to 15 inches thick. The depth to underlying stratified gravel, gravelly sand, and sand ranges from 8 to 15 inches.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is neutral or mildly alkaline.

The B2 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is sandy loam, gravelly loam, or loam.

Rossmoyne series

The Rossmoyne series consists of deep, moderately well drained soils on till plains. The soils are slowly permeable in and below the fragipan. They formed in loess and the underlying loamy glacial till. Slopes range from 0 to 6 percent.

Rossmoyne soils are similar to Avonburg and Cincinnati soils, and they are adjacent to these soils. Avonburg soils have more gray mottles in the upper part of the subsoil than Rossmoyne soils, and they are on ridgetops on till plains. Cincinnati soils have fewer gray mottles in the upper part of the subsoil, and they are on narrow ridgetops and hillsides.

Typical pedon of Rossmoyne silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 660 feet north and 1,430 feet west of the center of sec. 35, T. 7 N., R. 3 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; common medium faint yellowish brown (10YR 5/4) mottles; weak thick platy structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B1—7 to 15 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; discontinuous very pale brown (10YR 7/3) silt films on faces of peds; few fine very dark brown (10YR 2/2) iron and manganese oxide accumulations; very strongly acid; clear smooth boundary.

B2t—15 to 23 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine and medium roots; patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; thin discontinuous very pale brown (10YR 7/3) silt films on faces of peds; few fine very dark brown (10YR 2/2) iron and manganese oxide concretions; very strongly acid; gradual smooth boundary.

Bx1—23 to 31 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct yellowish brown (10YR 5/8) and common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium subangular and angular blocky; extremely firm; very brittle; few fine and medium roots in channels; discontinuous gray (10YR 5/1) clay films in channels and patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; continuous very pale brown (10YR 7/3) silt films on faces of peds; few fine very dark brown (10YR 2/2) iron and manganese oxide concretions; very strongly acid; gradual wavy boundary.

IIBx2—31 to 66 inches; yellowish brown (10YR 5/6) loam; many coarse distinct gray (10YR 6/1) mottles; strong very coarse prismatic structure parting to moderate medium angular and subangular blocky; extremely firm; very brittle; few fine roots in channels; gray (10YR 5/1) clay flows in channels and thin discontinuous gray (10YR 5/1) clay films on faces of peds; few fine very dark brown (10YR 2/2) iron and manganese oxide concretions; few till pebbles; strongly acid; clear wavy boundary.

IIB3—66 to 80 inches; gray (10YR 6/1) clay loam; many medium distinct yellowish brown (10YR 5/4) and common medium distinct yellowish brown (10YR 5/8) mottles; massive; firm; few fine very dark brown (10YR 2/2) iron and manganese oxide concretions; few till pebbles; slightly acid.

The solum is 60 to 96 inches thick. The loess is 18 to 40 inches thick. The depth to the fragipan ranges from 22 to 30 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from strongly acid to neutral.

The B2t horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6, and it is distinctly mottled. It is silt loam or silty clay loam and is very strongly acid or strongly acid.

The Bx and IIBx horizons have hue of 10YR, value of 4 or 5, and chroma of 4 to 6, and they are distinctly mottled. They are loam, silt loam, clay loam, or silty clay loam.

The IIB3 horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 4 to 6, and chroma of 1 to 6, and it is distinctly mottled. It is loam, silty clay loam, or clay loam, and it is medium acid to neutral.

Russell series

The Russell series consists of deep, well drained, moderately permeable soils on loess-covered till plains. The soils formed in loess and the underlying loamy glacial till. Slopes range from 1 to 4 percent.

Russell soils are similar to Fincastle soils and are adjacent to Hennepin soils. Unlike Russell soils, Fincastle soils have gray mottles in the upper part of the subsoil. Hennepin soils are very steep and have a solum that has less silt and is thinner than that of Russell soils.

Typical pedon of Russell silt loam, in an area of Russell-Fincastle silt loams, 1 to 4 percent slopes, in a

mixed hardwood forest, 600 feet east and 1,700 feet north of the southwest corner of sec. 12, T. 7 N., R. 1 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many fine roots; medium acid; clear smooth boundary.
A2—5 to 9 inches; light yellowish brown (10YR 6/4) silt loam; weak medium platy structure; friable; common fine roots; medium acid; clear smooth boundary.
B1—9 to 15 inches; brownish yellow (10YR 6/6) silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; patchy yellowish brown (10YR 5/6) clay films on surface of peds; patchy very pale brown (10YR 7/4) silt films on faces of peds; strongly acid; clear wavy boundary.
B21t—15 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine and medium roots; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; discontinuous very pale brown (10YR 7/4) silt films on faces of peds; strongly acid; gradual wavy boundary.
B22t—23 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; common medium prominent yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine irregular black (10YR 2/1) accumulations; medium acid; gradual wavy boundary.
IIB3t—30 to 42 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct yellowish red (5YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few fine and medium roots; continuous dark brown (10YR 4/3) clay films on faces of peds; few fine irregular black (10YR 2/1) accumulations; slightly acid; clear wavy boundary.
IIC—42 to 60 inches; yellowish brown (10YR 5/4) clay loam; massive; firm; violent effervescence; moderately alkaline.

The solum is 40 to 70 inches thick. The loess is 22 to 40 inches thick, and the depth to carbonates ranges from 40 to 70 inches.

The A1 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It ranges from medium acid to neutral.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam.

The IIC horizon is loam or clay loam and is mildly alkaline or moderately alkaline.

Stonelick series

The Stonelick series consists of deep, well drained soils on flood plains. The soils formed in loamy calcareous alluvium. They are moderately rapidly permeable. Slopes range from 0 to 2 percent.

Stonelick soils are similar to Chagrin and Jules soils, and they are adjacent to Chagrin soils. Chagrin soils formed in alluvium that had more clay and was more acid than that of Stonelick soils. They are on narrow bottom land adjacent to stream channels. Jules soils formed in alluvium that had less sand and more silt.

Typical pedon of Stonelick sandy loam, in a cultivated field, 580 feet south and 1,900 feet east of the northwest corner of sec. 13, T. 7 N., R. 1 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.
C1—10 to 23 inches; dark grayish brown (10YR 4/2) sandy loam; weak coarse subangular blocky structure; very friable; patchy very dark grayish brown (10YR 3/2) organic stains; strong effervescence; moderately alkaline; gradual wavy boundary.
C2—23 to 34 inches; dark brown (10YR 4/3) sand loam; weak medium subangular blocky structure; very friable; patchy very dark grayish brown (10YR 3/2) organic stains; strong effervescence; moderately alkaline; abrupt wavy boundary.
C3—34 to 50 inches; brown (10YR 5/3) stratified silt loam and loamy sand; massive; very friable; strong effervescence; moderately alkaline; abrupt wavy boundary.
C4—50 to 60 inches; brown (10YR 5/3) loamy sand; single grain; loose; strong effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is dominantly sandy loam, but the range includes loam. The A horizon is neutral or mildly alkaline.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loamy sand, sandy loam, loam, or silt loam.

Switzerland series

The Switzerland series consists of deep, well drained soils on ridgetops and hillsides on uplands. The soils formed in loess and in the residuum from underlying interbedded limestone and gray calcareous shale, but mostly from shale. The permeability is moderate in the upper part of the solum and slow in the lower part of the solum. Slopes range from 2 to 18 percent.

Switzerland soils are similar to Carmel soils, and they are adjacent to Carmel and Weisburg soils. Carmel soils formed in a thinner deposit of loess and have a thinner solum than Switzerland soils. They are on narrow ridgetops and hillsides on uplands. Cincinnati soils

formed in loess and till, have a fragipan, and are on narrow ridgetops and hillsides on till plains.

Typical pedon of Switzerland silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 800 feet south and 2,000 feet east of the northwest corner of sec. 33, T. 4 N., R. 2 W.

Ap—0 to 7 inches; brown (10YR 5/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B1—7 to 11 inches; strong brown (7.5YR 5/6) and brown (10YR 5/3) silt loam; weak medium subangular blocky structure; friable; common fine roots; medium acid; clear smooth boundary.

B2t—11 to 24 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; discontinuous dark brown (7.5YR 4/4) clay films and brown (10YR 5/3) silt films on faces of peds; very strongly acid; gradual smooth boundary.

A&B—24 to 28 inches; light yellowish brown (10YR 6/4) and dark brown (7.5YR 4/4) silt loam; weak medium and fine subangular blocky structure; firm; common fine roots; few fine concretions; very strongly acid; clear smooth boundary.

IIB2t—28 to 44 inches; yellowish brown (10YR 5/6) clay; few medium prominent light brownish gray (10YR 6/2) mottles; strong very coarse prismatic structure; very firm; few fine roots; discontinuous dark yellowish brown (10YR 4/6) clay films on faces of peds and linings of voids; very strongly acid; diffuse wavy boundary.

IIC—44 to 60 inches; brownish yellow (10YR 6/6) clay; many fine distinct light brownish gray (10YR 6/2) mottles; massive; extremely firm; many fine and medium black (N 2/0) concretions in the lower part; medium acid.

The solum is 40 to 70 inches thick. The loess is 18 to 30 inches thick, and the depth to interbedded limestone and calcareous shale ranges from 60 to more than 70 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It ranges from strongly acid to neutral.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam and is very strongly acid or strongly acid. In pedons that have an A&B horizon, it has value of 4 to 7 and chroma of 3 to 6.

The IIB2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 8. It is silty clay or clay. It is medium acid to very strongly acid in the upper part, and it is slightly acid to moderately alkaline in the lower part.

The IIC horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 to 6. It is flaggy clay, silty clay, or clay.

Weisburg series

The Weisburg series consists of deep, well drained soils on ridgetops and hillsides on till plains. The soils formed in loess, till, and the underlying residuum from interbedded limestone and gray calcareous shale. They are moderately permeable above the fragipan, and they are very slowly permeable in and below the fragipan. Slopes range from 2 to 12 percent.

Weisburg soils are similar to Cincinnati soils, and they are adjacent to Switzerland soils. Cincinnati soils formed in loess and till and have a thicker fragipan and are deeper to residuum than Weisburg soils. Switzerland soils formed in loess and the underlying interbedded limestone and shale, and they do not have a fragipan. They are on narrow ridgetops and hillsides on uplands.

Typical pedon of Weisburg silt loam, 2 to 6 percent slopes, eroded, in a cultivated field, 400 feet north and 950 feet east of the southwest corner of sec. 30, T. 6 N., R. 2 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; many medium prominent strong brown (7.5YR 5/6) mottles; weak medium platy structure parting to weak fine granular; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—7 to 10 inches; strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; patchy dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear smooth boundary.

B22t—10 to 16 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; patchy pale brown (10YR 6/3) silt films and discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

B23t—16 to 24 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium angular and subangular blocky structure; firm; few fine roots; discontinuous pale brown (10YR 6/3) and discontinuous yellowish brown (10YR 5/4) silt films on faces of peds; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bx1—24 to 28 inches; brown (7.5YR 5/4) silty clay loam; strong very coarse prismatic structure parting to moderate medium angular blocky; very firm; very brittle; discontinuous pale brown (10YR 6/3) silt films on vertical faces of prisms; discontinuous dark brown (7.5YR 4/4) and patchy brown (10YR 5/3) clay films on faces of secondary peds; very strongly acid; gradual wavy boundary.

IIBx2—28 to 39 inches; yellowish brown (10YR 5/4) clay loam; strong very coarse prismatic structure parting to moderate medium angular blocky; very firm; very brittle; discontinuous light brownish gray (10YR 6/2)

and grayish brown (10YR 5/2) silt films on vertical faces of prisms; discontinuous yellowish red (5YR 5/6) clay films on faces of secondary peds; 5 percent gravel less than 1 inch in diameter; very strongly acid; gradual wavy boundary.

IIB24tb—39 to 64 inches; strong brown (7.5YR 5/6) silty clay; moderate medium angular and subangular blocky structure; very firm; discontinuous reddish brown (5YR 5/4) and patchy brown (10YR 5/3) clay films on faces of peds; few yellowish brown (10YR 5/6) slickensides at nearly a vertical angle and about 2 inches in diameter; 3 percent gravel less than 1 inch in diameter; medium acid; gradual wavy boundary.

IIB25tb—64 to 69 inches; strong brown (7.5YR 5/6) silty clay; few medium faint yellowish brown (10YR 5/8) mottles; weak medium angular and subangular blocky structure; very firm; patchy light brownish gray (10YR 6/2) clay films on faces of peds; 3 percent gravel less than 1 inch in diameter; slightly acid; gradual wavy boundary.

IIIB3b—69 to 80 inches; yellowish brown (10YR 5/8) clay; many large distinct light gray (10YR 7/1) mottles; massive; very firm; neutral; gradual wavy boundary.

The solum is more than 80 inches thick. The loess is 22 to 40 inches thick. The depth to clay residuum ranges from 48 to 72 inches, and the depth to the fragipan ranges from 12 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It ranges from strongly acid to neutral.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is very strongly acid to slightly acid.

The Bx and IIBx horizons have value of 4 or 5 and chroma of 3 to 6. They are loam, silt loam, silty clay loam, or clay loam.

The IIB2tb horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8, and it is mottled. It is clay loam, silty clay, or clay. This horizon is not present in some pedons.

The IIIB3b horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 4 to 8, and it is mottled. It is silty clay or clay.

Wheeling series

The Wheeling series consists of deep, well drained, moderately permeable soils on river terraces. The soils formed in silty and loamy material. Slopes range from 0 to 2 percent.

Wheeling soils are similar to Fox and Ockley soils, and they are adjacent to Rahm soils. Fox and Ockley soils are less acid in the subsoil and below the subsoil, and they are on higher terrace positions than Wheeling soils. Rahm soils have more silt in the subsoil than Wheeling soils do, and they are on high bottom or low terrace positions near the Ohio River. Also, Rahm soils have gray mottles in the upper part of the subsoil.

Typical pedon of Wheeling silt loam, 0 to 2 percent slopes, in a cultivated field, 2,390 feet east and 625 feet south of the northwest corner of sec. 2, T. 3 N., R. 1 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and moderate granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

B1—8 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; few fine roots; medium acid; clear smooth boundary.

B21t—13 to 30 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous dark brown (7.5Y 4/4) clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—30 to 50 inches; yellowish brown (10YR 5/6) silt loam; moderate coarse subangular blocky structure; friable; few fine roots; discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; patchy pale brown (10YR 6/3) silt streaks; strongly acid; gradual wavy boundary.

IIB3—50 to 57 inches; yellowish brown (10YR 5/6) loam and thin lenses of light yellowish brown (10YYR 6/4) fine sandy loam; weak moderate and coarse subangular blocky structure; friable; strongly acid; gradual wavy boundary.

IIC—57 to 60 inches; yellowish brown (10YR 5/6) silt loam and thin lenses of loam and fine sandy loam; massive; friable; strongly acid.

The solum is 40 to 60 inches thick. The depth to stratified layers ranges from 40 to 60 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from strongly acid to neutral.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, silt loam, or silty clay loam.

The IIC horizon is stratified loam, loamy fine sand, fine sandy loam, or silt loam.

formation of the soils

This section discusses the major factors of soil formation and their degree of importance in the formation of the soils in the survey area.

factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point in its development are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. Relief conditions the effects of climate and plant and animal life. The parent material also affects the kind of soil profile that forms. In extreme cases it determines profile formation almost entirely. Finally, it takes time to change the parent material into a soil profile. It may be a long time or a short time, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are closely interrelated in their effects on the soil. Few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

parent material

A soil forms in the unconsolidated mass called parent material. Glaciers or melt water from the glaciers deposited the parent materials of some of the soils. Subsequent actions of water and wind reworked and redeposited some of these materials. Most of these glaciers covered the area about 100,000 years ago. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Dearborn and Ohio Counties are glacial till, outwash deposits, lacustrine deposits, alluvium, organic material, and interbedded limestone and calcareous shale.

Glacial till is material that glaciers have laid down directly with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, an indication that water washing has not worn them. The glacial till in Dearborn and Ohio Counties is acid and firm. It is clay loam, silty clay, or clay. Rossmoyne soils formed in glacial till, for example. Typically, these soils are medium textured and have a well-developed structure.

Outwash material was deposited by running water from melting glaciers. The size of the particles that make up the outwash deposits varies according to the speed of the water that carried them. As the water slowed it deposited the coarser particles first and then the finer particles, for example, very fine sand, silt, and clay. Outwash deposits generally consist of layers of particles of similar size. Sandy loam, sand, gravel, and other coarse particles are dominant. The Fox soils, for example, formed in outwash material.

Lacustrine materials were deposited by still, or ponded, glacial melt water. The coarser fragments drop out of moving water as outwash. Hence, only the fine particles, for example, very fine sand, silt, and clay, remain to settle out in still water. Lacustrine deposits are silty or clayey. In Dearborn and Ohio Counties soils formed in lacustrine deposits are typically fine. The Markland soils, for example, formed in lacustrine materials.

Alluvium was recently deposited by floodwaters of present-day streams. The texture of this material depends on the speed of the water that deposited it. The alluvial material deposited along the swift Whitewater River, for example, is coarser textured than the material deposited along the slower, more sluggish Ohio River Examples of alluvial soils are the Stonelick and Huntington soils.

In unglaciated areas, the soils formed in material weathered from the underlying bedrock. The bedrock in Dearborn and Ohio Counties is sedimentary rock of Ordovician age. This rock consists of limestone and calcareous shale, in alternate layers, that are highly fossilized. In areas where the rock was exposed at the surface, it has weathered to clayey material from which several soils have formed.

There are three formations directly related to some of the soils in the survey area. These formations have a

gentle, downward tilt toward the west. They differ mainly in the proportion of limestone and shale. The Saluda Member has the highest proportion of limestone. It is at higher elevations in the western part of the area and is covered mostly with glacial till. The Dillsboro Formation consists of shale interbedded with some limestone (fig. 12). The Eden, Carmel, and Switzerland soils formed in this material. The Kope Formation consists almost entirely of shale and a very small amount of limestone. This formation is at lower elevations near the Ohio River and its tributaries. The Pate soils formed in this material.

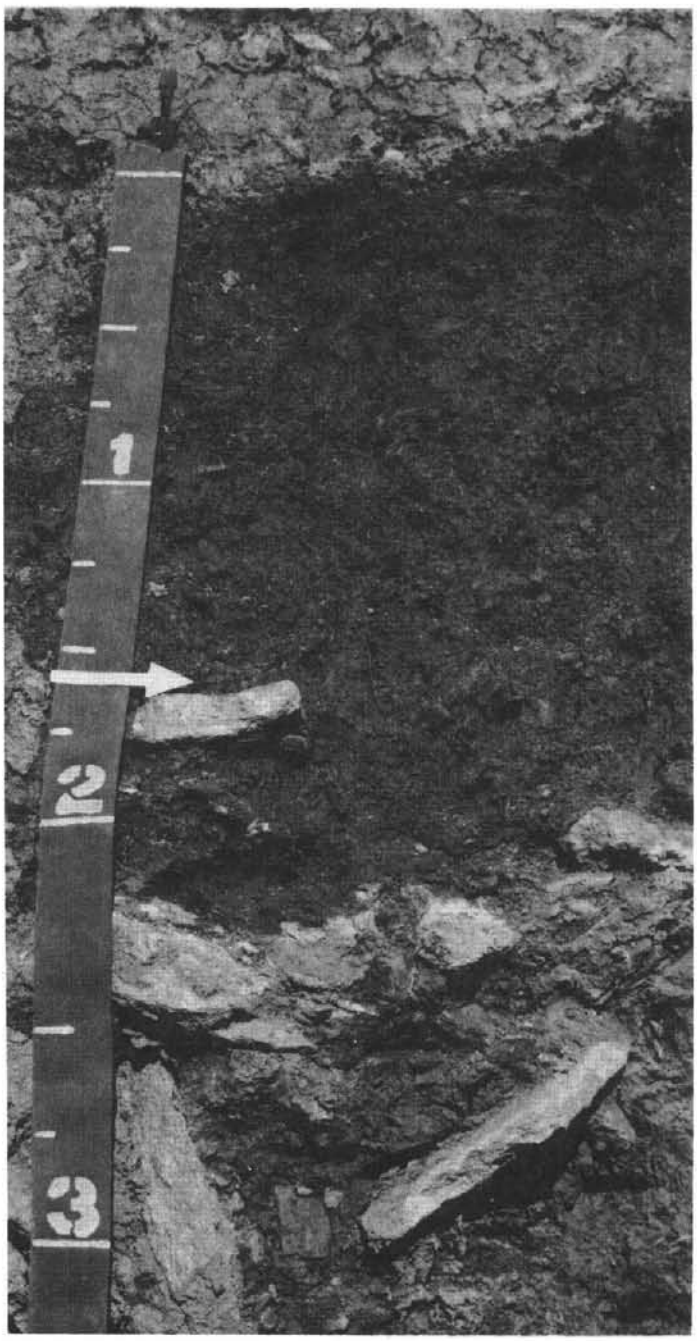

Figure 12.—Interbedded limestone and calcareous shale in the Dillsboro Formation, which is of Ordovician age.

plant and animal life

Plants have been the principal organism influencing the soils. Bacteria, fungi, earthworms, and the activities of man have also been important. Chiefly, plant and animal life has added organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind of plants that grew on the soil. The remains of these plants accumulate in the surface layer, decay, and eventually become organic matter. Plant roots provide channels for the downward movement of water and add organic matter to the soil when they decay. Growing plants use the organic matter in the soil that the bacteria helps to break down.

The original plant community in the survey area was mainly deciduous forest. Differences in natural soil drainage and minor changes in parent material have affected the composition of the forest species.

In general, the well drained upland soils, for example, the Eden and Cincinnati soils, were mainly covered with sugar maple, hickory, white oak, and red oak. The wet soils were covered primarily with beech, sweet gum, black gum, and pin oak.

climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for weathering minerals and transporting soil materials. Climate influences temperatures of the soil, which determine the rate of chemical reactions in the soil. Climate affects large areas rather than a relatively small area, for example, a county.

The climate in Dearborn and Ohio Counties is cool and humid. Presumably it is similar to that which existed when the soils formed. The soils in Dearborn and Ohio Counties differ from soils formed in a dry, warm climate or from those that formed in a hot, moist climate. Climate is uniform throughout the area, although its effect is modified locally by runoff, direction of slope, steepness of slope, and proximity to the Ohio River. Therefore, the differences in the soils are, to a minor extent, the result of the differences in climate. For more detailed information on the climate of this area, see the section "General nature of the area."

relief

Relief, or topography, has a marked influence on the soils through its influence on natural drainage, erosion, plant cover, and soil temperature. Slope ranges from 0 to 60 percent. The soils range from well drained on the hillsides to poorly drained on the broad, flat ridges.

Relief influences the formation of soils by affecting

runoff and drainage. Drainage in turn, through its effect on aeration of the soil, determines the color of the soil. Runoff is greatest on the steeper slopes, but on broad, flat ridges, water drains off slowly. Water and air move freely through well drained soils and slowly through poorly drained soils. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized, and in poorly aerated soils their color is dull gray and mottled. For example, the Bonnell soils are well drained and well aerated and the Clermont soils are poorly drained and poorly aerated.

time

It generally takes a long time for distinct horizons to form in the soil. The development of the soil profile reflects the time that the parent materials have been in place. Some soils develop rapidly, others slowly.

The soils in Dearborn and Ohio Counties range from young to mature. Many soils have distinct horizons because they formed in glacial deposits that have been exposed to soil-forming factors for a long enough time. Soils that are forming in recent alluvial sediment have not been in place long enough for distinct horizons to develop. The Jules soils, for example, are young soils that formed in alluvial material.

The Markland and Cincinnati soils, in contrast, show the effect of leaching of lime from the soil over a period of time. The solum of the Markland and Cincinnati soils at one time had about the same amount of lime as the underlying material of these soils has today. The Markland soils were not leached of lime because they were under glacial lake water. In contrast, the Cincinnati soils were above water and subject to leaching. The Cincinnati soils are leached of lime to a depth of more than 10 feet. On the other hand, the Markland soils are calcareous at a depth of 29 inches.

processes of soil formation

The processes involved in the formation of the soils in these counties are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils. The organic matter content of some soils is low, but that of other soils is high. Generally, the soils that have the most organic matter, like Dearborn and Huntington soils, have a thick dark surface layer or A horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils. Leaching is generally believed to precede the translocation of silicate clay minerals. Almost all the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, the absence of carbonates and an acid reaction indicates some leaching. Wet soils are leached slowly because of high water tables or because water moves slowly through wet soils.

Clay accumulates in pores and other voids and forms clay films on the surface. Water moves along the surface. Leaching of bases and translocation of silicate clays are important processes in horizon differentiation in the soils. The Switzerland soils are examples of soils in which translocated silicate clays have accumulated in the IIB2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, has occurred in all of the poorly drained and somewhat poorly drained soils. In the naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by the transfer of some of the iron, either from upper to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate segregation of iron.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (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 moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

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

Bottom land. The normal flood plain of a stream, subject to flooding.

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

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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 oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

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

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.
Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.
Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.
Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles and dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray or dull colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group

D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

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

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded 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 of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

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

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can

damage roads, dams, building foundations, and other structures. It can also damage plant roots.

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

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and 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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

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

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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, silt loam, 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."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Brookville, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	38.0	17.7	27.9	66	-12	19	2.64	1.23	3.79	5	4.9
February	40.9	19.7	30.3	68	-5	22	2.35	1.03	3.41	5	3.4
March	50.4	27.3	38.9	80	7	119	3.59	1.89	4.97	7	4.1
April	64.0	38.1	51.1	86	20	339	3.90	2.19	5.29	8	.3
May	74.1	47.3	60.7	91	27	642	4.53	2.39	6.27	8	.0
June	82.4	57.0	69.7	95	41	891	4.09	2.49	5.52	6	.0
July	85.8	61.0	73.4	96	47	1,035	4.78	3.12	6.28	7	.0
August	84.9	58.6	71.8	96	45	986	3.07	1.55	4.30	5	.0
September	79.7	51.3	65.5	96	33	765	2.79	1.21	4.07	6	.0
October	68.4	39.3	53.8	87	20	432	2.29	1.00	3.33	5	.0
November	53.1	30.1	41.6	78	8	100	2.88	1.56	3.96	6	1.9
December	41.6	22.1	31.9	69	-5	55	2.90	1.34	4.15	6	3.1
Year	63.6	39.1	51.4	99	-13	5,405	39.81	35.48	43.99	74	17.7

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Brookville, Indiana]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 18	May 6	May 16
2 years in 10 later than--	April 14	May 1	May 11
5 years in 10 later than--	April 6	April 22	May 1
First freezing temperature in fall:			
1 year in 10 earlier than--	October 16	October 11	September 29
2 years in 10 earlier than--	October 20	October 15	October 2
5 years in 10 earlier than--	October 29	October 22	October 9

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Brookville, Indiana]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32°F
	Days	Days	Days
9 years in 10	190	166	145
8 years in 10	195	172	150
5 years in 10	205	182	160
2 years in 10	214	192	170
1 year in 10	219	198	175

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent of area	Cultivated crops	Specialty crops	Woodland	Urban uses	Intensive recreation areas	Extensive recreation areas
	Pct						
1. Jules-Stonelick-Chagrin	3	Good	Poor: flooding.	Good	Poor: flooding.	Poor: flooding.	Good.
2. Huntington-Markland-Ockley	5	Good	Good	Good	Poor: flooding, high shrink-swell.	Good	Good.
3. Avonburg-Clermont	6	Good	Poor: wetness.	Fair: wetness.	Poor: wetness.	Poor: wetness.	Fair: wetness.
4. Cincinnati-Rossmoyne-Bonnell	24	Good	Fair: slope.	Good	Good	Fair: slow, permeability, slope.	Good:
5. Eden-Carmel	62	Poor: slope.	Poor: slope.	Fair: slope.	Poor: slope.	Poor: slope.	Fair: slope.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Dearborn County	Ohio County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
AvA	Avonburg silt loam, 0 to 2 percent slopes	6,569	628	7,197	2.9
BaA	Bartle silt loam, 0 to 3 percent slopes	99	246	345	0.1
BeC2	Bonnell silt loam, 6 to 12 percent slopes, eroded	1,014	68	1,082	0.4
BeC3	Bonnell silt loam, 6 to 12 percent slopes, severely eroded	497	46	543	0.2
BeD2	Bonnell silt loam, 12 to 18 percent slopes, eroded	4,206	330	4,536	1.8
BeD3	Bonnell silt loam, 12 to 18 percent slopes, severely eroded	5,886	673	6,559	2.6
BeE	Bonnell silt loam, 18 to 35 percent slopes	2,846	1,368	4,214	1.7
CaC2	Carmel silt loam, 6 to 12 percent slopes, eroded	258	230	488	0.2
CaD2	Carmel silt loam, 12 to 18 percent slopes, eroded	10,719	2,601	13,320	5.3
CaE2	Carmel silt loam, 18 to 25 percent slopes, eroded	1,267	617	1,884	0.7
CcC3	Carmel silty clay loam, 6 to 12 percent slopes, severely eroded	137	95	232	0.1
CcD3	Carmel silty clay loam, 12 to 18 percent slopes, severely eroded	12,888	2,164	15,052	6.0
CcE3	Carmel silty clay loam, 18 to 25 percent slopes, severely eroded	639	215	854	0.3
Ch	Chagrin silt loam	900	546	1,446	0.6
CnB2	Cincinnati silt loam, 2 to 6 percent slopes, eroded	7,298	1,255	8,553	3.4
CnC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded	3,500	450	3,950	1.6
CnC3	Cincinnati silt loam, 6 to 12 percent slopes, severely eroded	2,609	394	3,003	1.2
Ct	Clermont silt loam	4,833	127	4,960	2.0
De	Dearborn silt loam	1,942	276	2,218	0.9
Df	Dearborn flaggy loam	1,192	573	1,765	0.7
EcE2	Eden silty clay loam, 15 to 25 percent slopes, eroded	8,638	4,129	12,767	5.1
EdE3	Eden flaggy silty clay loam, 15 to 25 percent slopes, severely eroded	11,260	1,571	12,831	5.1
EdF	Eden flaggy silty clay loam, 25 to 50 percent slopes	42,155	18,072	60,227	23.9
EkA	Elkinsville silt loam, 0 to 2 percent slopes	75	305	380	0.2
EkB2	Elkinsville silt loam, 2 to 6 percent slopes, eroded	139	181	320	0.1
EkC2	Elkinsville silt loam, 6 to 12 percent slopes, eroded	184	126	310	0.1
FoB2	Fox silt loam, 1 to 4 percent slopes, eroded	379	266	645	0.3
HcG	Hennepin loam, 40 to 60 percent slopes	202	0	202	0.1
Hu	Huntington silt loam	3,353	2,421	5,774	2.3
Ju	Jules silt loam	1,756	453	2,209	0.9
MaB2	Markland silt loam, 2 to 12 percent slopes, eroded	588	203	791	0.3
MaF2	Markland silt loam, 18 to 35 percent slopes, eroded	304	186	490	0.2
MbD3	Markland silty clay loam, 6 to 18 percent slopes, severely eroded	327	258	585	0.2
Ne	Newark silt loam	159	298	457	0.2
OcA	Ockley silt loam, 0 to 3 percent slopes	681	696	1,377	0.5
Or	Orrville silt loam	796	44	840	0.3
PaD2	Pate silt loam, 12 to 18 percent slopes, eroded	1,635	970	2,605	1.0
PaE2	Pate silt loam, 18 to 25 percent slopes, eroded	3,322	618	3,940	1.6
Pg	Pits, gravel	47	54	101	*
Ra	Rahm silt loam	134	276	410	0.2
RdG	Rodman sandy loam, 40 to 60 percent slopes	178	40	218	0.1
RoA	Rossmoyne silt loam, 0 to 2 percent slopes	4,571	942	5,513	2.2
RoB2	Rossmoyne silt loam, 2 to 6 percent slopes, eroded	5,308	1,031	6,339	2.5
RxB	Russell-Fincastle silt loams, 1 to 4 percent slopes	166	0	166	0.1
St	Stonelick sandy loam	1,408	168	1,576	0.6
SwB2	Switzerland silt loam, 2 to 6 percent slopes, eroded	1,079	370	1,449	0.6
SwC2	Switzerland silt loam, 6 to 12 percent slopes, eroded	12,453	2,098	14,551	5.8
SwC3	Switzerland silt loam, 6 to 12 percent slopes, severely eroded	2,199	569	2,768	1.1
SwD2	Switzerland silt loam, 12 to 18 percent slopes, eroded	1,436	494	1,930	0.8
Ud	Udorthents, loamy	145	60	205	0.1
WbB2	Weisburg silt loam, 2 to 6 percent slopes, eroded	11,854	1,655	13,509	5.4
WbC2	Weisburg silt loam, 6 to 12 percent slopes, eroded	6,325	2,288	8,613	3.4
WbC3	Weisburg silt loam, 6 to 12 percent slopes, severely eroded	3,114	1,035	4,149	1.6
WhA	Wheeling silt loam, 0 to 2 percent slopes	171	901	1,072	0.4
	Water	150	0	150	
	Total	195,990	55,680	251,670	100.0

* Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
AvA---- Avonburg	110	38	50	3.6	7.2
BaA---- Bartle	110	38	50	3.6	7.2
BeC2---- Bonnell	100	30	35	3.6	7.2
BeC3---- Bonnell	85	25	30	3.3	6.6
BeD2---- Bonnell	85	---	30	3.0	6.0
BeD3---- Bonnell	---	---	---	2.5	5.0
BeE---- Bonnell	---	---	---	---	---
CaC2---- Carmel	90	28	36	2.6	5.2
CaD2---- Carmel	75	23	30	2.1	4.2
CaE2---- Carmel	---	---	---	1.8	3.6
CcC3---- Carmel	80	24	32	2.3	4.6
CcD3---- Carmel	---	---	---	1.8	3.6
CcE3---- Carmel	---	---	---	1.3	2.6
Ch---- Chagrin	115	35	---	4.0	8.0
CnB2---- Cincinnati	105	30	45	4.0	8.0
CnC2---- Cincinnati	100	30	40	4.0	8.0
CnC3---- Cincinnati	90	20	35	3.5	7.0
Ct---- Clermont	110	35	35	3.6	7.2
De---- Dearborn	90	38	40	3.0	6.0
Df---- Dearborn	70	25	30	2.8	5.6
EcE2---- Eden	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
EdE3---------- Eden	---	---	---	---	---
EdF---------- Eden	---	---	---	---	---
EkA---------- Elkinsville	120	42	48	4.0	8.0
EkB2---------- Elkinsville	115	40	46	3.8	7.6
EkC2---------- Elkinsville	105	37	42	3.4	6.8
FoB2---------- Fox	95	30	42	4.5	9.0
HcG---------- Hennepin	---	---	---	1.2	2.4
Hu---------- Huntington	100	37	---	3.0	6.0
Ju---------- Jules	83	27	---	3.5	7.0
MaB2---------- Markland	80	28	36	2.6	5.2
MaF2---------- Markland	---	---	---	1.0	2.0
MbD3---------- Markland	---	---	20	1.5	3.0
Ne---------- Newark	100	40	---	4.5	9.0
OcA---------- Ockley	110	38	44	3.6	7.2
Or---------- Orrville	110	35	45	4.5	9.0
PaD2---------- Pate	70	24	32	2.3	4.6
PaE2---------- Pate	---	---	24	1.8	3.6
Pg**. Pits					
Ra---------- Rahm	115	40	---	4.4	8.8
RdG---------- Rodman	---	---	---	---	0.2
RoA---------- Rossmoyne	110	35	40	4.5	9.0
RoB2---------- Rossmoyne	100	30	35	4.0	8.0
RxB---------- Russell-Fincastle	124	44	49	4.1	8.3

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
St---------- Stonelick	80	28	---	3.5	6.0
SwB2---------- Switzerland	90	32	40	3.0	6.0
SwC2---------- Switzerland	80	28	36	2.6	5.2
SwC3---------- Switzerland	70	24	32	2.3	5.6
SwD2---------- Switzerland	65	23	29	2.1	4.2
Ud**. Udorthents					
WbB2---------- Weisburg	105	30	45	4.5	5.0
WbC2---------- Weisburg	100	30	40	4.5	5.0
WbC3---------- Weisburg	90	20	35	4.0	4.5
WhA---------- Wheeling	125	40	---	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I:					
Dearborn County	927	---	---	---	---
Ohio County	1,902	---	---	---	---
II:					
Dearborn County	49,101	26,222	22,879	---	---
Ohio County	11,630	4,758	6,872	---	---
III:					
Dearborn County	29,155	24,322	4,833	---	---
Ohio County	5,590	5,463	127	---	---
IV:					
Dearborn County	26,552	26,552	---	---	---
Ohio County	6,534	6,534	---	---	---
V:					
Dearborn County	---	---	---	---	---
Ohio County	---	---	---	---	---
VI:					
Dearborn County	35,319	35,319	---	---	---
Ohio County	9,887	9,887	---	---	---
VII:					
Dearborn County	54,738	54,560	---	178	---
Ohio County	20,084	20,044	---	40	---
VIII:					
Dearborn County	47	---	---	---	---
Ohio County	54	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
AvA---- Avonburg	3o	Slight	Slight	Slight	Slight	White oak----	70	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Northern red oak----	75	
						Pin oak----	85	
						Yellow-poplar----	85	
						Sweetgum----	80	
BaA---- Bartle	3o	Slight	Slight	Slight	Slight	White oak----	75	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak----	85	
						Yellow-poplar----	85	
						Sweetgum----	80	
BeC2---- Bonnell	2c	Slight	Moderate	Slight	Slight	Northern red oak----	76	Yellow-poplar, eastern white pine, Virginia pine.
						Yellow-poplar----	90	
						Virginia pine----	80	
BeC3---- Bonnell	3c	Slight	Moderate	Moderate	Slight	Northern red oak----	66	Virginia pine.
						Virginia pine----	70	
BeD2---- Bonnell	2c	Moderate	Severe	Slight	Slight	Northern red oak----	76	Yellow-poplar, eastern white pine, Virginia pine.
						Yellow-poplar----	90	
						Virginia pine----	80	
BeD3---- Bonnell	3c	Moderate	Severe	Moderate	Slight	Northern red oak----	66	Virginia pine.
						Shortleaf pine----	70	
						Virginia pine----	70	
BeE---- Bonnell	2c	Moderate	Severe	Slight	Slight	Northern red oak----	76	Yellow-poplar, eastern white pine, Virginia pine.
						Yellow-poplar----	90	
						Virginia pine----	80	
CaC2, CaD2---- Carmel	1c	Slight	Slight	Severe	Severe	Northern red oak----	86	Eastern white pine, yellow-poplar, white ash.
						Yellow-poplar----	98	
						Virginia pine----	---	
						Shortleaf pine----	---	
						Eastern white pine--	---	
						Sweetgum----	---	
CaE2---- Carmel	1c	Moderate	Moderate	Severe	Severe	Northern red oak----	86	Eastern white pine, yellow-poplar, white ash.
						Yellow-poplar----	98	
						Virginia pine----	---	
						Shortleaf pine----	---	
						Eastern white pine--	---	
						Sweetgum----	---	
CcC3, CcD3---- Carmel	2c	Slight	Moderate	Severe	Severe	Northern red oak----	80	Eastern white pine, Virginia pine, yellow-poplar.
						White oak----	---	
						Yellow-poplar----	90	
						White ash----	---	
CcE3---- Carmel	2c	Moderate	Severe	Severe	Severe	Northern red oak----	80	Eastern white pine, Virginia pine, yellow-poplar.
						White oak----	---	
						Yellow-poplar----	90	
						White ash----	---	
Ch---- Chagrin	1o	Slight	Slight	Slight	Slight	Northern red oak----	86	Eastern white pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar----	95	
						Sugar maple----	85	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
CnB2, CnC2, CnC3--- Cincinnati	2d	Slight	Slight	Moderate	Moderate	Northern red oak---- White oak---------- Black walnut-------- Black cherry--------	80 --- --- ---	Eastern white pine, black walnut, yellow-poplar.
Ct---------- Clermont	2w	Slight	Severe	Moderate	Moderate	Pin oak---------- Sweetgum---------- Eastern white pine--	86 67 93	Sweetgum, eastern white pine, red maple, yellow-poplar.
De, Df---------- Dearborn	2f	Slight	Slight	Slight	Slight	Yellow-poplar------- Sweetgum---------- White ash----------	90 --- ---	Black walnut, eastern cottonwood, sweetgum, yellow-poplar, white ash, eastern white pine.
EcE2---------- Eden	3c	Moderate	Severe	Moderate	Moderate	Eastern redcedar----	44	Virginia pine, Austrian pine.
EdE3---------- Eden	4c	Moderate	Severe	Severe	Moderate	Eastern redcedar----	35	Virginia pine, Austrian pine.
EdF---------- Eden	3c	Severe	Severe	Moderate	Moderate	Eastern redcedar----	44	Virginia pine, Austrian pine.
EkA, EkB2, EkC2---- Elkinsville	1o	Slight	Slight	Slight	Slight	White oak---------- Yellow-poplar------- Sweetgum----------	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, white oak.
FoB2---------- Fox	2o	Slight	Slight	Slight	Slight	Northern red oak---- White oak---------- Sugar maple---------	80 --- ---	Yellow-poplar, white ash, eastern white pine.
HcG---------- Hennepin	1r	Severe	Severe	Slight	Slight	Northern red oak---- White oak----------	85 ---	Northern red oak, white oak, green ash, black walnut, eastern white pine, eastern redcedar.
Hu---------- Huntington	1o	Slight	Slight	Slight	Slight	Yellow-poplar------- Northern red oak----	95 85	Yellow-poplar, black walnut, white oak, eastern white pine.
Ju---------- Jules	1o	---	---	---	---		---	Black walnut, American sycamore, eastern cottonwood, red maple, green ash, sweetgum, common hackberry.
MaB2---------- Markland	2c	Slight	Slight	Moderate	Slight	White oak---------- Northern red oak----	75 78	Eastern white pine, yellow-poplar, white ash.
MaF2---------- Markland	2c	Moderate	Moderate	Moderate	Slight	White oak---------- Northern red oak----	75 78	Eastern white pine, yellow-poplar, white ash.
MbD3---------- Markland	2c	Slight	Slight	Moderate	Slight	White oak---------- Northern red oak----	75 78	Eastern white pine, yellow-poplar, white ash.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Ne Newark	1o	Slight	Slight	Slight	Slight	Pin oak Eastern cottonwood Northern red oak Yellow-poplar Sweetgum	99 94 85 95 88	Eastern cottonwood, sweetgum, red maple, American sycamore, eastern white pine, yellow-poplar.
OcA Ockley	1o	Slight	Slight	Slight	Slight	White oak Northern red oak Yellow-poplar Sweetgum	90 90 98 76	Eastern white pine, white ash, yellow-poplar, black walnut, white oak.
Or Orrville	2o	Slight	Slight	Slight	Slight	Pin oak Northern red oak Yellow-poplar Sugar maple Eastern white pine	85 80 90 80 90	Eastern white pine, yellow-poplar, pin oak.
PaD2 Pate	1o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar Virginia pine White oak Sweetgum	86 98 --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash, white oak.
PaE2 Pate	1r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar Virginia pine White oak Sweetgum	86 98 --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash.
Ra Rahm	1o	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar, white oak.
RdG Rodman	3s	Severe	Severe	Severe	Slight	Northern red oak White oak Red pine Eastern white pine	70 70 75 85	Eastern white pine, jack pine.
RoA, RoB2 Rossmoyne	2d	Slight	Slight	Moderate	Moderate	Northern red oak Yellow-poplar Black walnut Black cherry	80 90 80 ---	Eastern white pine, yellow-poplar.
RxB*: Russell	1o	Slight	Slight	Slight	Slight	White oak Northern red oak Yellow-poplar Sweetgum	90 90 98 76	Eastern white pine, white ash, yellow-poplar, black walnut, white oak.
Fincastle	3o	Slight	Slight	Slight	Slight	Northern red oak White oak Pin oak Yellow-poplar Sweetgum	75 75 85 85 80	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
St Stonelick	2o	Slight	Slight	Slight	Slight	Northern red oak	80	Eastern white pine, black walnut, yellow-poplar.
SwB2, SwC2 Switzerland	1o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar Virginia pine Shortleaf pine White oak Sweetgum	86 98 --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, white ash, northern red oak, white oak.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
SwC3---------- Switzerland	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Eastern white pine, Virginia pine, black walnut, yellow-poplar.
						White oak----------	---	
						Yellow-poplar-------	90	
						White ash----------	---	
SwD2---------- Switzerland	1o	Slight	Slight	Slight	Slight	Northern red oak----	86	Eastern white pine, yellow-poplar, black walnut, white ash, white oak, northern red oak.
						Yellow-poplar-------	98	
						Virginia pine-------	---	
						Shortleaf pine------	---	
						White oak----------	---	
						Sweetgum-----------	---	
WbB2, WbC2, WbC3--- Weisburg	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Eastern white pine, black walnut, yellow-poplar.
WhA---------- Wheeling	2o	Slight	Slight	Slight	Slight	Northern red oak----	80	Eastern white pine, yellow-poplar, black walnut, white ash.
						Yellow-poplar-------	90	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
AvA---------- Avonburg	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
BaA---------- Bartle	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
BeC2, BeC3, BeD2, BeD3, BeE-------- Bonnell	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
CaC2, CaD2, CaE2, CcC3, CcD3, CcE3- Carmel	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
Ch---------- Chagrin	---	Winged euonymus, autumn-olive, forsythia, Tatarian honeysuckle, nannyberry viburnum.	Norway spruce, Scotch pine, red pine.	Eastern white pine, Austrian pine.	---
CnB2, CnC2, CnC3-- Cincinnati	---	Winged euonymus, autumn-olive, Tatarian honeysuckle, nannyberry viburnum, forsythia, winged euonymus.	Norway spruce, Scotch pine, red pine.	Austrian pine, eastern white pine.	---
Ct---------- Clermont	---	Gray dogwood, redosier dogwood, silky dogwood.	European alder, northern white-cedar, tall purple willow, black willow.	White willow------	Eastern cottonwood, Carolina poplar.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
De, Df---------- Dearborn	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
EcE2, EdE3, EdF. Eden					
EkA, EkB2, EkC2--- Elkinsville	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
FoB2---------- Fox	---	Autumn-olive, Amur honeysuckle, blackhaw, shadblow serviceberry, American cranberrybush, cornelian cherry dogwood.	Red pine----------	Norway spruce, Austrian pine, honeylocust, American basswood.	Eastern white pine.
HcG. Hennepin					
Hu---------- Huntington	Mockorange--------	European burningbush, late lilac, shadblow serviceberry, autumn-olive, blackhaw, Amur honeysuckle, American cranberrybush.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
Ju---------- Jules	Gray dogwood, redosier dogwood.	Autumn-olive, silky dogwood.	Amur maple, Russian-olive, baldcypress.	Norway spruce, eastern white pine.	American sycamore, red maple, eastern cottonwood.
MaB2, MaF2, MbD3-- Markland	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
Ne---------- Newark	Gray dogwood------	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow.	White willow, silver maple, Norway spruce.	Eastern cottonwood, American sycamore, red maple.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
OcA---------- Ockley	Mockorange--------	Gray dogwood, cornelian cherry dogwood, Autumn-olive, American cranberrybush, late lilac, Tatarian honey-suckle, Amur honeysuckle.	White spruce------	Eastern white pine, Norway spruce.	Carolina poplar.
Or---------- Orrville	---	Gray dogwood, silky dogwood, American cranberrybush, redosier dogwood.	Northern white-cedar, Norway spruce.	European alder, pin oak, eastern white pine, silver maple.	Eastern cottonwood, Carolina poplar.
PaD2, PaE2-------- Pate	Mockorange--------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce-----	Honeylocust, eastern white pine.
Pg*. Pits					
Ra---------- Rahm	Mockorange--------	Blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Northern white-cedar.	Norway spruce-----	Eastern white pine, honeylocust, Carolina poplar.
Rdg. Rodman					
RoA, RoB2--------- Rossmoyne	---	Silky dogwood, Amur honeysuckle, redosier dogwood, forsythia, nannyberry viburnum.	Northern white-cedar, European alder, eastern redcedar, autumn-olive.	Norway spruce-----	Eastern white pine.
RxB*: Russell----------	Mockorange--------	Blackhaw, late lilac, Amur honeysuckle, shadblow service-berry, American cranberrybush, autumn-olive.	Eastern hemlock, northern white-cedar.	Norway spruce-----	Eastern white pine, honeylocust.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
RxB*: Fincastle	Cutleaf staghorn sumac.	Blackhaw, arrowwood, cornelian cherry dogwood, rose-of-sharon, Amur honeysuckle, American cranberrybush, autumn-olive.	---	American basswood, Norway spruce, white spruce.	Eastern white pine.
St Stonelick	Tatarian honeysuckle, Amur honeysuckle, wayfaringtree, winged euonymus.	Arrowwood, nannyberry viburnum, autumn-olive, cornelian cherry dogwood.	Austrian pine, eastern redcedar, red pine.	Eastern white pine	---
SwB2, SwC2, SwC3, SwD2 Switzerland	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Honeylocust, eastern white pine.
Ud*. Udorthents					
WbB2, WbC2, WbC3 Weisburg	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Honeylocust, eastern white pine.
WhA Wheeling	Mockorange	European burningbush, late lilac, shadblow serviceberry, autumn-olive, blackhaw, Amur honeysuckle, American cranberrybush.	Eastern hemlock	Norway spruce	Honeylocust, eastern white pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AvA--- Avonburg	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
BaA--- Bartle	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
BeC2, BeC3--- Bonnell	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
BeD2, BeD3--- Bonnell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
BeE--- Bonnell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
CaC2--- Carmel	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
CaD2, CaE2--- Carmel	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
CcC3--- Carmel	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
CcD3, CcE3--- Carmel	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
Ch--- Chagrin	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
CnB2--- Cincinnati	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
CnC2, CnC3--- Cincinnati	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Ct--- Clermont	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
De--- Dearborn	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
Df--- Dearborn	Severe: floods.	Moderate: floods, large stones.	Severe: large stones, floods.	Moderate: floods.	Severe: floods.
EcE2, EdE3--- Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
EdF Eden	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
EkA Elkinsville	Severe: floods.	Slight	Slight	Severe: erodes easily.	Slight.
EkB2 Elkinsville	Severe: floods.	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
EkC2 Elkinsville	Severe: floods.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
FoB2 Fox	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
HcG Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hu Huntington	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight	Moderate: floods.
Ju Jules	Severe: floods.	Moderate: floods.	Severe: floods.	Severe: erodes easily.	Severe: floods.
MaB2 Markland	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
MaF2 Markland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
MbD3 Markland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Ne Newark	Severe: floods, wetness.	Severe: wetness.		Severe: wetness, erodes easily.	
OcA Ockley	Slight	Slight	Slight	Severe: erodes easily.	Slight.
Or Orrville	Severe: floods, wetness.	Moderate: floods, wetness.	Severe: wetness, floods.	Severe: erodes easily.	Severe: floods.
PaD2, PaE2 Pate	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
Pg*. Pits					
Ra Rahm	Severe: floods, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness, floods.
RdG Rodman	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RoA Rossmoyne	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
RoB2 Rossmoyne	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
RxB*: Russell	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
Fincastle	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
St Stonelick	Severe: floods.	Moderate: floods, small stones.	Severe: small stones, floods.	Moderate: floods.	Severe: floods.
SwB2 Switzerland	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
SwC2, SwC3 Switzerland	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
SwD2 Switzerland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Ud*. Udorthents					
WbB2 Weisburg	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
WbC2, WbC3 Weisburg	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
WhA Wheeling	Slight	Slight	Slight	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AvA---- Avonburg	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BaA---- Bartle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BeC2, BeC3---- Bonnell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BeD2, BeD3---- Bonnell	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BeE---- Bonnell	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CaC2---- Carmel	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CaD2, CaE2---- Carmel	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CcC3---- Carmel	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CcD3, CcE3---- Carmel	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ch---- Chagrin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CnB2---- Cincinnati	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CnC2, CnC3---- Cincinnati	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ct---- Clermont	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
De, Df---- Dearborn	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
EcE2, EdE3---- Eden	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
EdF---- Eden	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
EkA, EkB2---- Elkinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EkC2---- Elkinsville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FoB2---- Fox	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HcG---- Hennepin	Very poor.	Poor	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
Hu---- Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ju Jules	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MaB2 Markland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MaF2 Markland	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MbD3 Markland	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ne Newark	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
OcA Ockley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Or Orrville	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
PaD2, PaE2 Pate	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Pg*. Pits										
Ra Rahm	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
RdG Rodman	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
RoA Rossmoyne	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
RoB2 Rossmoyne	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RxB*: Russell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fincastle	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
St Stonelick	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
SwB2 Switzerland	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
SwC2, SwC3 Switzerland	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
SwD2 Switzerland	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ud*. Udorthents										
WbB2 Weisburg	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WbC2, WbC3 Weisburg	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
WhA---------- Wheeling	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AvA---------- Avonburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
BaA---------- Bartle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BeC2, BeC3---- Bonnell	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
BeD2, BeD3, BeE--- Bonnell	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
CaC2---------- Carmel	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
CaD2, CaE2---- Carmel	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
CcC3---------- Carmel	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
CcD3, CcE3---- Carmel	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Ch---------- Chagrin	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
CnB2---------- Cincinnati	Moderate: dense layer, wetness.	Slight----------	Moderate: wetness.	Moderate: slope.	Severe: low strength, frost action.	Slight.
CnC2, CnC3---- Cincinnati	Moderate: dense layer, wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Ct---------- Clermont	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
De, Df---------- Dearborn	Moderate: large stones, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
EcE2, EdE3, EdF--- Eden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
EkA, EkB2---------- Elkinsville	Slight----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action.	Slight.
EkC2---------- Elkinsville	Moderate: slope.	Severe: floods.	Severe: floods.	Severe: floods, slope.	Severe: low strength, frost action.	Moderate: slope.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FoB2 Fox	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
HcG Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hu Huntington	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Moderate: floods.
Ju Jules	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
MaB2 Markland	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
MaF2, MbD3 Markland	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Ne Newark	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: floods.
OcA Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Or Orrville	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
PaD2, PaE2 Pate	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Pg*. Pits						
Ra Rahm	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, floods, frost action.	Moderate: wetness, floods.
RdG Rodman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
RoA Rossmoyne	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
RoB2 Rossmoyne	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
RxB*: Russell	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Fincastle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
St---------- Stonelick	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
SwB2---------- Switzerland	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
SwC2, SwC3-------- Switzerland	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Severe: shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
SwD2---------- Switzerland	Severe: slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Ud*. Udorthents						
WbB2---------- Weisburg	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell, slope.	Severe: frost action.	Slight.
WbC2, WbC3-------- Weisburg	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Severe: shrink-swell.	Severe: slope.	Severe: frost action.	Moderate: slope.
WhA---------- Wheeling	Slight----------	Moderate: frost action.	Slight----------	Moderate: frost action.	Moderate: frost action, low strength.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AvA Avonburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BaA Bartle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BeC2, BeC3 Bonnell	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
BeD2, BeD3, BeE Bonnell	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
CaC2 Carmel	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
CaD2, CaE2 Carmel	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
CcC3 Carmel	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
CcD3, CcE3 Carmel	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Ch Chagrin	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Fair: thin layer.
CnB2 Cincinnati	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Slight	Fair: too clayey.
CnC2, CnC3 Cincinnati	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Ct Clermont	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
De, Df Dearborn	Severe: floods.	Severe: floods.	Severe: floods, large stones.	Severe: floods.	Poor: large stones.
EcE2, EdE3 Eden	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey.
EdF Eden	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EkA, EkB2 Elkinsville	Moderate: floods.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
EkC2 Elkinsville	Moderate: slope, floods.	Severe: floods, slope.	Moderate: floods, slope, too clayey.	Moderate: floods, slope.	Fair: too clayey, slope.
FoB2 Fox	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
HcG Hennepin	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hu Huntington	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Good.
Ju Jules	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
MaB2 Markland	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
MaF2, MbD3 Markland	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Ne Newark	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
OcA Ockley	Slight	Severe: seepage.	Severe: seepage.	Slight	Poor: small stones.
Or Orrville	Severe: floods, wetness.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, wetness.	Poor: wetness.
PaD2, PaE2 Pate	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Pg*. Pits					
Ra Rahm	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, hard to pack, wetness.
RdG Rodman	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
RoA, RoB2 Rossmoyne	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RxB*: Russell	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Fincastle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
St Stonelick	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: seepage.
SwB2 Switzerland	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
SwC2, SwC3 Switzerland	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
SwD2 Switzerland	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Ud*. Udorthents					
WbB2 Weisburg	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
WbC2, WbC3 Weisburg	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
WhA Wheeling	Moderate: wetness.	Moderate: seepage, wetness.	Severe: seepage, wetness.	Moderate: wetness.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AvA Avonburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
BaA Bartle	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BeC2, BeC3 Bonnell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BeD2, BeD3 Bonnell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
BeE Bonnell	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
CaC2 Carmel	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
CaD2, CaE2 Carmel	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
CcC3 Carmel	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
CcD3, CcE3 Carmel	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Ch Chagrin	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
CnB2 Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
CnC2, CnC3 Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
Ct Clermont	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
De, Df Dearborn	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
EcE2, EdE3 Eden	Poor: thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.
EdF Eden	Poor: slope, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, small stones.
EkA, EkB2 Elkinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EkC2--- Elkinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
FoB2--- Fox	Good	Probable	Probable	Poor: small stones, area reclaim.
HcG--- Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hu--- Huntington	Poor: frost action.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ju--- Jules	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
MaB2--- Markland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MaF2--- Markland	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
MbD3--- Markland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Ne--- Newark	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
OcA--- Ockley	Good	Probable	Probable	Poor: small stones, area reclaim.
Or--- Orrville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
PaD2, PaE2--- Pate	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Pg*. Pits				
Ra--- Rahm	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
RdG--- Rodman	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
RoA, RoB2--- Rossmoyne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
RxB*: Russell---	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Fincastle---	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
St--- Stonelick	Good	Probable	Improbable: too sandy.	Poor: small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SwB2---------- Switzerland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
SwC2, SwC3---------- Switzerland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
SwD2---------- Switzerland	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ud*. Udorthents				
WbB2---------- Weisburg	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
WbC2, WbC3---------- Weisburg	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
WhA---------- Wheeling	Fair: frost action, low strength.	Probable----------	Probable----------	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AvA Avonburg	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
BaA Bartle	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
BeC2, BeC3, BeD2, BeD3, BeE Bonnell	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
CaC2, CaD2, CaE2, CcC3, CcD3, CcE3 Carmel	Severe: slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope.	Slope, large stones, erodes easily.	Slope, erodes easily.
Ch Chagrin	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Floods	Favorable	Favorable.
CnB2 Cincinnati	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Percs slowly, rooting depth, slope.	Erodes easily, rooting depth.	Erodes easily, rooting depth.
CnC2, CnC3 Cincinnati	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Percs slowly, rooting depth, slope.	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
Ct Clermont	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
De Dearborn	Moderate: seepage.	Severe: piping, large stones.	Severe: no water.	Deep to water	Large stones, droughty, erodes easily.	Erodes easily, large stones.	Large stones, erodes easily, droughty.
Df Dearborn	Moderate: seepage.	Severe: piping, large stones.	Severe: no water.	Deep to water	Large stones, droughty.	Large stones	Large stones, droughty.
EcE2, EdE3, EdF Eden	Moderate: depth to rock.	Moderate: hard to pack, thin layer, large stones.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, percs slowly, large stones.	Slope, large stones, percs slowly.
EkA Elkinsville	Moderate: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily	Erodes easily.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
EkB2---------- Elkinsville	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
EkC2---------- Elkinsville	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
FoB2---------- Fox	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Rooting depth	Too sandy------	Rooting depth.
HcG---------- Hennepin	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Droughty, percs slowly.	Slope, percs slowly.	Slope, droughty, percs slowly.
Hu---------- Huntington	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Not needed-----	Floods, slope.	Not needed-----	Not needed.
Ju---------- Jules	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily, floods.	Erodes easily	Erodes easily.
MaB2---------- Markland	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MaF2, MbD3---------- Markland	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Ne---------- Newark	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Floods, frost action.	Wetness, erodes easily, floods.	Erodes easily, wetness.	Wetness, erodes easily.
OcA---------- Ockley	Moderate: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
Or---------- Orrville	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Floods, frost action.	Wetness, floods.	Erodes easily, wetness.	Wetness, erodes easily.
PaD2, PaE2---------- Pate	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Droughty, percs slowly, rooting depth.	Slope, large stones, erodes easily.	Slope, erodes easily, droughty.
Pg*. Pits							
Ra---------- Rahm	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, floods, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
RdG---------- Rodman	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
RoA---------- Rossmoyne	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
RoB2---------- Rossmoyne	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly, rooting depth.	Erodes easily, wetness.	Erodes easily, rooting depth.
RxB*: Russell----------	Moderate: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
Fincastle----------	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
St---------- Stonelick	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, floods.	Too sandy, soil blowing.	Droughty.
SwB2---------- Switzerland	Moderate: seepage, slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
SwC2, SwC3, SwD2-- Switzerland	Severe: slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Ud*. Udorthents							
WbB2---------- Weisburg	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Percs slowly, rooting depth, slope.	Erodes easily, rooting depth.	Erodes easily, rooting depth.
WbC2, WbC3--------- Weisburg	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Percs slowly, rooting depth, slope.	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
WhA---------- Wheeling	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Not needed-----	Seepage, slope, erodes easily.	Slope, piping.	Slope, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AvA---------- Avonburg	0-17	Silt loam--------	CL, ML, CL-ML	A-4	0	100	100	95-100	75-95	20-30	2-10
	17-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	75-95	30-45	10-20
	26-72	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0-3	95-100	95-100	90-100	70-95	30-45	10-20
	72-80	Clay loam, loam	CL	A-6, A-7	0-3	95-100	90-100	75-95	60-85	30-45	10-20
BaA---------- Bartle	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	5-15
	16-28	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	28-58	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	58-60	Clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
BeC2, BeC3, BeD2, BeD3, BeE------- Bonnell	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	65-90	25-35	4-12
	9-36	Silty clay, clay, clay loam.	CH	A-7	0	100	100	90-100	75-95	50-65	30-40
	36-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	20-30
	60-80	Clay loam, loam	CL	A-6, A-7	0-10	95-100	90-100	85-95	60-80	35-50	20-30
CaC2, CaD2, CaE2-- Carmel	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	80-97	25-40	1-15
	6-11	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	25-45	10-20
	11-36	Clay, silty clay	CH	A-7	0-10	100	100	90-100	75-97	50-65	30-40
	36-60	Flaggy clay, very flaggy silty clay.	CL, CH	A-7	40-80	90-100	85-100	80-100	65-95	40-60	18-32
CcC3, CcD3, CcE3-- Carmel	0-3	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	25-45	10-20
	3-10	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	25-45	10-20
	10-33	Clay, silty clay	CH	A-7	0-10	100	100	90-100	75-97	50-65	30-40
	33-44	Flaggy clay, very flaggy silty clay.	CL, CH	A-7	40-80	90-100	85-100	80-100	65-95	40-60	18-32
	44	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ch---------- Chagrin	0-12	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	70-90	20-35	2-10
	12-46	Silt loam, loam, sandy loam.	ML, SM	A-4	0	90-100	85-100	75-90	45-85	20-40	NP-10
	46-60	Stratified silt loam to fine sand.	ML, SM	A-4, A-2	0	85-100	80-100	55-85	30-80	20-40	NP-10
CnB2, CnC2------- Cincinnati	0-13	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	13-29	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	29-50	Silt loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	20-35	6-14
	50-80	Clay loam, loam, silty clay loam.	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	20-35	3-14
CnC3---------- Cincinnati	0-3	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	3-14	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	14-31	Silt loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	20-35	6-14
	31-80	Clay loam, loam	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	20-35	3-14

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ct Clermont	0-24	Silt loam	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	85-95	75-90	22-40	4-18
	24-42	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	85-95	30-45	12-25
	42-80	Silt loam, silty clay loam, silty clay.	CL	A-6, A-7	0	95-100	85-100	75-95	65-90	32-48	12-28
De Dearborn	0-10	Silt loam	CL-ML, CL	A-4, A-6	0-10	90-95	85-95	70-95	55-85	25-40	5-20
	10-16	Clay loam, silt loam, loam.	CL, SC	A-6, A-7	0-20	85-90	75-90	65-90	45-80	30-45	10-20
	16-60	Very channery coarse sandy loam, very channery sandy clay loam.	CL-ML, CL, GC, SC	A-4, A-6, A-2-4, A-2-6	25-50	65-75	50-75	50-75	30-60	25-40	4-15
Df Dearborn	0-10	Flaggy loam	CL-ML, CL, SC, SM-SC	A-4, A-6	15-30	90-95	85-95	75-90	45-70	25-35	5-15
	10-16	Clay loam, silt loam, loam.	CL, SC	A-6, A-7	0-20	85-90	75-90	65-90	45-80	30-45	10-20
	16-60	Very flaggy silt loam, very channery clay loam.	CL-ML, CL, GC, SC	A-4, A-6, A-2-4, A-2-6	25-50	65-75	50-75	50-75	30-60	25-40	4-15
EcE2 Eden	0-6	Silty clay loam	ML, CL, MH, CH	A-7, A-6	0-15	85-100	80-100	75-100	70-100	35-65	12-35
	6-36	Flaggy silty clay, flaggy clay, silty clay.	MH, CH, CL	A-7	10-45	75-100	70-100	65-100	65-95	45-75	20-45
	36	Weathered bedrock	---	---	---	---	---	---	---	---	---
EdE3, EdF Eden	0-6	Flaggy silty clay loam, channery silty clay.	ML, CL, MH, CH	A-7, A-6	25-40	75-95	70-95	70-95	65-95	35-65	12-35
	6-36	Channery silty clay, very flaggy clay, silty clay.	MH, CH, CL	A-7	10-45	75-100	70-100	65-100	65-95	45-75	20-45
	36-50	Flaggy silt loam	CL	A-6	10-45	75-95	70-95	65-95	55-85	30-40	10-20
	50-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
EkA, EkB2, EkC2 Elkinsville	0-11	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	11-33	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	100	85-100	65-90	30-40	8-18
	33-58	Silty clay loam, loam, clay loam.	CL	A-4, A-6	0	100	100	80-100	50-90	30-40	8-18
	58-60	Stratified silty clay loam to sandy loam.	CL, CL-ML, ML, SM	A-4, A-6	0	100	100	70-100	45-80	<30	NP-15
FoB2 Fox	0-13	Silt loam	ML, CL, CL-ML	A-4	0	95-100	85-100	75-95	55-90	20-30	3-10
	13-23	Silty clay loam, silt loam, gravelly clay loam.	CL	A-6, A-7	0	85-100	70-100	70-95	55-90	25-50	10-25
	23-32	Clay loam, loam, sandy clay loam.	CL, SC	A-2, A-6, A-7	0-5	85-100	70-95	50-95	20-65	25-45	10-25
	32-60	Stratified sand to gravel.	SP, SM, GP, GM	A-1, A-2, A-3	0-10	40-100	35-100	15-95	2-20	---	NP
HcG Hennepin	0-5	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	70-100	60-95	25-40	5-20
	5-13	Loam, sandy loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
	13-60	Loam, sandy loam, gravelly clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Hu---------- Huntington	0-13	Silt loam--------	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-35	5-15
	13-60	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-35	5-15
	60-70	Stratified sandy clay loam to loam.	SM, SC, ML, CL	A-2, A-4	0	95-100	60-100	50-90	30-75	<30	NP-10
Ju---------- Jules	0-60	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
MaB2, MaF2------- Markland	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	7-29	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	29-60	Stratified clay to silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	75-95	35-60	20-35
MbD3---------- Markland	0-3	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-35
	3-7	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	7-60	Stratified clay to silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	75-95	35-60	20-35
Ne---------- Newark	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	55-95	<32	NP-10
	9-38	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-95	22-42	4-20
	38-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	75-100	70-100	65-100	55-95	22-42	4-20
OcA---------- Ockley	0-8	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	3-12
	8-38	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	75-100	65-90	50-90	35-50	15-30
	38-50	Gravelly clay loam, gravelly sandy clay loam.	CL, SC, GC	A-6, A-7	0-2	70-85	45-75	40-70	35-55	30-50	15-30
	50-60	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP
Or---------- Orrville	0-8	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	90-100	65-80	22-35	4-10
	8-41	Silt loam, loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0-2	95-100	90-100	85-95	65-90	20-40	2-16
	41-60	Stratified loamy sand to silt loam.	ML, CL, SM, SC	A-4	0-2	95-100	85-100	60-85	35-75	15-35	NP-10
PaD2, PaE2------- Pate	0-6	Silt loam--------	CL	A-4, A-6	0-5	90-100	85-100	80-100	70-100	25-35	8-20
	6-36	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	90-100	85-100	80-100	70-100	45-65	25-40
	36-72	Channery silty clay, channery silty clay loam.	CL, CH	A-6, A-7	5-40	75-100	70-100	65-100	60-75	25-45	10-25
	72	Weathered bedrock	---	---	---	---	---	---	---	---	---
Pg*. Pits											
Ra---------- Rahm	0-8	Silt loam--------	CL	A-6, A-7	0	100	100	90-100	75-95	30-50	10-25
	8-23	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	75-95	30-50	10-25
	23-48	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-30
	48-60	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-55	20-30

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RdG---------- Rodman	0-5	Sandy loam-------	SM-SC, SM	A-1, A-2, A-4	0-2	70-85	65-85	40-60	20-40	<25	NP-5
	5-13	Gravelly loam, sandy loam, loam.	ML, CL-ML, SM-SC, SM	A-4, A-2, A-1	0-2	70-85	60-85	40-75	20-55	<25	NP-5
	13-60	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
RoA, RoB2-------- Rossmoyne	0-7	Silt loam--------	ML	A-4	0	90-100	90-100	90-100	85-100	30-40	4-10
	7-23	Silty clay loam, silt loam, clay loam.	CL, ML	A-6, A-7, A-4	0	90-100	90-100	85-100	75-95	30-48	8-20
	23-66	Silt loam, loam, silty clay loam.	CL	A-6, A-4	0	90-100	85-95	80-90	70-85	25-40	9-19
	66-80	Clay loam, loam, clay.	CL	A-6, A-7, A-4	0	80-95	70-90	65-85	60-80	25-42	8-20
RxB*: Russell----------	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	20-35	5-15
	9-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	20-35
	30-42	Clay loam, loam	CL	A-6, A-7	0	90-100	90-95	80-90	65-75	35-50	17-31
	42-60	Loam, clay loam	CL, ML, CL-ML	A-4, A-6	0-3	85-95	80-90	75-85	50-65	<30	2-14
Fincastle--------	0-10	Silt loam--------	CL, ML	A-4, A-6	0	100	95-100	90-100	75-93	27-36	4-12
	10-29	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	38-54	20-32
	29-45	Clay loam, loam, silty clay loam.	CH, CL	A-7	0	95-100	90-98	85-95	75-85	45-58	30-38
	45-60	Loam, clay loam	CL, ML, CL-ML	A-4, A-6	0-3	88-96	82-90	70-86	50-66	20-35	3-12
St---------- Stonelick	0-10	Sandy loam-------	SM, ML, SM-SC, CL-ML	A-4, A-2	0	85-100	70-100	45-75	25-55	<24	NP-6
	10-60	Stratified loam to loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-B	0	85-100	70-95	40-60	5-40	<15	NP
SwB2, SwC2, SwC3, SwD2---------- Switzerland	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	80-100	20-40	5-15
	7-28	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-100	25-45	15-25
	28-60	Silty clay, clay	CL, CH	A-7	0	95-100	90-100	85-100	75-95	45-65	25-40
Ud*. Udorthents											
WbB2, WbC2, WbC3- Weisburg	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-40	4-15
	7-24	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-95	25-40	4-15
	24-39	Silt loam, silty clay loam, clay loam.	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-100	65-95	25-40	5-15
	39-80	Silty clay, clay	CH	A-7	0	95-100	90-100	80-100	60-95	50-70	25-40
WhA---------- Wheeling	0-8	Silt loam--------	ML, CL, SM	A-4, A-6, A-7	0	90-100	90-100	85-100	45-90	20-50	1-25
	8-60	Silt loam, loam, gravelly sandy loam.	ML, CL, SM	A-4, A-6, A-7	0-5	90-100	70-100	65-100	45-80	20-50	1-25

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
AvA	0-17	10-18	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	<2	Low	0.43	4	5	1-3
Avonburg	17-26	22-30	1.35-1.50	0.6-2.0	0.18-0.20	4.5-5.5	<2	Moderate	0.43			
	26-72	22-30	1.60-1.85	<0.06	0.06-0.08	4.5-5.5	<2	Moderate	0.43			
	72-80	14-30	1.50-1.70	<0.06	0.06-0.10	4.5-8.4	<2	Moderate	0.43			
BaA	0-16	15-26	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	<2	Low	0.43	4	5	1-2
Bartle	16-28	22-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	<2	Low	0.43			
	28-58	22-35	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	<2	Low	0.43			
	58-60	22-35	1.40-1.60	0.2-0.6	0.15-0.18	5.1-7.3	<2	Low	0.43			
BeC2, BeC3, BeD2, BeD3, BeE	0-9	15-25	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	<2	Low	0.43	3	5	1-3
Bonnell	9-36	40-60	1.50-1.70	0.06-0.2	0.09-0.13	4.5-6.0	<2	High	0.32			
	36-60	27-40	1.45-1.60	0.2-0.6	0.14-0.19	5.1-6.5	<2	Moderate	0.32			
	60-80	27-40	1.45-1.60	0.2-0.6	0.08-0.15	6.1-8.4	<2	Moderate	0.32			
CaC2, CaD2, CaE2-	0-6	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	<2	Low	0.43	4	6	1-4
Carmel	6-11	25-40	1.40-1.60	0.6-2.0	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
	11-36	50-60	1.55-1.75	<0.06	0.09-0.11	4.5-6.5	<2	High	0.32			
	36-60	40-55	1.55-1.75	<0.06	0.03-0.08	7.4-8.4	<2	Moderate	0.32			
CcC3, CcD3, CcE3-	0-3	27-40	1.40-1.60	0.6-2.0	0.21-0.23	5.1-7.3	<2	Moderate	0.43	4	7	1-3
Carmel	3-10	25-40	1.40-1.60	0.6-2.0	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
	10-33	50-60	1.55-1.75	<0.06	0.09-0.11	4.5-6.5	<2	High	0.32			
	33-44	40-55	1.55-1.75	<0.06	0.03-0.08	7.4-8.4	<2	Moderate	0.32			
	44	---	---	---	---	---	---	---	---			
Ch	0-12	10-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low	0.32	5	5	2-4
Chagrin	12-46	18-30	1.20-1.50	0.6-2.0	0.14-0.20	5.6-7.3	<2	Low	0.32			
	46-60	5-25	1.20-1.40	0.6-2.0	0.08-0.20	5.6-7.3	<2	Low	0.32			
CnB2, CnC2	0-13	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	<2	Low	0.37	4-3	6	1-3
Cincinnati	13-29	22-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	<2	Low	0.37			
	29-50	24-35	1.60-1.85	0.06-0.2	0.08-0.12	4.5-6.5	<2	Moderate	0.37			
	50-80	18-43	1.55-1.75	0.06-0.2	0.14-0.18	4.5-6.5	<2	Moderate	0.37			
CnC3	0-3	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	<2	Low	0.37	4-3	6	1-3
Cincinnati	3-14	22-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	<2	Low	0.37			
	14-31	24-35	1.60-1.85	0.06-0.2	0.08-0.12	4.5-6.5	<2	Moderate	0.37			
	31-80	18-43	1.55-1.75	0.06-0.2	0.14-0.18	4.5-6.5	<2	Moderate	0.37			
Ct	0-24	13-27	1.30-1.55	0.2-0.6	0.22-0.24	3.6-5.5	<2	Low	0.37	5	6	1-3
Clermont	24-42	25-35	1.45-1.65	<0.06	0.18-0.22	4.5-5.5	<2	Moderate	0.37			
	42-80	30-45	1.45-1.70	<0.06	0.10-0.18	5.1-7.3	<2	Moderate	0.37			
De	0-10	20-30	1.30-1.45	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low	0.37	3	5	4-5
Dearborn	10-16	20-35	1.40-1.60	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low	0.28			
	16-60	20-35	1.50-1.75	0.6-2.0	0.05-0.07	7.4-8.4	<2	Low	0.28			
Df	0-10	20-27	1.35-1.50	2.0-6.0	0.12-0.15	7.4-8.4	<2	Low	0.28	3	8	4-5
Dearborn	10-16	20-35	1.40-1.60	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low	0.28			
	16-60	20-35	1.50-1.75	0.6-2.0	0.05-0.07	7.4-8.4	<2	Low	0.28			
EcE2	0-6	27-50	1.35-1.55	0.06-0.6	0.12-0.18	5.1-8.4	<2	Moderate	0.43	3	---	.5-3
Eden	6-36	40-60	1.45-1.65	0.06-0.2	0.08-0.13	5.1-8.4	<2	Moderate	0.28			
	36	---	---	---	---	---	---	---	0.17			
EdE3, EdF	0-6	27-60	1.45-1.65	0.06-0.6	0.11-0.17	5.1-8.4	<2	Moderate	0.28	3	---	.5-3
Eden	6-36	40-60	1.45-1.65	0.06-0.2	0.08-0.13	5.1-8.4	<2	Moderate	0.28			
	36-50	20-27	1.40-1.60	0.2-0.6	0.08-0.13	5.1-8.4	<2	Moderate	0.28			
	50-60	---	---	---	---	---	---	---	---			
EkA, EkB2, EkC2-	0-11	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	<2	Low	0.37	5	5	1-3
Elkinsville	11-33	22-30	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.0	<2	Moderate	0.37			
	33-58	16-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	<2	Moderate	0.37			
	58-60	20-34	1.40-1.60	0.6-2.0	0.17-0.21	4.5-6.0	<2	Low	0.37			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
FoB2	0-13	10-17	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	<2	Low	0.32	4	5	1-3
Fox	13-23	25-35	1.55-1.65	0.6-2.0	0.15-0.22	5.1-7.3	<2	Moderate	0.32			
	23-32	25-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	<2	Moderate	0.32			
	32-60	0-2	1.30-2.20	>6.0	0.02-0.04	7.4-8.4	<2	Low	0.10			
HcG	0-5	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	<2	Low	0.32	4	5	1-2
Hennepin	5-13	18-30	1.30-1.60	0.2-0.6	0.14-0.22	6.1-7.8	<2	Low	0.32			
	13-60	18-30	1.45-1.70	0.2-0.6	0.07-0.11	6.1-8.4	<2	Low	0.32			
Hu	0-13	18-25	1.30-1.40	0.6-2.0	0.18-0.24	5.6-7.8	<2	Low	0.28	5	5	2-4
Huntington	13-60	18-25	1.30-1.45	0.6-2.0	0.10-0.16	5.6-7.8	<2	Low	0.28			
	60-70	14-22	1.30-1.45	0.6-2.0	0.10-0.16	5.6-7.8	<2	Low	0.28			
Ju	0-60	10-20	1.15-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low	0.37	5	5	1-3
Jules												
MaB2, MaF2	0-7	20-27	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	<2	Low	0.43	3	5	1-3
Markland	7-29	40-55	1.55-1.70	0.06-0.2	0.11-0.13	5.1-6.5	<2	High	0.32			
	29-60	35-50	1.55-1.70	0.06-0.2	0.09-0.11	7.9-8.4	<2	High	0.32			
MbD3	0-3	28-40	1.35-1.50	0.2-0.6	0.18-0.20	5.6-7.3	<2	Moderate	0.43	2	7	1-3
Markland	3-7	40-55	1.55-1.70	0.06-0.2	0.11-0.13	5.1-6.5	<2	High	0.32			
	7-60	35-50	1.55-1.70	0.06-0.2	0.09-0.11	7.9-8.4	<2	High	0.32			
Ne	0-9	18-25	1.30-1.45	0.6-2.0	0.15-0.23	5.6-7.8	<2	Low	0.43	5	5	2-4
Newark	9-38	22-32	1.35-1.45	0.6-2.0	0.18-0.23	5.6-7.8	<2	Low	0.43			
	38-60	22-32	1.35-1.45	0.6-2.0	0.15-0.22	5.6-7.8	<2	Low	0.43			
OcA	0-8	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-6.5	<2	Low	0.37	5	5	.5-3
Ockley	8-38	27-35	1.45-1.60	0.6-2.0	0.15-0.20	4.5-6.0	<2	Moderate	0.37			
	38-50	20-35	1.40-1.55	0.6-2.0	0.12-0.14	5.6-6.5	<2	Moderate	0.24			
	50-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	<2	Low	0.10			
Or	0-8	12-27	1.25-1.45	0.6-2.0	0.18-0.22	5.1-6.5	<2	Low	0.37	5	6	1-3
Orrville	8-41	18-30	1.30-1.50	0.6-2.0	0.15-0.19	5.1-6.5	<2	Low	0.37			
	41-60	10-25	1.20-1.40	0.6-6.0	0.08-0.15	5.1-7.3	<2	Low	0.37			
PaD2, PaE2	0-6	20-27	1.35-1.50	0.2-0.6	0.22-0.24	5.6-7.3	<2	Moderate	0.37	3	6	1-4
Pate	6-36	35-55	1.50-1.70	<0.06	0.08-0.16	5.6-7.3	<2	High	0.37			
	36-72	35-55	1.60-1.80	<0.06	0.05-0.12	6.1-8.4	<2	High	0.37			
	72	---	---	---	---	---	---	---	---			
Pg*.												
Pits												
Ra	0-8	22-34	1.30-1.45	0.6-2.0	0.21-0.23	6.1-7.3	<2	Moderate	0.43	5	5	1-3
Rahm	8-23	22-34	1.40-1.60	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.43			
	23-48	30-42	1.40-1.60	0.06-0.2	0.13-0.18	4.5-6.0	<2	High	0.43			
	48-60	27-34	1.40-1.60	0.06-0.2	0.18-0.20	5.1-6.0	<2	Moderate	0.43			
RdG	0-5	5-20	1.1-1.4	2.0-6.0	0.09-0.12	6.6-7.8	<2	Low	0.15	3	8	1-3
Rodman	5-13	5-25	1.1-1.5	2.0-6.0	0.09-0.12	6.6-7.8	<2	Low	0.20			
	13-60	0-10	<1.8	>20	0.02-0.04	7.4-8.4	<2	Low	0.10			
RoA, RoB2	0-7	13-27	1.35-1.50	0.6-2.0	0.20-0.24	4.5-7.3	<2	Low	0.37	4	6	1-3
Rossmoyne	7-23	22-35	1.40-1.60	0.6-2.0	0.14-0.19	4.5-5.5	<2	Moderate	0.37			
	23-66	24-35	1.70-1.90	0.06-0.2	0.06-0.10	4.5-5.5	<2	Moderate	0.37			
	66-80	18-45	1.60-1.75	0.06-0.2	0.06-0.10	5.6-8.4	<2	Moderate	0.37			
RxB*:												
Russell	0-9	11-25	1.30-1.45	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low	0.37	5	5	.5-2
	9-30	25-33	1.40-1.60	0.6-2.0	0.18-0.20	4.5-6.0	<2	Moderate	0.37			
	30-42	23-33	1.40-1.60	0.6-2.0	0.15-0.19	5.6-7.3	<2	Moderate	0.37			
	42-60	14-30	1.60-1.80	0.6-2.0	0.05-0.19	7.4-8.4	<2	Low	0.37			
Fincastle	0-10	11-22	1.40-1.55	0.6-2.0	0.22-0.24	5.1-6.5	<2	Low	0.37	5	5	1-3
	10-29	20-35	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.0	<2	Moderate	0.37			
	29-45	20-35	1.45-1.65	0.2-0.6	0.15-0.19	5.1-7.3	<2	Moderate	0.37			
	45-60	20-30	1.55-1.90	0.06-2.0	0.05-0.19	7.4-8.4	<2	Low	0.37			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
St	0-10	8-18	1.25-1.50	2.0-6.0	0.09-0.14	7.4-8.4	<2	Low	0.24	5	3	.5-2
Stonelick	10-60	5-18	1.20-1.55	2.0-6.0	0.05-0.11	7.4-8.4	<2	Low	0.24			
SwB2, SwC2, SwC3, SwD2	0-7	20-27	1.30-1.50	0.6-2.0	0.22-0.24	5.1-7.3	<2	Low	0.43	4	5	.5-3
Switzerland	7-28	25-35	1.40-1.65	0.6-2.0	0.18-0.22	4.5-6.0	<2	Moderate	0.43			
	28-60	55-70	1.35-1.60	0.06-0.2	0.09-0.13	4.5-8.4	<2	High	0.32			
Ud*. Udorthents												
WbB2, WbC2, WbC3-	0-7	18-27	1.30-1.45	0.6-2.0	0.22-0.24	5.1-7.3	<2	Low	0.37	4	6	1-3
Weisburg	7-24	18-35	1.35-1.50	0.6-2.0	0.20-0.22	4.5-6.5	<2	Low	0.37			
	24-39	18-35	1.55-1.80	<0.06	0.06-0.08	4.5-5.5	<2	Moderate	0.37			
	39-80	40-65	1.50-1.70	<0.06	0.08-0.14	5.6-6.5	<2	High	0.32			
WhA	0-8	12-20	1.20-1.40	0.6-6.0	0.12-0.18	5.1-6.0	<2	Low	0.32	4	5	1-3
Wheeling	8-60	18-30	1.30-1.50	0.6-2.0	0.08-0.12	5.1-6.0	<2	Low	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding," "water table," and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AvA--- Avonburg	D	None	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High	High	High.
BaA--- Bartle	D	None	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High	High	High.
BeC2, BeC3, BeD2, BeD3, BeE--- Bonnell	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
CaC2, CaD2, CaE2, CcC3, CcD3, CcE3- Carmel	C	None	---	---	>6.0	---	---	>40	Soft	Moderate	High	Moderate.
Ch--- Chagrin	B	Frequent	Brief	Nov-May	4.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low	Moderate.
CnB2, CnC2, CnC3-- Cincinnati	C	None	---	---	4.0-6.0	Perched	Jan-Apr	>60	---	High	Moderate	High.
Ct--- Clermont	D	None	---	---	0-1.0	Apparent	Nov-May	>60	---	High	High	High.
De, Df--- Dearborn	B	Frequent	Very brief	Nov-Mar	>6.0	---	---	>60	---	Moderate	Low	Low.
EcE2, EdE3, EdF--- Eden	C	None	---	---	>6.0	---	---	20-40	Soft	---	Moderate	Low.
EkA, EkB2, EkC2--- Elkinsville	B	Rare	---	---	>6.0	---	---	>60	---	High	Moderate	High.
FoB2--- Fox	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
HcG--- Hennepin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Hu--- Huntington	B	Frequent	Brief	Jan-May	3.0-6.0	Apparent	Dec-Apr	>60	---	High	Low	Moderate.
Ju--- Jules	B	Frequent	Brief	Mar-Jun	>6.0	---	---	>60	---	High	Low	Low.
MaB2, MaF2, MbD3-- Markland	C	None	---	---	3.0-6.0	Perched	Mar-Apr	>60	---	Moderate	High	Moderate.
Ne--- Newark	C	Frequent	Brief	Jan-Apr	0.5-1.5	Apparent	Dec-May	>60	---	High	High	Low.
OcA--- Ockley	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Or Orrville	C	Frequent	Very brief to brief.	Nov-May	1.0-2.5	Apparent	Nov-Jun	>60	---	High	High	Moderate.
PaD2, PaE2 Pate	C	None	---	---	>6.0	---	---	>50	Soft	Moderate	High	Moderate.
Pg*. Pits												
Ra Rahm	C	Occasional	Brief	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	High.
RdG Rodman	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
RoA, RoB2 Rossmoyne	C	None	---	---	1.5-3.0	Perched	Jan-Apr	>60	---	High	High	High.
RxB*: Russell	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
Fincastle	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.
St Stonelick	B	Frequent	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low	Low.
SwB2, SwC2, SwC3, SwD2 Switzerland	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	High.
Ud*. Udorthents												
WbB2, WbC2, WbC3 Weisburg	C	None	---	---	>6.0	---	---	>60	---	High	Moderate	High.
WhA Wheeling	B	None	---	---	4.0-6.0	Apparent	Dec-Apr	>60	---	Moderate	Low	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Avonburg	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Bartle	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Bonnell	Fine, mixed, mesic Typic Hapludalfs
Carmel	Fine, vermiculitic, mesic Typic Hapludalfs
Chagrin	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Cincinnati	Fine-silty, mixed, mesic Typic Fragiudalfs
Clermont	Fine-silty, mixed, mesic Typic Ochraqualfs
Dearborn	Loamy-skeletal, mixed, mesic Fluventic Hapludolls
Eden	Fine, mixed, mesic Typic Hapludalfs
Elkinsville	Fine-silty, mixed, mesic Ultic Hapludalfs
Fincastle	Fine-silty, mixed, mesic Aeric Ochraqualfs
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Hennepin	Fine-loamy, mixed, mesic Typic Eutrochrepts
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Jules	Coarse-silty, mixed (calcareous), mesic Typic Udifluvents
*Markland	Fine, mixed, mesic Typic Hapludalfs
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Ockley	Fine-loamy, mixed, mesic Typic Hapludalfs
*Orrville	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Pate	Fine, illitic, mesic Typic Hapludalfs
Rahm	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Rodman	Sandy-skeletal, mixed, mesic Typic Hapludolls
Rossmoyne	Fine-silty, mixed, mesic Aquic Fragiudalfs
Russell	Fine-silty, mixed, mesic Typic Hapludalfs
Stonelick	Coarse-loamy, mixed (calcareous), mesic Typic Udifluvents
Switzerland	Fine-silty over clayey, mixed, mesic Typic Hapludalfs
Udorthents	Loamy, mixed, nonacid, mesic Typic Udorthents
Weisburg	Fine-silty, mixed, mesic Typic Fragiudalfs
Wheeling	Fine-loamy, mixed, mesic Ultic Hapludalfs

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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